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THE ONTOGENY AND EVOLUTION OF *KOZŁOWSKIELLA* (PŘIBYL) (OSTRACODA)

Abstract. — This paper deals with results of investigations on genus *Kozłowskiella* (Přibyl) from Middle Devonian beds in localities Wydryszów, Grzegorzowice and Skały (Holy Cross Mountains, Poland). The assignment of the mentioned genus to *Ulrichia* Jones as its subgenus — as advocated by Přibyl — is here rejected. Ontogeny and variability of described forms, including some new species, are analyzed.

INTRODUCTION

This paper presents information obtained during researches on ostracods of the genus *Kozłowskiella* (Přibyl) from the Middle Devonian of the Holy Cross Mts.

The copious material, on which the investigations are based, has been collected by the writer in localities of Wydryszów, Grzegorzowice and Skały in 1955 and 1956. No ostracod descriptions have thus far been published from the first two of these localities and the material now collected there sheds some light on the evolution of the Middle Devonian genus *Kozłowskiella* (Přibyl). The ontogeny and variations of the here described species have been studied in detail, hence it has been possible to determine the mutual relations between these forms as well as the modifications which they experience in the course of ontogeny.

The relation of *Kozłowskiella* to *Ulrichia* Jones has also been analyzed. According to A. Přibyl (1953) *Kozłowskiella* is a subgenus of *Ulrichia*. The present writer, however, has arrived at the conclusion that *Kozłowskiella* should be separated into a distinct genus and, in regard to its dimorphism, perhaps similar to the cruminal one, probably placed within the family Beyrichiidae.

The author here expresses his warmest gratitude to Prof. Dr. R. Kozłowski for the valuable suggestions and criticism generously offered during the preparation of the paper. Many thanks are also due to Dr. Z. Kielan for reading the manuscript and to Mrs. J. Humnicka for translating the text into English, as well as to Miss L. Łuszczewska for the pains taken in doing the photographs.

Cordial thanks are also due to Dr. E. N. Polenova of the VNIGRI Institute in Leningrad, for her gift of comparative material and for facilities offered to inspect the rich ostracod collection from Devonian beds of the USSR during the writer's visit to Leningrad in 1957.

The present work is the second in a series of papers to be devoted to Devonian ostracods from the Holy Cross Mts.[1]

TERMINOLOGY

The terms used here for the various morphological elements of the carapace are those introduced by I. Hessland (1949), R. V. Kessling (1951), A. Martinsson (1956) and V. Jaanusson (1957). Furthermore, there are also some terms introduced into literature by G. Henningsmoen (1954) and accepted by the present writer.

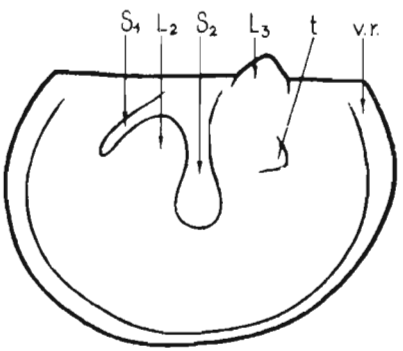


Fig. 1. — Ornamental details of carapace surface; *S1* anterior sulcus, *L2* median lobe, *S2* median sulcus, *L3* posterior lobe, *t* tubercles, *vr* velar ridge.

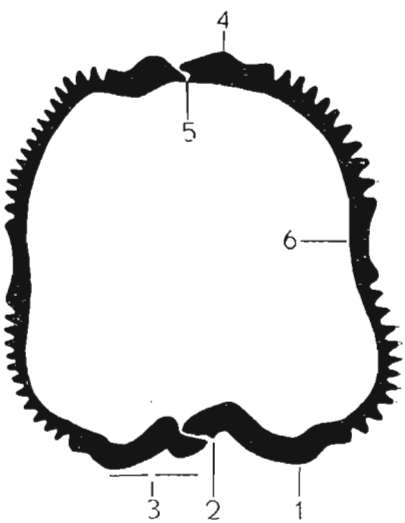


Fig. 2. — Transverse section of carapace of female *K. praetuberculata* n. sp., simplified; *1* velar ridge, *2* admarginal ridge, *3* subvelar area, *4* dorsal plica, *5* hinge groove, *6* muscle scar.

An additional term is that of "dark lines" used to designate peculiar microscopic structure elements of the carapace which have been investigated in thin sections of representatives of genus *Kozłowskiella* (Přibyl).

[1] The first paper: F. Adamczak, *Polyzygia* Gürich, an Ostracod genus from the Givetian of the Holy Cross Mts. — *Acta Palaeont. Pol.*, vol. I, No. 1, pp. 35—48.

These are dark lines vertical to the surface of the carapace and arranged to form distinct reticulation of the carapace.

In what the marginal valve elements are concerned it has been ascertained that the so-called admarginal ridge is gradually transformed into admarginal tubercles. Both these elements are, therefore, homologous and may be of some significance for the comparison of related forms (fig. 1-4).

MATERIAL AND METHODS OF WORK

The material studied in the present paper has been yielded by marly-argillaceous beds of Middle Devonian age in the Łysogóry region of the Holy Cross Mts. Samples were taken in the localities of Wydryszów, Grzegorzowice and Skały. Within the two first named localities the occurrence is noted of fairly complete Lower Couvinian (Eifelian) series. In either of these localities, however, the Couvinian series are represented by a slightly different facial type and, most likely, they do not belong

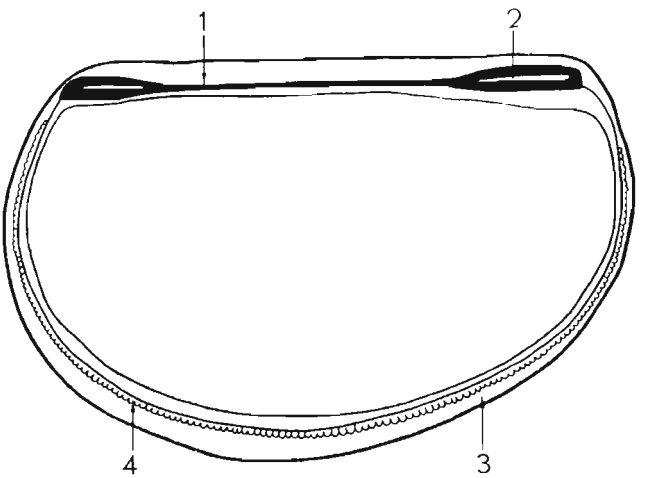


Fig. 3. — *K. kozłowskii* (Přibyl), right valve, inside view (diagram somewhat schematic); *1* hinge groove, *2* list, *3* velar ridge, *4* admarginal tubercles.

to exactly the same stratigraphic horizon. It rather seems that the Wydryszów complex is older than that of Grzegorzowice. That this is so may, to a certain extent, be inferred from the quantitative share of the

three representatives of genus *Kozłowskiella* (Přibyl) yielded by the two successions.

The state of preservation of the ostracod fauna is not everywhere uniform. On the whole quite a number of the Wydryszów zones display

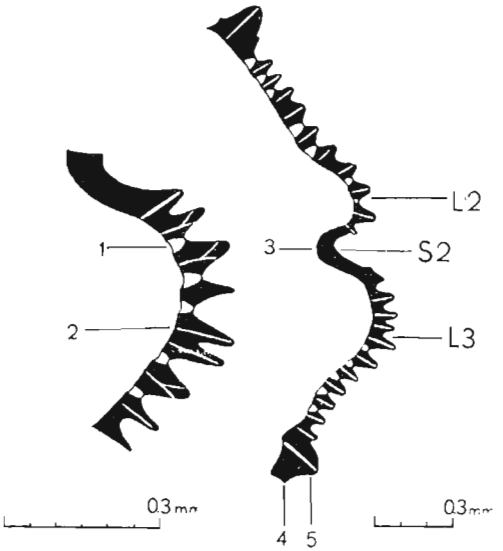


Fig. 4. — Longitudinal section of right valve of *K. praetuberculata* n. sp. (schematic diagram); *1* pore canals, *2* dark line, *3* muscle scar, *4* admarginal ridge, *5* velar ridge.

populations in excellent state of preservation, containing a fair abundance of representatives of all, even the youngest ontogenetic stages. Only within the basal parts, the valves are scarce and damaged so that it was possible to collect but some few specimens. The Grzegorzowice material is less complete, since large parts of the section here are covered by loess. Ostracod valves from the basal portions of that section have not been studied at all in view of their unsatisfactory state of preservation. The upper portions of the Grzegorzowice succession have yielded a fairly rich faunal assemblage containing other fossils besides ostracods. However, when comparing the populations, collected from these two sections, the assemblage from Wydryszów is pronouncedly the richer one.

Within both these sections, the occurrence is noted, besides ostracods, also of bryozoans, brachiopods, trilobites and crinoids. Some foraminifers have been found too.

Material of Givetian age has been yielded by one horizon only, i. e. by the so-called brachiopod shales of the Skały series. The presence of representatives of genus *Kozłowskiella* (Přibyl) has not thus far been recorded from either the lower or the upper parts of the Skały section. Ostracod valves collected from the brachiopod shales are in an excellent state of preservation; they include the youngest instars too.

An analysis of this material has shown that we are here dealing with species *Kozłowskiella kozłowskii* (Přibyl 1953), closelly allied with the Couvinian forms.

In the Skały material the majority of specimens are adult forms, while in that from the Wydryszów section immature valves predominate. A total of approx. 3000 valves of genus *Kozłowskiella,* corresponding to various instars, has been collected from material sampled in the three mentioned localities.

The copious Wydryszów material has yielded some specimens, with carapaces of the younger instar still attached to them. These specimens no doubt represent the moment of moulting and, unquestionably, such immature forms may be regarded as necrocoenosis. The isolated valves, on the other hand, in the writer's opinion, represent mostly moulting material, in this particular case — a pseudocoenosis. Such observations can have some significance for the study of populations.

Samples taken from marly and marly-argillaceous rocks were macerated with Glauber's salt. The washing residuum was next examined under binocular microscope, using a simplified Triebel tray to pick out the microfossils.

Measurements were taken by means of an ocular micrometer under × 30 magnification. To carry out the measurement the valves were placed on a glass plate coated with a thin wax layer enabling a convenient orientation of the valves. This is a time-sparing method, as several hundred specimens may be placed for comparison on one glass plate.

Some valves were treated by hydrofluoric acid (I. G. Sohn, 1956; Ch. F. Upshaw and alies, 1957). The fluoridization method has produced good results. Many ornamentation and structure details may thus be studied in transmitted light without mutilating the valves as in the case of thin sections (fig. 5). 10% hydrofluoric acid was used by the writer. Detached valves were immersed in a wax vessel for about fifteen minutes and then taken out and washed with water. Carapaces, after treatment by acid, in most cases proved to be damaged, cracked, and unsuitable for study in transmitted light; whereas single valves studied in transmitted light, under a × 600 magnification, revealed even the most minute structural details.

No difficulties were encountered during segregation of copious material with immature forms. Kesling's method (1953c), warranting great economy of time, is a most suitable one for this purpose.

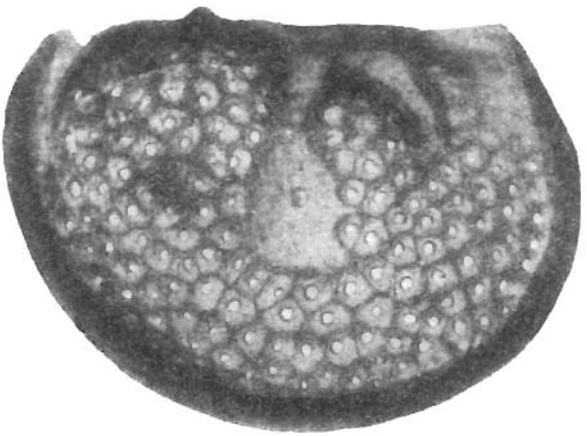


Fig. 5. — *K. praetuberculata* n. sp., right valve, fluoridized; × 40.

OBSERVATIONS ON THE VARIABILITY IN GENUS *KOZŁOWSKIELLA* (PŘIBYL)

The three new Couvinian species differentiated by the writer within genus *Kozłowskiella* (Přibyl) and that described from the Skały (Givetian) by A. Přibyl (1953) are genetically very closely interallied. The forms from the Couvinian constitute fairly well differentiated populations displaying two essential evolutionary trends.

The first trend is represented by *Kozłowskiella similis* n.sp. This species is with a prominent L3 and with elongated valves.

The other trend is represented by *Kozłowskiella tuberculata* n. sp., distinguished by a broad subvelar area and by the presence of two tubercles on L3. In addition, representatives of this species are of a size decidedly greater than that of the remaining forms. Associated with the same trend of evolution is the third species, namely *Kozłowskiella praetuberculata* n. sp., characterized by a tendency to produce tubercles on L3 (fig. 6).

