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BOHUSLAV RŮŽIČKA, FERDINAND PRANTL, ALOIS PŘIBYL:

O některých pectinoidních mlžích českého siluru a devonu (Pelecypoda).

Some pectinoid Pelecypods from the Silurian and Devonian of Central Bohemia

(S 15 obr. v textu a tab. I—XI)

(15 text figures, 11 plates)

(Předloženo — Presented 29. X. 1958)

Shrnutí: Pectinoidní mlži středočeského siluru a devonu, kladení J. Barrandem (1881) do rodu *Aviculopecten* MacCoy, jsou po kritické redeskripci přeřazeni do rodu *Pterinopecten* Hall, 1883, *Newellipecten nov. gen.* a *Anulipecten nov. gen.* Taxionomické vymezení jednotlivých forem bylo současně zpřesněno biometrickou analysou.

J. Barrande (1881) rozlíšil a vyobrazil ze středočeského siluru a devonu celkem sedm různých forem, které považoval za samostatné druhy, a které přiřadil k rodu *Aviculopecten* McCoy. (*Aviculopecten cybele, simia, niobe, fossulosus, consolans, multiplicans* a *amicus.*) Na základě celkového charakteru jejich misek je však nutno přeřadit tyto formy k rodům jiným. Druh *Aviculopecten cybele* Barr., do jehož synonymiky stahujeme současně i druh *A. simia,* klademe k rodu *Pterinopecten* Hall (1883). K témuž rodu klademe i další, nově zjištěnou formu, kterou až na další zaznamenáváme jen s otevřenou nomenklaturou. Ostatní J. Barandem stanovené formy nepodařilo se nám přiřadit k žádnému již vymezenému rodu pectinoidních mlžů. Proto jsme byli nuceni navrhnout pro ně nové rodové taxony. Formy stanovené Barrandem pod specifickým označením *Aviculopecten niobe, fossulosus, consolans* a *multiplicans* klademe do námi nově utvořeného rodu *Newellipecten nov. gen.,* za jehož genotyp současně označujeme druh *A. niobe* Barr. Do synonymiky posledně zmíněného druhu stahujeme současně i Barrandovu formu *A. fossulosus.* Konečně pro druh *Aviculopecten amicus* Barr. utvořili jsme současně další samostatný rod *Anulipecten nov. gen.*

Vedle klasického způsobu vymezení paleontologických taxonů druhové i rodové kategorie, použili jsme k dalšímu zpřesnění níže popisovaných forem i metod biometrických, z nichž některé považujeme za nové. Jednou z nich je i pokus o použití grafické integrace obrysových křivek pectinoidních misek, založené na modifikované metodě M. Dopity a B. Růžičky (1953).

Zvláštní pozornost byla věnována i otázce významu žebrování na miskách pectinoidních mlžů *(Pectinacea)*, vyvinutého obvykle jako paprsčitá žebra. Vycházeli jsme při tom ze základního poznatku o dialektické jednotě organismu a jeho vnějšího životního prostředí. Žebrování na miskách mlžů, především paprsčitá žebra, nelze podle našeho názoru proto považovat za pouhou ozdobu. Z téhož důvodu odmítáme důsledně i samo používání termínu „ozdoba" misek (ornamentace), ve kterém spatřujeme projev idealistického antropomorfizmu. Domníváme se totiž, že paprsčité žebrování misek mlžů mělo především veliký význam funkční a to jako výstuž hmoty misky proti vnějšímu tlaku. Žebra sama měla v tomto případě funkci nosníku. Paprsčitě žebrovaná miska připomíná v takovém případě obdobu skořepinové konstrukce, známé z mechaniky, v níž je dosaženo maximální pevnosti a odolnosti při minimální spotřebě materiálu.

Systematické postavení a příslušnost námi studovaných pectinoidních mlžů ze středočeského siluru a devonu lze znázornit tímto přehledem:

Pterinopectinidae Newel, 1938
Pterinopecten Hall, 1883
P. (Pterinopecten) Hall, 1883
P. (Pterinopecten) cybele (Barr., 1881)
P. (Pterinopecten) sp.
Newellipecten nov. gen.
N. (Newellipecten) nov. subgen.
N. (Newellipecten) niobe (Barr., 1881)
N. (Fascinewellipecten) nov. subgen.
N. (Fascinewellipecten) consolans (Barr., 1881)
N. (Fascinewellipecten) multiplicans (Barr., 1881)
Anulipecten nov. gen.
Anulipecten amicus (Barr., 1881)

SOME PECTINOID PELECYPODS FROM THE SILURIAN AND DEVONIAN OF CENTRAL BOHEMIA.

(15 text figures, 11 plates)

Abstract: Pectinoid pelecypods from the Silurian and Devonian of Bohemia which were assigned by J. Barrande (1881) to the genus *Aviculopecten* McCoy are newly revised and transferred to the genus *Pterinopecten* Hall, 1883, *Newellipecten nov. gen.* and *Anulipecten nov. gen.* Taxonomic description of single forms has been made more precise by biometrical analysis.

Introduction

I. General Part

I n t r o d u c t i o n.

The representatives of the order *Pectinacea* represent a very interesting and manyshaped group of the Silurian and Devonian of Central Bohemia. J. B a r r a n l e (1881) considered them members of the genus *Aviculopecten* M c C o y. He distinguished several species among them which he named and figured without giving any diagnosis or description. Since then no one has dealt with them. For this reason we thought it useful to describe these forms. Besides the classical definition of paleontological taxons of generic and specific category we used, in order to make them more precise, biometrical methods, some of which are new.

I. G e n e r a l P a r t.

We had at our disposal only a limited number of specimens among which J. B a r r a n d e distinguished seven independent forms, namely: *Aviculopecten cybele, simia, niobe, fossulosus, consolans, multiplicans* and *amicus*. The general character of their valves shows, however, that it is necessary to assign those forms to other genera. The species *Aviculopecten cybele*, in the synonymy of which we place also *Aviculopecten simia*, belongs to the genus *Pterinopecten* H a l l, 1883. To the same genus is referred also another newly ascertained form which is recorded with open nomenclature. The remaining B a r r a n d e's forms could not have been ranged to any known pectinoid genus and new generic taxons had to be established for them. The forms designated by J. B a r r a n d e as *Aviculopecten niobe, fossulosus, consolans* and *multiplicans* are placed in our newly established genus *Newellipecten nov. gen.*, the genotype of which was selected *Aviculopecten niobe* B a r r. At the same time we place into the synonymy of that species the forms designated by B a r r a n d e as *Aviculopecten fossulosus*. Finally, another new genus — *Anulipecten nov. gen.* — was established for the species *Aviculopecten amicus* B a r r.

