

Francisco de Borja SANCHÍZ & Marian MLYNARSKI

Remarks on the Fossil Anurans from the Polish Neogene

[With 10 text-figures]

Uwagi o kopalnych płazach bezogonowych neogenu Polski *

Observaciones sobre Anuras fósiles de Neogeno polaco

Abstract: Based on new material, this article discuss some additions to the anuran fossil record of the Polish Neogene. Fossil remains of the families *Discoglossidae*, *Palaeobatrachidae*, *Pelobatidae* and *Hylidae* are described. The taxonomic status of the group *Latonia* — „*Discoglossus giganteus*” is discussed. The Polish Pliocene has provided the oldest known remains of the genus *Bombina*, with forms morphologically closest to the living *Bombina bombina*. In the same period, the extinct *Eopelobates* is present. Some previously unknown skeletal elements of *Pliobatrachus* are described. The latter genus is revalidated and a new diagnosis proposed.

I. INTRODUCTION

Poland is possibly the only country in the World for which the whole fossil record on amphibians and reptiles has been studied and summarized through faunal lists and review papers (MLYNARSKI 1962, 1977 and references therein), and where these data are continuously being updated.

On account of its abundance, a further review of the taxonomically non-described remains from some of the localities has led us to the discovery of several anuran rests that either add to the current faunal lists or to our knowledge on the morphology of some extinct animals. It is the purpose of this article to describe and interpret those Tertiary remains, as well as to briefly discuss their phylogenetic and biogeographic implications.

Data on the localities can be found in MLYNARSKI (1962, 1977 and references therein). All sites are bone breccias in karstic fillings, and thus the material is exclusively composed of isolated bone fragments. The youngest are Przeworno I and II, with a Middle Miocene age (NM biozone, MEIN 1975, still undetermined). Podlesice can be dated in the Lower Ruscian (NM 14; MEIN 1975; see also AGUIRRE & ALBERDI 1977), Weże I in the Upper Ruscian (NM 15), while

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

Rebiełice Królewskie I and II (both NM 16) represent the Lower Villafranchian, and thus extend almost to the end of Tertiary.

With the exception of some remains from Weże I in the collection of the Earth Sciences Museum (Polish Academy of Sciences, Warsaw). The material belongs to the Institute of Systematic and Experimental Zoology (Polish Academy of Sciences, Cracow).

The anatomical nomenclature follows (with some modifications) that of BOLKAY (1919) and VERGNAUD-GRAZZINI (1966). All measurements are given in mm. Each division on the graphic scales represents 1 mm.

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We acknowledge with thanks the collaboration of Doc. Dr. T. MARYAŃSKA and personnel of the Museum of Earth Sciences (Warsaw) for kindly making available their collections. Profs. Dr. H. DE BRUIJN (Utrecht), Dr. Z. ŠPINAR (Prague) and Dr. C. VERGNAUD-GRAZZINI (Paris) greatly contributed through loan of specimens and discussions. We thank Prof. R. ESTES (San Diego, USA) for reading the manuscript and many helpful suggestions.

II. SYSTEMATIC PALEONTOLOGY

Order: *Anura* GIEBEL, 1847

Family: *Discoglossidae* GÜNTHER, 1858

Latonia H. v. MEYER, 1843

Latonia cf. *seymfiedii* H. v. MEYER, 1843

(Fig. 1)

Localities: Przeworno I and II, Upper Silesia, SW Poland

Material: See Table I.

Description

The various elements recovered in those localities are closely correlated in morphology, and there can be very little doubt that a single anuran species is present. The majority of this material has been already described by MŁYNARSKI (1976), and will not be repeated here. Nevertheless, other elements have appeared that deserve consideration.

Frontoparietal: Unfortunately only a minute fragment and a badly damaged external cast have been recovered. Although almost devoid of useful information, a continuous dermal sculpture based on individualized small tubercles, sometimes fused on short ridges, can be seen.

Maxilla: In addition to the description of MLYNARSKI (1976), it should be pointed out that the sculpture only covers the distal part of the bone, on a roughly triangular zone delimited anteriorly by a bifurcated furrow.

Mandible: Additional fragments of the angular confirm the constancy of the presence of paracoronoid process (MLYNARSKI 1976; VERGNAUD-GRAZZINI 1970). Its basal part forms a crest and its apex is a tubercle.

V—1 („Atlas”): Figures 1.1 and 1.2. Although the only recovered element is damaged (lacking the neural arch), an almost complete reconstruction of its centrum shape is possible. Its main features are as follows: element free, not fused with V—2; opisthococlous centrum; ventral surface not flat, but slightly concave in the median area; presence of a well developed median ridge (here after crista medialis); roughly elliptical cotyles with their major axese

Table I

Latonia cf. seyfriedi H. v. MEYER

Element	Przeworno I	Przeworno II
Maxilla R	—	1
„ L	—	1
Frontoparietal	—	2
Parasphenoid	—	2
Mandible R	—	2
„ L	1	4
V. 1	—	1
V. 2—8	—	6
Sacrum	—	4
Urostyle	1	1
Coracoid L	—	2
Scapula R	—	4
„ L	—	1
Clavicle	—	1
Cleithrum L	1	—
Humerus R	—	8
„ L	—	6
Radioulna R	—	3
„ L	—	2
Ilium R	—	9
„ L	—	8
Ischium	—	2
Femur R (fragments)	1	6
„ L	—	7
Tibiofibulare R (fragments)	—	9
„ L	—	15
Tibiale	—	1
Fibulare R	1	1
„ L	1	2
(R: right; L: left)		

oriented ventro-laterally; intercotylar relationship apparently of the type III (LYNCH 1971), although due to determination this point is not beyond doubt.

The association of the above mentioned features permits the differentiation of this animal from any other anuran with the exception of *Discoglossus* and *Latonia*. Furthermore, the type III of intercotylar relationship (fused and continuous articular surfaces), if our interpretation is confirmed, is unknown in *Discoglossus pictus* (n: 100 specimens) and other species of the genus (sensu lato), with possibly the exception of *D. sardus* (SANCHÍZ, unpubl.), where it seems to appear, at least as anomaly. Both types II and III have been observed in *Latonia*, but never mixed in one population. The latter point is of course open to question, as concerning this element no sample available for us exceeds 10 individuals.