K. praetuberculata n. sp. will be here discussed first, since it is apparently that from which the other forms have derived. Within Lower Couvinian rocks representatives of this species predominate in the majority of samples. On the evidence of analyzed material, yielded by successive horizons, a constant tendency to increase size has been ascer-

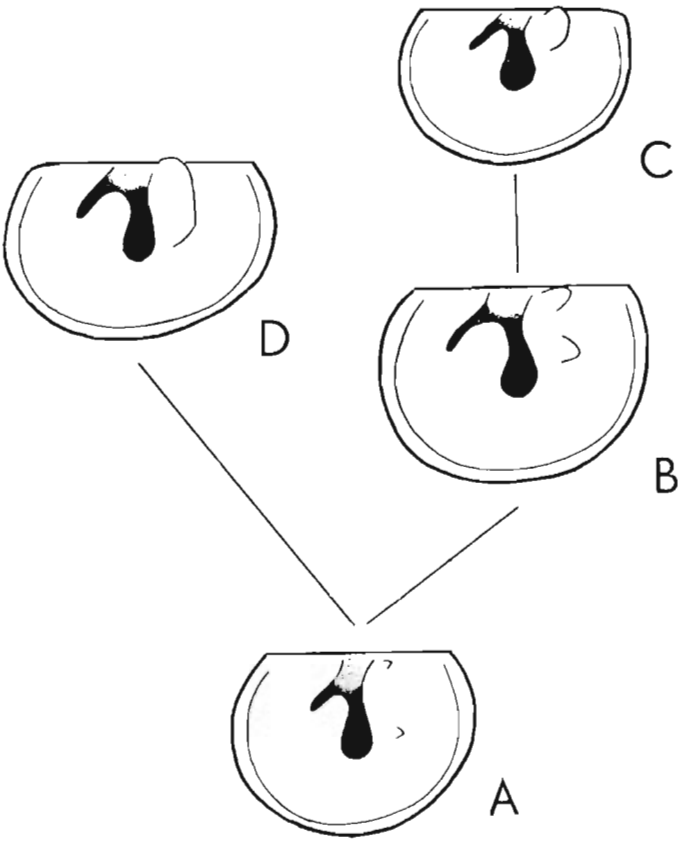


Fig. 6. — Mutual relationship between species of genus *Kozłowskiella* (Přibyl) in Middle Devonian layers of the Holy Cross Mts.; *A K. praetuberculata* n. sp., *B K. tuberculata* n. sp., *C K. kozłowskii* (Přibyl). *D K. similis* n. sp. (left valves).

tained as taking place here. Adult forms within the basal parts of the section as a rule do not exceed 1.9 mm in length. Within upper portions of the succession their length ranges from 1.8 to 2.15 mm, while forms with a length from 1.95 to 2.4 mm have been found within top horizons (fig. 7*A*, *B*). The outline of carapace is not subject to any greater variations. In particular instars the length/height ratio (fig. 8*a*) shows a mean figure of 1.33, indicating a nearly suboval shape of all these carapaces. Immature specimens do not display any important variations. Differences in respect to the quantitative per cent participation of *Kozłowskiella praetuberculata* n. sp., as compared against those of other here described species, are obviously important. *K. praetuberculata* n. sp. (fig. 9) is

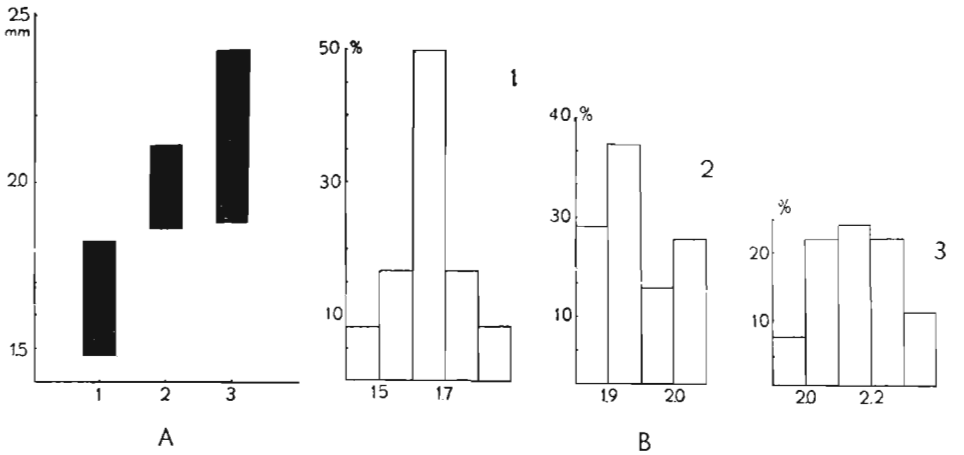


Fig. 7. — *A* Size of complete adult carapaces and of single left valves in *K. praetuberculata* n. sp. from three different Wydryszów horizons. Length of valves in mm — on ordinate, samples from successive layers — on abscissa. *B* Per cent figures of adult forms of *K. praetuberculata* in the faunal composition of three different Wydryszów horizons. Numbers of left valves and of complete carapaces in per cent figures — on ordinate, size in mm — on abscissa.

distinctly predominant in samples collected from the lower layers of the Wydryszów section. In the Grzegorzowice section (fig. 10), which has yielded relatively less abundant material (approx. 50 specimens), the participation of this species is smaller. The predominant form is here *K. similis* n. sp. which, on the average, represents 49.8 per cent of the total population. *K. tuberculata* n. sp. makes up only 4 per cent in samples from the Grzegorzowice section, but it is an interesting form owing to its intermediate position between *K. praeturberculata* n. sp. and *K. kozłowskii* from the Givetian. These three species are characterized by a constant ontogenetic trend to produce a broad subvelar area (fig. 11, 12), a prominent L3 and admarginal tubercles. A branch line in the evolution of this species is represented by *K. similis* n. sp. (fig. 6).

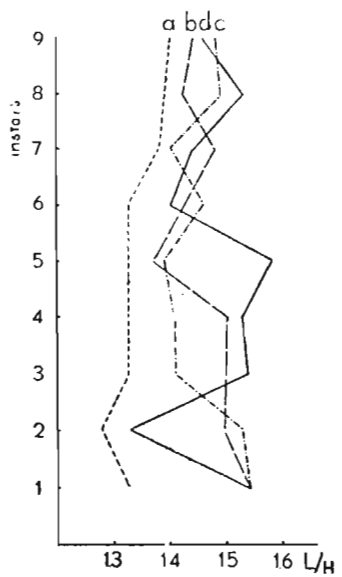


Fig. 8. — Length/height ratio of carapace in various instars; *a K. praetuberculata* n. sp., *b K. tuberculata* n. sp., *c K. kozłowskii* (Přibyl), *d K. similis* n. sp.

The numerical share of *K. tuberculata* n. sp. within the basal parts of the Wydryszów section does not exceed 10 per cent (fig. 9) of the total material in this sample.

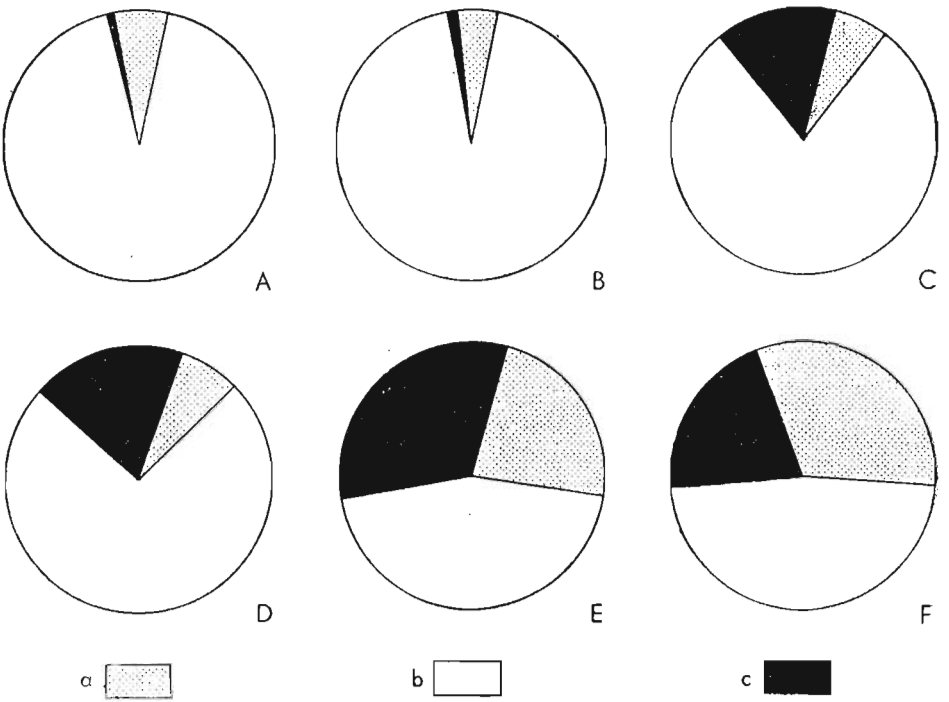


Fig. 9. — Per cent figures of three species of *Kozłowskiella* (Přibyl) in the faunal composition of six Wydryszów horizons; *A-F* successive horizons, *a K. similis* n. sp., *b K. praetuberculata* n. sp., *c K. tuberculata* n. sp.

Within the following higher layers the numerical participation of this species increases steadily. In the Grzegorzowice material, however, the first rank is occupied by *K. praetuberculata* n. sp. and *K. similis* n. sp. (fig. 13) whose numerical participation in the different samples varies strongly. Every maximum share of one species (e. g. *K. similis* n. sp.) corresponds to the minimum share of another one (*K. praeturberculata* n. sp.). *K. tuberculata* n. sp. has but few representatives.

K. kozłowskii, described by Přibyl from Givetian beds within the Skały section, apparently constitutes the terminal stage of the here considered evolutionary line. Even at first sight this form strongly differs from its predecessors. The most obvious difference lies in the smaller dimensions of its carapace whose length does not exceed 1.8 mm (fig. 14). The posterior lobe (L3) is prominent with outline resembling that of L3 in *K. similis* n. sp. There is, however, a fundamental difference between these elements in the two species. The posterior lobe in *K. kozłowskii*

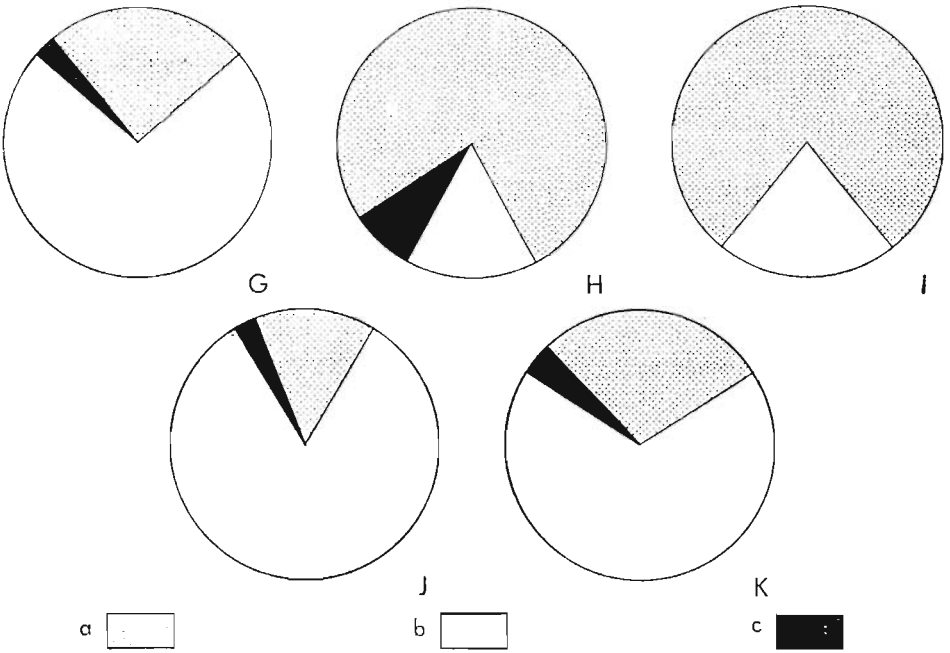


Fig. 10. — Per cent figures of three species of *Kozłowskiella* (Přibyl) in the faunal composition of five Grzegorzowice horizons; *G-K* successive horizons, *a K. similis* n. sp., *b K. praetuberculata* n. sp., *c. K. tuberculata* n. sp.

(Přibyl) has been produced by the gradual evolution of two tubercless, which finally merge into one prominent lobe (L3), while in *K. similis* n. sp. the same element has probably been formed in a saltatory mode, becoming constant in the following generations. Thus, the same detail of carapacial ornamentation has, within the same genus, evolved in two different ways and not contemporaneously, finally resulting in specific differentiation. This interpretation is also suggested by the ontogeny of the carapace (text-pl. I), which completely explains the gap within the available material derived from Upper Couvinian and Lower Givetian beds.

The changes experienced by the here considered species, during their evolution, were not, naturally, confined to one character only, speaking precisely, in this case to L3. The velar ridge and the formation of the so-called admarginal tubercles on the right valve of the ostracods are closely correlated with this ornamental detail. In specimens of *K. praetuberculata* n. sp. the subvelar part is narrow and its width in adult individuals does not exceed 0.4 mm: in addition, the so-called admarginal ridge (right valve) has developed along the free margin of the valve. The

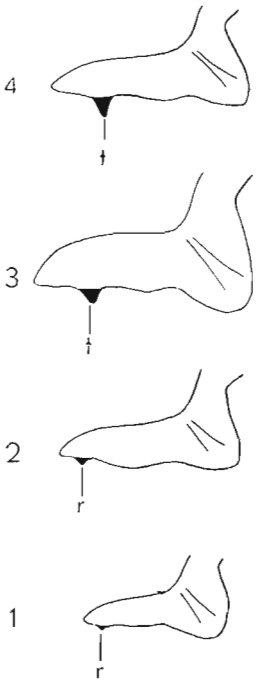


Fig. 11. — Cross section of ventral side of right valve (schematic diagram); *1 K. praetuberculata* n. sp., *2 K. similis* n. sp., *3 K. tuberculata* n. sp., *4 K. kozłowskii* (Přibyl), *r* admarginal ridge, *t* admarginal tubercles.

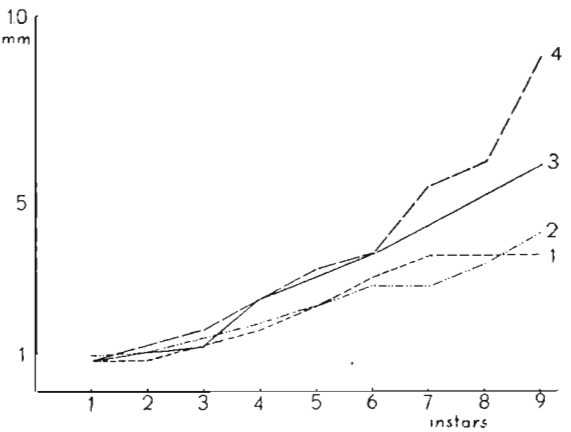


Fig. 12. — Width of subvelar area in various instars; *1 K. praetuberculata* n. sp., *2 K. kozłowskii* (Přibyl), *3 K. similis* n. sp., *4 K. tuberculata* n. sp. Width in mm — on ordinate, instars — on abscissa.

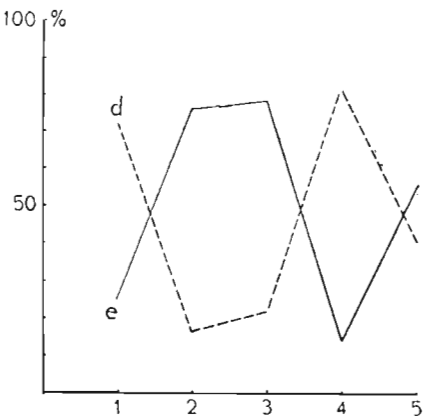


Fig. 13. — Per cent figures of two species of *Kozłowskiella* (Přibyl) in the faunal composition of five Couvinian horizons in Grzegorzowice; *d K. praetuberculata* n. sp., *e K. similis* n. sp. Per cent figures of numbers of individuals — on ordinate, successive horizons — on abscissa.