In this connection it should be noted that the pectinoid pelecypods occur as early as the Ordovician of Central Bohemia. They, however, shall be dealt with in an independent study.

M e t h o d s o f W o r k.

The material under study was worked up in the following way: First of all, the reconstruction of the wanting parts, or parts covered by rock was carried out on fivefold photographic enlargements, with regard to the course of the growth lines, the fine fila and the remaining features typical of this or that type of a valve. Then, the following relations were studied:

1. The relations between the distance of the extreme point of the anterior ear and that of the extreme point of the posterior ear (measured from the highest point of the beak).

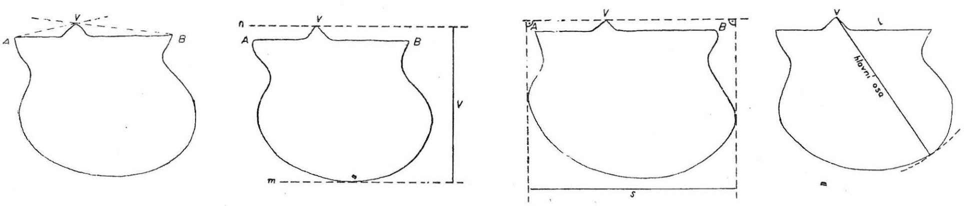
2. The height/length ratio of the valve.

3. The graphical integration of the outline of single forms and the computation of the constant k at single integration lines were carried through.

Notes concerning the study of the relation between the distance of the extreme point of the anterior ear and that of the extreme point of the posterior ear.

In the present paper we define the extent of both ears by the extreme points. The extreme point of the anterior ear is designated A, the extreme point of the posterior ear being designated B.

The highest point of the beak (be it V) is defined as that point of the beak which is farthest from the straight line connecting both extreme points (fig. 1).



1. 2. 3. 4.

Fig. 1. V — The highest point of the beak. A — the extreme point of the anterior ear. B — the extreme point of the posterior ear.
Fig. 2. V — The highest point of the beak. A — the extreme point of the anterior ear. B — the extreme point of the posterior ear. V — the heigth of the valve.
Fig. 3. A — the extreme point of the anterior ear. B — the extreme point of the posterior ear. S — the lenght of the valve.
Fig. 4. V — the beak. *hlavní osa* — the cardinal axis of the valve.

After having fixed the points V, A, B on fivefold enlargements of the studied forms, we measured in all cases the lengths of the abscissas $\overline{VA}$, $\overline{VB}$ and their values were plotted in the graph. The values of $\overline{VA}$ (z) were plotted on the x-axis, the values of $\overline{VB}$ (p) on the y-axis. Thus the points M_k (x_k, y_k) were obtained. It became evident that the relations of both abscisses of single studied forms of the same type follow aproximately a straight line.

In single cases the calculation of the correlation coefficient and regresssion coefficients of the relation between p and z was carried out. This relation was found to be very close, consequently, generally only one regression line could have been drawn in the graph.

Notes concerning the study of the height/length ratios of the valves.

The values of length and height of single valves were obtained on the fivefold enlargements by following way:

Through the point V a parallel to the straight line $\overline{AB}$ was drawn. This imaginary straight line be designated n. Then a tangent to the lower margin of the valve, parallel to $\overline{AB}$, was drawn. It was designated m. The distance between these parallels indicates the valve height v (fig. 2).

The value of the valve length was obtained by following way:

Through the extreme points of the valve (the anterior and posterior) vertical lines were dropped to the straight lines n (m). The distance between these parallel lines (designated p and o) indicates the valve length s (fig. 3). It must be noted that the extreme points (the anterior and posterior) do not in all cases correspond to the extreme points of the anterior and posterior ear, but they may lie on the anterior or posterior margin of the valve.

The values of length and height thus obtained were plotted in the graph so that on the x-axis the values of s (length) and on the y-axis the values of v (height) were plotted. Thus the points N_k (x_k, y_k) were obtained. It was evident that the relations of both abscissas of single studied forms of the same species follow approximately a straight line.

In single cases again the calculation of the correlation coefficient and regression coefficients of the relation between v and s was carried out, and this relation was ascertained to be v e r y c l o s e. Consequently, only one regression line could have been drawn in the graph.

Besides this method which is current in statistical analysis, we tried in both mentioned cases to determine the position of the straight line about which the points M_k (N_k) are scattered, by means of the equalling calculus. The constants of the wanted straight line were then calculated in several cases according to the formulas:

$$k = \frac{n\,[x\,.\,y] - [x]\,[y]}{n\,[x\,.\,x] - [x)^2}$$

$$b = \frac{[x\,.\,x]\,[y] - [x]\,[x\,.\,y]}{n\,[x\,.\,x] - [x)^2}$$

The accomplished calculation proved the equation of the wanted straight line to be nearly identical with the first regression line, and showed that also this method can be used for biometrical studies of pectinoid pelecypods.[1])

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1) Here should be noted that the opponents of the biometrically statistical methods usually point out that those methods can be used only with numerous material. This opinion, however, is quite wrong, as these methods are suitable not only for large collections but also for the small ones, consisting at least of two specimens of the same species. Naturally, the biometrical characteristic of the studied hypodigm is increasing by adding new material, and thus the knowledge of the new species is enlarged.

Notes concerning the use of the graphical integration of the outlines as biometrical method.

One disadvantage of the older systematic works dealing with fossil pelecypods was found in the fact that, besides the rather vague description of the shell outline, no more attention was paid to it by the authors. The importance of the shell outline consists in the fact that the shells of mollusks grow up on the level of the free margin by the function of the mantle. The outline represents therefore a certain stage of mollusks grow up on the level of the free margin by the function of the shell development, and its shape is in close relationship to the shape of the animal. Thus it is the expression of the resultant of the environmental factors to which a pelecypod had to adapt during its development.

While studying the outline of pectinoid pelecypods of the Paleozoic of Central Bohemia, we used the adapted method of M. Dopita. and B. Růžička (1951), namely the graphical integration.

The basis of the graphical integration consists in the ascertainment of the line k whose first derivation k' is known.

The line k' be given by the expression: $y' = f'(x) = \frac{dy}{dx}$

The line k is given by the expression: $k = y = f(x)$

In the first equation $dy = f'(x)$ or $y = \int f(x)\, d_x + C = \int y \, . \, d_x + C$ in which C is the intergration constant.