Urostyle: Distinctly bicotylar. Presence of a large crista dorsalis. One pair of well developed transverse processes in the anterior region, continued by a lateral ridge (= „lamina horizontalis” of FÉJERVÁRY 1917).

Scapula: Short and cleft element, with a well developed crista in the margo anterior. Excluding size, those elements are identical with the ones observed in the living *Discoglossus*. As in *Latonia* and *Discoglossus* the whole pars glanoidalis have been lost through fracture. (Fig. 1.3.)

Coracoid, clavicle and cleithrum: The morphology of those elements, at least as can be inferred from the badly preserved material at hand, closely agrees with the known or expected morphology of *Latonia* and (save in size) the living *Discoglossus*.

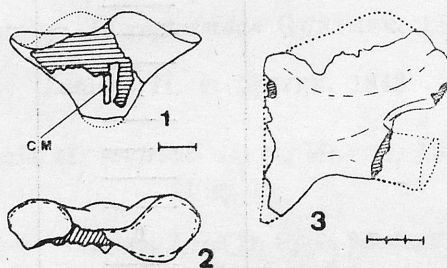


Fig. 1. *Latonia* cf. *seyfriedi*. Przeworno I. 1,2: V. 1, ventral and cranial views. CM-crista medialis. 3 — Scapula, outer view (all figures del. F. B. SANCHÍZ)

Humerus: Clearly referred to *Latonia*, their morphology is once more (except for size) identical with living *Discoglossus*. The fossa cubitus ventralis, although rudimentary, is clearly present.

Measurements

(ø): Proximo-distal diameter of eminentia capitata. (MDW): Maximal distal width.

(ø): 7.0 7.3 7.4 7.6 8.0

(MDW): 9.8 10.2 10.9 11.0 —

Ilium: It is quite possible to distinguish between the characteristic *Latonia* ilia

(with very little variation among the various populations) and that of *Discoglossus*, especially the living species. Besides the much larger size of *Latonia*, ilia in this genus show a noticeably less developed pars descendens ilii (p. d. i.) than *Discoglossus* and *Eodiscoglossus*, (see VERGNAUD-GRAZZINI & WENZ 1975, Fig. 2), and thus (in an extrict „lateral” view) the angle between the ventral margins of the p. d. i and the pars cylindrophormis is $> 90^\circ$ in the former and $\simeq 90^\circ$ in the latter. An examination by one of us (SANCHÍZ) of more than 250 individuals of *Discoglossus pictus*, as well as lesser quantities of the other species in both genera, has convinced us of the usefulness of this character. Another character that can be useful in this regard is the morphology of the tuber superius, much thicker and swollen in *Discoglossus* than in *Latonia*, where it is almost as thin as the remaining crista dorsalis.

Miscellaneous: Other elements, such as the distal limb bones, in full agreement with the morphology of *Latonia*, *Discoglossus* and other anurans, not be will described.

Discussion

In a previous paper by one of us (MLYNARSKI 1976), this material was placed in the species *Discoglossus giganteus* WETTSTEIN-WESTERHEIMB, described from the locality of Dévinská Nová Ves (= Neudorf a. d. March, Slovakia, CSSR; NM. 6). Nevertheless, an increasing knowledge on the European fossil anurans, developed in the last years, has given the necessary background to establish that this species should be included in the genus *Latonia*, and most probably only represents a junior synonym of *Latonia seyfriedi* H. v. MEYER, 1843. This situation is rather confusing, as it concerns a large number of taxa and has never been summarized. Although a full discussion of this „synonymcomplex” would exceed the limits of this paper, and will be presented elsewhere by one of us (SANCHÍZ, Ms.), some of the taxa involved can be found in Table II (see also SANCHÍZ & SANZ, in press, for some of its ramifications). As we shall briefly indicate here, most of the confusion arises through a wrong association of desarticulated elements, followed by many authors, in the locality of Dévinská Nová Ves.

The original description of *Discoglossus giganteus* was based on mandible and postcranial elements (WETTSTEIN-WESTERHEIMB 1955). This material shows the typical features of *Latonia* (some of them were not known in 1955; e. g. paracoronoid crest in the angular, ilial characters noted above etc.), that distinguishes it from *Discoglossus*. Later in the same paper, and from the same locality, WETTSTEIN-WESTERHEIMB (op. cit.) described a supposedly new pelobatid genus and species, *Miopelobates zapfei*, based on cranial material (type series) and referred-postcranial elements. While the latter are unmistakable pelobatid (probably from the only other pelobatid described there, *Eopelobates bayeri*; see ESTES 1970 and ŠPINAR 1972), the type series shows clear discoglossid (*Latonia*) features on the sculpture of roof bones, endocranial pattern of frontoparietals (ŠPINAR 1975a, 1976a), only posteriorly sculptured maxilla etc. It seems clear