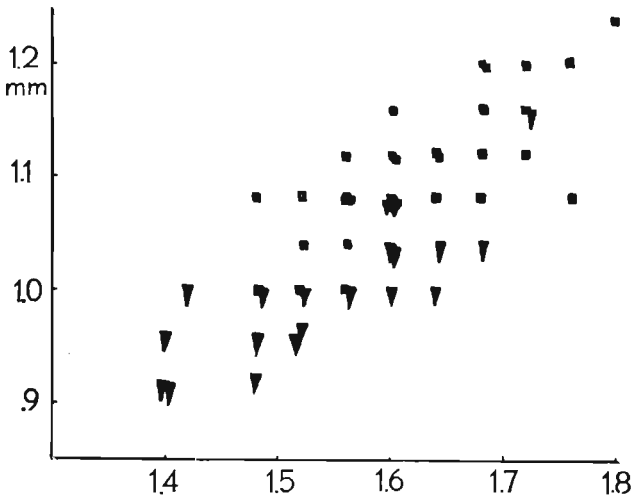


Fig. 14. — Size of adult carapaces of *K. kozłowskii* (Přibyl). Height of carapaces in mm — on ordinate, length — on abscissa. Female specimens marked by squares, males — by triangles.

subvelar part is considerably broader in *K. tuberculata* n. sp., being 0.88 mm (fig. 12). On the other hand, however, instead of the admarginal ridge the appearance is noted in this form of admarginal tubercles which are markedly larger and better pronounced in *K. kozłowskii* (Přibyl) (fig. 11, 15). In what the width of the subvelar area is concerned, it is less than that in *K. tuberculata* n. sp., but in proportion to the size of the carapace when we consider that these are forms one instar smaller.

STRUCTURE OF CARAPACE

Ostracod carapaces studied in thin sections provide interesting information regarding the mode of formation and differentiation of the various details of ornamentation. This is particularly so in respect to the marginal parts of the carapace and to its structure since these are subject to minor though occasionally fundamental modifications and hence may be of some taxonomic significance.

In papers on living ostracods, available to the writer, problems concerned with carapacial structure have been discussed by G. W. Müller (1894), K. Fassbinder (1912), R. V. Kesling (1951) and others. Many observations have also been made on fossil material: B. Zalanyi (1929), E. Triebel (1941), I. Hessland (1949), S. A. Levinson (1949), N. Spjeldnaes (1951), V. Jaanusson (1957) and R. V. Kesling (1957*a*).

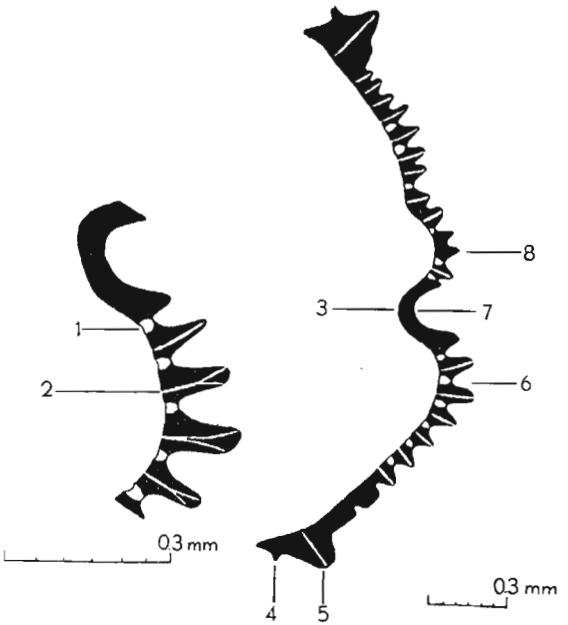


Fig. 15. — Longitudinal section of right valve of *K. kozłowskii* (Přibyl) (schematic diagram); *1* pore canals, *2* dark line, *3* muscle scar, *4* admarginal tubercles, *5* velar ridge, *6* L3, *7* S2, *8* L2.

In the case of species of *Kozłowskiella* (Přibyl), the author has done a number of thin slides of mature and immature carapaces. Furthermore, he has also studied the thin sections of species belonging to other genera, such as *Saccarchites ornatissimus* (Gürich) [2], *Polyzygia symmetrica* Gürich and *Polyzygia trigonata* Gürich. A "dark line", by Jaanusson (1957) referred to as the bisecting line, has been noted in these forms in some parts of the free margin. In species of *Kozłowskiella* and in *S. ornatissimus* it has been ascertained that these lines are regularly arranged over the other parts of the carapace also (fig. 4, 15). Quite recently, Kesling (1957*a*) describes such elements in genus *Hibbardia* Kesling where, according to that author's statement, they produce a reticulation readily discernible in tangential sections. The occurrence of "dark lines" on carapaces is not an uncommon phenomenon. In genus *Kozłowskiella* (Přibyl) they constitute, as in *Hibbardia* Kesling, distinct reticulation also discernible

[2] This species has been described by Gürich (1896, p, 383, pl. 14, fig. 3 a, b) as *Primitia ornatissima* from Lower Couvinian rocks (zone with *Spirifer dombroviensis* Gürich) from Dąbrowa near Kielce. In view of the close resemblance of this species to representatives of genus *Saccarchites* Swartz & Whitmore, there is more reason to refer it to this genus.

in transmitted light under × 600 magnification of fluoridized valves (fig. 16). Most likely, these details thus far recorded in few forms only, are all of the same type. This, among other things, seems to be pointed out by their position. In polarized light the structure of the "dark lines"

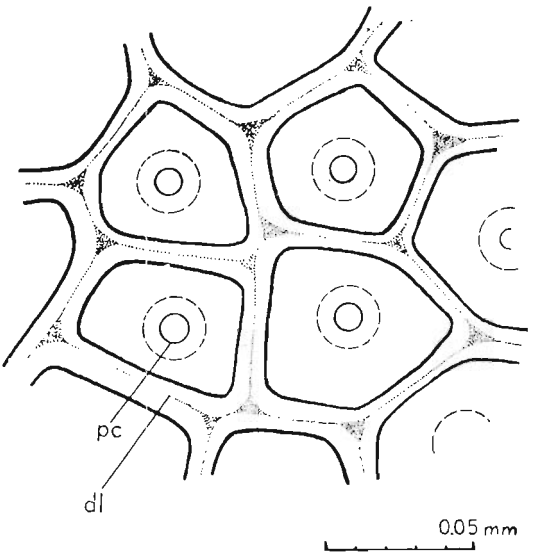


Fig. 16. — Fragment of the surface of carapace in *K. praetuberculata* n. sp. (diagram slightly simplified): *pc* pore canal, *dl* dark line.

is distinguishable from that of adjacent parts solely by smaller dimensions of calcite crystals. It should be here mentioned that these lines widen out towards the outer surface of valves in a fan-like shape and always occur on the margins of reticulation.

In view of their minute dimensions these are not pore canals as alleged by Jaanusson (1957) and Kesling (1957*a*). In *Kozłowskiella* (Přibyl) their size does not exceed 5 microns. The occurrence of the dark belt may be interpreted by the existence there, during lifetime of the ostracod, of some organic substance whose presence caused a slightly different mode of formation of the calcite crystals. Valves when dissolved in hydrochloric or acetic acid do not reveal the presence of any such organic matter. It seems probable that the dark lines may in some way be associated with the calcification process of the valves. K. Fassbinder (1912), who has studied the immature instars of the living *Cypris pubera*, states that the calcification process starts earliest within the free margin

area, immediately after moulting. In immature forms of *Kozłowskiella* (Přibyl) the presence of the dark line has been noted already during the first instar (fig. 17), but within the free margin area only, no such dark lines being observable in the remaining parts of the carapace. In this instar the valves are very fine, while within the free margin area a distinct velar structure is already in existence, transected by a dark line. In the following instars the dark lines gradually make their appearance on the other parts of the carapace as well. Their orientation is constant from the ventral to the dorsal margin. By the 6th instar the whole carapacial surface is covered with them. The same details of structure have been noted in *Saccarchites ornatissimus* (Gürich), but they

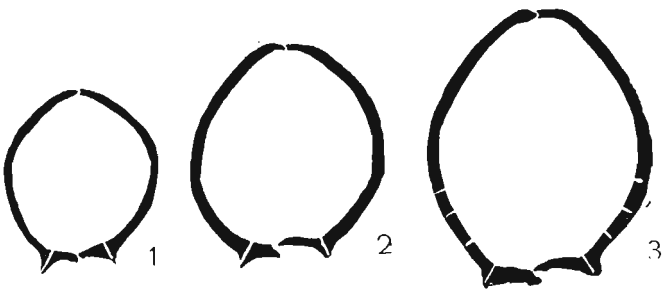


Fig. 17. — Cross sections of three earliest instars of *K. praetuberculata* n. sp. (diagram figure).

are missing during the earliest instars of this species; the velar structure being, moreover, in these forms less pronounced, and the reticulation more delicate. Here the dark lines begin to appear during the 3rd or 4th instar, in the same manner as in genus *Kozłowskiella* (Přibyl).

Pore canals show a most regular arrangement within reticulation pits (fig. 4, 15, 16). They are funnel shaped canalets readily discernible on fluoridized valves (fig. 5). They are absent from the free margin area.

ONTOGENY

The problem of ontogeny, i. e. of developmental changes experienced by the carapace in the course of successive moultings, is one of great significance for phylogenetic studies. Stress has been laid on it in many papers beginning with that by M. Verworn (1887). So far, however, it was not possible to draw any general phylogenetic conclusions concerning the described forms on account of the inadequacy of the available material. Often the described instars were not linked subsequently with

phylogeny or were investigated from a different aspect. This will be easily understood upon considering that immature forms are not always found in the residuum of the washed material.

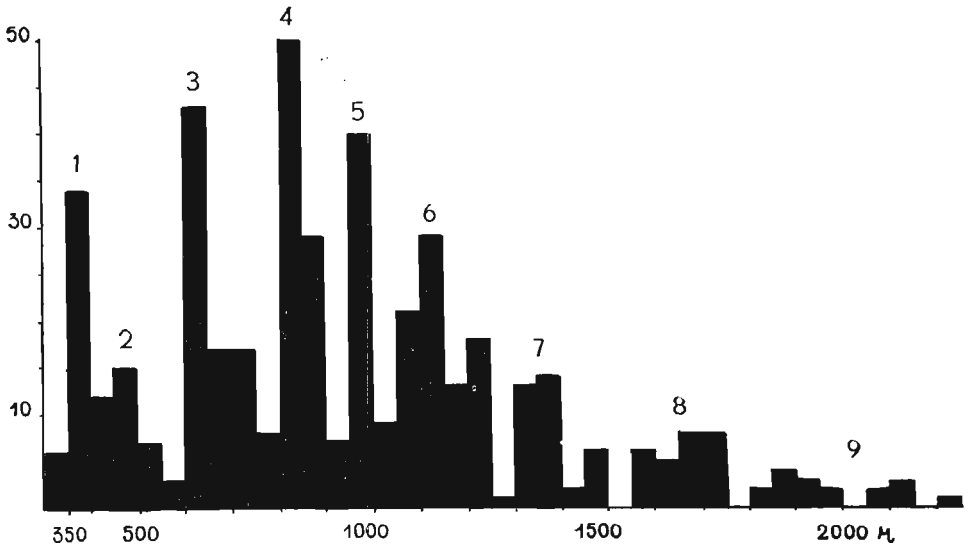
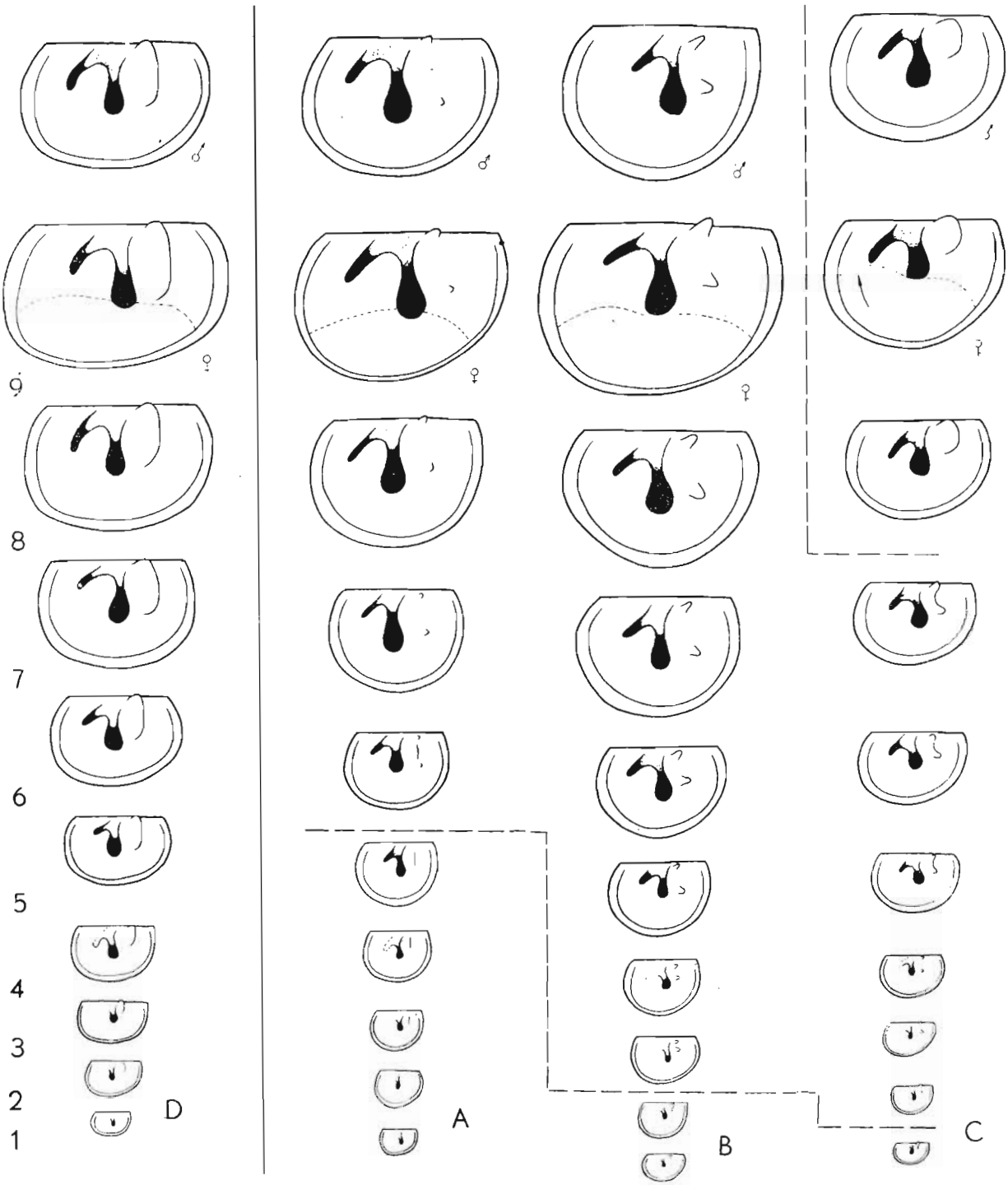


Fig. 18. — Diagram figure showing dimensions and numbers of carapaces during various instars in *K. praetuberculata* n. sp. Numbers of carapaces — on ordinate, size in microns — on abscissa.

