A C T A P A L A E O N T O L O G I C A P O L O N I C A
Vol. XIII 1968 No. 4

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ON ABNORMAL MORPHOLOGY OF THE GENUS *LENTICULINA* LAMARCK, 1804 (FORAMINIFERA)

Abstract. — A detailed analysis has been made of the specimens of different species assigned to *Lenticulina* Lamarck, 1804 and having a trochospirally coiled test, abnormal for this genus. On the basis of morphological studies and observations in a transmitted light, the groundlessness has been shown of separating such specimens and erecting for them the genus *Darbyella* Howe & Wallace, 1932. These trochospiral lenticulins from the Jurassic, Cretaceous and Paleocene of Poland correspond to abnormal ontogenetic stages of respective symmetric species.

INTRODUCTION

Beginning the studies on the materials, collected for tracing the evolution of the genus *Lenticulina* Lamarck, 1804, from the Jurassic and Cretaceous sediments of Poland, I observed asymmetric forms which, in some samples, occurred next to normal, symmetric specimens of this genus.

In 1932, studying the microfauna of the Upper Eocene Jackson formation in the State of Louisiana, the American authors, Howe and Wallace, described specimens otherwise similar to *Lenticulina*, but having in adult stage trochoidal tests with a low spiral. This character, along with the type of aperture in the form of a single elongate slit without any accessory radiate opening, induced these authors to separate such specimens and to erect a new genus *Darbyella*, with *D. danvillensis* Howe & Wallace as a type species. Since in the material, including 689 samples from 15 bore-holes and outcrops from different localities in Poland, I found, next to normal specimens, also others with a trochospiral structure, a somewhat closer examination of this problem seemed to be interesting.

The material examined, marked *ZNG*, is housed at the Micropalaeontological Laboratory of the Polish Academy of Sciences, Institute of Geological Sciences. The specimens, shown in Pl. III, Figs. 3, 4 and 7, come from the collections of the Palaeozoological Institute, Polish Academy of Sciences (*Z. Pal.*) and have been kindly placed at my disposal

by Prof. K. Pożaryska, whom I would like to express my heartfelt thanks for this. My gratitude is also due to Prof. R. Kozłowski, Prof. O. Pazdro and Prof. K. Pożaryska for their critical remarks, correcting my manuscript and friendly advice.

I feel indebted to Dr. J. Błaszyk and Miss L. Łuszczewska for taking photographs, and to Mrs. K. Budzyńska for inking of my pencil drawings.

REMARKS ON CLASSIFICATION

The detailed analysis of the abnormal structure, recorded in different groups of foraminifers, is a relatively recent subject of literature. In view of a considerable morphological variability of *Lenticulina*, some authors understand a species very broadly, whereas some others excessively narrow this concept giving various specific and even generic names to the forms which only slightly differ from each other.

In 1864, mostly on the basis of an asymmetric development of the test, Terquem described a new species *Cristellaria turbiniformis* from Lias of Alsace. Similar asymmetric specimens from Lias of Jutland were mentioned by Nørvang (1957) as *Darbyella turbiniformis* (Terquem).

Wiśniowski (1890) uses twice the name of *Cristellaria* sp. for the forms coming from Callovian clays and which are asymmetrically developed. Some specimens with a trochospiral structure and aperture in the form of a slit, rarely met with in his material, are assigned by him to the family Rotaliidae as a new species *Pulvinulina calva*. Since the last chamber of the specimen, presented in his work, seems to be partly broken, according to Soviet authors (Mityanina, 1955), Wiśniowski insufficiently examined the aperture, and judging by other characters of their structure, the representatives of *Pulvinulina calva* Wiśn. rather belong to Lagenidae. Mityanina found, in Jurassic sediments of Byelorussia, asymmetric foraminifers very similar to *P. calva* Wiśn. except for the structure of their apertures, developed in the form of an opening at the peripheral angle of the last chamber, i. e. identically as in *Lenticulina*. She called them *Darbyella* (*Cristellaria*?) *calva* (Wiśn.), thus emphasizing their assignment to Lagenidae and identifying them with Wiśniowski's forms.

Darbyella calva from the Upper Callovian of the Mangishlak Peninsula has been illustrated in „Osnovy Paleontologii" („Fundamentals of Palaeontology") (1959, vol. I, p. 254, Figs. 4 a, b, v).

After examining of about 2000 spirally coiled tests of Jurassic Lagenidae, Kuznetsova (1960*b*) attracts attention to the fact that individuals with trochoid tests differ from *Darbyella* Howe & Wallace in the structure of aperture and that the feature of trochospirality alone seems to be insufficient as a basis for distinguishing a separate genus. Thus, she replaces the name of *Darbyella kutsevi* Dain (Dain, 1948) with that of *Lenticulina kutsevi* (Dain), and consequently, *Darbyella* (*Cristellaria*?) *calva* (Wiśn.), described by Mityanina, becomes *Lenticulina calva* (Wiśn.). The fact should, however, be pointed out that the introduction of the name *Lenticulina calva* (Wiśn.) for Mityanina's asymmetric specimens, confuses them with another, completely different, symmetric species *Lenticulina calva* (Wiśn.), existing since 1890 and which has been described by Wiśniowski (1890, Pl. 10, Figs. 4 a, b). Thus, Bielecka (1960) identifies, from the sediments of the same age as Kuznetsova's materials, about 100 specimens of *L. calva* (Wiśn.) which have nothing in common with an abnormal *L. calva* (Wiśn.), cited by Kuznetsova (1960b, Pl. 2, Figs. 3 a, b, v) and, therefore, an identical name for both these different species is unacceptable.