Some taxa here referred to *Latonia seyfriedi* H. v. MEYER

Taxa	Original family allocation	Locality and Neogene biozone	Some references
1 — <i>Latonia seyfriedi</i>	<i>Discoglossidae</i>	Oenningen (NM. 7)	MEYER (1843); FRIANT (1960)
2 — <i>Rana gigantea</i>	<i>Ranidae</i>	Sansan (NM. 6)	LARTET (1851); COPE (1865); VERGNAUD-GRAZZINI & HOFFSTETTER (1972); VERGNAUD-GRAZZINI & WENZ (1975)
3 — <i>Rana rugosa</i>	<i>Ranidae</i>	ibidem	ibidem
4 — <i>Diplopelturus ruscensis</i>	<i>Discoglossidae</i>	Serrat d'en Vacquer (NM 15)	DEPÉRET (1897); RAGE & VERGNAUD-GRAZZINI (1972); VERGNAUD-GRAZZINI & WENZ (1975)
5 — <i>Pelobates robustus</i>	<i>Pelobatidae</i>	Plogardi (NM 13)	BOLKAY (1913); summary and other references in SANCHÍZ & SANZ (in press)
6 — <i>Rana batthyany</i>	<i>Ranidae</i>	ibidem	ibidem
7 — <i>Discoglossus giganteus</i>	<i>Discoglossidae</i>	Dévinská Nová Ves (NM 6)	WETTSTEIN-WESTERHEIM (1955); VERGNAUD-GRAZZINI (1970); see text
8 — <i>Miopelobates zapfei</i> (Type series only)	<i>Pelobatidae</i>	ibidem	WETTSTEIN-WESTERHEIM (1955); ŠPINAR (1975a); see text
9 — <i>Neusibatrachus estesi</i>	<i>Palaeobatrachidae</i>	ibidem	ŠPINAR (1975b); see text
10 — <i>Miopelobates fejfari</i>	<i>Pelobatidae</i>	Františkovy Lazné (NM 5)	ŠPINAR (1975a; 1976a)

that *Discoglossus giganteus* and *Miopelobates zapfei* (type series) form a morphological and size unit, and represent a single animal species. This statement is supported by the following considerations:

1. The frontoparietal endocranial pattern, as established by ŠPINAR (1975a, 1976), is in agreement with the peculiar discoglossid shape and far from the also characteristic pelobatid pattern.

2. Since *Latonia seyfriedi* is known by articulated remains, the association of a sculptured skull roof of discoglossid type with the posterianal and mandible elements of the pattern found in the material of Dévinská Nová Ves can be observed.

3. In several Spanish localities, where no pelobatid have been found, the association cranial and posterianal materials (as desarticulated elements) of the type mentioned in the paragraph 2 — does occur (SANCHÍZ, unpubl.). If the sample of Przeworno is considered, the same argument holds, stressed in this case because no other anuran has been found at that locality.

From the same locality of Dévinská Nová Ves, ŠPINAR (1975b) described

a new paleobatrachid, *Neusibatrachus estesi*. This taxon was based on a single scapula, that through the lack of the pars glenoidalis resembled the morphology of an Uppermost Jurassic palaeobatrachid (*N. wilferti* SEIFFERT). In our opinion (also now accepted by Prof. Dr. ŠPINAR, pers. com., 1978) it only represents a broken element of *Latonia*.

All taxa from Table II, with the exception of *L. seyfriedi*, are known through desarticulated, isolated elements. We have been able to examine samples of taxa 2, 3, 8 and 9, and although these fossil populations are not always represented by homologous elements, they basically agree in all observable features, as well as (through literature) with taxa 4, 5, 6 and 7. The same morphology also appears in several undescribed fossil populations from France, Greece and Spain (SANCHÍZ pers. obs.), and their features do not contradict the few ones comparable through photographs and a cast of the type species *L. seyfriedi*. Other morphological groups, still undescribed, do exist (SANCHÍZ ms.), but in these cases some differences from *L. seyfriedi* can be observed.

Although a redescription of the latter is needed, we provisionally suggest reference of all taxa in Table II (and materials referred to them from other localities, e. g. VERGNAUD-GRAZZINI 1970) to this species, with the addition of the taxonomic particle cf. (conformis) in the sense of SANCHÍZ (1977b). *Rana rugosa* LARTET, 1851, referred to this form by COPE (1865), VERGNAUD-GRAZZINI & HOFFSTETTER (1972) and VERGNAUD-GRAZZINI & WENZ (1975) among others, we believe, to the contrary, that belongs to the genus *Eopelobates*, as a maxillar (labeled by LARTET himself) attributed to this species has appeared in this collection of the Museum National d' Histoire Naturelle (pers. obs. SANCHÍZ).

The specimens from Przeworno I and II are no exception, and in fact their description can be taken as representative of the group. Nevertheless, it should be pointed out that if the differences in the intercotylar relationship noted above (type II versus III) were as constant as they are in other anurans, it could be taken as a strong indication to the necessity of splitting this group (*Latonia* cf. *seyfriedi*) in several species.

The insufficiently described taxa *Baranophrys discoglossoides* KRETZOI and *Spondylophryne villanyensis* KRETZOI from Villany 6, Hungary (KRETZOI 1956), and as well as *Alytes grandis* BRUNNER from Gössweinstein (F. R. Germany; BRUNNER 1957) might perhaps be included in the same group. Their relationships cannot be evaluated in the absence of a proper description (see RAGE 1974).

Bombina OKEN, 1816

Bombina bombina (LINNAEUS, 1761)

(Fig. 2)

Localities: Weże I and Rebiełice Królewskie I.

Material: Weże I: Left ilium (1) (Museum of Earth Sciences, Warsaw); Right ilium (1);

V—5(1); Rebiełice Królewskie: I.: Left otoccipital (1); V 3—4 (1):

V—5(2); V 6—8(5); urostyl (1); humeri (right: 7, left: 6); ilia (r: 8, l: 10); tibiofibulare (r: 2)

Description

The two European species of *Bombina* are osteologically very similar indeed, but also clearly distinct with respect to other anurans. Their comparative osteology and variation will be commented elsewhere by one of us (SANCHÍZ). For the sake of brevity, we shall mainly limit the descriptions to point out the features that permit the specific allocation of our fossils. Characters not mentioned do not differ from the situation observed in both European living species (see also Fig. 2).

