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***Discoglossus giganteus* WETTSTEIN - WESTERHEIMB, 1955 (*Discoglossidae*, *Anura*)
from the Miocene of Przeworno in Silesia (Poland)**

[Pp. 1—12, pl. I; 2 text-figures]

Discoglossus giganteus WETTSTEIN-WESTERHEIMB 1955 (*Discoglossidae*, *Anura*)
z miocenu Przeworna na Śląsku (Polska) *

Discoglossus giganteus WETTSTEIN-WESTERHEIMB, 1955 (*Discoglossidae*, *Anura*) из миоцена
Пршеворно в Силези (Польша)

Abstract. Bones and bony fragments belonging to several big individuals of *Discoglossus giganteus* from the fossil fauna of Upper Vindobonian age from Przeworno in Silesia are described. In morphology these remains correspond to the analogous skeletal fragments of the holotype from the Miocene of Dévinská Nová Ves (Slovakia, ČSSR) and to the bones of specimens from the Pliocene of Arondelli (Italy). The systematic position of the species *D. giganteus* is discussed special attention being given to the remains from Przeworno; The significance of the occurrence of this form to the ecological and climatological interpretation of the locality is briefly referred to and the remains of reptiles and amphibians so far found at Przeworno are mentioned in the introductory part.

I. INTRODUCTION

Discoglossus giganteus is the largest known member of the family *Discoglossidae* Guenther, 1858 (= *Bombinidae* Fitzinger, 1826, nom. corr. ŠPINAR, 1969). This species has been described from a quarry at Dévinská Nová Ves (Neudorf a. d. March) near Bratislava, Slovakia, ČSSR, by WETTSTEIN-WESTERSHEIMB

* Praca wykonana w ramach planu resortowego PAN-27.

(1955). The well-preserved isolated bones of this amphibian come from the Middle Miocene loams of the "D" horizon. The author suggests that the occurrence of bones of anurans in this layer may have been caused by the accumulation of owls' pellets there.

Dr. FEJFAR found a bony material of this species in the Middle Miocene locality at Frantiskovy Lázně in Czechoslovakia. It has been described shortly by ŠPINAR (1972, p. 229, Pl. 182 and text-fig. 92).