The graphical integration of all reconstructed forms was made as follows:

The main axis of single shells [determined by the highest point of the beak and that point of the shell outline which is farthest from the beak (fig. 4)] was enlarged to 8 cm and identified with the positive branch of the x-axis, the highest point of the beak being fixed as the beginning.

In order to avoid some errors due to the imperfect construction of the integration line carried out by means of a ruler and compasses, we used the Intergraph of the type G. Corady, by setting up the constant on 10 cm². The values of the areas were given ten times diminished. The resultant values were measured with the maximum error of ± 0,5 cm².

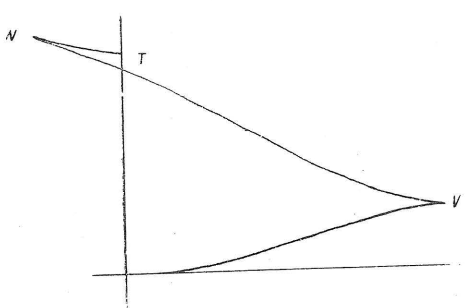


Fig. 5. On the integration lines of single form there are three expressive points: V, T, N.

On the integration lines of single forms there are three expressive points (fig. 5). The first point (designated *V*) lies in the first quadrant and corresponds to this point of the outline in which the outline is intersected by the main axis. The second point (designated *N*) corresponds to the extreme point of the anterior ear. The third point (designated *T*) corresponds to the highest point of the beak.

In order to be able to compare the obtained integration lines with each other, it was necessary to characterize them by a certain chosen constant. In our case two of the prominent points of the integration line have been chosen, namely the points *N* and *V*, and the area of the shell as well. Each line was expressed by the constant *k* according to the formula:

$$k = \frac{\frac{x_v}{y_v} \cdot \frac{x_n \, . \, x_n}{x_n}}{PL}$$

In this expression x_v, y_v are the coordinates of the point *V*, x_n, y_n the coordinates of the point *N*, and *Pl* is the area of the shell.

After having calculated the constant *k* for single integration lines we ascertained that the values of the constant are very close to each other within the limits of a single species. According to our opinion this feature can be used for completing and making more precise the characteristic of the studied species. As the constants of different species of the same genus show considerable differencies, they can be used also for correlation and investigation of the shape affinities.[1])

The significance of the ribs in *Pectinacea.*

The most usual type of the so-called shell ornamentation in this group seem to be the radial ribs. Also when studying Barrande's material of the Paleozoic of Central Bohemia we found this type of ribs most often As Barrande evidently attached great importance to the different course of the radial ribs and established his species for the great part on the surface ornamentation, more attention was paid especially to the radial ribs in the present study.

Our consideration started with the knowledge that a living organism forms an unseparable unity with its environment. Its ontogeny manifests itself by a number of reactions by which the organism reacts on the environmental factors which influence it. From this point of view the surface ribs of lamellibranch shells, especially the radial ribs, can not be considered a mere ornamentation, and therefore we refuse to use the term „shell ornamentation". On the contrary, we believe that the surface modelation of the shells was of great functional importance as a support of the shell material, and represented to a certain degree a beam. Thus the entire

[1]) This of course does not mean that the constant *k* can not be in particular cases the same at several species belonging to quite different genera. It can be therefore used only for characteristic within the limits of a single genus.

shell with radial ribs reminds of the shell construction known from mechanics.

Only lack of material and unfavorable preservation of the ribs prevented us from calculating the construction of single shells by means of methods used in mechanics.

In spite of our not having exact mathematical proofs of our supposition that the radial ribs represent a sort of a beam, we believe that our opinion is right for the following reasons:

The vaulting of the shell does not provide only the space for the soft parts of the animal, but according to our opinion it has also a supporting function. The shell vaulting enables the animal to produce a shell as thin as possible and at the same time highly resistant. The resistance of the shell and a further possibility of thinning the shell material are then enabled by the ribs which must assume, in this case, the supporting function for the whole shell. This function have the first order ribs. Those ribs do not always begin on the oldest part of the beak, as the shell material is usually thick enough in this part, but they slowly develop and gradually become thicker in the course of further growth stages.

In places where the intercostal areas (the areas limited by two adjacent cardinal ribs) attain certain width, the second order ribs set in and gradually become thicker. According to our opinion those ribs form the support of the intercostal areas and set in like the ribs mentioned above. This development in the formation of the ribs was testified on detailed drawings representing the course of single ribs on fivefold enlargements of those specimens of *Newellipecten (Newellipecten) niobe* (*B a r r.*) *which* have the surface sculpture well preserved. From the accompanying figures it is evident that our consideration is justified (fig. 6).

When comparing the number of cardinal ribs in single figured types of *Newellipecten (Newellipecten) niobe* (B a r r.) we see that it varies between 9 — 13 (in all studied types between 9 — 15). Such a great difference in the number of ribs may seem unable to be sufficiently explained by the variability deviations, especially as the number of cardinal ribs is not directly depending on the size of the apical angle. However, we suppose that the number of cardinal ribs is not a deciding factor and does not represent a characteristic feature on the basis of which it would be possible to determine the varieties because, as it is possible to ascertain, the second order ribs take over in some cases the function of cardinal ribs. Consequently, the total number of all ribs in a certain growth stage appears to be the characteristic feature of single species. This opinion can be supported only by a rather limited proof as the shell ribs in our studied material are not always preserved in such a condition that it could be used in all cases for detailed studies.

However, we tried to express the number of ribs in the graph so that on the x-axis was plotted the value of the longest rib of a studied shell, and on the y-axis the total number of all ribs of the shell. From the graph it is evident that the points thus obtained follow approximately a straight line (fig. 7).