At present, about 20 species of the genus *Darbyella*, cited from Jurassic, Cretaceous and Tertiary, as well as Recent ones, are known in literature. Since the apertures of these species are shaped either as in typical lenticulins, i. e. in the form of a radial opening at the peripheral angle of the last chamber, or as radiate aperture with a „*Robulus*"-type slit, it is only a trochoid structure of the test in adult stages that makes up the main character, on the basis of which several authors considered the specimens they examined to be representatives of *Darbyella*. The species *D. nitida* Ten Dam & Reinhold, cited in textbooks on foraminifers, is characterized by an aperture typical of *Robulus* (Sigal, 1952; Pokorný, 1958).

Consequently, a detailed examination of the trochospirality to ascertain whether or not it is sufficiently stable feature to make up a generic character, seems to be necessary. The lenticulins with a trochoid structure of test from Jurassic, Cretaceous and Lower Tertiary of Poland have been examined precisely from this viewpoint. The results of these observations are as follows:

1. Specimens with a disturbed symmetry occur together with those having their structure typical of the genus *Lenticulina*. They have all characters of *Lenticulina* but, reaching the adult stage, change the symmetry of their structure by shifting the last coil of chambers to one side of the test.

2. The degree and direction of this displacement in trochoid representatives of one species are not stable. This may be either a slight disturbance in equilibrium, with which the apertural face in the place of contact with the keel is divided by the latter at a ratio of 1 : 2, or a considerable displacement of the last 2–3 (or, rarely, 4) chambers of the last coil to the left or, mostly, to the right side of the test (Pls. I, II, III). In some cases, specimens with a different degree of shifting of the chambers may be arranged in a series with a symmetric species of the genus *Lenticulina* on the one, and the „*Darbyella*" stage of this species —

on the other end of it. The determination of trochospiral forms as definite although atypical species of the genus *Lenticulina*, mostly does not present major difficulties. This shows that the character of trochospirality is not in itself a sufficient basis for separating a genus.

3. The observation of the behaviour of trochospiral lenticulins over a long stretch of time indicates that the asymmetric structure is not hereditary character transmitted from generation to generation. Despite the fact that asymmetric individuals occur in different stratigraphic horizons, they neither form any continuous development line, nor display a more extensive horizontal development. Consequently, these are not representatives of some new development trend, but they should be examined as atypical ontogenetic stages of symmetric species. The observations of Kuznetsova (1960*b*) who separated, within *Lenticulina,* the species which never develop asymmetric tests, from those whose asymmetric structure gives a basis for erecting a new species, have not been confirmed by the studies on the Polish material. In an abundant material trochospiral individuals are met with within different species of *Lenticulina*, and therefore it seems appropriate to ascribe the potentiality of this anomaly to all species of *Lenticulina*. It should be, however, emphasized that the disorders in the symmetric plan of structure occur mostly in the species which reach large dimensions and are tightly coiled. This phenomenon occurs less frequently in small species or in those displaying a tendency to uncoiling the last chambers. New species, erected on the basis of the deviations of such type, would only slightly differ from each other, have only local significance and be of no stratigraphic value. There are the cases, described in literature, in which on the basis of an incomplete material, particular ontogenetic stages of the same species are considered separate species. In this way, encumbrance of names is produced which additionally involves a complex taxonomy of this group.

4. The number of lenticulins with a trochoid structure of test occurring in the Jurassic Cretaceous and Tertiary material, is not great and makes up a small percentage of the entire foraminiferous assemblage. It is characteristic that in both large and small, both coiled and uncoiled species, this anomaly occurs almost exclusively in adult forms with closed ontogenetic development. The loss of equilibrium occurs in the last stage of ontogeny, whereas the entire, previously developed part of test displays a symmetric structure. Apertures of these forms are developed as in normal *Lenticulina* or, less frequently, they may occur in the form of a radiate opening with the „*Robulus*"-type slit.

Observations, made on Polish materials, do not deviate from others, known from literature. Many authors express similar views.

Describing few, asymmetrically built specimens from Eocene of America as *Darbyella*?, Toulmin (1941) supposes that these may be abnormal forms of *Robulus*. Likewise, studying the foraminifers of the northern part of the Patagonian Shelf, Boltovskoy (1954) does not preclude the possibility that the representatives of *Darbyella* do not form independent species, but make up varieties of the species of the genus *Robulus*, originated as a result of unfavourable living conditions. Describing *Darbyella volgensis*, Tappan (1955) suggests that, after a detailed examination, the trochospiral species may turn out to be synonyms of symmetric species. Kuznetsova (1960*b*), who closely studied this problem, considers — in some cases — the character of trochospirality to be a sufficiently stable basis for distinguishing a new species, but not genus.

Observations, very similar to those, made on Polish material, are presented in Kaptarenko-Chernousova's (1961) and Kasimova's (1964) works. Studying the Upper Jurassic microfauna, these authors met with forms which, according to their structural characters, might be assigned to *Darbyella* and which had their symmetric equivalents. The determination of *Lenticulina subinvoluta* Kaptarenko — a symmetric variety of the species *Darbyella kutsevi*, erected by Dain (1948), is one more proof of the erroneousness of separating trochospiral forms as independent species.

The taxonomy of foraminifers, worked out by Loeblich and Tappan (1964), includes *Darbyella* Howe & Wallace, together with its uncoiling equivalent, i.e. *Darbyellina* Harris & Sutherland, in the synonymy of *Lenticulina*. The results of studies, described in the present paper, confirmed the correctness of this decision.