Otooccipital: Figures 2-1 and 2-2. Very similar to both European species. The occipital condyle occupies a more posterior position with respect to the crista supracondyloidea in our fossil and living *Bombina bombina* than in *B. variegata*. An interesting character is the shape (dorsal view) of the orbital margin. In

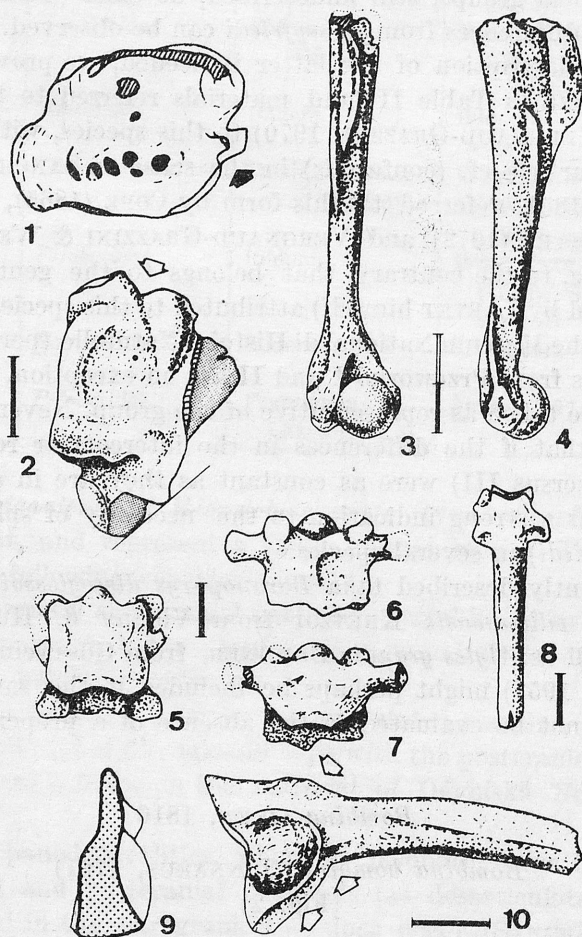


Fig. 2. *Bombina bombina*. Rebielice Królewskie I. 1, 2 — otooccipital, inner and dorsal views 3, 4 — Humerus, ventral and lateral views, 5 — V. 6—8, ventral view. 6, 7 — V. 3—4, dorsal and ventral views. 8 — Urostyle, dorsal view. 9, 10 — Ilium, articular surface and lateral view

our fossil (Fig. 2·1) it is clearly concave, while in *B. variegata* it is almost straight. The corresponding shape of *B. bombina* is generally slightly concave, but we have observed in one case a situation identical to the fossil one. The anterior process (Fig. 1·1, arrow) is connected by a crest with the ventral margin in *B. variegata*, but it is free and distinct in *B. bombina*, like in our fossil. The lower perilymphatic foramen opens very close to the jugular foramen, in the same concavity, but in the Pliocene material and living *B. bombina* it opens outside this concavity.

Vertebral column: There are no differences between our fossils and both European species. The urostyle represented in Fig. 2·8 is to some extent anomalous, as a rudiment of the prezigapophyses are present.

Humeri: No constant differences with respect to *B. bombina* and *B. variegata* have been found (Fig. 2·3 and 2·4).

Measurements

— Maximum distal width: 1·51 1·59 1·70 1·61 1·73 1·83 1·80 1·46

— Antero-posterior diameter of eminentia capitata:

0·96 1·08 1·17 1·05 1·19 1·24 1·18 0·98

— Side: R R R R R L L L

Ilia: Fig. 2·9 and 2·10. The ilia of living *B. bombina* and *B. variegata* only have very slight differences. In order to ascertain if some of them could be taken as taxonomic criteria, an examination of 50 ilia from each species has been made (material prepared for the study of anomalies of MADEJ 1965). The characters could be summarized as follows:

1. **Tuber superius:** Although rudimentary in both, it is slightly higher (lateral view) in *B. bombina* than in *B. variegata* (BÖHME 1977). In the latter it is more swollen, through externo-laterally directed.

2. **Pre-acetabular fossa:** Present in *B. bombina*, absent in *B. variegata*.

3. **Pars descendens:** Small in both, but better developed in *B. bombina*, as can be clearly seen in outer lateral view and symphysary projection (BÖHME 1977).

None of these characters allows an unequivocal attribution, as there are specimens where some of these features are reduced or even overlap, but their combination permits the differentiation between both species without doubt. In this respect, it should be noted that for all criteria the material from Weże I and Rebielice Królewskie I presents the most typical morphology of *B. bombina*.

Tibiofibulare: No differences among the Pliocene material and both living species are apparent.

Discussion

Through extremely similar, both European species are unanimously accepted as distinct forms. Hybridization between them has been recently well documented (SZYMURA 1976 a and b).

From the osteological features noted above, we believe that the presence of living species *B. bombina* in the Upper Pliocene can be accepted with reasonable confidence. Besides the Polish localities, the genus has been recovered from Arondelli, Italy (NM. 16; VERGNAUD-GRAZZINI 1970), but no specific allocation was made there.

The paleontological record of the *Bombina*-group is very poor, being *Pelophilus agassizii* TSCHUDI, 1839, the only taxa that has been considered as closely related to *Bombina* (e. g. FRIANT 1960; VERGNAUD-GRAZZINI & WENZ 1975). *Pelophilus* is an articulated form from Oeningen (NM. 7), but it has been never reviewed after the original description. It is evident that this work should be undertaken before its phylogenetic relationships are evaluated.

Most of the few osteological characters that distinguish *B. bombina* and *B. variegata* cannot be evaluated for their phylogenetical information content, as it is for us impossible to infer a polarity of character-states. Nevertheless, such polarity can be deduced for iliac characters 1 and 3, since from the remaining discoglossids (selected for outgroup comparisons) it is then obvious that the reduction of tubersuperius or pars descendens are derived states. If this polarity is accepted, *B. variegata* would show autapomorphies in both, since the situation in *B. bombina* is plesiomorphic when compared with its sister group. Then, it would follow, so far as the available morphology concerns, that the phylogenetic relationship of *B. variegata* is either directly derived from *B. bombina* or both from an ancestral species, but the possibility that *B. bombina* and *B. variegata* as ancestor has to be dismissed. For the moment, none of those two possibilities can be preferred over the other, and this is unfortunate because the timing for the origin of *B. variegata* cannot be evaluated.

Nevertheless, *B. bombina* seems to be already established in the Pliocene, and thus any consideration of the Pleistocene period as a time for this particular speciation event should be discarded.