On evidence of the available material the writer has been able to identify probably all the instars in the here considered three new species of genus *Kozłowskiella* (Přibyl) and in the form previously described by Přibyl (1953) as *Ulrichia (Kozłowskiella) kozłowskii*. Since these are closely allied species it was possible to clarify their interrelations. In connection with these observations the writer is of the opinion that the speciation may take place either by sudden leaps (*K. similis* n. sp.) or by way of slow evolutionary changes as is illustrated by the carapacial ontogeny of *K. praetuberculata* n. sp., *K. tuberculata* n. sp. and *K. kozłowskii* (Přibyl) (text-pl. I).

The number of moults within Beyrichiacea has not been exactly determined, ranging from 6 to 10. Apparently this is controlled by the same factors as those now acting in the living forms (Kesling, 1952*a*). In species of genus *Kozłowskiella* (Přibyl) 9 instars, i. e. 8 moultings, have been ascertained.

Carapaces of immature forms are as a rule complete, but the youngest instars are very scarcely represented. They are fragile and brittle, often filled in by calcite. Separate valves of instars 5, 6 and 7 are fairly common. Considerable difficulties have been encountered in distinguishing the



Slightly schematic diagram of individual ontogeny of carapaces in: *A K. praetuberculata* n. sp., *B K. tuberculata* n. sp., *C K. kozłowskii* (Přibyl), *D K. similis* n. sp.

immature instars in the three Couvinian species. At first sight, their earliest instars are practically indistiguishable. The various lines of ontogeny could be differentiated by indirect means only, e. g. a close comparative study of the different instars, with respect to their state of preservation, has revealed that in representatives of *K. tuberculata* n. sp. the colouration of the carapace is nearly always darker that that in the remaining species. Such biometric methods as determining the dimensions in the various instars, the growth coefficient etc. did not prove of any help in the study of this problem. The youngest instars differ very insignificantly in what size is concerned. In order to identify the various instars Kesling's (1953c) methods were applied, theoretically based on Brooks law. When dealing with large amounts of material this method has proved extremely valuable. Furthermore, a graph has been plotted of immature and adult individuals (fig. 18), which coincides entirely with data obtained with the help of a "slide rule".

On evidence of such morphological elements as S2, L2 and L3, also on reticulation, it was possible to determine the generic position of carapaces already in the first instar. Specific characters make their appearance later and stabilize in instars 6 and 7. This, however, is not always the case. In *Kozłowskiella tuberculata* n. sp., for instance, the specific position could be assigned already in the 4th instar. Sexual dimorphism does not occur before the last moulting. In some instances, however, on the size of carapaces (*K. praetuberculata* n. sp.) we are led to the suggestion that sexual maturity is reached earlier (in the 8th instar).

When studying individual ontogeny the writer has taken into consideration the two essential trends, mentioned at the beginning of the paper, of which the first is represented by *K. praetuberculata* n. sp., *K. tuberculata* n. sp. and *K. kozłowskii* (Přibyl), the other one — by *K. similis* n. sp.

In *K. praetuberculata* n. sp., as in the other species, S2 appears as early as the first instar. L2 and L3, together with reticulation, are still indistinct. In the 3rd instar, a delicate border is outlined, formed by the arrangement into two parallel rows of the reticulation meshes. In the 4th instar S1 is outlined, while in instar 6 or 7 two minute tubercles appear on the posterior lobe with a constant tendency to increase (text-pl. I *A*).

K. tuberculata n. sp. displays already in the first instar well developed L2 and L3, as well as S2. The reticulation here is at that stage more conspicuous that in the previous species. After the second moulting the tubercles on L3 are nearly completely formed (text-pl. I *B*). S1 becomes outlined in the following instar.

The last species of this evolutionary line is the Givetian *K. kozłowskii* (Přibyl). Its first instar is smaller than in the previously mentioned species, while the other characters coincide. Already in the second instar, however, two minute tubercles make their appearance on L3. S1 appears, as usually, in the 4th instar. Up to the time of the 6th or even the 7th moulting two tubercles persist on L3. After the 7th moulting, i. e. in the 8th instar, L3 becomes more prominent and produces a large knob not carrying any tubercles on its surface (text-pl. *I* C).

S2 is that character of ornamentation which has fundamentally altered the sculpture of the carapace of *Kozłowskiella* (Přibyl). Its formation is reasonably probable during the youngest instars only, when the resistance power of the carapace against centripetal traction is relatively weakest (adductor muscle). All additional alterations occur around the sulcus which has thus formed, i. e. the formations of lobes L2 and L3, the enlargement of the subvelar area as well as several minor changes brought about by the formation of these elements.

The appearance of a new character was investigated in the different instars (text-pl. I) by observing the moment and mode of its formation and its changes in subsequent instars. In *K. praetuberculata* n. sp., for instance, tubercles on L3 make their appearance in later stages of ontogeny; subsequently this character transgresses onto earlier stages *(K. tuberculata* n. sp.) which is probably connected with stabilization of this character. These elements, however, are not constant in the here considered evolutionary line. In *K. kozłowskii* (Přibyl) the tubercles occur in young instars only and constitute transitional elements leading to the strongly developed L3. Furthermore, on ontogeny of the carapace in *K. praetuberculata* n. sp. it may be inferred that this species is, in all probability, the ancestral form from which the other representatives of genus *Kozłowskiella* have derived.

SYSTEMATIC DESCRIPTION

Suborder **Palaeocopa** Henningsmoen, 1953
Superfamily **Beyrichiacea** Ulrich & Bassler, 1923
Family **Beyrichiidae**(?) Jones, 1894
Genus *Kozłowskiella* (Přibyl, 1953)

Genotype: Ulrichia (Kozłowskiella) kozłowskii Přibyl (1953, p. 241—244, pl. 1, fig. 1-18).

Diagnosis. — Trilobate forms, hinge line straight. In central part of carapace an adductor muscle scar. Velar ridge along the free edge.

Surface of carapace reticulated. Well pronounced dimorphism.

Representatives: *Kozłowskiella kozłowskii* (Přibyl, 1953)
Kozłowskiella praetuberculata n. sp.
Kozłowskiella tuberculata n. sp.
Kozłowskiella similis n. sp.

Remarks. — Genus *Kozłowskiella* (Přibyl), recorded from Middle Devonian rocks of Wydryszów, Grzegorzowice and Skały (Łysogóra region of the Holy Cross Mts.), by Přibyl (1953) described as a new subgenus within genus *Ulrichia* Jones, is by the present writer separated into a new genus, independent of *Ulrichia,* and tentatively included into the family Beyrichiidae. This conclusion is founded on detailed studies on the morphology, ontogeny and variations of the considered forms, grounded chiefly on the dimorphism similar to the cruminal type, as defined by Jaanusson (1957).

Kozłowskiella (Přibyl) displays similarities with genus *Ulrichia,* whose representatives are mentioned by Přibyl, in some morphological details only. The cardinal difference between *Ulrichia* and *Kozłowskiella* lies in the presence in the latter genus of S1 and S2, and in the distinct sexual dimorphism occurring throughout all the species of this genus. An additional difference is a well developed muscle area in the central portion of the valve. Of the other forms with which *Kozłowskiella* is compared by Přibyl, that of *Bolbiprimitia* Ulrich only displays a certain resemblance; also some other forms subsequently described and referred to here below. The assignment of *Kozłowskiella* to genus *Ulrichia* has also been questioned by Jaanusson (1957). He writes that in type of lobation this genus resembles *Thomasatia* Kay and probably for this reason he places *Kozłowskiella* (Přibyl) within the family Bassleratiidae.

The reference of genus *Kozłowskiella* to the Beyrichiidae is not beyond doubt in the light of the latest studies done by Kesling (1957*a*) and of certain observations carried out by the present writer on his own material. A comparison of our form with genus *Hibbardia* Kesling (1953*b*) reveals certain analogies. These consist among others of the external resemblance of dimorphism and close similarities in the development of the velar ridge and of ornamentation. The cardinal difference is that of the origin of dimorphism in *Kozłowskiella.*

The origin of genus *Kozłowskiella* is not thoroughly known. On the comparison of certain morphological elements it may be supposed to have derived from forms coming near to *Saccarchites ornatissimus* (Gürich), distinguished by dimorphism resembling that in *Kozłowskiella. Saccarchites ornatissimus* displays a moderate amount of resemblance to the species described by Swartz and Whitmore (1956) as *Saccarchites*

saccularis. Those authors allege that the considered form resembles genus *Phlyctiscapha* described by Kesling (1953*a*). Nevertheless, though these forms do display a certain resemblance, yet the present writer is of the opinion that the well known genus *Saccarchites* has more characters in common with *S. ornatissimus* (Gürich) than with the representatives of *Phlyctiscapha*. Features resembling those in *Phlyctiscapha* are the type of dimorphism, outline of carapace and the muscle scar.

Noteworthy are also forms which in some respects are similar to *Saccarchites*, in others to *Kozłowskiella*. They have been described by Polenova (1955) from the Volga-Ural province in the Soviet Union territory under the name of *Aparchitellina decorata*. One of these forms in particular, namely *Aparchitellina* cf. *decorata*, kindly presented to the writer by Mrs. Polenova, is to some extent a transitionary form. Particularly noteworthy in this species is the muscle scar, developed similarly as in *Saccarchites*, while the carapacial outline and details of ornamentation come closer to these characters in *Kozłowskiella*.

It seems reasonably probable that forms such as: *Saccarchites saccularis* Swartz & Whitmore, 1956, *S. ornatissimus* (Gürich, 1896) and *Aparchitellina* cf. *decorata* Polenova, 1955 — constitute a morphological evolutionary line, with *S. saccularis* as the probable ancestral form, in view of its poorly differentiated ornamentation and its occurrence within Upper Silurian rocks. The two other species have been recorded from the Middle Devonian.

R. Ruedemann in 1909 (fide Ellis & Messina, 1952-57) has described *Macronotella fragaria* from the Ordovician of the United States of America. This form is an interesting one on account of its resemblance to *Saccarchites ornatissimus* (Gürich), as is stated by its author. In both these forms there are similarities of the outline of carapace, of ornamentation and of muscle scar. A comparative study of *S. ornatissimus* with *Macronotella hypercala* Kesling & Kilgore (1952) points out some interesting conclusions too. Dr. Kesling was kind enough to provide the present writer with an assemblage of Devonian ostracods from North America. Direct comparisons of the two above mentioned species did not, however, lead him to detect any differences between the immature form of *S. ornatissimus* (5th and 6th instars) and the American species.

Presumably, a detailed study of these forms may clarify this problem. Sections would, it is believed, be of special significance. Forms of *S. ornatissimus*, including their ontogeny, have been studied by the writer. He has also made a number of thin sections of both, the immature and adult, forms and has arrived at the conclusion that they may be phylogenetically related with *Kozłowskiella* (Přibyl).

Kozłowskiella praetuberculata n. sp.

(fig. 19, 20; pl. I, III)

Holotypus: female carapace in pl. I, fig. 1 *a-c*.

Stratum typicum: Lower Couvinian, Łysogóry region, Holy Cross Mts.

Locus typicus: Wydryszów.

Derivatio nominis: praetuberculata — species less advanced than *K. tuberculata*.

Diagnosis. — Trilobate, outline of carapace suboval, hinge line straight; subvelar area narrow; two small tubercles on L3. Left valve overlaps the right along the free edge. Surface reticulated. Delicate admarginal ridge on subvelar area (right valve). Distinct dimorphism.

Description. — Outline of carapace suboval, preplete; dorsal border straight. A velar ridge along the free edge. Dorsally, S1 and S2 extend from a common base. One of them, S1, follows the antero-ventral direction; the other, S2, markedly longer, is perpendicular to the dorsal

Table 1

Kozłowskiella praetuberculata n. sp.

Dimensions* of carapaces and growth factor in the several instars

Instar	Length (*mm*)	Growth factor	Length of dorsal margin (*mm*)	Growth factor	Height (*mm*)	Growth factor	Thickness (*mm*)	Growth factor	Width of admarginal area (*mm*)	Growth factor
I	0.36		0.28		0.28		0.20		0.08	
		1.22		1.29		1.14		1.30		1.50
II	0.44		0.36		0.32		0.26		0.12	
		1.18		1.05		1.25		1.15		1.16
III	0.52		0.38		0.40		0.30		0.14	
		1.23		1.26		1.20		1.33		1.28
IV	0.64		0.48		0.48		0.40		0.18	
		1.18		1.25		1.25		1.20		1.44
V	0.76		0.60		0.60		0.48		0.26	
		1.31		1.26		1.20		1.08		1.07
VI	1.00		0.76		0.72		0.52		0.28	
		1.32		1.26		1.33		1.38		1.21
VII	1.32		0.96		0.96		0.72		0.34	
		1.27		1.33		1.25		1.24		1.17
VIII	1.68		1.28		1.20		0.88		0.40	
		1.14		1.15		1.10		1.36		1.00
♀	1.92		1.48		1.32		1.20		0.40	
♂	1.84		1.40		1.28		0.88		0.40	

* Quoted data are modal values.

border. In the centre of carapace S2 becomes club-shaped and bears the muscle scar. Lobes moderately prominent. Posterior lobe (L3) tending to produce tubercles. On the right valve a well developed hinge groove, over the entire surface, with the exception of the triangular area in the subvelar area, the larger on the left valve, the smaller and more delicate one — the so-called admarginad ridge — on the right valve.

Dimensions and growth factor of carapaces — see table 1.