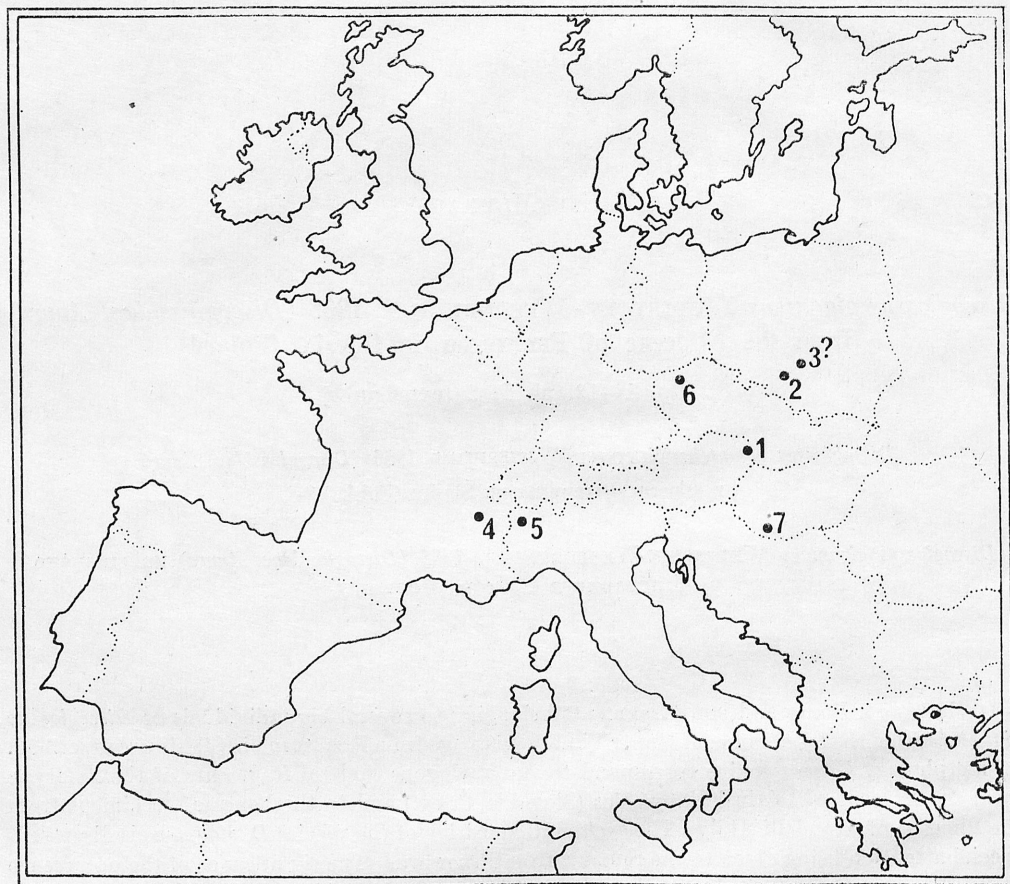


Fig. 1. Distribution of *Discoglossus giganteus* in the Tertiary of Europe. 1. Dévinská Nová Ves, 2. Przeworno, 3. Weże I., 4. La Grive-Saint-Alban, 5. Arondelli, 6. Frantiskovy Lázně, 7. Villany VI. Del. K. MALCZEWSKI

The remains of a large discoglossid from the classic Miocene locality at La Grive-Saint-Alban in south-eastern France, mentioned by VERGNAUD-GRAZZINI (1966), probably belong to the same species.

The occurrence of *Discoglossus giganteus* in the Upper Pliocene ("Villafranchian ancien") at Arondelli near Villafranca in Piedmont, Italy (VERGNAUD-GRAZZINI, 1970), proves its evident phylogenetic longevity. This locality has

provided a fairly abundant material, which added much to our knowledge in so far as the osteological structure of the species under study is concerned.

Discoglossus giganteus may have occurred also in the Pliocene of Poland. From the known locality Weże I described but few and fragmentary remains of a large discoglossid (*Discoglossus* sp.), which may well have belonged to a member of the species discussed (MLYNARSKI, 1961, 1962).

According to VERGNAUD-GRAZZINI (1970), the occurrence of *Discoglossus giganteus* at the Pliocene locality Villany 6 in Hungary cannot be excluded. It is well known that from this locality we have remains of various amphibians, including discoglossids, which so far have been only mentioned in Hungarian publications.

All the remains described in the present paper were collected during the palaeontological exploration made by the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences, at Przeworno in 1974 and belong to the collection of fossil vertebrates of this Institute in Cracow.

II. LOCALITY

The locality Przeworno II has been described by GLAZEK, OBERC and SULIMSKI (1971). These authors determined its age as Younger Vindobonian (Middle Miocene). Further data concerning this locality are given by KOWALSKI and ZAPFE (1974), who demonstrated its resemblance in fauna to other Miocene localities in Europe. Przeworno II is a typical karst crevice extending obliquely to the rock wall of the quarry and filled with loam. If mammalian remains are fairly often met with in the material from this locality, only few and poorly preserved bone fragments of reptiles and amphibians have been found hitherto. These last remains are chiefly fragments of turtle shells of hardly any taxonomic value. On the basis of the material collected by the workers of the Institute and by Dr SULIMSKI at the localities Przeworno I and II it may be supposed that they are probably the same forms as those encountered at Nowa Wieś Królewska near Opole (?*Geoemyda erureia* WERGEN; *Emydidae*, *Batagurinae*; WEGNER, 1913; KHOSATZKY and MLYNARSKI, 1966). The occurrence of similar forms (KHOSATZKY and MLYNARSKI, 1966) confirms the supposition (KOWALSKI and ZAPFE, 1974) as to the relationship of the Miocene localities at Opole and Przeworno.

It was only in 1974 that fairly numerous and well-preserved anuran remains and a vertebra of a small snake of the family *Colubridae* were found. Nearly all bone fragments of anurans belonged to members of one large discoglossid form, whose systematic position can be fairly closely determined on the basis of these remains. It may well be that the practically unidentifiable material of small elements contains remains of rather large frogs (*Ranidae*). This supposition will probably be confirmed and more details about the whole of the herpetofauna of the site examined obtained, when more material has been collected in the following years.