The occurrence of anomalies in foraminifers is not a rare phenomenon. Deviations from the normal development are observed within various groups. Mostly, they consist in an abnormal development of the last chambers, or in the disturbance in a usual direction of the test growth. Sometimes, both these peculiarities occur simultaneously and, in such cases, chambers, asymmetrically arranged in relation to a previous plan of structure, are also differently shaped. Thus formed specimens within the genera *Nonion*, *Globigerina*, *Bolivina* and *Nodosaria*, are described by Džanelidze (1957) from Miocene of Georgia, USSR.

Polish materials also display another type of anomaly, represented by the specimens which, with a normal structure of chambers, develop additional morphological elements, mostly accessory apertures. Such apertures are usually situated on top of additional chambers which may appear at any place on the test. The occurrence of a double proloculum is a rare type of anomaly.

The anomalies, referred to above, are noted in literature. They are extensively described by Pożaryska (1957).

The problem of influence exerted by an environment on the development of test was experimentally studied by Myers (1943) who, observing Recent *Elphidium crispum*, found a correlation between the formation of chambers and the amount of food. Disadvantage effects may be exerted on the development of test by both the scarcity and excess of food.

Boltovskoy (1954) suggests that poor nutrition cause, in most foraminifers, changes which consist in a general decrease in dimensions and poorer ornamentation. In some species, they evoke asymmetry. This cannot, however, explain anomalies, observed in lenticulins, since, as mentioned above, the loss of a symmetric plan of structure is primarily recorded in bulky individuals.

Changes in salinity and temperature of water, in secretion of $CaCO_3$ and disturbances in a normal gaseous regime are also considered factors which may cause certain deviations. In such cases, however, abnormal characters appear in a large number of individuals, whereas only few asymmetric lenticulins were found in studied samples.

An interesting hypothesis, which may explain the causes of the formation of abnormal chambers in adult foraminifers, was presented by Okropiridze (1956). After a detailed examination of adult specimens of the genus *Globigerina* in which such a deviation was observed, this author supposes that, after reaching the stage of adulthood, they could not for some reason pass to the stage of reproduction. In the course of their further life, as a result of metabolism, they were compelled to produce new and new chambers but, since the stage of proper growth was already completed, these new chambers, as a result of a further abnormal development of test, were mostly differently shaped. It seems that, since the disorders in the structure also concern only the last phase of the development, this explanation may be also applied to the anomalies in lenticulins. In addition, the development of abnormal forms may be also evoked by diseases, or such forms may represent gerontic stages.

Another type of anomalies, caused by a mechanical damage of tests during an individual's life time, was also observed in lenticulins. Thanks to the phenomenon of regeneration, a reconstruction of the test may take place, frequently accompanied by the loss of the planispiral structure.

OBSERVATIONS IN THE TRANSMITTED LIGHT

I tried to solve the problem of trochospiral lenticulins not only on the basis of morphological observations. The preparation of several thin sections for observations in the transmitted light, allowed me to analyze the internal structure of these foraminifers and the structure of the test walls. For the purposes of comparative observations both the trochospiral and symmetric lenticulins were subject of thin sections. Building up of chambers in lenticulins usually takes place according to the following pattern: a lamella of calcite, forming the wall of a new chamber, in each case posteriorly overlaps a previously built part of test, tegularly covering previous chambers. Thereby, the walls of older chambers become secondarily multi-laminar and, depending on how far is the posterior extent of the covering layer, an appropriate number of laminae in a wall may be observed in the cross section through the test. Thus, it is only the wall of the last chamber that remains unilaminar, whereas the walls of previous chambers become thickened. In the case, when the wall of a newly formed chamber simultaneously covers the entire previously built part of test, a maximum number of lamellae forming the test wall is equal to the number of chamber occurring in a coil. One lamella of the wall corresponds to each chamber in a coil. The laminar structure of the test of *Lenticulina* results from the manner of building up new chambers. Several species of *Lenticulina* develop tests completely covered by the walls of built up chambers only in younger ontogenetic stages and it is during later development period that they switch to the tegular type of accretion. This has been previously described by Kuznetsova (1961) who, examining lenticulins in a wide interval from Middle Jurassic to Upper Eocene, cited one more type of building up chambers in which the wall of test from proloculum up to the last chamber is always unilamellar. A secondary nonlamellar type of microstructure in some lenticulins was observed by Norling (1968) in the materials from Lower Lias of Sweden. Kuznetsova's observations seem to indicate that this type of microstructure is not limited to Lias only. In the Polish material, no cases were recorded in which the test walls of lenticulins would remain unilamellar during the entire period of the ontogenetic development.

In my studies, particular attention was paid to the thin sections of trochospiral lenticulins. The comparison of young ontogenetic stages of corresponding asymmetric and symmetric specimens has shown that in this stage of development there were no differences between them and, therefore, if such tests were found in this growth stage in the sediment, they would be undoubtedly identified as the same species. In the course of a further development, a decisive majority of individuals continue the previously started planispiral plan of structure, whereas few of them, reaching the adult stage, lose the symmetry as a result of the displacement of the plane of coiling the spiral. The loss of equilibrium takes place gradually and affects the chambers of the last coil only. The last but one and the last chamber most strongly deviate from the original plane of coiling and most strongly emphasize the asymmetric development of the test. Comparing the manner of building up of the last chambers with those forming a symmetric part of test, it has been observed that laminae corresponding to trochospiral chambers less strongly embrace the test posteriorly. No cases have been recorded either in which the trochoid specimens, which in their symmetric part built up the chambers by complete covering of the test, would maintain this type of microstructure up to the end of the development (Text-figs. 1 *A*, *B* and 2). Depending on the degree of deviation of the last chambers from the original plane of coiling with the loss of planispirality, a more or less unequal covering of test by laminae, related to these chambers, is observed. The involute side of the test, i.e. that to which the chambers are shifted, is in all cases more strongly covered, whereas on the opposite side of the chamber, laminae, not reaching the umbilicus, uncover the preceding coil.