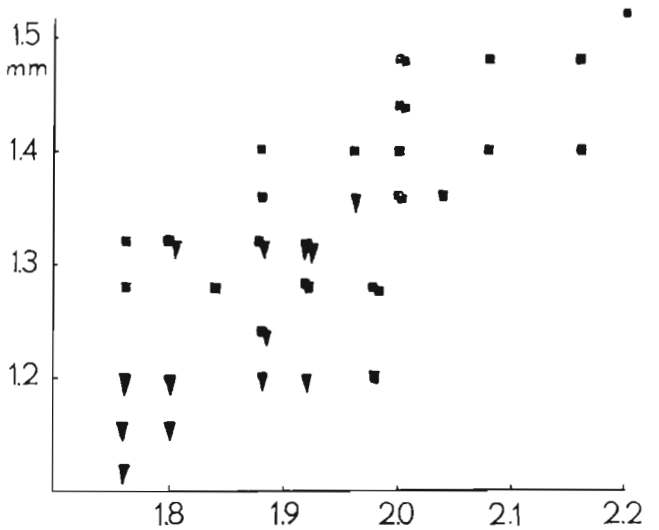


Fig. 19. — Size of carapaces in adult forms of *K. praetuberculata* n. sp. Height of carapaces in mm — on ordinate, length — on abscissa. Female specimens marked by squares, males — by triangles.

Variation. — Size of valves varies rather strongly in dependence on the stratigraphic horizon from which the material was sampled. The reticulation meshes are usually subpentagonal and uniformly dispersed over the entire surface, with the exception of the triangular area in the antero-dorsal portion of the carapace. Well developed pore canals in the reticulation.

Dimorphism. — In female specimens, which predominate among mature individuals (68 per cent), the ventral valve is distinctly swollen (fig. 19).

Ontogeny. — The collected immature valves probably represent complete series of instars. It is not excluded that in some cases adult individuals also moult their carapace, this being suggested by the great size range of mature valves (fig. 20).

Instar I — Dimensions (in mm): length 0.36, height 0.28, thickness 0.20. Outline of valve distinctly preplete, hinge line straight. L2 and L3, and median S2 already well marked. Delicate velar ridge extending along the free edge; reticulation still rather indistinct.

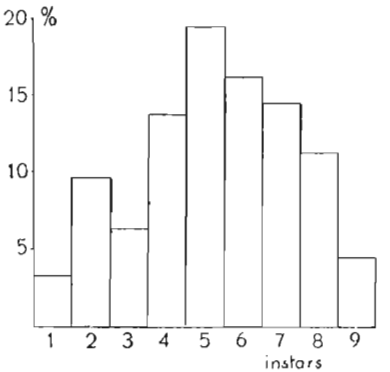


Fig. 20. — Per cent figure of carapaces of *K. praetuberculata* n. sp. in various instars.

Instar II — Dimensions (in mm): length 0.44, height 0.32, thickness 0.26. Valve still bilobate; reticulation more distinct; L3 larger. The remaining characters unchanged.

Instar III — Dimensions (in mm): length 0.52, height 0.40, thickness 0.30. Reticulation meshes larger than in earlier instars; L2 and L3 more prominent.

Instar IV — Dimensions (in mm): length 0.64, height 0.48, thickness 0.40. In this instar S1 is outlined, gently arcuate, somewhat obliquely directed forward. The edge on L3 faintly outlined.

Instar V — Dimensions (in mm): length 0.76, height 0.60, thickness 0.48. S1 and S2 deepened. Edge on L3 distinctly marked. Remaining characters unchanged.

Instar VI — Dimensions (in mm): length 1.00, height 0.72, thickness 0.52. Various ornamentation details are in this stage quite distinct. Two minute tubercles appear on L3. A small rib is outlined between S2 and S3.

Instar VII — Dimensions (in mm): length 1.32, height 0.96, thickness 0.72. Tubercles on L3 more distinct; the remaining characters unchanged.

Instar VIII — Dimensions (in mm): length 1.68, height 1.20, thickness 0.88. This instar precedes the mature form. Small tubercles on L3 still increase. Other details of ornamentation are those of mature forms.

Instar	Length of carapace (*mm*)	Height of carapace (*mm*)
I	0.31 — 0.36	0.20 — 0.28
II	0.37 — 0.45	0.22 — 0.32
III	0.47 — 0.56	0.32 — 0.42
IV	0.59 — 0.68	0.42 — 0.55
V	0.69 — 0.88	0.50 — 0.63
VI	0.94 — 1.14	0.62 — 0.96
VII	1.17 — 1.43	0.96 — 1.15
VIII	1.48 — 1.82	1.10 — 1.35
Adult	1.84 — 2.40	1.32 — 1.50

Remarks. — *Kozłowskiella praetuberculata* n. sp. displays numerous analogies with the other species here described. Differences between them consist in details of ornamentation and varying size. There are also some differences in the successive ontogenetic stages. This species is similar to *Aparchitellina* cf. *decorata* Polenova. Its resemblance to genus *Hibbardia* Kesling is by the writer regarded as less striking, chiefly due to different type of dimorphism.

Kozłowskiella tuberculata n. sp.
(fig. 21, 22; pl. II, IV)

Holotypus: female carapace in pl. II, fig. 3 *a-c*.
Stratum typicum: Lower Couvinian, Łysogóry region, Holy Cross Mts.
Locus typicus: Wydryszów.
Derivatio nominis: tuberculata — two distinct tubercles on L3.

Diagnosis. — Trilobate, outline of valve preplete; hinge line straight. Two distinct tubercles on L3. A velar ridge along the free edge of carapace. Subvelar area broad. Surface reticulated. Well defined dimorphism.

Description. — Valves of this species are of greater size than in any of the remaining forms of *Kozłowskiella* (Přibyl). The posterior lobe (L3) bears two distinct tubercles constituting one of the specific characters. S1 and S2 extend from a common base in the dorsal part of the valve, separating L1, L2 and L3. S1 gently arched forward, while S2 occupies a central position. Muscle scar in the middle of valve. Subvelar area

broad (0.88 mm), delicate admarginal tubercles on the right valve. Dorsally (right valve) well developed hinge groove, expanded at both ends. Pore canals in reticulation meshes. Left valve overlapping the right.

Dimensions and growth factor of carapaces — see table 2.

Table 2

Kozłowskiella tuberculata n. sp.

Dimensions* of carapaces and growth factor in the several instars

Instar	Length (*mm*)	Growth factor	Length of dorsal margin (*mm*)	Growth factor	Height (*mm*)	Growth factor	Thickness (*mm*)	Growth factor	Width of admarginal area (*mm*)	Growth factor
I	0.40		0.32		0.26		0.22		0.08	
		1.20		1.13		1.23		1.09		1.00
II	0.48		0.36		0.32		0.24		0.08	
		1.16		1.27		1.18		1.33		1.50
III	0.56		0.46		0.38		0.32		0.12	
		1.28		1.21		1.26		1.12		2.00
IV	0.72		0.56		0.48		0.36		0.24	
		1.22		1.28		1.33		1.33		1.25
V	0.88		0.72		0.64		0.48		0.30	
		1.36		1.27		1.31		1.33		1.20
VI	1.20		0.92		0.84		0.64		0.36	
		1.33		1.39		1.28		1.37		1.50
VII	1.60		1.28		1.08		0.88		0.54	
		1.15		1.15		1.18		1.13		1.11
VIII	1.84		1.48		1.28		1.00		0.60	
		1.26		1.21		1.25		1.48		1.46
♀	2.32		1.80		1.60		1.48		0.88	
♂	1.96		1.52		1.44		1.02		0.68	

Quoted data are modal values.

Variation. — Only the size of valves is subject to certain variations. The subvelar length/width ratio varies from 4.4 to 7.1 (fig. 21).

Dimorphism. — In female specimens the valves are ventrally strongly swollen. The male specimens are more slender; their valves constitute a minority among adult specimens.

Ontogeny (fig. 22):

Instar I — Dimensions (in mm): length 0.40, height 0.26, thickness 0.22. Outline suboval; reticulation distinct. L3 forms a fairly pointed tubercle. Valve monosulcate.

Instar II — Dimensions (in mm): length 0.48, height 0.32, thickness 0.24. Outline and details of morphology without changes.

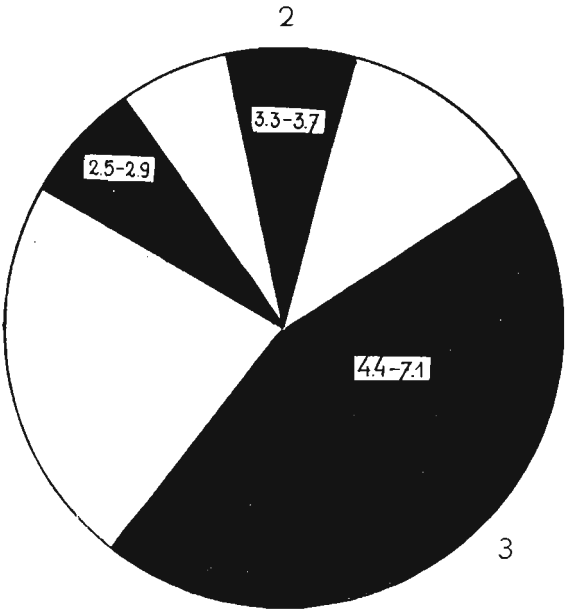


Fig. 21. — Diagram of carapace length/width of subvelar area ratio: *1 K. praetuberculata* n. sp., *2 K similis* n. sp.. *3 K. tuberculata* n. sp.

Instar III — Dimensions (in mm): length 0.56, height 0.38, thickness 0.32. Two tubercles make their appearance on L3.

Instar IV — Dimensions (in mm): length 0.72, height 0.48, thickness 0.38. In this instar S1 is initially outlined. The width of the subvelar area has doubled.

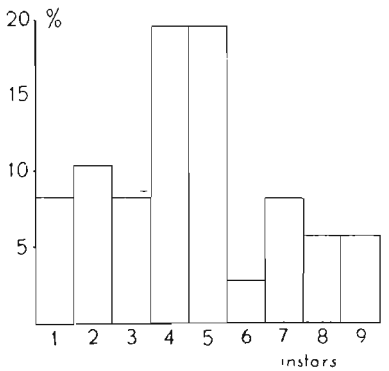


Fig. 22. — Per cent figure of carapaces of *K. tuberculata* n. sp. in various instars. Per cent figure of the number of individuals — on ordinate, instars — on abscissa.

Instar V — Dimensions (in mm): length 0.88, height 0.64, thickness 0.48. Details of ornamentation more distinctly marked and not subject to any essential changes during the following instars.

Instar VI — Dimensions (in mm): length 1.20, height 0.84, thickness 0.64. No changes.

Instar VII — Dimensions (in mm): length 1.60, height 1.08, thickness 0.88. In this instar the subvelar area increases considerably. Details of ornamentation have been definitely developed.

Instar VIII — Dimensions (in mm): length 1.84, height 1.28, thickness 1.00. This instar precedes the mature form.

Instar	Length of carapace (*mm*)	Height of carapace (*mm*)
I	0.29 — 0.40	0.22 — 0.26
II	0.40 0.48	0.27 — 0.32
III	0.48 — 0.56	0.32 — 0.38
IV	0.56 — 0.72	0.37 — 0.55
V	0.75 — 0.89	0.50 — 0.68
VI	1.00 — 1.28	0.64 — 0.84
VII	1.38 — 1.60	0.87 — 1.10
VIII	1.64 — 1.85	1.10 — 1.30
Adult	1.88 — 2.70	1.42 — 1.80

Remarks. — *Kozłowskiella tuberculata* n. sp. is a transitionary stage in the evolutionary trend leading from *K. praetuberculata* to *K. kozłowskii* (Přibyl). A number of morphological characters traced throughout its ontogeny confirm this assumption. Tubercles situated on L3 are of particular significance when comparing these forms. In *K. tuberculata* n. sp. they make their appearance during the earliest stages of ontogeny (3rd instar), while in *K. kozłowskii* — from 2nd instar; in *K. praetuberculata* n. sp., which is undoubtedly a more primitive form, they appear later and are less strongly developed. Furthermore, in *K. tuberculata* n. sp. admarginal tubercles on the right valve are equivalent to the admarginal ridge in *K. praetuberculata* n. sp. (fig. 11).

Kozłowskiella kozłowskii (Přibyl)
(fig. 23, 24; pl. II)

Type species: Ulrichia (Kozłowskiella) kozłowskii Přibyl (1953, p. 242—244, pl. I, fig. 1—18).

Diagnosis. — The original diagnosis, as given by Přibyl (1953, p. 318), is: "Anterior node placed much lower than the posterior node, which usually projects above the dorsal margin. There is a deep furrow between two nodes. Anterior to the anterior node there is also a furrow directed obliquely forward. The surface of the valves and nodes is coarsely reticulated".

Description. — Carapace trilobate, almost preplete; hinge line straight. Hinge groove on right valve along the dorsal border. Posterior lobe (L3) in the shape of a prominent knob. Velar ridge along the free edge. S1 extends somewhat obliquely in relation to S2, separating the two lobes. The central part of the valve is occupied by the medial furrow (S2), which stretches to the centre of the valve; it is there swollen, suggesting the muscle scar. Very fine reticulation discernible on the posterior lobe (L3). Admarginal tubercles developed on the right valve along the free edge. Hinge furrow as in the remaining species, with a hinge list on the left valve.

Dimension and growth factor of carapaces — see table 3.

Table 3

Kozłowskiella kozłowskii (Přibyl)

Dimensions* of carapaces and growth factor in the several instars

Instar	Length (*mm*)	Growth factor	Length of dorsal margin (*mm*)	Growth factor	Height (*mm*)	Growth factor	Thickness (*mm*)	Growth factor	Width of admarginal area (*mm*)	Growth factor
I	0.28		0.26		0.22		0.18		0.08	
		1.28		1.23		1.18		1.11		1.25
II	0.36		0.32		0.26		0.20		0.10	
		1.33		1.00		1.15		1.40		1.20
III	0.48		0.32		0.30		0.28		0.12	
		1.20		1.50		1.40		1.00		1.00
IV	0.58		0.48		0.42		0.28		0.12	
		1.24		1.33		1.28		1.28		1.66
V	0.72		0.64		0.54		0.38		0.20	
		1.26		1.25		1.25		1.26		1.60
VI	0.91		0.80		0.68		0.48		0.32	
		1.14		1.15		1.17		1.08		1.00
VII	1.04		0.92		0.80		0.52		0.32	
		1.30		1.17		1.10		1.15		1.25
VIII	1.36		1.08		0.88		0.60		0.40	
		1.23		1.25		1.31		1.56		1.40
♀	1.72		1.36		1.16		0.94		0.50	
♂	1.64		1.24		1.16		0.60		0.56	

* Quoted data are modal values.

Variation. — Length of valve ranges from 1.4 to 1.8 mm and the length/width ratio from 1.3 to 1.7 (fig. 23).