III. DESCRIPTION OF MATERIAL

The bones of *Discoglossus giganteus* were found accumulated in a small area. They belonged to a small number of individuals of various size, several of them being very large. It is interesting that the bones of the same specimen were found either at one spot, as if "in situ", or a dozen to several dozen centimetres apart. A few of the bones were successfully removed from rock, others were damaged, some of them still in the period preceding the process of fossilization. This fairly abundant material comprises elements of the skull, the axial skeleton and the skeleton of hind limbs. Some of the bones are of essential taxonomic importance and the systematic position can be determined exactly on their basis. These bones are described in detail in order of taxonomic importance below. The bones, or rather their fragments, which are of no importance to the determination of the material are mentioned at the end of the description. All the skeletal elements of *Discoglossus giganteus* from Przeworno II are in the possession of the Institute of Systematic and Experimental Zoology (Inventory No. AF. 77/75).

Os ilium

Material: 10 fragments of ilium of specimens varying in size; 9 of these fragments include the part that surrounds the acetabulum and one is of the distal portion of the ala with the vexillum.

The best preserved fragments of the ilium are shown in Pl. I. Special attention should be given to the fragment of the ilium of a large specimen (2) with its ascending part (processus = pars ascendens ilii — p. a. i.) characteristic of discoglossids preserved complete. The length of this bone from the tip of the process mentioned to the end of the broken ala (processus iliacus) is 20 mm. The structure of the acetabulum and the distinct typical tuber superius (t.s.) are very well preserved in this fragment. The spina pelvis anterior (s.p.a.) is strongly marked in the pars ascendens (p.a.i.). In this fragment the crista ossis ilii (= vexillum ossis ilii — c.o.i.), which begins behind the tuber superius, is broken. On comparing the length of this fragment with that of the distal fragment of the ala of a specimen more or less equal in size, we may assume that the overall length of the bone before its being damaged was at least 45 mm. As regards the other fragment mentioned (Pl. I, 1), the vexillum is perfectly well preserved. The lamina is very fine, strongly convex towards the inner part of the bone; in this connection it forms a characteristic broad groove, visible on the internal side. The vexillum runs all along the edge of the ala and is a generic character. The shape of the complete ilium (Fig. 2) can be easily restored on the basis of these two fragments and the other ones mentioned in the specification of material.

Os sacrum (vertebra sacralis)

Material: Two damaged sacral vertebrae belonging to two big specimens, more or less equal in size.

In both these vertebrae the structure of the condyles, the caput gleinoidalis anterior (c.g.a.) and the caput duplex glenoidale posterior (c.d.g.p.), is well seen. Thus, at first sight they both resemble the sacrum of anurans, the group *Diplasiocoela* (*Ranidae*), all the more so as one of them has not a single lateral process (processus transversus vertebrae sacralis — p.t.v.s.) preserved. It was possible to restore the shape of these processes, important to taxonomy, on the basis of the other specimen, in which however the centrum itself is damaged. After reconstruction (Fig. 2) the shape of the sacral vertebra corresponds to that of the sacrum in the holotype from Slovakia (WETTSTEIN-WESTERHEIMB, 1955, Pl. 1, Fig. 1b). It is noteworthy that the bones discussed here are considerably larger than those described by the above-mentioned author. For example, in our case the distance between the tips of the two transverse processes approximates 20 mm, whereas in the typical form it does not exceed 15 mm.

Vertebrae

Material: Three well-preserved dorsal vertebrae of big specimens.

All the vertebrae preserved have their transverse processes damaged. Their centra are relatively poorly developed compared with the part of the neural arch that forms a broad roof over the wide neural canal, comparatively larger

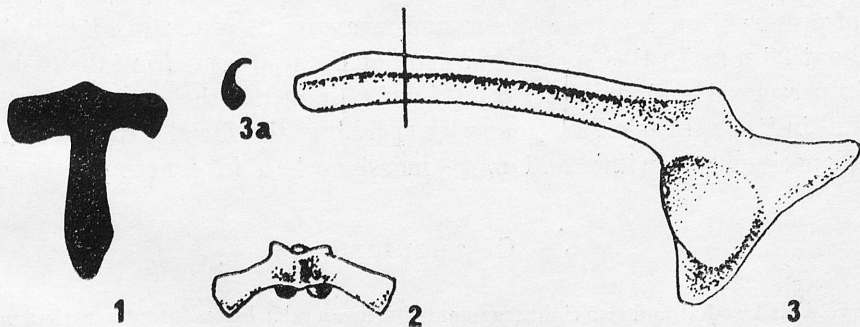


Fig. 2. Reconstructions. 1. Parasphenoid, 2. sacrum (sacral vertebra), 3. ilium, 3a. cross section of the processus iliacus with crista ossis ilii (vexillum). Del. K. MALCZEWSKI