Family: *Pelobatidae* LATASTE, 1879

Eopelobates PARKER, 1929

Eopelobates sp.

(Figs. 3 and 4)

As already mentioned in a previous paper (MŁYNARSKI 1977), both living species *Pelobates fuscus* and *P. syriacus* seem to have been presented in the Polish Pliocene. This material will be elaborated by Prof. Z. ŠPINAR (Prague), and therefore will not be discussed here.

With the new available material, a point concerning pelobatids needs further consideration, namely, the presence of the extinct *Eopelobates*. The presence of this genus was suggested by MŁYNARSKI (1961) in Weże I, based

on a sacrum showing a lack of fusion with respect to the urostyle. Since that time, it has been found that in almost all species of *Pelobates* the free sacrum condition appears sporadically, and that this character state is, indeed, the most frequent situation in large samples of *P. cultripes* (SANCHÍZ & SANZ in press). Thus, the support for this presence has been now considerably weakened.

Although an unequivocal list of referred material cannot be given, we shall discuss three elements that in our view confirm the presence of this genus.

Description

Frontoparietal: One small fragment of frontoparietal from Weże I (coll. Earth Sciences Museum, Warsaw) shows a dorsal sculpture based on polygonal pits delimited by ridges, emphasized on the lateral side preserved. Such a type of sculpture is present in all *Eopelobates* (ESTES 1970, ŠPINAR 1972), but it is unknown in any other European anuran.

Ilium: (Weże I—2 elements, one in the Earth Sciences Museum). As justified by SANCHÍZ & SANZ (in press), the very homogenous ilial morphology of the genus *Pelobates* can be differentiated at least from some of the similar *Eopelobates* elements because in the former (inner lateral view) the region that correspond on this opposite side to the pars descendens and lower part of the acetabulum is striated and with a different orientation than the rest, the articulation between both ilia being thus much stronger. Desarticulated ilia from the French Oligocene, in large samples without *Pelobates* do not present such striation, nor this symphysis type (SANCHÍZ pers. obs.). The elements from Weże I (Fig. 3) agree with *Eopelobates* at this respect.

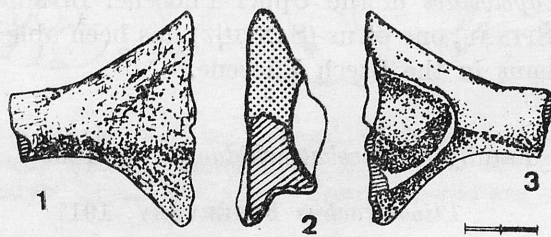


Fig. 3. *Eopelobates* sp. Weże I. Ilium. 1 — inner, 2 — articular surface, and 3 — outer lateral views

Posterior vertebrae: In Weże I, as well as in Rebielice Królewskie I and II, it is rather frequent to find pelobatid posterior vertebrae (V. 6—8) with a conspicuous nerve foramen at each side. VERGNAUD-GRAZZINI (1970) reports a similar element from the Italian Uppermost Pliocene. Although in the available samples noted above, where (for other elements) only *Eopelobates* has been found, the posterior vertebrae show such foramina, we became suspicious about the character because it seemed to appear with a much larger frequ-

ency in relation to *Pelobates* than the expected one by other elements. A subsequent search in all living species of *Pelobates* has been negative with the exception of 1 specimen of *P. syriacus* (Dep. Paleontology, Charles Univ., Prague), where those foramina, though small, clearly appears in V. 6 and V. 7. For this particular species only 6 specimens were available, and thus the frequency of the foramina versus notch remains unknown.

Another feature can be considered in association, namely the development of neurapophysis and lateral longitudinal ridges on the neural arch. In *Pelobates*, a rudimentary neurapophysis is present and the two lateral ridges are well developed. In *Eopelobates* samples the former is usually absent and the lateral crests reduced. If we combine those characters, the vertebra of the type represented in Fig. 4 might represent *Eopelobates*.

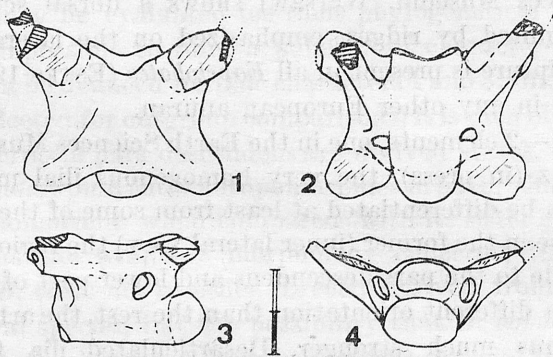


Fig. 4. *Eopelobates* ? Rebielice Królewskie I. V. 6—8. 1 — dorsal, 2 — ventral, 3 — lateral, 4 — posterior views

Thus, and only based on the frontoparietal and ilia, it is possible to infer the presence of *Eopelobates* in the Upper Pliocene. In addition, through the kindness of Prof. ŠPINAR, one of us (SANCHÍZ) has been able to observe several remains of this genus in the Czech Pliocene.

Family: *Palaeobatrachidae* COPE, 1865

Pliobatrachus FEJÉRVÁRY, 1917

Pliobatrachus cf. *langhae* FEJÉRVÁRY, 1917

Localities: Weże I, Rebielice Królewskie I and II.

Material: Table III — In this table the material described in VERGNAUD-GRAZZINI & MLYNARSKI (1969) is not included.

Description

The Polish Pliocene palaeobatrachid *Pliobatrachus* has been already described and discussed at length (VERGNAUD-GRAZZINI & MLYNARSKI 1969; MLYNARSKI 1977 and references therein). Thus, we shall focussed mainly in the previously

unknown elements of this extinct genus, as well as to some other necessary details in order to provide a differential diagnosis. The size of this animal is very large.

Premaxilla and maxilla: See MEYNARSKI (1977). It should be noted that the number of teeth is reduced, that a diastema exists, and that are supported lingually by alternative osseous knobs.