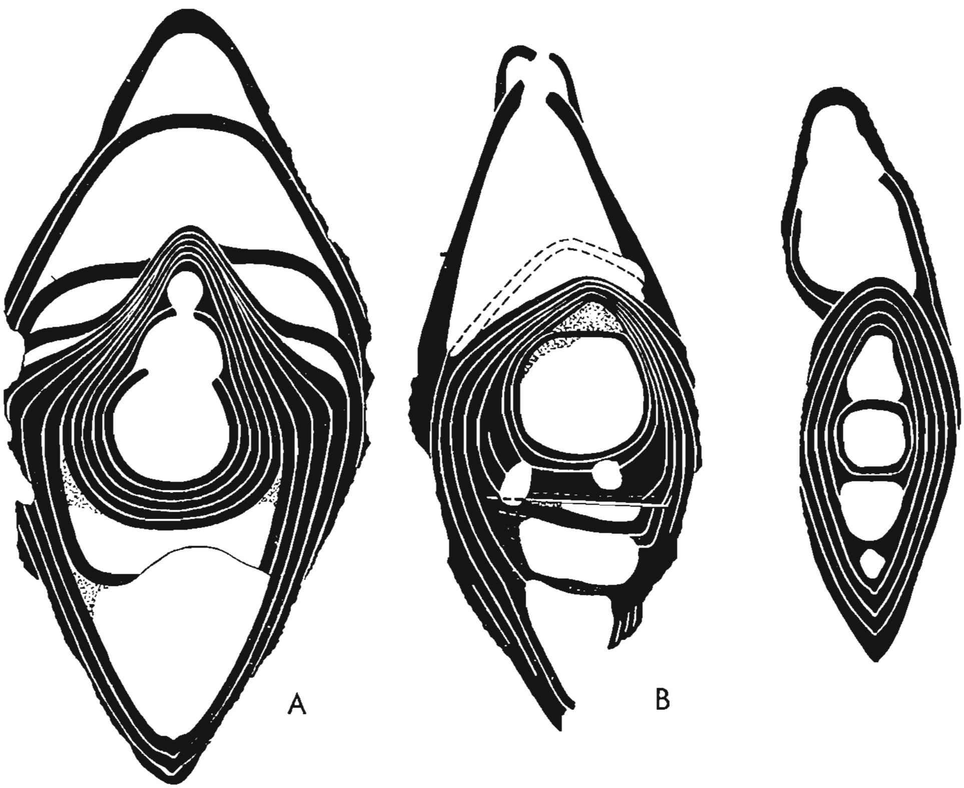

Fig. 1 Fig. 2

Fig. 1. — Axial section through *Lenticulina comptoni* (*Sowerby*): *A* specimen with a normal, planispiral structure. Sulejów, Lower Campanian (ZNG No. 2/i); × 100. *B* specimen with a trochospiral structure, formed as a result of a gradual deviation of the chambers of the last coil from the original plane of coiling. Wesołówka, Emscherian (ZNG No. $4/d_1$); × 100.

Fig. 2. — *Lenticulina* ex gr. *muensteri* (Roemer), axial section through an asymmetric individual. Slight and non-uniform posterior encirclement of the test by laminae corresponding to trochospiral chambers visible in the picture. Wesołówka, Upper Turonian (ZNG No. $6/c_1$); × 100.

The determination which type of microstructure represents a definite species is a difficult problem. Difficulties, involved in the preparation of thin sections and interpretation of the picture, cause that some authors who studied the microstructures of identical genera and species, sometimes obtained different results. The problem of an extent to which the microstructure of the wall is useful for taxonomy and stratigraphy, is not unequivocally solved either. Norling (1968) emphasizes that it should be taken into account with a necessary revision of „*Lenticulina*" plexus. According to Zobel (1966), the lamellar structure of wall is identical in all representatives of *Lenticulina* and from Lias α to the Recent period no phylogenetic differences were recorded in the microstructure of wall and, consequently, it is not useful for the purposes referred to above. At present, the studies on the microstructure of the Foraminifera become a more and more generally accepted method and, therefore, it should be expected that the problems dealt with here will soon be solved.

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O ANORMALNEJ BUDOWIE OTWORNIC RODZAJU *LENTICULINA* LAMARCK, 1804

Streszczenie

W czasie prowadzenia badań nad ewolucją otwornic rodzaju *Lenticulina* Lamarck zaobserwowano, że w niektórych próbach, obok normalnych, planispiralnie zwiniętych gatunków *Lenticulina*, występują osobniki realizujące budowę trochoidalną o niskiej spirali. W roku 1932 Howe i Wallace opisali z górnego eocenu formacji Jackson w stanie Luizjana okazy bardzo zbliżone innymi cechami do *Lenticulina*, lecz mające w stadium dojrzałym budowę trochoidalną o niskiej spirali oraz ujście wykształcone w postaci szczeliny. Na podstawie tych nietypowych dla rodzaju *Lenticulina* cech, osobniki te wydzielono w odrębny rodzaj *Darbyella*, z gatunkiem typowym *D. danvillensis* Howe & Wallace.