than it is in modern species. All the vertebrae are opisthocoelous. The lateral epiphysis is preserved in the incomplete vertebrae VD-1 and VD-2. It is robust, broad and turned forward. Unfortunately this vertebra has its neural part destroyed. The remains of the lateral apophyses are preserved on vertebra VD-5, which can be recognized by their almost perpendicular deflection from the centrum of the vertebra. The carina neuralis, distinct and well developed

in the other vertebrae, is here poorly developed and damaged. It is difficult to determine the serial numbers of the other vertebrae, the more so as their broken processes are for the most part turned caudally. It is however noticeable that their centrum is pushed forward rather far beyond the margin of the characteristically sculptured massive plate of the neural arch. The articular junctions, i.e. the *cavitas glenoidalis posterior* and the *caput glenoidalis anterior*, are small in relation to the total mass of the vertebra. In general, the build of the vertebrae preserved in our material agrees with that of the vertebrae of the holotype and with the description of the vertebrae from Arondelli, especially VD-8 (VERGNAUD-GRAZZINI, 1970, Pl. 1, Fig. 9), which in our material is preserved probably in the analogous state, being however considerably larger (about 9 mm long).

Os maxillare

Material: Right maxillary bones of two individuals differing in size.

This is the first find of the above-named bones from members of the species *Discoglossus giganteus*. Preserved nearly complete, though with their edges crumbled, the maxillae have the characteristic "original" sculpture of the external surface. In the larger specimen there are furrows as if after subcutaneous blood and lymph canals in the place where the skin and the bone surface grow closely together. Fine small teeth are arranged loosely as in contemporary forms. It is hard to estimate the overall length of the bone and to restore its shape with both specimens. The fragment of the larger maxilla is 23 mm long, so the total length may have been 30 mm. The fragment of the shorter bone is in a better state of preservation, has lesser losses and measures 21 mm; thus, its total length was about 23 mm. In this specimen a part of the *processus frontalis ossis maxillaris* is preserved and its width and height indicate the strong vaulting of the skull in its nasal portion. Generally speaking, the facial part of the maxilla of our specimens is wider and more massive than in contemporary species.

Os angulare

Material: Two left and two right fragments of the angular bones from the articular portion of the mandible, of which two belonged to the same relatively small individual (length of these last fragments — about 16 mm).

The mandibular fragments preserved are marked by their robust structure. The *sulcus pro cartilagine Meckeli* is deep and very distinct. On the internal surface of the bone are the very well developed *processus "coronoideus"* and the *processus paracoronoideus*, characteristic only of the species under study and probably of other fossil discoglossids, in the form of a blunt protruding edge, vertical to the previous process (the role of these processes as the attachments for the muscles of the mandible has been discussed more closely by VERGNAUD-

GRAZZINI, 1970, p. 50). The length of the largest preserved fragment of the angulare is about 20 mm, and so it is evidently smaller than the holotype from Nová Ves but nearly twice as large as the specimen from Arondelli.

Os parasphenoideum (= os parabasale)

Material: Complete parasphenoid of a large individual and a parasphenoid fragment of a smaller individual, probably of the same species.

A complete 20-millimetre parasphenoid of a large specimen is preserved in our material. The edge of its left lateral process is broken off but the right process is complete, which permits the restoration of the shape of the whole bone (Fig. 2). The width, measured between the ends of the lateral processes, may therefore have been about 18 mm.

The shape of our parasphenoid resembles that of the incomplete parasphenoid of the holotype (WETTSTEIN-WESTERHEIM, 1955, Pl. 1, Fig. 1b), but this last shows a certain "pathological" asymmetry.

The fragment of the parasphenoid of the smaller specimen differs clearly from that described above. Its lateral processes (pars lateralis) are poorly developed and taper pointedly instead of swelling at ends. Consequently, it may be the parasphenoid of another anuran, e.g. one of the genus *Bufo*. It may well be as well that in the species discussed the dilation of the lateral processes accompanies the growth of the specimen.

Os humeri

Material: Nearly complete left humerus of a large individual, 35 mm long; headless right humerus of a smaller individual, about 28 mm in length; three right humeral heads of large specimens, more or less the same size.