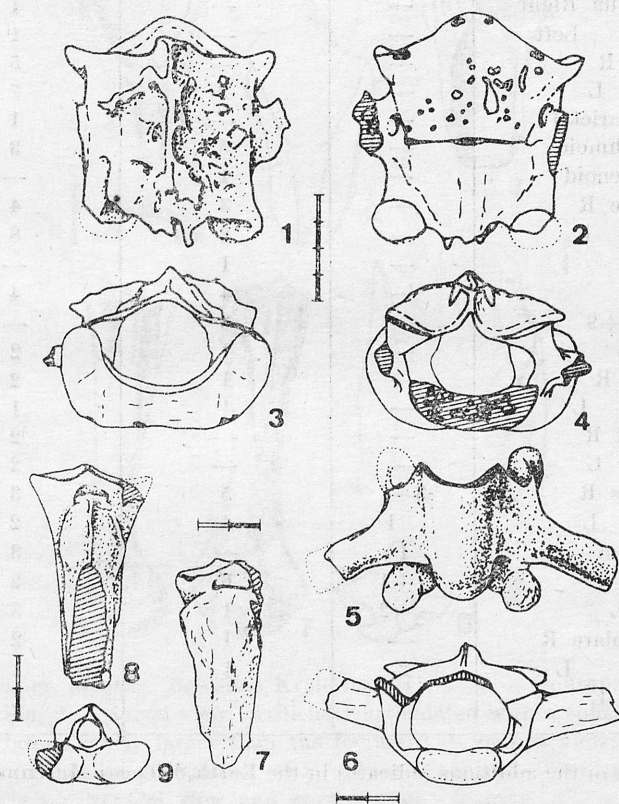


Fig. 5. *Pliobatrachus* cf. *langhae*. Rębielice Królewskie I. V. 1, 1 — dorsal, 2 — ventral, 3 — cranial, 4 — caudal views. Rębielice Królewskie II. 5, 6 — V. 3—6, ventral and caudal views. 7 — Urostyle, dorsal view. 8, 9 — Urostyle, dorsal and cranial views

Frontoparietal: One single fragment from Rębielice Królewskie II possibly represents this previously unknown element. As represented in Fig. 6, it is a single bone without any sutures. Dorsally, an anterior U-shaped groove is well developed, the bone in this area being slightly curved downwards; on the ventral side, an articular striation occurs. Posteriorly to the area delimited by the groove, the bone takes a very convex shape (cross section Fig. 6.1), with the lateral wall almost perpendicular. Dorsally, a pair of parallel ridges are present. In this region, a conspicuous ventral foramen appears, but it is not represented in the dorsal surface unless it were connected with the groove.

Table III

Pliobatrachus langhae FEJÉRVÁRY
(Material studied)

Element	Weže I	Rębiełice Kr. I	Rębiełice Kr. II
Premaxilla Right	—	—	1
" Left	—	—	1
Maxilla R	—	—	5
" L	—	2	7
Frontoparietal	—	—	1
Sphenethmoid	—	5	3
Parasphenoid	—	1	—
Mandible R	—	3	4
" L	—	2	8
V. 1+2	—	1	—
V. 3—6	—	4	4
V. 7+8+9	—	3	—
Urostyle	—	1	2
Scapula R	—	1	2
" L	—	1	1
Coracoid R	—	—	2
" L	—	—	2
Humerus R	3+1	5	3
" L	1	4	2
Radioulua	1	—	3
Ilium R	1+1	6	2
" L	—+2	1	3
Tibiofibulare R	—	1	2
" L	2	1	1
Fibulare L	—	—	1

* Second terms in the additions indicates in the Earth Sciences Museum.

We have referred this fragment to a *Pliobatrachus* frontoparietal with some hesitation, as it is of a very unusual morphology (see ŠPINAR 1972; VERGNAUD-GRAZZINI & HOFFSTETTER 1972). Nevertheless, it fits rather nicely with one sphenethmoid (of slightly larger size) from the same locality, and we have no alternative attribution.

Sphenethmoid: Fig. 8. As discussed by VERGNAUD-GRAZZINI & MLYNARSKI (1969) and VERGNAUD-GRAZZINI & HOFFSTETTER (1972), this element is similar in *Pliobatrachus* and other palaeobatrachids.

Parasphenoid: The only available fragment of this bone has been found fused to the sphenethmoid. It seems to be an anomaly, as this has not happened in the other sphenethmoids.

Mandible: Characterized by a coronoid process with the from of a round tubercle depressed in the middle.

V. 1+2: Fig. 5.1 and 5.4. This first atlas from *Pliobatrachus* shows the main Palaeobatrachid features: fusion at least to V—2 (with the associated presence of transverse processes and foramina); intercotylar relationship type III (LYNCH 1971). A neurapophysis presents, but shows many ramifications.

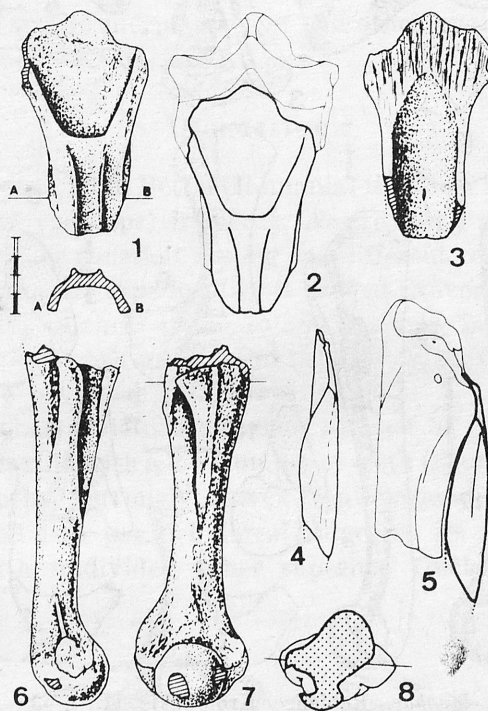


Fig. 6. *Pliobatrachus* cf. *langhae*. Rebiełice Królewskie II. 1—5 — frontoparietal. 1 — dorsal view and cross section, 2 — dorsal view, artificially articulated with a sphenethmoid from the same locality (the later slightly larger than the femur); 3 — ventral view; 4 — lateral view; 5 — lateral view, artificially articulated with sphenethmoid; 6—8 — humerus in lateral, ventral view and cross section (dotted)

V. 3—6: Fig. 5.5 and 5.6. As discussed by VERGNAUD-GRAZZINI & HOFFSTETTER (1972), they resemble the bufonid type, but with centra dorso-ventrally depressed.