Do chwili obecnej znanych jest w literaturze około 20 gatunków rodzaju *Darbyella* z jury, kredy, trzeciorzędu i czasów współczesnych. Autorzy tych gatunków opierali się w głównej mierze na trochospiralnej budowie skorupki w stadium dojrzałym, ujścia bowiem wykształcone są albo jak u typowych *Lenticulina* — w postaci promienistego otworu przy peryferycznym kącie ostatniej komory, albo w postaci ujścia promienistego z „robulusową" szczeliną.

Autorka, dysponując materiałem o szerokim zasięgu stratygraficznym, uważała za interesujące dokładne zbadanie cechy trochospiralności dla wyjaśnienia, czy jest ona dostatecznie trwała i wystarczająca by uznać ją za cechę rodzajową. Na podstawie badań morfologicznych i obserwacji szlifów w świetle przechodzącym stwierdzono, że egzemplarze trochospiralne mają pod względem budowy wszystkie cechy rodzaju *Lenticulina*; osiągając jednak stadium dojrzałe naruszają symetryczny plan budowy wskutek przemieszczania płaszczyzny zwinięcia spirali. Stopień i kierunek tego przemieszczenia u trochospiralnych przedstawicieli danego gatunku nie jest stały. W niektórych przypadkach okazy o różnym stopniu przemieszczenia komór można ustawić w szereg, otrzymując na jednym jego końcu symetryczny gatunek rodzaju *Lenticulina*, na drugim — stadium „darbyellowe" tego gatunku. Mimo, że osobniki asymetryczne występują w różnych poziomach stratygraficznych, nie tworzą one ciągłej linii rozwojowej, nie wykazują też szerszego rozprzestrzenienia poziomego.

W obfitym materiale osobniki trochospiralne występują w obrębie różnych gatunków rodzaju *Lenticulina*, jednak w większości przypadków zachwianie symetrycznego planu budowy występuje u osobników tych gatunków, które osiągają duże rozmiary skorupek. Jest charakterystyczne, że zarówno u gatunków dużych, jak i małych, zwiniętych czy rozwijających się, cecha ta dotyczy prawie wyłącznie form dojrzałych, o zakończonym rozwoju osobniczym.

Trudno jednoznacznie odpowiedzieć, jaka przyczyna spowodowała anormalne wykształcenie się niektórych skorupek, przy ogromnej przewadze zbudowanych symetrycznie. Obserwacja struktury komór asymetrycznych nasuwa przypuszczenie, że utrata planispiralności jest wynikiem osłabionej aktywności życiowej otwornicy. Porównując sposób nawarstwiania się komór ostatnich w stosunku do budujących symetryczną część skorupki zaobserwowano, że laminki, odpowiadające komorom trochospiralnym, słabiej obejmują skorupkę do tyłu. Nie stwierdzono też przypadku, aby egzemplarze trochospiralne dobudowywały komory metodą całkowitego pokrywania skorupki, aż do zakończenia rozwoju osobniczego. Przebadane lentikuliny trochospiralne z jury, kredy i paleocenu Polski stanowią anormalne stadia rozwojowe odpowiednich gatunków symetrycznych. Zaliczanie okazów zbudowanych nietypowo do odrębnego rodzaju *Darbyella* Howe & Wallace tylko na podstawie trochospiralności jest bezpodstawne.

БРОНИСЛАВА ЕНДРЫКА

ОБ АНОРМАЛЬНОМ СТРОЕНИИ ФОРАМИНИФЕР РОДА *LENTICULINA* LAMARCK, 1804

Резюме

Во время исследований над эволюцией фораминифер рода *Lenticulina* Lamarck замечено, что в некоторых образцах, рядом с нормальными, планоспиральными раковинами видов *Lenticulina*, находятся особи, имеющие трохоидное строение с низкой спиралью. В 1932 году, Howe и Wallace описали из верхнеэоценовой формации Jackson, в штате Луизиана, экземпляры очень сходные по отношению иных признаков с *Lenticulina*, но имеющие в зрелой стадии трохоидное строение с низкой спиралью и устье в форме щели. На основании таких нетипичных для рода *Lenticulina* признаков, особи эти выделено в отдельный род *Darbyella*, с типичным видом *Darbyella danvillensis* Howe & Wallace.

До сих пор в литературе известно около 20 видов рода *Darbyella* из юрских, меловых, третичных, а также современных осадков. Авторы этих видов основывались главным образом на трохоспиральном строении раковины в зрелой стадии, так как устья развиты или в форме типичной для *Lenticulina*, т.е. в виде радиального отверстия около периферийного угла последней камеры, или же в форме радиального устья с „робулусовой" щелью.

В связи с обильным материалом, о широком стратиграфическом распространении, который был в распоряжении автора, большой интерес имеет детальное исследование признака трохоспиральности, есть-ли он довольно устойчивый и достаточный, чтобы иметь ранг родового признака. На основании морфологических наблюдений и изучения шлифов в проходящем свете констатировано, что трохоспиральные экземпляры в отношении строения имеют все признаки *Lenticulina*, но в зрелой стадии нарушают симметричный план строения вследствие смещения плоскости навивания спирали. Степень и направление этого смещения у трохоспиральных представителей этого вида не постоянный. В некоторых случаях экземпляры с разной степенью смещения камер можно уставить в ряд, на одном его конце получая симметричный вид рода *Lenticulina*, на втором — „дарбыэлловую" стадию этого вида. Несмотря на то, что асимметричные особи находятся в различных стратиграфических горизонтах, не образуют они последовательной линии развития, а также не проявляют широко горизонтального распространения.