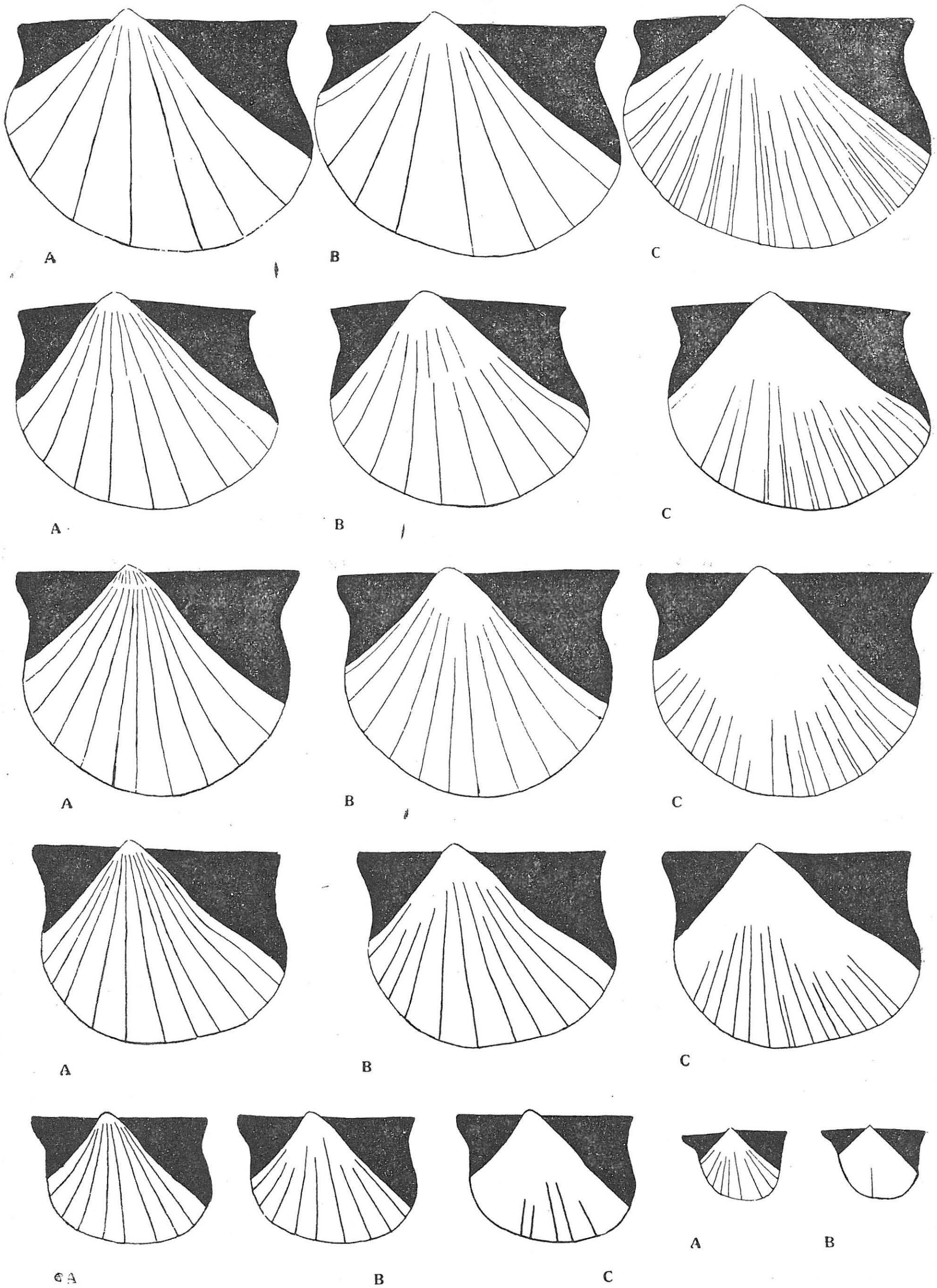


Fig. 6. The sequence of the ribs in *Newellipecten (Newellipecten) niobe* (B a r r.). *A* — first order ribs, *B* — second order ribs, *C* — third and lower order ribs.

II. Descriptive Part.
Pterinopectinidae NEWEL, 1938.
Pterinopecten Hall 1883.

Genolectotype: Selected by S. A. Miller (1889, p. 507) *Pterinopecten undosus* (Hall, 1883) (=*Aviculopecten undulatus* Hall, in Miller, 1877, non *Aviculopecten undulosus* Mc Coy, 1853).

Stratum locusque typicus: Middle Devonian (Hamilton Group), USA.

Diagnosis: Typical representative of the family with prosocline subquadrate shell, the dorsal line shorter than the dorso-ventral parameter, the right valve shorter and less vaulted than the left. Beak minute, more or less subcentral. The ears more or less distinctly separated from the valve body, the separation of the anterior ear bing usually more expressive. The surface consists of radial ribs, concentric fila and sometimes also concentric growth folds.

Remarks and Observations: The genus *Pterinopecten* Hall is subdivided into three subgenera, namely the typical subgenus *Pterinopecten (Pterinopecten)* Hall, 1883, the subgenus *Pterinopecten (Dunbarella)* Newell, 1938, and the subgenus *Pterinopecten (Pseudaviculopecten) Newell*, 1938.

Our newly established genus *Newellipecten nov. gen.* differs from *Aviculopecten* McCoy and the remaining related genera before all in having the dorsal line longer than the dorso-ventral parameter.

A further newly established genus *Anulipecten nov. gen.* differs from *Pterinopecten* in the nearly central beak, the subequal ears, in the dorsal line longer than the dorso-ventral parameter, and in the lamellous concentric ridges.

Pterinopecten (Pterinopecten) Hall, 1883.

Subgenolectotype: *Pterinopecten undosus* (Hall, 1883).
Stratum locusque typicus: Middle Devonian (Hamilton Group), USA.

Diagnosis: Typical subgenus of the genus *Pterinopecten* with the right valve always shorter and less vaulted than the left; the posterior ear of both valves is nearly indistinctly separated from the valve body; deep sinus is wanting, and the surface sculpture consists of fine intercalated radial ribs and more or less expressive concentric folds.

Remarks and Observations: We range to the subgenus *P. (Pterinopecten)* the Bohemian Silurian forms determined and figured by J. Barrande (1881) under the name of *Aviculopecten cybele* and *Aviculopecten simia*. Both forms belong according to our opinion to the same species — *P. (Pterinopecten) cybele* (Barrande, 1881) which is one of the biostratigraphically oldest representatives of the genus.

Besides, the typical subgenus was ascertained also in the Bránik Limestones g_α of the Lower Devonian of Central Bohemia. We record it only with open nomenclature, as there is so far only one very incomplete valve at our disposal.

Pterinopecten (Pterinopecten) cybele (Barrande, 1881)

(Pl. I.—IV.)

1881 — *Aviculopecten cybele* Barrande. Système Silurien du Centre de la Bohême, I. vol. VI. Mollusques, pl. 228, fig. II, 1—10.

1881 — *Aviculopecten simia* Barrande, ibidem, pl. 225 fig. I, 1—2.

Lectotype: Here designated, a left valve figured by J. Barrande (1881) on pl. 228, fig. II, 9—9a. In the present report figured on pl. II. fig. 5.