The structure of the bones preserved is typical of discoglossids; the distal head (eminentia capitata) is not quite symmetrical in relation to the long axis of the bone, which is due to the strong development of the epicondylus ulnaris and the much weaker development of the epicondylus radialis. In our specimens the crests are very pronounced. Thus apart from the broad crista ventralis, the small but distinct and strong crista ventralis lateralis occurs vertical to it. The presence of this edge is characteristic of the modern genera *Discoglossus* and *Alytes* (RAGE, 1974, p. 286, Fig. 8, 1—2). The crista medialis is also well developed in our specimens. According to RAGE (1974) the humerus is a bone of essential taxonomic importance but more difficult to determine than, e.g. the ilium. Thanks to the good state of preservation of the fragments the determination is unquestionable in our case. We are here concerned with humeri typical of big discoglossids, analogous to the corresponding bones from Arondelli.

Os femoris

Material: Three femoral fragments without articular surfaces. The longest of the specimens measures 45 mm.

These femoral fragments are marked by their slender structure. The longest and best preserved fragment is bent, characteristically of this bone, in the shape of an "s". The articular surfaces, which in discoglossids remain cartilaginous or poorly ossified throughout life, have not been preserved. The margins of the attachments for muscles are poorly seen. These bones are of minor taxonomic importance, but in comparisons they give an idea of the size of the whole animal.

Os cruris (tibio-fibulare)

Material: One nearly complete right cruris and five fragments belonging to several large individuals.

Although this bone is itself of no major taxonomic importance, its length, as in the previous case, permits the estimation of the size of specimens from Przeworno. The nearly complete right cruris (Pl. I, 3) is 60 mm in length. Special attention should be given to the lateral edge in the distal portion of the pars fibulare. On the external and internal surfaces of this bone, using a magnifying glass, one can see small round foramina for supplying arterial branches (arteria nutritia ossis cruris posterior et inferior).

Material of No Taxonomic Importance

In our case this group of bony material contains five small fragments of the os antibrachium (radio-ulna) of large individuals, a well-preserved fragment of the pelvis including the right and left ischium and pubis, united with each other and making up the margin of the acetabulum of a large individual, small fragments of the bones of limbs and indeterminable fragments of the shoulder girdle, digits, vertebrae and, probably, skull.

IV. SYSTEMATIC POSITION OF *DISCOGLOSSUS* FROM PRZEWORNO

The anuran remains described above could be easily referred to the members of the family *Discoglossidae* on the basis of the opisthocelous structure of the vertebrae, above all, the sacral vertebra. The morphology of the ilium is here also decisive, especially the marked development of the processus (= pars) ascendens. Well seen and very convex, as in contemporary *Rana arvalis* NILSEN, the vexillum is characteristic of the genus *Discoglossus* and in RAGE's (1974, p. 284) opinion, it is of indisputable taxonomic importance. The structure of the humerus is also typical of the same contemporary genus. The size of the

bones and their fragments preserved resembles that of the specimens from Dévinská Nová Ves and Arondelli. The determination of specific membership is therefore relatively easy also in our case.

The bones from Przeworno are marked by their large size. They mostly belonged to individuals which were considerably larger than the specimens from the two above-mentioned localities. Notwithstanding, they represent the same type of morphological structure. They should be included in the species *Discoglossus giganteus* on the basis, among other things, of the structure of the articular portion of mandible (angulare — “angulaires munis d’une crête paracoronoid volumineux doublant le processus coronoid vers l’extérieur”, VERGNAUD-GRAZZINI, 1970, p. 52). Similarly, as regards the structure of vertebrae, special attention should be given to the greater displacement of the centrum in relation to the neural arch than in modern species, observed in the specimens from both Slovakia and Italy.

Apart from the foregoing, a number of characters unobserved in the previous specimens were found in the material from Przeworno. They concern the structure of the parasphenoid, hitherto known only from a very incomplete fragment, and the maxillare, which has not been found in other localities.

With regard to the characters of *Discoglossus giganteus* which differentiate it from the modern species *Discoglossus pictus* OTTH, it may be assumed that to a certain extent they are connected with the considerably larger size of the fossil species. It is characteristic that both forms are in fact very similar to each other (e.g. structure of humerus and ilium). Therefore, in spite of great differences in age, I see no grounds so far for the distinction of a separate genus for the species under discussion.