В обильном материале трохоспиральные особи встречаются в пределах различных видов рода *Lenticulina*, но в большинстве случаев нарушение симметричного плана строения проявляется у особей достигающих больших размеров. Характерно, что так у больших, как и малых, а также завитых и развёртывающихся видов, эта черта почти исключительно касается зрелых особей, у которых индивидуальное развитие уже закончилось.

Затруднительно ответить однозначно, что было причиной анормального образования некоторых раковин, при большом превосходстве построенных симметрично. Наблюдения асимметричной структуры камер позволяет предполагать, что потеря планиспиральности является последствием ослабевшей жизненной активности фораминифер. Сравнивая образ наслоения последних камер по отношении к образующим симметричную часть створки, замечено, что пластинки отвечающие трохоспиральным камерам обнимают створку более слабо к заду. Не констатировано тоже случая, чтобы трохоспиральные экземпляры достраивали камеры путем сплошного прикрывания створки вплоть до окончания индивидуального развития. Изученные юрские, меловые и палеоценовые лентикулины Польши составляют анормальные стадии развития соответствующих симметричных видов. Причисляние нетипично построенных экземпляров к отдельному роду *Darbyella* Howe & Wallace только на основании трохоспиральности, совсем необосновано.

PLATES

Plate I

Lenticulina quenstedti (Gümbel)

Specimens with a different degree and different directions of shifting of the last chambers

Fig. 1. Turów bore-hole, depth 382.6 m, Middle Vesulian (ZNG No. 18/II); × 50.
Fig. 4-6. Specimens from one sample. Jaworznik bore-hole, depth 59 m, Upper Vesulian (ZNG No. 14/II); × 70.
Fig. 11. Turów bore-hole, depth 397.1 m, Middle Vesulian (ZNG No. 2/III); × 50.
Fig. 12. Turów bore-hole, depth 417.4 m, Middle Vesulian (ZNG No. 7/III); × 50.
Fig. 13. Jaworznik bore-hole, depth 57,9 m, Upper Vesulian (ZNG No. 15/II); × 50.

Lenticulina polymorpha (Terquem)

Specimens with a lost symmetry of structure

Fig. 2. Turów bore-hole, depth 391.9 m, Middle Vesulian (ZNG No. 20/II); ×45.
Fig. 3. Jaworznik bore-hole, depth 31.5 m, Middle Bathonian (ZNG No. 10/II); × 45.

Lenticulina volubilis Dain

Fig. 7. Chambers of an uncoiled part shifted in relation to the original plane of coiling. Turów bore-hole, depth 402.3 m, Middle Vesulian (ZNG No. 4/III); × 40.

Lenticulina ex gr. *quenstedti* (Gümbel)

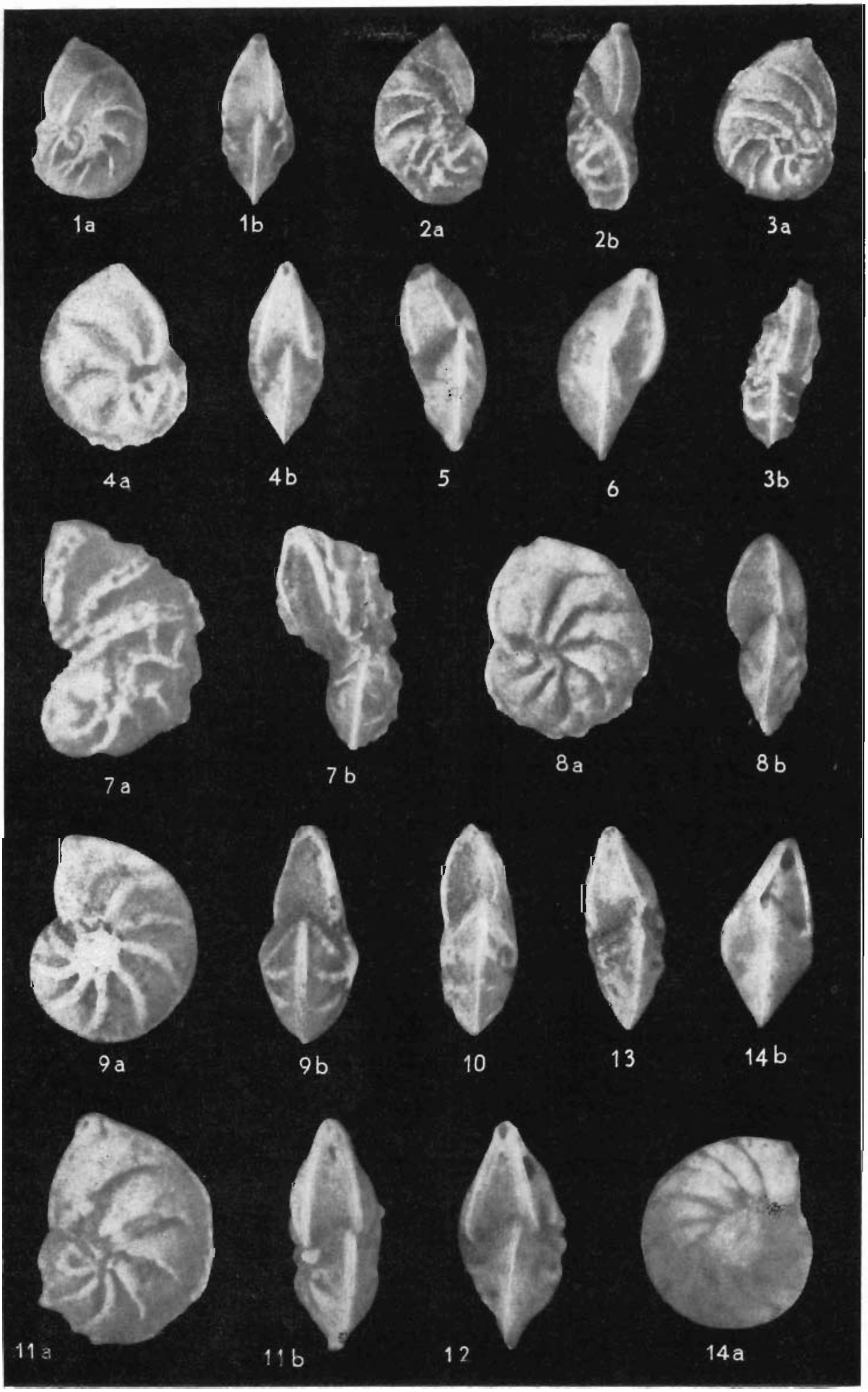
Fig. 8. Last chambers shifted to the lateral part of test. Turów bore-hole, depth 395.8 m, Middle Vesulian (ZNG No. 1/III); × 50.