Stratum typicum: Přídolí Beds — eβ_2, the zone of *Pristiograptus transgrediens* — Middle Ludlow.

Locus typicus: Prague XV. — Dvorce, quarry of the former Podolí Cements-Works.

Material: In addition to the 10 syntypes of this species figured by J. Barrande (1881), we had further 16 sculptured casts of left and right valves at our disposal. The substance proper of the valves is not preserved even in fragments.

Diagnosis: Valves small, moderately inequilateral, shell inequivalve. Left valve higher than the right one. Beak minute, moderately prosogyrate, extending over the dorsal line, situated in about the first third of the parameter the anterior—posterior extreme point. The apical angle about 79 degrees. Ears marked, distinctly separated from the body proper of the valve, the anterior being smaller than the posterior. Surface of the sculptured casts bears fine, close, faintly undulated radial ribs and more or less prominent concentric growth folds. Muscle scars, pallial line as well as the hinge unknown.

Description: Lectotype: A well preserved, moderately vaulted, faintly elongated left valve. A minute, sharply pointed, feebly prosogyrate beak is situated at about the first third of the parameter the anterior—posterior extreme point. The oldest portion of the beak extends moderately, yet always distincly, over the dorsal margin. Apical angle about 72 degrees.

Anterior ear small, narrowly subtriangular, separated from the valve body by a shallow groove. Posterior ear much larger, subtriangular, separated from the valve body, likewise the anterior ear, by a shallow groove. However, the boundary between the ears and the body proper of the valve is quite distinctly marked by the abrupt refinement of the radial ribs.

The surface bears characteristic radial, close, fine striation formed by thin, faintly undulate ribs. Among them there can be distinguished somewhat stronger ribs of the first order which extend almost to the apex of the valve, and a little ahorter and weaker second order ribs. Close to the free margin 16—19 ribs fall within 5 mm.

The radial ribs are less expressive on the ears, hove larger interspaces and cannot be distinguished in the first and second order. However, there are rather broad and relatively regularly spaced concentric growth folds on the ears which disappear under the more expressive radial striation on the valve body.

The remaining paratypes of this species, figured by J. Barrande (1881), are similarly formed, but many of them are smaller and represent younger specimens.

The right valve figured by J. B a r r a n d e (1881, pl. 228, fig. II, 1—1a) is smallest of all, having a somewhat damaged anterior border which on its preserved portion shows only faintly marked radial ribs not differentiated in the first and second order. On the valve body both coarser and sharper growth folds are well visible. The interspaces between the single folds are moderately concave, the concavity becoming more intensive towards the free margin.

The paratype figured on pl. 228 as fig. II, 2—2a is a little larger right valve with the outline entirely preserved. Only its anterior part is covered by another left valve which is omitted in B a r r a n d e's figuring. The apical portion is morphologically marked by the depressions of both ears. Apical angle about 74 degrees. The valve body is considerably vaulted, especially in the apical portion. Ribs of the first order and those of the second order well differentiated. Between the individual stronger first order ribs there are two to three second order ribs intercalated. 5—6 ribs fall within 5 mm. The growth folds are especially prominent in the central part of the valve.

The paratype figured on pl. 228, fig. II, 3—3a is a very damaged right valve. Its dorsal margin as well as the anterior and posterior margin is incomplete, the free margin being partly broken off, partly covered by rock. The original B a r r a n d e's figure is consequently considerably idealized. Radial ribs are distinct only near to the free margin, the ribs being partly smoothed off in the apical portion. In the proximity of the free margin 17—20 ribs fall within 5 mm. Growth folds are rather coarse, well marked.

The paratype figured on pl. 228, fig. 4—4a is a right valve. Its anterior ear is sharply pointed, the surface sculpture not very expressive.

The paratype figured on pl. 228, fig. II, 5—5a is an incomplete right valve having the ventral and posteroventral margin broken off, the posterior ear being preserved only in a small fragment. Radial ribs of both orders differentiated. Between the individual first order ribs 2—3 weaker and shorter second order ribs are intercalated. Prominent, rather regularly spaced growth folds are especially well marked in the central portion of the valve body.

The syntype figured on pl. 228, fig. II, 6—6a, was not found among B a r r a n d e's specimens and is considered as lost.

The paratype figured on pl. 228, fig. II, 7—7a is a well preserved, faintly vaulted left valve. Apical angle about 84 degrees. Radial ribs do not extend on the posterior ear which bears only fine concentric growth ledges. Radial ribs of the first and second order differenciated. In the anterior portion of the valve the ribs are nearly straight, in the posterior part, however, they show characteristic undulation. Near to the free margin 17—19 radial ribs fall within 5 mm.

The paratype figured on pl. 228, fig. II, 10—10a, was not found among B a r r a n d e's forms, and is considered as lost.

Into the synonymy of this species is placed also the specimen on which J. B a r r a n d e (1881) established its species *Aviculopecten simia*. It is a tiny incomplete valve with the anterior ear, the anterior margin and a portion of the posterior ear wanting. This specimen shows both in the apical and in the central part of the valve the structure of the inner valve surface. A small portion of the original valve surface with the characteristic radial striation is preserved only close to the free margin.

Further material belonging to the species (16 valves) which is at our disposal, does not show such great differences in the variability of the form of the valve surface as to be necessary to describe them separately. The variability ascertained in those types fall within the limits of the variability of Barrandes paratypes described above.

Biometrical characteristics.

$\overline{VA} : \overline{VB}$ ratio was studied on thirteen specimens. Diagram of the relation between p and z is designated as fig. 8. The calculation of the correlation coefficient and regression coefficients of the relation between p and z is given on pl. 1.

Equation of the regression line of $p : z$

$$p = 0{,}4794\, z + 2{,}65$$

Equation of the regression line of $z : p$

$$z = 1{,}9398\, p - 2{,}34$$

From the calculation carried out by means of the equalling calculus (given on pl. 2.) it becomes evident, that the $\overline{VA} : \overline{VB}$ ratios follow approximately a straight line according to the expression:

$$p = 0{,}47856\, v + 2{,}6$$

It is obvious that this expression is very close to the equation of the first regression line.

Then we followed the height/length ratio of single valves. In the course of our biometrical studies, however, it became evident that the shells of the described species have the valves unequal and therefore it was necessary to study separately the right and left valves.

The height/length ratio of the left valves was studied on eight specimens. Diagram of the relation between v and s is designated as fig. 9. The calculation of the correlation coefficient and regression coefficients of the relation between v and s in the left valves is given on pl. 3.