Dimorphism. — In female specimens the antero-ventral portions of the carapace are distinctly swollen. As compared against the remaining species of genus *Kozłowskiella* (Přibyl), this ventral inflation has been shifted somewhat anteriorly. Furthermore, it has been ascertained

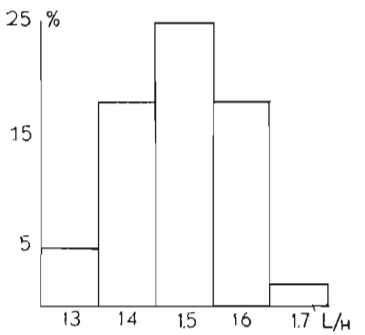


Fig. 23. — *K. kozłowskii* (Přibyl), variation diagram. Per cent figure in the composition of various groups — on ordinate.

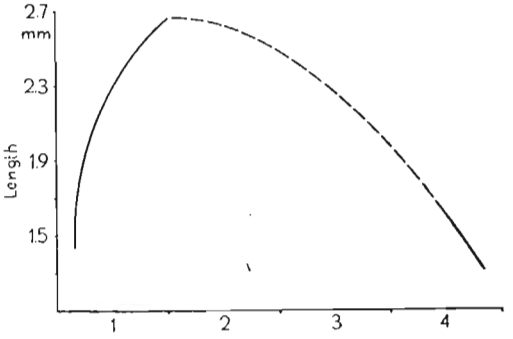


Fig. 24. — Diagram figure showing carapaces dimensions of four species of genus *Kozłowskiella* (Přibyl) in Middle Devonian layers of Holy Cross Mts. Supposed changes within the Upper Couvinian and Lower Givetian indicated by broken line; *1* Lower Couvinian, *2* Upper Couvinian, *3* Lower Givetian, *4* Upper Givetian.

on the available material that females constitute 54.7 per cent of all mature forms. Hence, among Givetian forms, the number of male specimens has increased (fig. 14).

Instar	Length of carapace (*mm*)	Height of carapace (*mm*)
I	0.28 — 0.30	0.21 — 0.26
II	0.32 — 0.36	0.22 — 0.27
III	0.38 — 0.48	0.20 — 0.30
IV	0.49 — 0.58	0.30 — 0.42
V	0.61 — 0.78	0.38 — 0.54
VI	0.79 — 0.91	0.50 — 0.70
VII	0.93 — 1.12	0.62 — 0.80
VIII	1.18 — 1.38	0.78 — 1.00
Adult	1.40 — 1.88	0.92 — 1.24

Ontogeny:

Instar I — Dimensions (in mm): length 0.28, height 0.22, thickness 0.18. Bilobate form; outline of carapace preplete. L3 fairly prominent and sharp pointed. Delicate reticulation on surface of valves. Velar ridge along the free margin.

Instar II — Dimensions (in mm): length 0.36, height 0.26, thickness 0.20. Two minute tubercles appear on the anterior lobe (L3). Remaining features without changes.

Instar III — Dimensions (in mm): length 0.48, height 0.30, thickness 0.28. L3 and the tubercles more prominent.

Instar IV — Dimensions (in mm): length 0.58, height 0.42, thickness 0.28. In this instar S1 separating the two lobes (L1 and L2) is outlined.

Instar V — Dimensions (in mm): length 0.72, height 0.54, thickness 0.38. L2 and L3 distinctly marked. Trilobation well defined.

Instar VI — Dimensions (in mm): length 0.91, height 0.68, thickness 0.48. Reticulation uniform throughout the valve surface.

Instar VII — Dimensions (in mm): length 1.04, height 0.80, thickness 0.52. In this instar many individuals lose the tubercles on L3 which becomes more prominent.

Instar VIII — Dimensions (in mm): length 1.36, height 0.88, thickness 0.60. The disappearance of tubercles on L3 is connected with formation of a more prominent lobe. The remaining details of ornamentation are definitely developed. This instar precedes the mature form.

Remarks. — *Kozłowskiella kozłowskii* (Přibyl) has so far been recorded from the Givetian and within one horizon only, in the so-called brachiopod shales. This species has not as yet been found in other sections of the same age in Holy Cross Mts., being restricted perhaps to one locality only. It is closely allied with Couvinian species, its dimensions, however, are smaller. During the evolutionary line of *K. kozłowskii* we first observe an increase of dimensions (Couvinian species) and then a sensible reduction (fig. 24). The limited horizontal and vertical distribution of this species suggest that it was nearing extinction.

Kozłowskiella similis n. sp.

(fig. 25; pl. I)

Holotypus: female carapace in pl. I, fig. 3, 4.

Stratum typicum: Lower Couvinian, Łysogóry region, Holy Cross Mts.

Locus typicus: Wydryszów.

Derivatio nominis: similis — called so to stress its close similarity to species belonging to the evolutionary line: *K. praetuberculata* n. sp., *K. tuberculata* n. sp. and *K. kozłowskii* (Přibyl).

Diagnosis. — Trilobate form with outline almost amplete. Posterior lobe (L3) in the shape of a prominent knob. Left valve overlapping the right; surface reticulated; distinct dimorphism.

Description. — Carapaces elongated, trilobate and reticulated. S1 and S2 extend from one common base, separating the particular lobes. L3 prominent, considerably larger than L1. Along the free edge of the right valve a delicate admarginal ridge, with minute tubercles in some individuals (tendency to produce admarginal tubercles). The left valve somewhat larger and overlapping the right along the free edge. Pore

canals developed in reticulation meshes. A hinge furrow developed on the right valve, dilated at both ends, and a hinge list on the left valve.

Dimensions and growth factor of carapaces — see table 4.

Variation. — The outline of the carapace and the dimensions of L3 are subject to certain variations. The length/subvelar area ratio varies from 3.3 to 3.7 (fig. 21).

Dimorphism. — Carapaces of female individuals are somewhat larger (fig. 25), ventrally distinctly inflated. Male specimens constitute 20 per cent of the total mature forms.

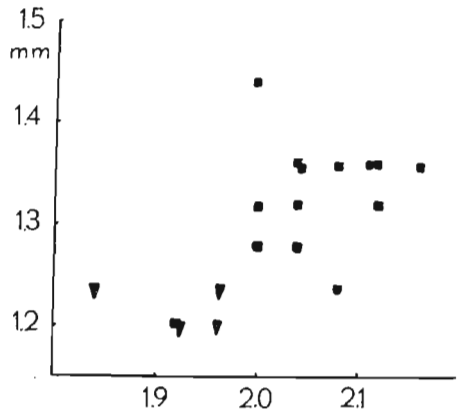


Fig. 25. — Size of carapaces in adult forms of *K similis* n. sp. Height of carapaces in mm — on ordinate, length — on abscissa. Female specimens marked by squares, males — by triangles.

Ontogeny:

Instar I — Dimensions (in mm): length 0.36, height 0.22, thickness 0.16. Outline suboval; S2 developed approximately in the middle of the carapace. Reticulation faint.

Instar II — Dimensions (in mm): length 0.48, height 0.36, thickness 0.24. In this instar L3 is rather prominent. The remaining characters unchanged.

Instar III — Dimensions (in mm): length 0.68, height 0.44, thickness 0.32. Main details of ornamentation without changes.

Instar IV — Dimensions (in mm): length 0.86, height 0.56, thickness 0.44. S1 makes its appearance. Reticulation more distinct.

Instar V — Dimensions (in mm): length 1.08, height 0.68, thickness 0.52. S1 and S2 have deepened. L3 prominent.

Instar VI — Dimensions (in mm): length 1.24, height 0.88, thickness 0.64. No changes.

Instar VII — Dimensions (in mm); length 1.44, height 1.00. In the writer's collection this instar is represented by one valve only. Details of ornamentation unchanged.

Instar VIII — Dimensions (in mm): length 1.72, height 1.12, thickness 0.80. All details of ornamentation have developed definitely. This instar precedes the mature form.

Table 4

Kozłowskiella similis n. sp.

Dimensions* of carapaces and growth factor in the several instars

Instar	Length (*mm*)	Growth factor	Length of dorsal margin (*mm*)	Growth factor	Height (*mm*)	Growth factor	Thickness (*mm*)	Growth factor	Width of admarginal area (*mm*)	Growth factor
I	0.36		0.28		0.22		0.16		0.08	
		1.33		1.57		1.63		1.50		1.50
II	0.48		0.44		0.36		0.24		0.12	
		1.40		1.27		1.22		1.33		1.33
III	0.68		0.56		0.44		0.32		0.16	
		1.26		1.14		1.27		1.37		1.50
IV	0.86		0.64		0.56		0.44		0.24	
		1.25		1.37		1.21		1.18		1.33
V	1.08		0.88		0.68		0.52		0.32	
		1.15		1.09		1.29		1.23		1.12
VI	1.24		0.96		0.88		0.64		0.36	
		1.16		1.25		1.13		—		—
VII	1.44		1.20		1.00		—		—	
		1.20		1.13		1.12		—		—
VIII	1.72		1.36		1.12		0.80		0.52	
		1.16		1.18		1.21		1.50		1.15
♀	2.00		1.60		1.36		1.20		0.60	
♂	1.88		1.48		1.24		1.20		0.54	

* Quoted data are modal values.

Remarks. — On the carapacial outline and various details of ornamentation this species may be opposed to the remaining representatives of genus *Kozłowskiella* (Přibyl). The cardinal features in which it differs from them are: prominent lobe (L3) considerably larger than that in *K. kozłowskii* (Přibyl); absence of tubercles and edges on this lobe during ontogenic stages; presence of velar ridge along the free margin, with the subvelar area, as a rule, not exceeding 0.6 mm in width (fig. 12). Another noteworthy element here is the so-called admarginal ridge (on the right valve) which, in a small number of individuals, displays distinct tendency to produce admarginal tubercles. On evidence of its ontogenetic changes, this species is believed independently to attain in the formation of morphological details results similar to those of *Kozłowskiella kozłowskii*.

Paleozoological Laboratory
of the University of Warsaw,
Warszawa, January 1958

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FRANCISZEK ADAMCZAK

ONTOGENEZA I EWOLUCJA RODZAJU *KOZŁOWSKIELLA* (PŘIBYL) (OSTRACODA)

Streszczenie

Materiał, na jakim oparto badania ontogenezy i ewolucji rodzaju *Kozłowskiella* (Přibyl), zebrany został w latach 1955-56 w środkowym dewonie Gór Świętokrzyskich, w miejscowościach Wydryszów, Grzegorzowice i Skały.

Kozłowskiella opisana została po raz pierwszy przez A. Přibyla (1953) jako *Ulrichia (Kozłowskiella)*. Autor, opierając się na morfologii, ontogenezie i zmienności, uznał ten podrodzaj za rodzaj nie zależny od *Ulrichia* i, ze względu na pewne podobieństwo do kruminalnego typu dimorfizmu (łac. *crumena* = torebka), umieścił go warunkowo w obrębie rodziny Beyrichiidae.

Na dużym materiale (około 3000 egzemplarzy form dorosłych i młodocianych) prześledzono m. in. rozwój ontogenetyczny — czyli zmiany, jakim podlega skorupka w czasie kolejnych wylinek — trzech nowych gatunków z eiflu, (Wydryszów i Grzegorzowice), a mianowicie:

Kozłowskiella praetuberculata n. sp.
Kozłowskiella tuberculata n. sp.
Kozłowskiella similis n. sp.

i jednego opisanego już wcześniej przez Přibyla (1953), z miejscowości Skały (żywet), jako *Ulrichia (Kozłowskiella) kozłowskii* Přibyl. Zaobserwowano też zmiany, jakim podlegają opisane gatunki w procesie zarówno ontogenezy, jak ewolucji w eiflu i żywecie.

Jeśli chodzi o poszczególne stadia rozwoju osobniczego, to zostały one wydzielone, opierając się na metodach opracowanych przez R. V. Keslinga (1953c). Autor ten — na podstawie prawa Brooksa głoszącego, że po każdej wylince skorupka powiększa swoje rozmiary w stosunku procentowym, który jest w przybliżeniu stały dla gatunku i płci, a który wynosi 1,26 — opracował tabele w postaci cyklów logarytmicznych, odpowiadających teoretycznej wartości wzrostu dla jednego wymiaru, powierzchni i objętości.

W ewolucji rodzaju *Kozłowskiella* (Přibyl) autor wyróżnił dwa szeregi rozwojowe. Jeden reprezentowany jest przez *Kozłowskiella praetuberculata* n.sp. — *K. tuberculata* n. sp. — *K. kozłowskii* (Přibyl), a drugi przez jeden tylko gatunek — *K. similis* n. sp.

Szereg pierwszy wyróżniony został na podstawie przeobrażeń podobnych elementów morfologicznych skorupki, które prześledzić można także wśród form młodocianych (text-pl. I *A-C*). Stwierdzono, że zmianom podlega m. in. płat L3, który u formy wyjściowej (*K. praetuberculata* n. sp.) wykazuje na swej powierzchni tendencję do tworzenia guzków już od 6 lub 7 stadium. U *K. tuberculata* n. sp. ten sam

element rzeźby jest większy i pojawia się na skorupce od 3 stadium. U *K. kozłowskii* (Přibyl), która zamyka ten szereg rozwojowy (fig. 6c), guzki na płacie L3 pojawiają się w 2 stadium i zanikają po 6 lub 7 wylince (text-pl. I C). W konsekwencji tych przekształceń powstaje wydatny płat L3. Z przeobrażeniami tymi skorelowane są: szerokość powierzchni subwelarnej, która się powiększa, oraz listwa admarginalna, przekształcająca się w szereg drobnych brodawek admarginalnych.

K. similis n. sp. reprezentuje drugi szereg rozwojowy. Płat L3 u tego gatunku jest duży i w zasadzie podobny do L3 u *K. kozłowskii* (Přibyl); poza tym nie wykazuje on guzków na swej powierzchni. Gatunek ten (*K. similis* n. sp.) powstał prawdopodobnie w szybkim tempie, przy czym zasadnicze zmiany dokonały się we wczesnych stadiach ontogenezy. U form młodocianych płat tylny (L3) jest z reguły większy, wydatniejszy, niż u pozostałych gatunków.

Nawiązując do tych przeobrażeń autor wysunął wniosek, że, w obrębie jednego rodzaju, powstanie podobnych elementów (wydatny płat L3) może nastąpić bądź na drodze powolnych, stopniowych przekształceń [*K. praetuberculata* n. sp. — *K. tuberculata* n. sp. — *K. kozłowskii* (Přibyl)], bądź też skokowo (*K. similis* n. sp.). W wyniku tych zmian powstaje, oczywiście, nowa jednostka taksonomiczna w randze gatunku.