Sacrum and urostyle: Identical not only to the type material of *Pliobatrachus langhae* (see FEJÉRVÁRY 1917) but to other palaeobatrachids as well. A crista dorsalis in the urostyle is absent or at the most rudimentary * (Fig. 5.7 and 5.9).

* Concerning this character, VERGNAUD-GRAZZINI & MLYNARSKI (1969) refer *Bufo tarlovi* MLYNARSKI, 1961 as synonym of *Pliobatrachus langhae*. On this point the authors opinions disagree, as for SANCHÍZ the holotype of *B. tarlovi* represents a *Bufo* (probably *B. bufo*) urostyle with a well developed crista dorsalis (see op. cit., plate 1, fig. 13), and furthermore no paratype can be referred to *Palaeobatrachidae*, while MLYNARSKI maintains his 1969 opinion.

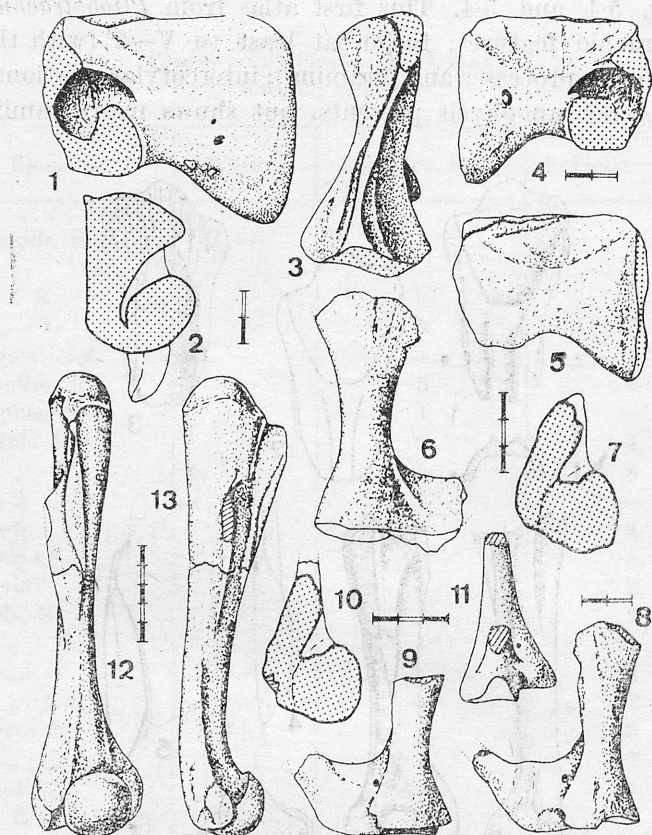


Fig. 7. *Pliobatrachus* cf. *langhae*. Rebiełice Królewskie II. 1-3 — scapula, outer, cranial views, and articular surface. Rebiełice Królewskie I. 4, 5 — scapula, outer and inner views. 6, 7 — coracoid, outer and articular surface views. 8 — coracoid, inner view. 9-11 — coracoid, inner cranial and articular surface views. Weże I. 12, 13 — humerus, ventral and lateral views

Scapula: Fig. 7-1 and 7-5. First time recovered on this genus, their morphology (short, uncleft, well developed crista in the margo anterior) is identical to the other palaeobatrachids (ŠPINAR 1972; VERGNAUD-GRAZZINI & HOFFSTETTER 1972).

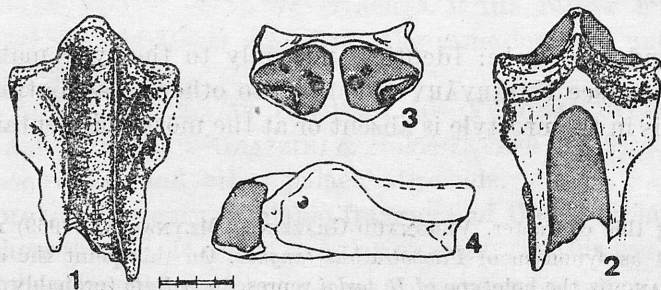


Fig. 8. *Pliobatrachus* cf. *langhae*. Rebiełice Królewskie II. Sphenethmoid. 1 — ventral, 2 — dorsal, 3 — anterior, 4 — lateral views

Coracoid: Fig. 7-6 and 7-11. As discussed by VERGNAUD-GRAZZINI & MEYNARSKI (1969), characteristic through the type of relation with the clavicle (processus rostralis).

Ilium: Fig. 9. The tuber superius is single. Other characters as in other palaeobatrachids.

Other elements: The morphology of the other available bones seems to be rather constant among this family.

Discussion

Pliobatrachus langhae, from Betsia (Romania) is known through the mandible sacrum, urostyle and (perhaps) humerus. As we have already noted above, these elements are rather constant among the different members of the family, and more material from the type locality is needed. Nevertheless, if we take the morphological identity of these elements and the very large size as arguments for the inclusion of the Polish material in this genus, its diagnosis (and that of *P. langhae*) could be proposed as follows:

Very large palaeobatrachid characterized at least by the combination of the following features: Maxilla with a low number of teeth (about 8) and anterior diastema. Premaxilla toothed. Strongly convex frontoparietal with a dorsal anterior groove U-shaped and two parallel dorsal ridges in its middle part; without sculpture. Ilium with undivided tuber superius. Uncleft scapula with pars acromialis.