Equation of the regression line of $v : s$

$$v = 0{,}8107\, s + 5{,}60$$

Equation of the regression line of $s : v$

$$s = 1{,}2326\, v - 6{,}83$$

From the calculation carried out by means of the equalling calculus (pl. 4.) it is evident that the $\overline{VA} : \overline{VB}$ ratios follow approximately a straight line according to the expression:

$$v = 0{,}81067\, s + 5{,}6$$

This expression is very close to the first regression line.

The height/length ratio of the right valves was studied on four specimens. Diagram of the relation between v and s is given on fig. 9 as well. The calculation of the correlation coefficient and regression coefficients of the relation between v and s in the right valves is given on pl. 5.

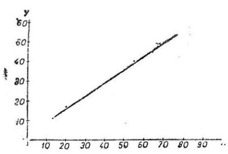
Equation of the regression line of $v : s$

$$v = 0{,}7897\, s - 0{,}52$$

Equation of the regression line of $s : v$

$$s = 1{,}2446\, v + 0{,}76$$

The studies of the outline by means of the graphical integration were made on four left and four right valves. The calculation of the constant k is given on pl. 6. There is evident that the value k in left valves varies from 4,39 to 4,68. The mean value $k = 4{,}48$. In right valves the value k ranges from 3,81 to 3,97. The mean value $k = 3{,}90$. As can be seen, the biometrical studies have fully proved the inequivalvity of the shells of the described species.



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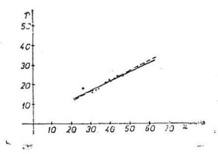

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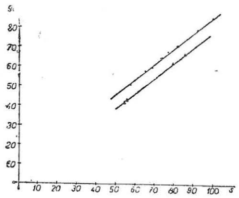

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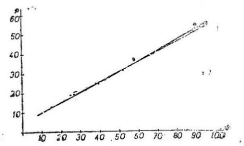


10.

Fig. 8. Diagram of the relation between p and z in *Pterinopecten (Pterinopecten) cybele* (B a r r a n d e, 1881). The first regression line is indicated by the full line, the second regression line by the dashed line.

Fig. 9. Diagram of the relation between v and s in *Pterinopecten (Pterinopecten) cybele* (B a r r a n d e, 1881). (● left valves, ▲ right valves). Owing to the relation between s and v being very close, only one regression line is drawn. From the diagram it is evident that the growth principles in both valves are the same even if the valves are unequal.

Fig. 10. Diagram of the relation between p and z in *Newellipecten (Newellipecten) niobe* (B a r r a n d e, 1881). Only one regression line is drawn. Owing to the high degree of correlation both lines are nearly coincident.

R e m a r k s a n d O b s e r v a t i o n s : The above described species considerably reminds of the type of the genus *(Pterinopecten undosus* [H a l l, 1883]) of the Middle Devonian of North America. It differs from it mainly in having the growth folds much sharper than those of the American species, which are broader and more rounded, and in having the differentiation of the ears from the valve body more morphologically marked than H a l l's species. In the remaining features both species are very alike.

O c c u r e n c e: Přídolí Beds $e\beta_2$ (Middle Ludlow) shale facies.

L o c a l i t y : Prague XV — Quarry of the former Dvorec Cementworks.

Pterinopecten (Pterinopecten) sp.

(Pl. X, fig. 5.)

Stratum typicum: Bráník Limestones $g\alpha$ (Lower Devonian)
Locus typicus: Kosoř, „v Sudech".

Material: Sculptured cast of an incomplete left valve.

Description: Incomplete strongly vaulted left valve with the beak, the anterior ear and the end of the posterior ear broken off. The beak, however, seems to have been subcentral. The posterior ear is subtriangular, moderately vaulted, separated from the valve body by a shallow depression. It bears rather obscure, coarse radial ribs and growth folds passing on it from the valve body. According to the growth folds bent posteriorly, the ear seems to have finished sharply and to have had a shallow notch.

The body proper of the valve bears 9 strongly protruding, coarse, rounded ribs of the first order which are rather regularly spaced. Compared with the cardinal ribs, the interspaces are considerably broad; each of them is stiffened by two second order ribs which are considerably coarse and rounded as well. A third order rib intercalates only in the third anterior interspace between the second order ribs.

The growth folds are coarse and especially visible close to the free margin, undulating the radial ribs.

The muscle scars as well as the pallial line and the hinge apparatus were not ascertained.

Remarks and Observation: Our specimen reminds to a certain degree of the species described by McCoy (1846) from the Carboniferous limestone of England under the name of *Pecten segregatus* which was ranged by the same author (1855, p. 489) to his new genus *Aviculopecten* McCoy, 1852.

Both species differ especially in the number of the second order ribs which are three in each interspace in the English species and only two in the Czech form.

The surface sculpture of the form described above differs very expressively from all hitherto known pterinopectinid forms of the Silurian and Devonian of Bohemia. The incompleteness of the unique valve, however, does not allow the establishing of a new species.

Occurence: Bráník Limestones — $g\alpha$ (Lower Devonian).

Locality: Kosoř, „v Sudech".

Newellipecten nov. gen.

Derivatio nominis: In honour of Mr. N. D. Newell, an excellent expert in fossil Pelecypods.
Genoholotype: Here determined, the species *Aviculopecten niobe* Barrande, 1881.
Stratum locusque typicus: Upper Koněprusy Limestones f. (Lower Devonian) Bohemia.

Diagnosis: Pectinoid pelecypods with the left valve more or less convex, inequilateral, the dorsal line expressively longer than the dorso-ventral parameter, the anterior ear always smaller than the posterior, both ears being more or less notched. The beak is always excentric, minute, moderately prosogyrate, raised over the hinge line. The surface of the valve body bears simple or fasciate radial ribs developed in different orders. Fila more or less prominent, growth folds coarse, rounded. Muscle scars, palial line and hinge apparatus unknown.

R e m a r k s a n d O b s e r v a t i o n s : According to the different types of radial ribs our new genus is divided into two subgenera, viz. the typical subgenus *Newellipecten (Newellipecten) nov. subgen.* with simple radial ribs, and the subgenus *Newellipecten (Fascinewellipecten)* nov. subgen. with fasciate radial ribs.

Newellipecten nov. gen. differs from *Pterinopecten* H a l l, 1883, as well as from *Aviculopecten* M c C o y, 1852, and the related genera by the expressive relation between the dorsal line and the dorso-ventral parameter. In the above mentioned genera the dorsal line is shorter than the dorso-ventral parameter while it is the reverse in our newly established genus. Some newly not revised species of the Devonian of Belgium and Germany belong, according to our opinion, to the new genus *Newellipecten nov. gen.*

N e w e l l i p e c t e n (N e w e l l i p e c t e n) n o v. s u b g.