Osobny rozdział w tej pracy stanowi zagadnienie struktury skorupek oraz zmian, jakim one podlegają w procesie ewolucji. Chodzi tu o tzw. „ciemne smugi", stwierdzone na cienkich przekrojach u rodzajów *Kozłowskiella* (Přibyl) i *Saccarchites* Swartz & Whitmore. Na skorupkach gatunków *Kozłowskiella* stwierdzono je wzdłuż wolnego brzegu skorupki, w postaci ciemnego pasma, oraz na wyniosłych elementach siatki tworzącej rzeźbę. Struktury te pojawiają się już od wczesnych stadiów rozwoju ontogenetycznego, początkowo w strefie wolnego brzegu, a później, stopniowo, w pozostałej części skorupki (fig. 15). U *Saccarchites ornatissimus* (Gürich) „ciemne smugi" pojawiają się w późniejszych stadiach ontogenezy, lecz w identyczny jak u *Kozłowskiella* sposób. Zdaniem autora, nie jest wykluczone, że mogą one mieć pewien związek z procesem kalcyfikacji skorupki.

Na podstawie pewnych analogii rzeźby i struktury skorupki autor przypuszcza, że form wyjściowych dla rodzaju *Kozłowskiella* należałoby poszukać w obrębie gatunków rodzaju *Saccarchites*. Jedyny przedstawiciel tego rodzaju, znany dotychczas z Polski, opisany został przez G. Güricha (1953) jako *Primitia ornatissima*. Przy bliższym porównaniu okazało się, że gatunek ten wykazuje dużo analogii z przedstawicielami rodzaju *Saccarchites* i z tego powodu umieszczono go w obrębie tego właśnie rodzaju.

Morfologicznie biorąc, stanowisko pośrednie między tymi rodzajami zajmuje *Aparchitellina* Polenova. Szczególnie jeden gatunek tego rodzaju, *A.* cf. *decorata*, który otrzymałem od Dr E. N. Polenowej w 1957 r., wykazuje dużo analogii z obu wymienionymi rodzajami. Definitywne rozstrzygnięcie tego zagadnienia wymaga jednak gruntownych studiów porównawczych, zwłaszcza struktury skorupki.

OBJAŚNIENIA DO ILUSTRACJI

Fig. 1 (p. 76)

Elementy rzeźby powierzchni skorupki; *S1* bruzda przednia, *L2* płat środkowy, *S2* bruzda medialna, *L3* płat tylny, *t* guzki, *vr* listwa welarna.

Fig. 2 (p. 76)

Przekrój poprzeczny przez skorupkę samicy *K. praetuberculata* n. sp., uproszczony; *1* listwa welarna, *2* listwa admarginalna, *3* area subwelarna, *4* fałd dorsalny, *5* bruzda zawiasowa, *6* odcisk mięśnia.

Fig. 3 (p. 77)

K. kozłowskii (Přibyl), skorupka prawa od strony wewnętrznej (rysunek nieco schematyczny); *1* bruzda zawiasowa, *2* listwa, *3* listwa welarna, *4* brodawki admarginalne.

Fig. 4 (p. 78)

Przekrój podłużny przez skorupkę prawą *K. praetuberculata* n. sp. (rysunek schematyczny); *1* kanały porowe, *2* ciemna smuga, *3* odcisk mięśnia, *4* listwa admarginalna, *5* listwa welarna.

Fig. 5 (p. 80)

K. praetuberculata n. sp., skorupka prawa sfluorydyzowana; × 40

Fig. 6 (p. 81)

Stosunki pokrewieństwa między gatunkami rodzaju *Kozłowskiella* (Přibyl) w środkowym dewonie Gór Świętokrzyskich; *A K. praetuberculata* n. sp., *B K. tuberculata* n. sp., *C K. kozłowskii* (Přibyl), *D K. similis* n. sp. (skorupki lewe).

Fig. 7 (p. 82)

A — Wielkość skorupek dorosłych (kompletnych i lewych pojedynczych) *K. praetuberculata* n. sp. w trzech różnych poziomach w Wydryszowie. Na osi rzędnych — długości skorupek w mm, na osi odciętych — próby z kolejnych warstw.

B — Procentowy udział form dorosłych *K. praetuberculata* w trzech różnych poziomach w Wydryszowie. Na osi rzędnych — liczba skorupek lewych i kompletnych w ‰, na osi odciętych — wielkość w mm.

Fig. 8 (p. 82)

Stosunek długości do wysokości skorupki w poszczególnych stadiach; *a K. praetuberculata* n. sp., *b K. tuberculata* n. sp., *c K. kozłowskii* (Přibyl), *d K. similis* n. sp.

Fig. 9 (p. 83)

Procentowy udział trzech gatunków *Kozłowskiella* (Přibyl) w sześciu poziomach Wydryszowa; *A-F* kolejne poziomy, *a K. similis* n. sp., *b K. praetuberculata* n. sp., *c K. tuberculata* n. sp.

Fig. 10 (p. 84)

Procentowy udział trzech gatunków *Kozłowskiella* (Přibyl) w pięciu poziomach Grzegorzowic; *G-K* kolejne poziomy, *a K. similis* n. sp., *b K. praetuberculata* n. sp., *c K. tuberculata* n. sp.

Fig. 11 (p. 85)

Przekrój poprzeczny przez część wentralną skorupki prawej (rys. schemat.); *1 K. praetuberculata* n. sp., *2 K. similis* n. sp., *3 K. tuberculata* n. sp., *4 K. kozłowskii* (Přibyl), *r* listwa admarginalna, *t* brodawki admarginalne.

Fig. 12 (p. 85)

Szerokość powierzchni subwelarnej w poszczególnych stadiach rozwoju osobniczego; *1 K. praetuberculata* n. sp., *2 K. kozłowskii* (Přibyl), *3 K. similis* n. sp., *4 K. tuberculata* n. sp. Na osi rzędnych — szerokości w mm, na osi odciętych — stadia.

Fig. 13 (p. 85)

Procentowy udział dwóch gatunków *Kozłowskiella* (Přibyl) w pięciu różnych poziomach eiflu w Grzegorzowicach; *d K. praetuberculata* n. sp., *e K. similis* n. sp. Na osi rzędnych — ilość osobników w %%, na osi odciętych — kolejne poziomy.

Fig. 14 (p. 86)

Wymiary skorupek form dojrzałych *K. kozłowskii* (Přibyl). Na osi rzędnych — wysokość w mm, na osi odciętych — długość. Kwadracikami oznaczono samice, trójkątami — samców.

Fig. 15 (p. 87)

Przekrój podłużny przez skorupkę prawą *K. kozłowskii* (Přibyl) (rysunek schematyczny); *1* kanały porowe, *2* ciemna smuga, *3* odcisk mięśnia, *4* brodawki admarginalne, *5* listwa welarna, *6* L3, *7* S2, *8* L2.

Fig. 16 (p. 88)

Fragment powierzchni skorupki *K. praetuberculata* n. sp. (rysunek nieco schematyczny); *pc* kanał porowy, *dl* ciemna smuga.

Fig. 17 (p. 89)

Przekroje poprzeczne przez trzy pierwsze stadia *K. praetuberculata* n. sp. (rysunek schematyczny).

Fig. 18 (p. 90)

Graficzne przedstawienie wymiarów i liczby skorupek w poszczególnych stadiach rozwoju osobniczego *K. praetuberculata* n. sp. Na osi rzędnych — liczba, na osi odciętych — wymiary skorupek w mikronach.

Fig. 19 (p. 96)

Wymiary skorupek form dojrzałych *K. praetuberculata* n. sp. Na osi rzędnych — wysokość w mm, na osi odciętych — długość. Kwadracikami oznaczono samice, trójkątami — samców.

Fig. 20 (p. 97)

Procentowy udział skorupek *K. praetuberculata* n. sp. w poszczególnych stadiach.

Fig. 21 (p. 100)

Graficzne przedstawienie stosunku długości skorupki do szerokości powierzchni subwelarnej; *1 K. praetuberculata* n. sp., *2 K. similis* n. sp., *3 K. tuberculata* n. sp.

Fig. 22 (p. 100)

Procentowy udział skorupek *K. tuberculata* n. sp. w poszczególnych stadiach. Na osi rzędnych — liczba osobników w %%, na osi odciętych — stadia.

Fig. 23 (p. 103)

K. kozłowskii (Přibyl), diagram zmienności. Na osi rzędnych — procentowy udział w poszczególnych klasach.

Fig. 24 (p. 103)

Graficzne przedstawienie wymiarów skorupek 4 gatunków rodzaju *Kozłowskiella* (Přibyl) w środkowym dewonie Gór Świętokrzyskich. Linią przerywaną zaznaczono przypuszczalne zmiany wielkości w górnym eiflu i dolnym żywecie; *1* dolny eifel, *2* górny eifel, *3* dolny żywet, *4* górny żywet.

Fig. 25 (p. 105)

Wymiary skorupek form dojrzałych *K. similis* n. sp. Na osi rzędnych — wysokość w mm, na osi odciętych — długość. Kwadracikami oznaczono samice, trójkątami — samców.

Text-Pl. I (p. 90/91)

Rysunek (nieco schematyczny) rozwoju osobniczego skorupek; *A K. praetuberculata* n. sp., *B K. tuberculata* n. sp., *C K. kozłowskii* (Přibyl), *D K. similis* n. sp.

Pl. I

Kozłowskiella praetuberculata n. sp.

Fig. 1. Holotyp, skorupka samicy: *a* lewa skorupka, *b* strona dorsalna, *c* strona wentralna; × 23.

Fig. 2. Skorupka samca: *a* lewa skorupka, *b* strona wentralna; × 23.

Kozłowskiella similis n. sp.

Fig. 3. Holotyp, skorupka samicy: *a* lewa skorupka, *b* strona dorsalna, *c* strona wentralna; × 23. 5. Płat L2 na prawej skorupce uszkodzony.

Fig. 4. Skorupka samca: *a* lewa skorupka, *b* strona dorsalna; × 26.

Pl. II

Kozłowskiella kozłowskii (Přibyl)

Fig. 1. Skorupka samicy: *a* lewa skorupka, *b* strona dorsalna, *c* strona wentralna; × 23.

Fig. 2. Skorupka samca: *a* lewa skorupka, *b* strona wentralna; × 23.

Kozłowskiella tuberculata n. sp.

Fig. 3. Holotyp, skorupka samicy: *a* lewa skorupka, × 22; *b* strona dorsalna, *c* strona wentralna paratypu, × 23.

Fig. 4. Skorupka samca: *a* lewa skorupka, *b* strona wentralna; × 22.

Pl. III

Kozłowskiella praetuberculata n. sp., × 32

Fig. 1-8. Stadia młodociane I-VIII

Fig. 9. Skorupka samca.

Fig. 10. Skorupka samicy.

Pl. IV

Kozłowskiella tuberculata n. sp., × 32

Fig. 1-8. Stadia młodociane I-VIII
Fig. 9. Skorupka samca.
Fig. 10. Skorupka samicy.

ФРАНЦИШЕК АДАМЧАК

ОНТОГЕНЕЗ И ЭВОЛЮЦИЯ РОДА *KOZŁOWSKIELLA* (PŘIBYL) (OSTRACODA)

Резюме

Материал, на котором производились исследования над онтогенезом и изменчивостью рода *Kozłowskiella* (Přibyl), был собран в 1955-56 годах из среднего девона Свентокржиских Гор в местностях Выдрышув, Гржегоржовице и Скалы.

Kozłowskiella была впервые описана Пржибылем (A. Přibyl, 1953) как *Ulrichia (Kozłowskiella)*. Опираясь на морфологии, онтогенезе и изменчивости автор признал в ней независимый род, а из-за сходства до т. наз. круминального типа диморфизма (*crumena* = лат. сумка) поместил ее условно в пределах семейства Beyrichiidae.

На большом материале (около 3000 экземпляров молодых и взрослых форм) был прослежен между прочим онтогенезис — т.е. изменения, которым подвергается раковина в течение очередных линек — трех новых видов из эйфельского яруса (Выдрышув и Гржегоржовице):

Kozłowskiella praetuberculata n. sp.
Kozłowskiella tuberculata n. sp.
Kozłowskiella similis n. sp.

и одного вида описанного уже раньше Пржибылем (1953) из местности Скалы (живетский ярус) под названием *Ulrichia (Kozłowskiella) kozłowskii* Přibyl. Были изучены изменения, каким подвергаются описанные виды в процессах онтогенеза и эволюции в течение эйфеля и живета.

Что касается отдельных стадей индивидуального развития, они были выделены на основании методов обработанных Кеслингом (R. V. Kesling, 1953c). На основании закона Брукса (Brooks), согласно которому раковинка увеличивает свои размеры в процентном соотношении [1] после каждой линьки, этот автор обработал табели в виде логарифмических циклов, отвечающих теоретической величине роста для одного измерения (напр. длины), поверхности и объема.

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[1] Соотношение это, приблизительно постоянно для вида и пола, равно 1,26.

В эволюции рода *Kozłowskiella* (Přibyl) автор выделил два эволюционные ряды. Один из них представлен видами: *K. praetuberculata* n. sp. — *K. tuberculata* n. sp. — *K. kozłowskii* (Přibyl), другой только одним видом — *K. similis* n. sp.

Первый ряд был выделен на основании сходных преобразований морфологических элементов раковины, дающихся проследить также среди юных форм (текст-пл. I *A-C*). Было установлено, что изменениями подвергается между прочим лопасть L_3 (posterior lobe), которая проявляет у исходной формы (*K. praetuberculata* n. sp.) тенденцию образования на поверхности бугорков уже начиная с 6 или 7 стадии. У *K. tuberculata* n. sp. тот же элемент скульптуры бо́льших размеров и появляется на раковине начиная с 3-ей стадии. *K. kozłowskii* (Přibyl), которая замыкает этот эволюционный ряд (фиг. 6 *C*), бугорки на L_3 появляются во 2-ой стадии и исчезают после 6 или 7 линьки (текст-пл. I *C*). В результате этих преобразований возникает выразительная L_3. В корреляции с упомянутыми преобразованиями состоят: ширина субвелярной поверхности (subvelar area), которая увеличивается, и адмаргинальная кайма (admarginal ridge), которая превращается в ряд мелких адмаргинальных бородавок (admarginal tubercles).