Lenticulina ex gr. *subalata* (Reuss)

Fig. 9-10. *9* Normal specimen, *10* asymmetric specimen. Kcynia I bore-hole, depth 248 m, Bononian (ZNG No. 20/III); × 50.

Lenticulina integra Kaptarenko

Fig. 14. A large umbonal boss, developed as a result of a lost symmetry on one side of test. Jaworznik bore-hole, depth 62.4 m, Middle Vesulian (ZNG No. 13/II); × 30.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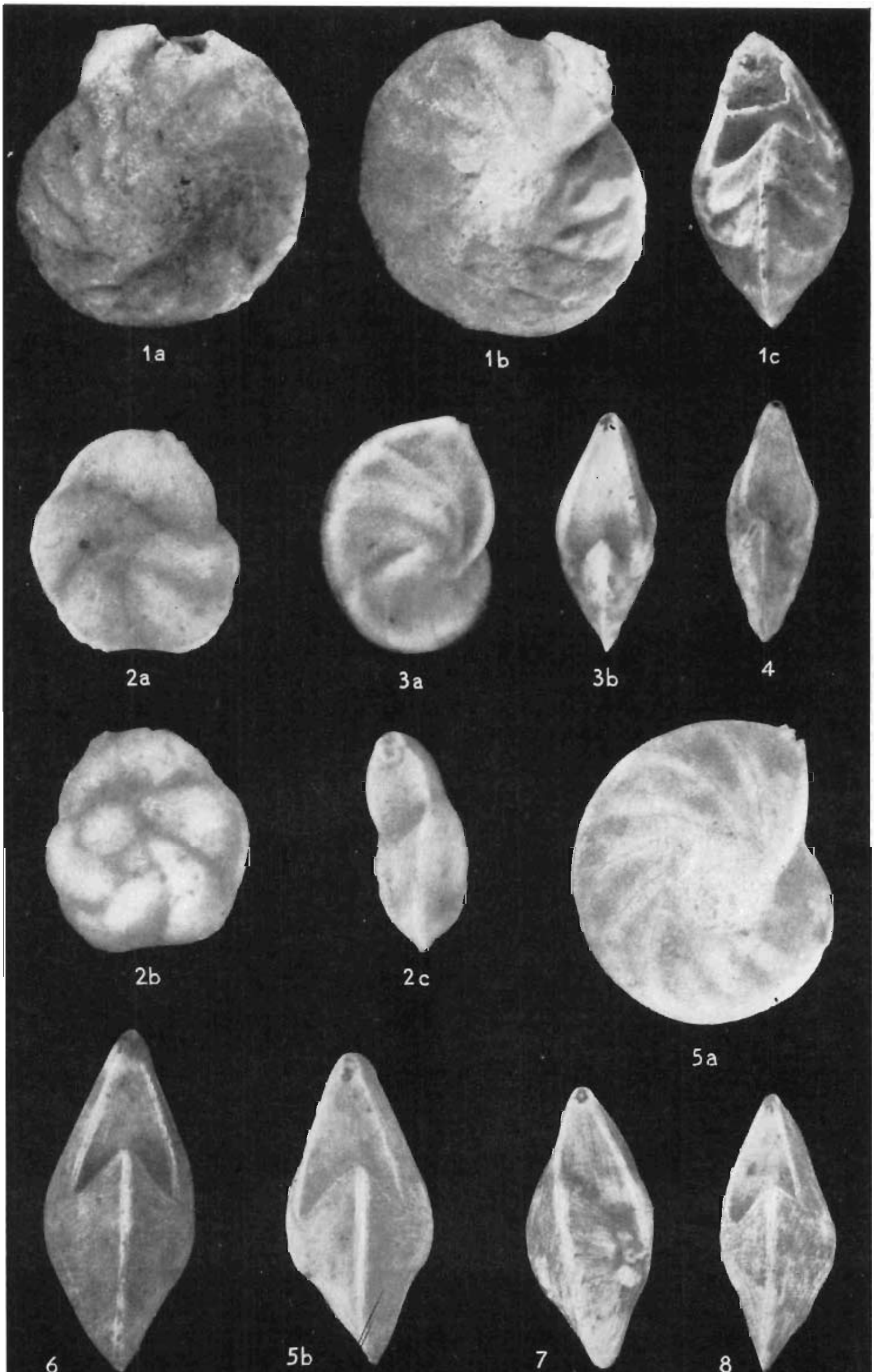
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Plate II

Fig. 1. *Lenticulina* aff. *secans* (Reuss), an asymmetric specimen. Wesołówka, Santonian (ZNG No. 10/I); × 20.