Discoglossus giganteus is a member of the “archaic” group of *Anura*, which now has a relict character and is marked by its clearly disjunctive geographical distribution (see VERGNAUD-GRAZZINI, 1966, p. 51, Fig. 10). The species under study was, like some turtles, exceptionally long-lived phylogenetically, which is indicated by its occurrence from the Middle Miocene to the Upper Pliocene, and perhaps even to the very beginning of the Pleistocene. In the younger Tertiary this form was undoubtedly widely distributed in the present European territory (see Fig. 1). The presence of this species has been ascertained in three localities, but we know about the occurrence of other “large discoglossids” in several other sites mentioned at the beginning of this paper and plotted on the map. Perhaps in future it will be possible to include several forms of the family *Discoglossidae* described under different genera and species among the synonyms of this form.

V. ECOLOGICAL AND CLIMATIC INFERENCES

During their active life all discoglossids are closely associated with water. In the Miocene they probably occupied the ecological niche of some of edible frogs (“*Rana esculenta*”, VERGNAUD-GRAZZINI, 1970). On the other hand,

members of this group did not hibernate or spend an unfavourable spell under water at the bottom of a reservoir but buried in the ground. Neither are they as a rule met with on large water reservoirs and their ways of living resemble those of *Rana lessonae* CAMERANO. In our case we may have been concerned with the remains of several individuals which buried themselves in earth, looking for shelter in a damp karst crevice during drought.

The members of the genus *Discoglossus* are notably thermophilous. Now they live in Europe in the warmest regions of Spain and southern France, whereas another geographical race (*Discoglossus pictus sardus* TSCHUDI) inhabits several islands in the Mediterranean Sea. They well tolerate very high temperatures, reaching 30°C. The presence of a big member of this genus in the fauna of Przeworno therefore points to a hot subtropical though not necessarily damp climate. A fairly great resistance of the members of *Discoglossus giganteus* to changes in climate and even to its cooling is confirmed by their occurrence not only in Italy but probably also in Central Europe in the Pleistocene. This is indubitably connected with the association of this form with very specific water environments marked by a peculiar microclimate and also with its capability of burying itself in earth.

Discoglossus giganteus did not outlive the rapid leaps in climate in the Pleistocene. Its dwarfed relatives were driven far to the south and there they now subsist in refuges. They have never returned to Central Europe, where instead members of the genera *Alytes* and *Bombina*, well adapted to cool weather and occupying different ecological niches, appeared in the Pleistocene and have survived up to the present time.

Translated into English
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STRESZCZENIE

Z wypełnienia krasowej szczeliny w Przewornie (Przeworno II) na Śląsku opisano kości kilku osobników *Discoglossus giganteus* WETTSTEIN-WESTERHEIM, 1955 (*Anura*, *Discoglossidae*). Fauna tego stanowiska, jak wynika z dotychczasowych opracowań (GŁĄZEK, OBERC, SULIMSKI 1971 oraz KOWALSKI i ZAPFE 1974), pochodzi z górnego Vindobonian.

Kości płazów bezogonowych (*Anura*) opisane w niniejszej publikacji odpowiadają morfologicznie kościom okazów z Dévinská Nová Ves na Słowacji (ČSSR) oraz Arondelli w Piemonte we Włoszech. Okazy nasze były przeważnie większe od form opisanych dotychczas. Opisane szczątki kostne uzupełniają znajomość morfologii szkieletu *Discoglossus giganteus*. Był to gatunek filogenetycznie długowieczny, szeroko rozsiadlony w Europie od środkowego miocenu po granicę pliocenu z plejstocenem. Była to prawdopodobnie forma ciepłolubna, ale stosunkowo wytrzymała na niezbyt drastyczne zmiany klimatyczne.