K. similis представляет второй эволюционный ряд. L_3 у этого вида большая и в принципе сходна с L_3 у *K. kozłowskii* (Přibyl); на ее поверхности нет бугорков. Вид *K. similis* n. sp. возник вероятно быстро, причем основные перемены произошли в ранних стадиях онтогенеза. У юных форм задняя лопасть L_3, как правило, больше и выразительнее чем у остальных видов.

На основании этих преобразований автор делает вывод, что образование сходных элементов (выразительная L_3) в пределах одного рода может происходить либо путем медленных постепенных преобразований (*Kozłowskiella praetuberculata* n. sp. —*K. tuberculata* n. sp. — *K. kozłowskii* (Přibyl)), либо скачкообразно (*K. similis* n. sp.). В результате этих изменений возникает очевидно новая таксономическая единица в ранге вида.

Отдельная глава статьи посвящена вопросу структуры раковин и изменениям, которым они подвергаются в процессе эволюции. Дело здесь в „темных полосах" (dark line) констатированных на тонких разрезах у родов *Kozłowskiella* (Přibyl) и *Saccarchites* Swartz & Withmore. На раковинах видов *Kozłowskiella* они были установлены вдоль свободного края раковины в виде темной полосы и на выдающихся элементах сетки образующей скульптуру. Эти структуры появляются начиная с ранних стадий онтогенетического развития, первоначально в зоне свободного края, а затем, постепенно, в остальной части раковины (фиг. 15). У *S. ornatissimus* (Gürich) „темные полосы" появляются в более поздних стадиях онтогенеза, но таким же образом как у *Kozłowskiella*. По мнению автора не исключается возможность связи этого явления с процессом кальцификации раковины.

На основании некоторых элементов скульптуры и структуры раковин автор предполагает, что исходных форм для рода *Kozłowskiella* (Přibyl) следует искать среди видов рода *Saccarchites* Swartz & Whitmore. Единственный до сих пор представитель этого рода известный из Польши был описан Гюрихом (G. Gürich, 1953) под названием *Primitia ornatissima*. При более внимательном изучении этого вида оказалось, что он проявляет много аналогии с представителем рода *Saccarchites* и по этой причине он должен быть помещен в пределах именно этого рода.

С морфологической точки зрения, промежуточную позицию между этими родами занимает *Aparchitellina* Polenova. В особенности один вид этого рода, *A.* cf. *decorata*, предоставленный автору Е. Н. Поленовой в 1957 году, проявляет много аналогии по отношению к обоим вышеназванным родам. Окончательное разрешение этой проблемы требует однако основательных сравнительных исследований, особенно над структурой раковины.

PLATES

EXPLANATIONS OF PLATES

Pl. I

Kozłowskiella praetuberculata n. sp.

Fig. 1. Holotype, female: *a* left valve, *b* dorsal view, *c* ventral view; × 23.
Fig. 2. Male: *a* left valve, *b* ventral view; × 23.

Kozłowskiella similis n. sp.

Fig. 3. Holotype, female: *a* left valve, *b* dorsal view, *c* ventral view; × 23.5. L2, on the right valve, damaged.
Fig. 4. Male: *a* left valve, *b* ventral view; × 26.

Pl. II

Kozłowskiella kozłowskii (Přibyl)

Fig. 1. Female: *a* left valve, *b* dorsal view, *c* ventral view; × 23.
Fig. 2. Male: *a* left valve, *b* ventral view; × 23.

Kozłowskiella tuberculata n. sp.

Fig. 3. Holotype, female: *a* left valve, × 22; *b* dorsal view, *c* ventral view of paratype, × 23.
Fig. 4. Male: *a* left valve, *b* ventral view; × 22.

Pl. III

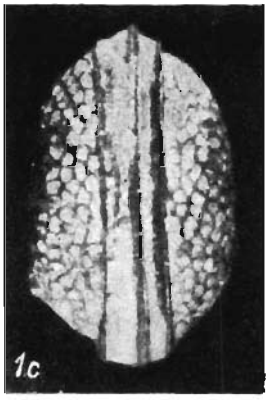
Kozłowskiella praetuberculata n. sp., × 32

Figs. 1-8. Instars I-VIII.
Fig. 9. Male.
Fig. 10. Female.

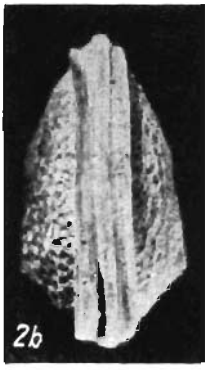
Pl. IV

Kozłowskiella tuberculata n. sp. × 32

Figs. 1-8. Instars I-VIII.
Fig. 9. Male.
Fig. 10. Female.


1c


1b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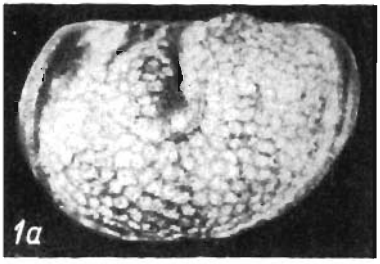
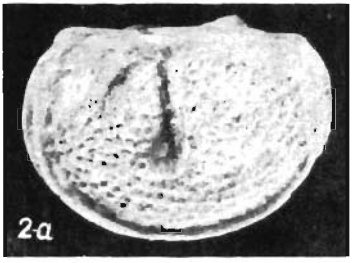

1a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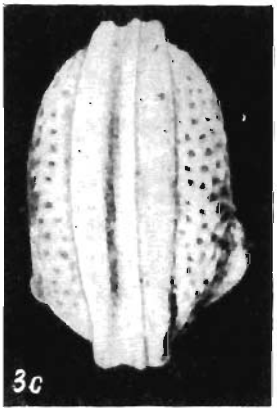
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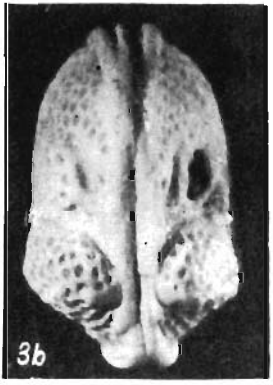
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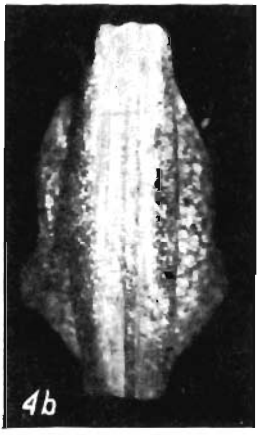
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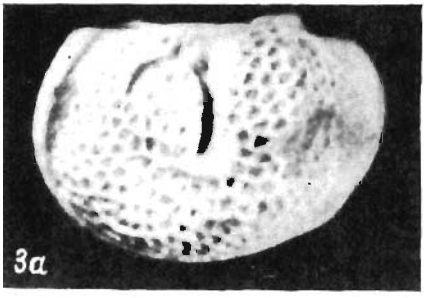
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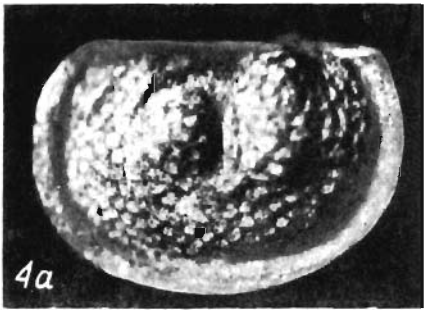
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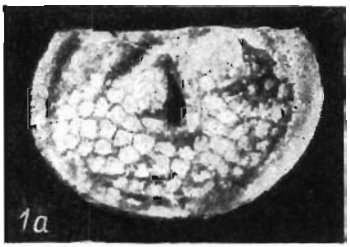
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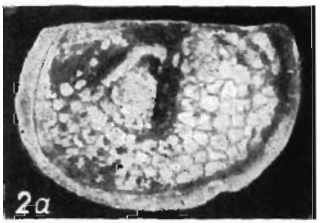
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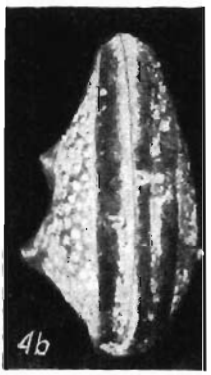
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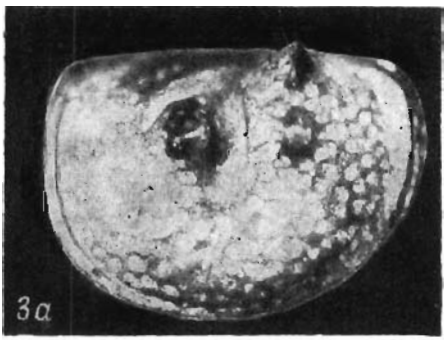
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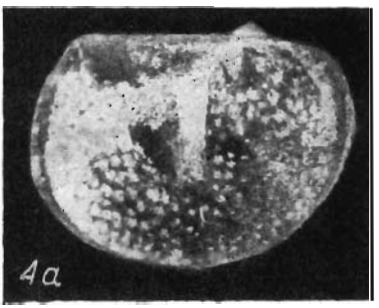
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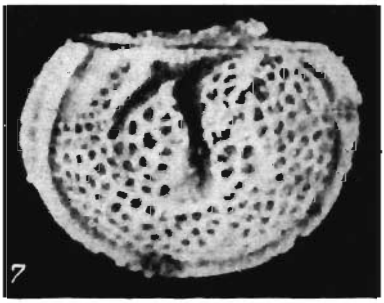
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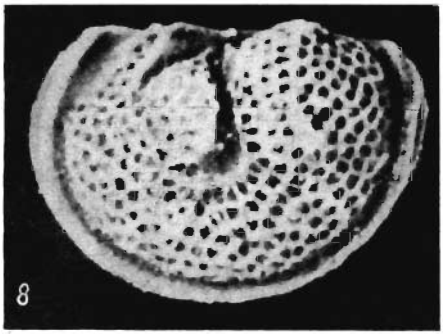
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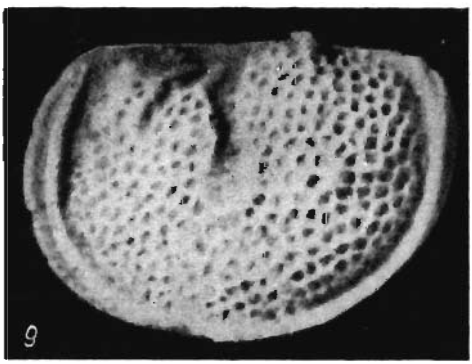
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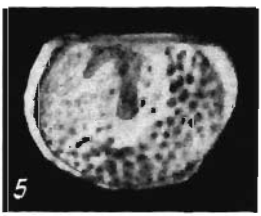
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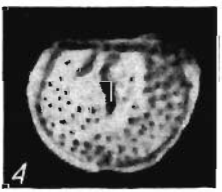
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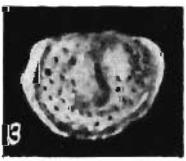
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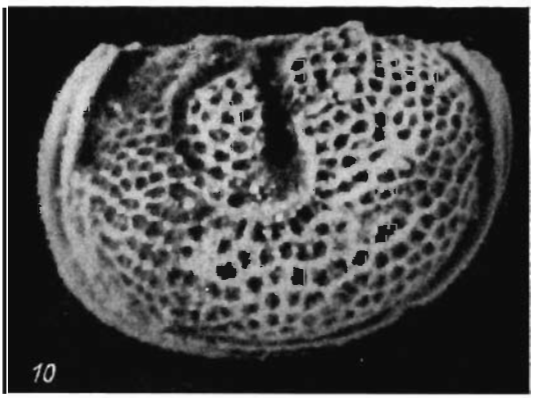
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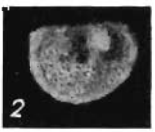
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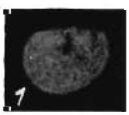
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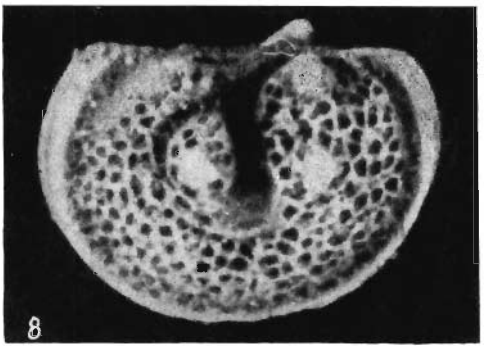
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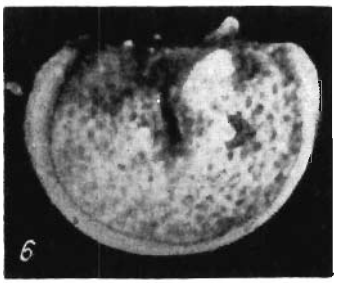
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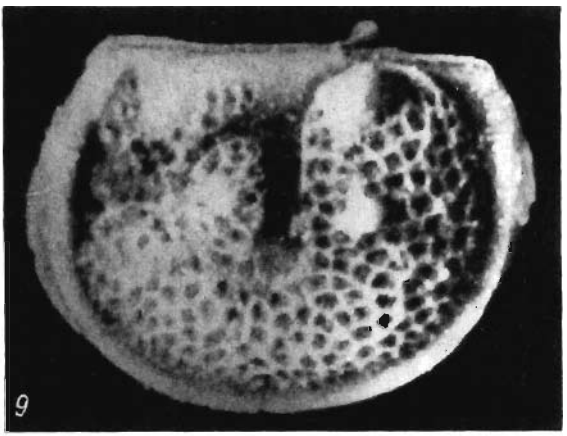
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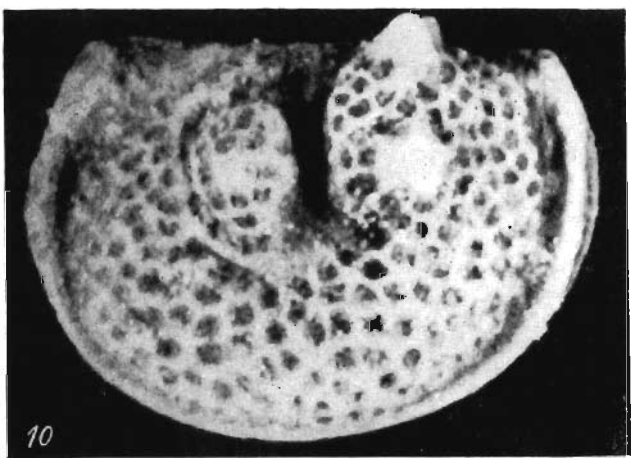
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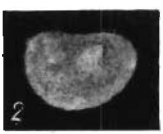
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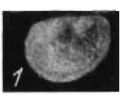
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