Fig. 2. *Lenticulina* (*Planularia*) *pulavensis* (Pożaryska), a trochospiral specimen. Dęblin bore-hole, depth 66.7-77.8 m, Danian (ZNG No. 14/I); × 40.

Figs. 3-4. *Lenticulina exarata* (v. Hagenov): *3* normal specimen, *4* asymmetric specimen. Lucimia, Middle Maastrichtian (ZNG No. 9/I); × 20.

Figs. 5-8. *Lenticulina comptoni* (Sowerby), specimens with a different degree and different directions of shifting of the last chamber, × 25; *5* specimen ZNG No. 17/I, *6* specimen ZNG No. 1/I, *7* specimen ZNG No. 2/I, Wesołówka, Emscherian; *8* specimen ZNG No. 6/I, Ciszyca Górna, Campanian.

Plate III

Lenticulina (Planularia) pulavensis (Pożaryska)

Fig. 1. Asymmetric specimen, Góra Puławska (ZNG No. 1/IV).

Fig. 2. Frontal view of a specimen with chambers shifted opposite to those in Fig. 1b, Góra Puławska (ZNG No. 2/IV).

Fig. 3. Specimen with an uncoiled younger part of test and with chambers of this part considerably shifted, as compared with the original plane of coiling, Nasiłów (Z. Pal. No. F/128).

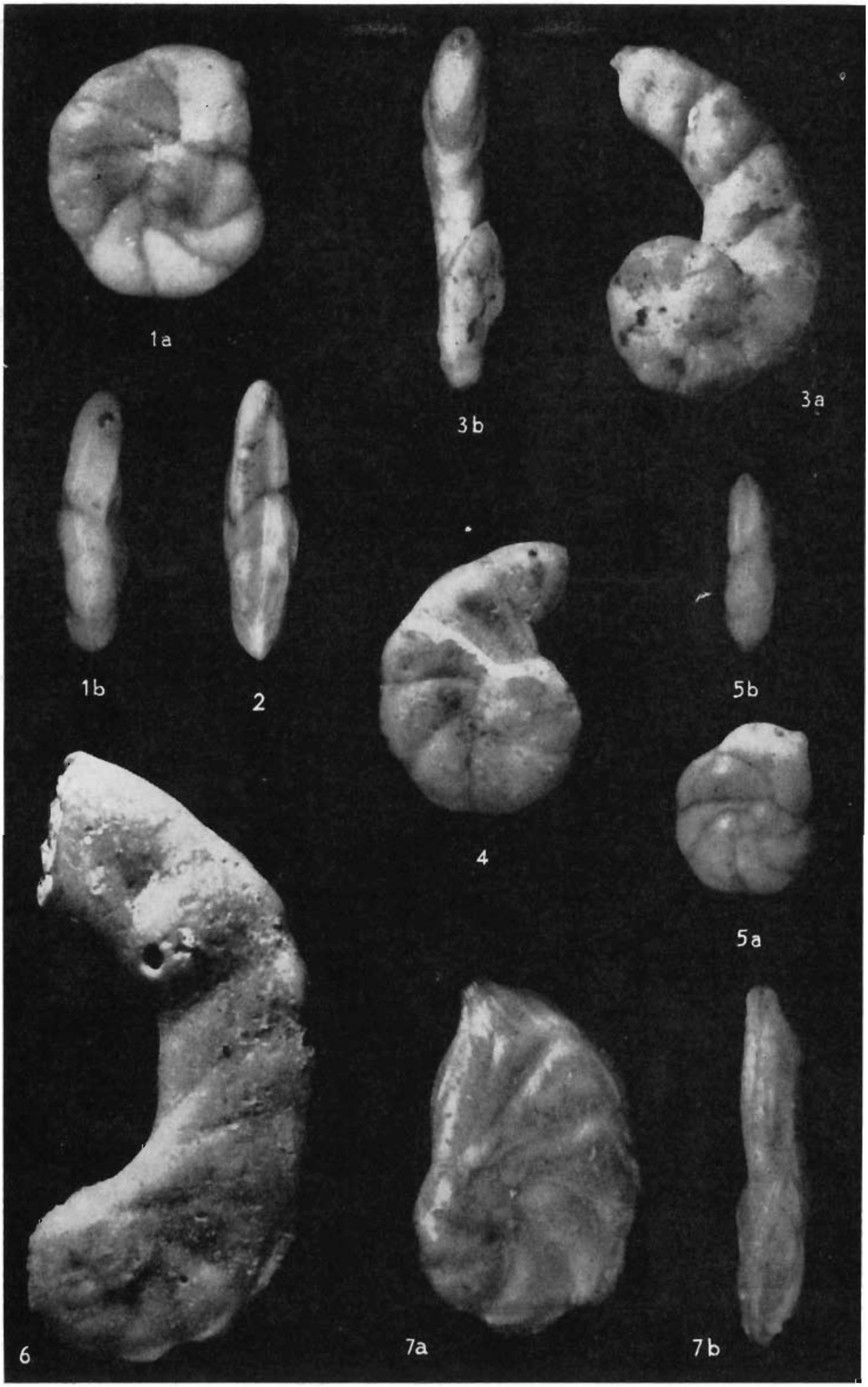
Figs. 4-5. Normal specimens, Góra Puławska (ZNG No. 5/IV).

Lenticulina (Planularia) bzurae (Pożaryska)

Fig. 6. Lateral view of a symmetric, uncoiling specimen, Góra Puławska (ZNG No. 6/IV).

Fig. 7. Asymmetric specimen; only the last chambers are shifted laterally. Boryszew (Z. Pal. No. F/99).

All specimens from Danian; × 20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