S u b g e n o t y p e: — identical with the type of the genus — *Aviculopecten niobe* B a r r a n d e, 1881.
S t r a t u m l o c u s q u e t y p i c u s: Upper Koněprusy Limestones f (Lower Devonian) Bohemia.

D i a g n o s i s : Typical subgenus of the genus *Newellipecten nov. gen.* with the left valve strongly vaulted, stiffened by simple radial ribs of several orders.

R e m a r k s a n d O b s e r v a t i o n s : The closely related subgenus *Newellipecten (Fascinewellipecten) nov. subg.* differs from the typical subgenus described above in the less vaulted left valves and the expressive fasciate radial ribs. So far, only the species *N. (Newellipecten) niobe* (B a r r a n d e, 1881) is referred to the subgenus *Newellipecten (Newellipecten) nov. subg.*

Newellipecten (Newellipecten) niobe (B a r r a n d e, 1881).

(Pl. V, fig. 4—6; pl. VII, fig. 3—6; pl. VIII, fig. 1, 5, 6; pl. IX, fig. 3—6; pl. X, fig. 1—4, 6; pl. XI, fig. 2—4, 6.

1881 — *Aviculopecten niobe* B a r r a n d e, Système Silurien du Centre de la Bohême, I., vol. VI. Mollusques, pl. 221, fig. II, 1—24.
1881 — *Aviculopecten fossulosus* B a r r a n d e, ibidem pl. 221, fig. I, 1—5.
1881 — *Aviculopecten consolans* B a r r a n d e, ibidem pl. 222, fig. I, 1—2 and 13—14, non pl. 222, fig. II, 3—12.

L e c t o t y p e: Here designated left valve figured by J. B a r r a n d e (1881) as fig. II, 9—10, on pl. 221. In the present report figured on pl. XI, fig. 6.
S t r a t u m t y p i c u m: Upper Koněprusy Limestones f (Lower Devonian) Bohemia.
L o c u s t y p i c u s: Koněprusy near Beroun.

M a t e r i a l : We know only B a r r a n d e's types of this species. They are for the most part sculptured casts preserved in different degrees of fossilization. The original substance of the shell is not preserved.

D i a g n o s i s : Only the left valve is known. It is strongly vaulted, moderately inequilateral. The dorsal margin longer than the valve height. The beak situated generally in the two fifths of the parameter the anterior—posterior extreme point, being moderately prosogyrate and extending over the dorsal line. Ears depressed, subtriangular, pointedly terminated, the anterior being smaller than the posterior, their margins being notched, the surface vaulted. The surface sculpture of the ears is identical with that of the valve body, except for the different orders of radial ribs which cannot be distinguished on the ears. The surface of the body proper of the valve bears prominent radial cardinal ribs as well as the second and further orders ribs. Regular growth fila cross the radial ribs producing characteristic more or less expressive nodes on the lower orders ribs. Muscle scars, pallial line and hinge unknown.

D e s c r i p t i o n : Lectotype: Middle sized, well preserved, strongly vaulted left valve, moderately inequilateral. Dorsal margin longer than the length of the valve.

The beak situated at about two fifths of the parameter the anterior—posterior extreme point, being moderately prosogyrate, slightly raised above the dorsal line. The apical portion morphologically marked by the depression of the ears. Apical angle about 90 degrees. Anterior ear minute, subtriangular, pointed, sinuously bent, separated from the apical portion by a deep depression. Posterior lear larger, broadly subtriangular, its surface being moderately vaulted; it extends into a short rostrum. From the valve body it is separated by a mere morphological depression. The surface sculpture of the ears is identical with that of the valve body.

The surface of the valve body bears 12 expressive, considerably narrow, rather regularly spaced radial ribs which are moderately bent backwards in the posterior part, and forwards in the anterior part of the valve. Ribs on the apical portion have a distinctly different direction from those in younger growth stages of the valve. The slightly concave interspaces are stiffened by one feebly developed second order rib, between which and the cardinal ribs are still fainter third and lower orders ribs intercalated, the latter being developed only in a narrow zone along the free margin.

On the anterior ear there are only five ribs of the same order. Those are, however, less prominent than the ribs of the valve body. The ribs of the posterior ear belong to two orders. Five first order ribs and seven second order ribs are generally weaker than the corresponding ribs of the valve body. Five first order ribs fall within 5 mm, measured at the free margin.

On the entire valve surface there are expressive fine fila in number of 14—15 within 5 mm of the height. In places where the fila cross the radial ribs of lower orders, minute nodes arise.

The paratype figured on pl. 221 as fig. II. 13—14 is a left valve strongly vaulted, middle sized, well preserved, corresponding on the whole to the lectotype. The anterior ear of this valve, however, is broken off on the proximal end and seems to be less vaulted than that of the lectotype. There are nine first order ribs, eight second order ribs, thirty two third and lower orders ribs. Apical angle about 90 degrees.

The paratype figured on pl. 221 as fig. II. 15—16 is a middle sized, vaulted left valve with a portion of both the anterior and the lower margin wanting. The interspaces between the single ribs are nearly flat in this form. There are thirteen cardinal ribs, eleven second order ribs, sixteen third and lower orders ribs. Apical angle about 100 degrees.

The paratype figured on pl. 221 as fig. II. 7—8 is a middle sized vaulted left valve with the anterior ear and a part of the posterior portion of the dorsal margin broken off. The original B a r r a n d e's figure does not exactly express the reality. Some cardinal ribs and the second order ribs are not continuous in this form but finish at about the first upper third of the valve height, and set in again being shifted a little backwards. This is, however, not due to the valve deformation. There are eleven first order ribs, ten second order ribs, twenty one third and lower orders ribs. Apical angle about 90 degrees.

The paratype figured on pl. 221 as fig. II. 3—4 is a tiny, strongly vaulted left valve with both ears morphologically depressed, the anterior ear being large. There are ten first order ribs, nine second order ribs, five third and lower orders ribs. Apical angle about 90 degrees.

The paratype figured on pl. 221 as fig. II 1—2 is a tiny left valve with the outline wholly preserved. There are eleven first order ribs and one second order rib. Apical angle about 90 degrees.