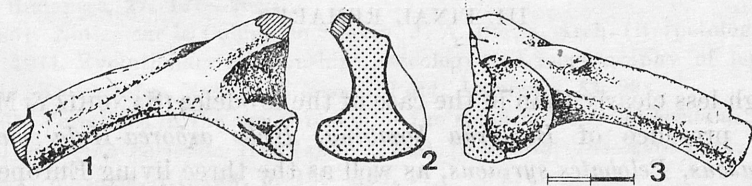


Fig. 9. *Pliobatrachus* cf. *langhae*. Weże I. Ilium. 1 — inner lateral, 2 — articular surface, 3 — lateral view

Family: *Hylidae* HALLOWELL, 1857

Hyla LAURENTI, 1768

Hyla arborea (LINNAEUS, 1758) — species group

Localities: Rebieńce Królewskie I and II.

Material: Rebieńce Królewskie I: Humerus (1, right); ilia (right 3, left 6). Rebieńce Królewskie II: Ilii (right 1, left 1).

The osteological variation of the ilium have been examined in living *Hyla arborea* and *H. meridionalis* in sample of a dozen individuals each, but no criteria

have been found that alone or in combination could permit the differentiation between both. The material from the Polish Pliocene agrees in morphology with both European species, but no proper allocation is possible.

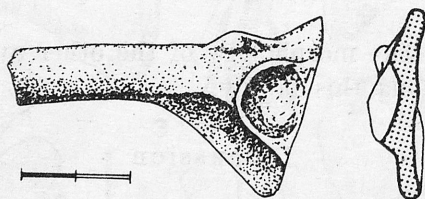


Fig. 10. *Hyla* cf. *arborea*. Rebiełice Królewskie I. Ilium. 1 — outer lateral view, 2 — articular surface

The *Hyla* ilia are nevertheless highly characteristic among anurans by their extremely large pars descendens, tuber superius above the anterior edge of the acetabular fossa, and lack of crista dorsalis and symphysary specializations.

This form should be added to Polish Pliocene faunal lists. It has been reported from the Italian Uppermost Pliocene (VERGNAUD-GRAZZINI 1970), and has recently been found in the Greek Upper Miocene (SANCHÍZ, unpubl.).

III. FINAL REMARKS

Although less clearly than in the case of the urodeles (SANCHÍZ & MLYNARSKI 1979), the presence of *Bombina bombina*, *Hyla arborea*-*Hyla meridionalis*, *Pelobates fuscus*, *Pelobates syriacus*, as well as the three living European species of *Bufo* (two of them in the Polish Pliocene, *Bufo bufo* also in Podlesice) (SANCHÍZ 1977a), are additional data that support the opinion that the importance traditionally attributed in Herpetology to the Pliocene-Pleistocene boundary as a faunistic major change date should be diminished. The same idea stressed when it is realized that a typical extinct form like *Pliobatrachus* survives at least until the Middle Pleistocene (MLYNARSKI 1977). It is hoped that the study of other anuran groups (e. g. *Ranidae*), still in a somewhat chaotic taxonomic status, will give results of importance in this area.

Dr. Francisco de Borja SANCHÍZ
Departamento de Paleontología
Instituto „Lucas Mallada” (C. S. I. C.)
c/J. Gutierrez Abascal 2.
Madrid (6), Spain

Prof. Dr. Marian MLYNARSKI
Institute of Systematic and
Experimental Zoology, Polish
Academy of Sciences,
Ślawkowska 17, 31-016 Kraków, Poland

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STRESZCZENIE

Na podstawie nowego materiału dokonano uzupełnień do wykazu kopalnych płazów bezogonowych (*Anura*) z neogenu Polski, należących do rodzin *Discoglossidae*, *Palaeobatrachidae*, *Pelobatidae* i *Hylidae*. Ustalono i zrewidowano stanowisko systematyczne „*Discoglossus giganteus*” — *Latonia* (por. MLYNARSKI 1976).

W pliocenie polskim stwierdzono obecność najstarszych ze znanych dotychczas szczątków rodzaju *Bombina*, formy morfologicznie bardzo bliskiej *Bombina bombina*. W tym samym okresie geologicznym, razem ze współczesnymi gatunkami *Pelobates fuscus* i *P. syriacus* (*Pelobatidae*), potwierdzono obecność kopalnego rodzaju *Eopelobates*. Opisano również liczne elementy szkieletu nie znane dotychczas dla rodzaju *Pliobatrachus*, na podstawie których można było ugruntować jego stanowisko generyczne i przedstawić nową diagnozę tego paleobatrachida.

Praca niniejsza została wykonana w ramach problemu resortowego MR. II. 3 dzięki przyznaniu dr F. B. SANCHÍZOWI stypendium wymiennego Polskiej Akademii Nauk z hiszpańskim Consejo Superior de Investigaciones Cientificas dla odbycia stażu w Zakładzie Zoologii Systematycznej i Doświadczalnej PAN w latach 1977 i 1978.

RESUMEN

Con base en nuevo material, se presentan algunas adiciones al registro fósil de los anuros del Neógeno polaco, correspondientes a las familias *Discoglossidae*, *Palaeobatrachidae*, *Pelobatidae* e *Hylidae*. Se discute el status taxonómico del complejo *Latonia*—„*Discoglossus giganteus*” (comp. MŁYNARSKI 1976).

El Plioceno polaco ha proporcionado los restos más antiguos conocidos del género *Bombina*, con una forma morfológicamente muy cercana a la especie *Bombina bombina*.

En el mismo periodo, y junto a los vivientes *Pelobates fuscus* y *P. syriacus* (*Pelobatidae*), se aprecia la pervivencia del extinto género *Eopelobates*.

Se describen varios elementos previamente desconocidos del extinto *Pliobatrachus* (*Palaeobatrachidae*), lo que permite su revalidación genérica y la propuesta de una nueva diagnosis.

Dicho trabajo fue realizado en años 1977—1978 bajo de un proyecto científico MR. II. 3. El que lo realizo fue Dr. F. B. SANCHÍZ que obtuvo una beca en el Instituto de Zoología Sistemática y Experimental, APCs. en Cracovia en base de un convenio entre Academia Polaca de Ciencias y Consejo Superior de Investigaciones Cientificas de España.