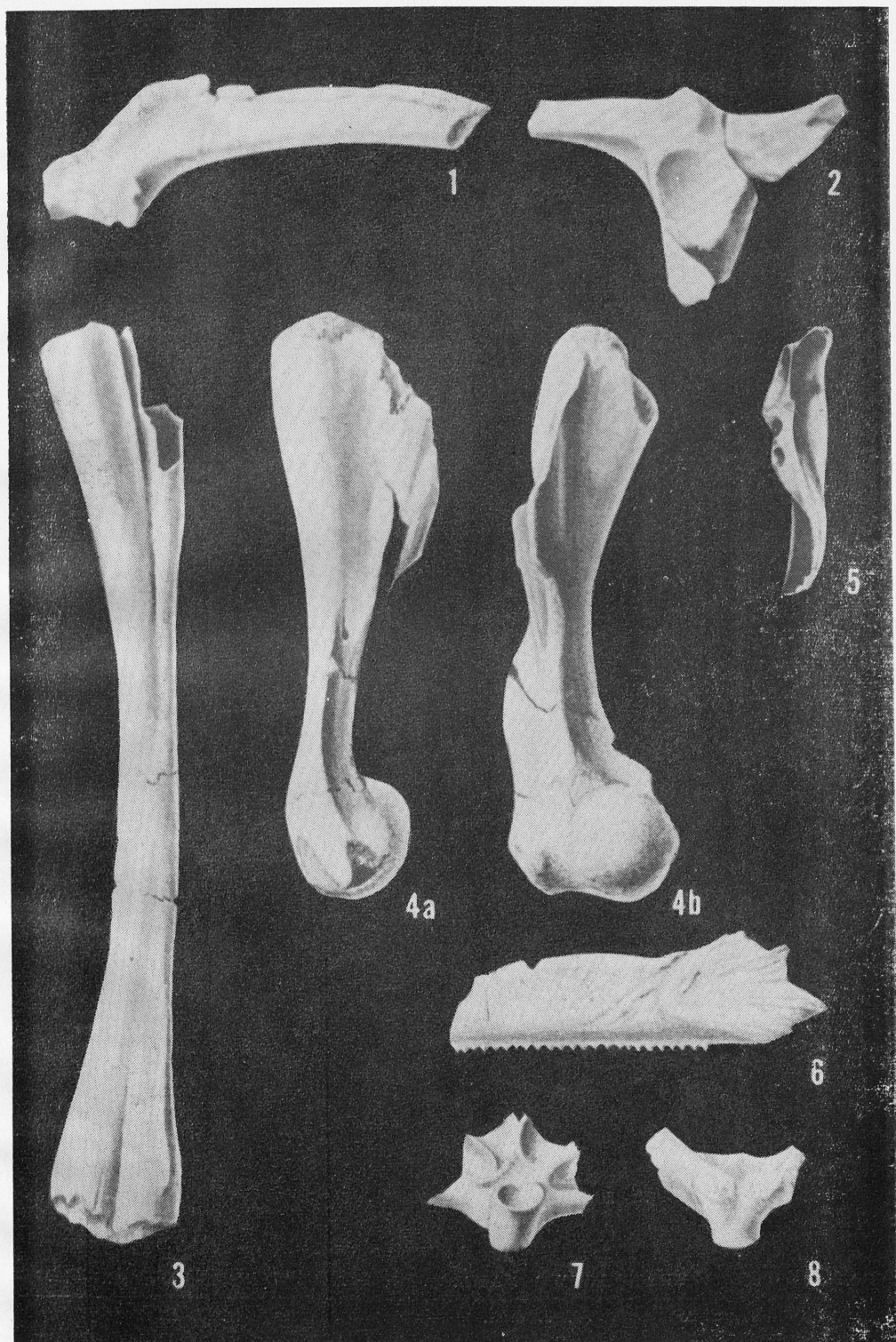
РЕЗЮМЕ

Из выполнения карстовой трещины в Пшеворне (Пшеворно II) на Силезии описано кости нескольких особей *Discoglossus giganteus* WETTSTEIN-WESTERHEIM 1955 (*Anura*, *Discoglossidae*). Фауна этого места находки, как вытекает из работ (GŁĄZEK, OBERC, SULIMSKI 1971, а также KOWALSKI и ZAPFE 1974) происходит из верхнего Виндобоняна.

Кости бесхвостых амфибий (*Anura*), описанные в настоящей работе морфологически соответствуют костям экземпляров из Девинска Нова Вес в Словакии (ЧССР) и Аронделли в Пьемонт (Италия). Наши экземпляры были преимущественно большие форм описанных до сих пор. Описанные костные фрагменты дополняют познание морфологии скелета *Discoglossus giganteus*. Это был филогенетически долговечный вид, широко распространённый в Европе от среднего миоцена по границу плиоцена из плейстоценом. Это, вероятно, была теплолюбивая форма, но, относительно, выносливая на не особенно резкие климатические изменения.

Plate I

Discoglossus giganteus WETTSTEIN-WESTERHEIMB from Przeworno. 1—2 ilium, 3 — cruris, 4a nad 4b — humerus in two views, 5 — angulare, 6 — maxillare, 7 — dorsal vertebra, 8 — sacral vertebra (about 2,5 natural size)



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