The paratype figured on pl. 221 as fig. II. 17—18 is a considerably large, strongly vaulted left valve with the outline well preserved. The ribs are rather smoothed off, consequently, only fourteen cardinal ribs could have been ascertained. Apical angle about 95 degrees.

The remaining B a r r a n d e's syntypes are left valves generally strongly damaged. The paratype figured on pl. 221 as fig. II. 5—6 has the anterior ear broken off and the anterior valve margin damaged. The surface ribs are considerably smoothed off, so that the real number of the cardinal ribs rannot be determined.

The syntypes figured on pl. 221 as fig. II. 11—12, 19—22, and 23—24 are generally poorly preserved. Only in the type figured as fig. 19—20 there can be distinguished eleven first order ribs. In all syntypes the cardinal ribs are coarse, strongly prominent, the ribs of the lower order considerably smoothed.

Into the synonymy of this species also two specimens designated by J. B a r r a n d e (1881) as *Aviculopecten consolans* are placed.

The paratype figured on pl. 222 as fig. II. 1—2 described by J. B a r r a n d e (1881) as *Aviculopecten consolans* is a juvenile left valve considerably vaulted with the rostrate end of the posterior ear broken off. The surface ribs are considerably smoothed and only in the oldest part of the valve there are distinct thread-like cardinal ribs. This specimen reminds in all features of the lectotype of the above described species.

The paratype described by J. B a r r a n d e (1881) as *Aviculopecten consolans* figured on pl. 222 as fig. 13—14 is a proportionally large, moderately vaulted valve with the outline poorly preserved. In the surface sculpture of the valve body and in the general shape it does not differ from the representatives of the above described species.

Our studies and biometrical analyses proved the necessity of placing into the synonymy of this species also the forms on which J. B a r r a n d e (1881) established his species *Aviculopecten fossulosus*. Those are two middle sized vaulted left valves figured on pl. 221 as fig. I. 1—2, 3—5, which in their general appearence do not at all differ from the above described representatives of *Pterinopecten (Pterinopecten) niobe* (B a r r a n d e 1881).

Both forms have more expressive nodes on the radial ribs, due to the crossing of radial ribs and the growth folds, than the specimens described above. This difference is supposed to be due to the state of preservation. The number of cardinal ribs is ten in both forms. The lower orders ribs are partly indistinct.

B i o m e t r i c a l c h a r a c t e r i s t i c.

The $\overline{VA} : \overline{VB}$ ratio was studied on twelve specimens. Diagram of the relation between p and z is designated as fig. 10. The calculation of the correlation coefficient and regression coefficients of the relation between p and z is given on pl. 7.

The equation of the regression line of $p : z$

$$p = 0{,}5178\, z + 4{,}96$$

The equation of the regression line of $z : p$

$$z = 1{,}8927\, p - 8{,}60$$

From the calculation carried out by means of the equalling calculus (the calculation is given on pl. 8) it is evident that the $\overline{VA} : \overline{VB}$ ratios follow approximately a straight line according to the expression:

$$p = 0{,}52149\, z + 4{,}9$$

This expression is very close to the equation of the first regression line.

Then we have studied the hight/length ratios of the valves. The diagram of the relation between v and s is designated as fig. 11. The calculation of the correlation coefficient and regression coefficients of the relation between v and s is given on pl. 9.

The equation of the regression line of $v : s$

$$v = 0{,}8152\, s - 0{,}39$$

The equation of the regression line of $s : v$

$$s = 1{,}2022\, v + 2{,}61$$

The outline was studied by means of the graphical integration on all studied specimens. The calculation of the constant k is given on pl. 10. There is evident that the constant k varies between 2,44—2,63. The mean constant $k = 2{,}52$.

R e m a r k s a n d O b s e r v a t i o n s : *N. (Newellipecten) niobe* (B a r r a n d e, 1881) is the only representative of the subgenus which we know from the Devonian of Bohemia.

O c c u r e n c e : Upper Koněprusy Limestones fβ (Lower Devonian).

L o c a l i t y : Koněprusy near Beroun.

Newellipecten (Fascinewellipecten) nov. subg.

Derivatio nominis: The name was formed by adding the prefix fasci — (fasces = bundles) to the generic name *Newellipecten* to express the fasciate character of the ribs.
Subgenotype: *Aviculopecten consolans* Barrande, 1881.
Locus stratumque typicum: Upper Koněprusy Limestones f (Lower Devonian) Bohemia.

Diagnosis: Subgenus of *Newellipecten nov. gen.* with the left valve moderately vaulted, stiffened by flat, variously broad fasciate ribs, the surface of which bears threadlike longitudinal ribs.

Remarks and Observations: The closely related subgenus *Newellipecten (Newellipecten) nov. subg.* differs from the above described subgenus in the more vaulted left valves which bear simple radial ribs of different orders. Two closely related Barrande's species *N. (Fascinewellipecten) consolans* and *N. (Fascinewellipecten) multiplicans* (Barrande, 1881) are placed into the subgenus *N. (Fascinewellipecten) nov. subg.*

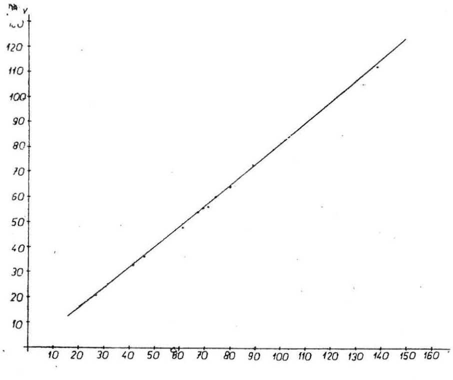


Fig. 11. Diagram of the relation between v and s in *Newellipecten (Newellipecten) niobe* (Barrande, 1881). Only one regression line is drawn. Owing to the high degree of correlation both lines are nearly coincident.

Newellipecten (Fascinewellipecten) consolans (Barrande, 1881).

(Pl. VI, fig. 3—6; pl. VII, fig. 1; pl. VIII, fig. 2; pl. IX, fig. 1, 2; pl. XI, fig. 1, 5).

1881 — *Aviculopecten consolans* Barrande, Système Silurien du Centre de la Bohême, vol. VI., Mollusques, pl. 222, fig. II, 7—12 non pl. 222, fig. II, 1—6, 13—14.
1881 — *Aviculopecten multiplicans* Barrande, ibidem pl. 221, fig. III, 1. non pl. 221, fig. III, 2—6.
1891 — *Aviculopecten (Pterinopecten) consolans,* Frech, Abh. z. Geol. Spezialkarte von Preussen, Bd. 9. Heft 3, p. 26, pl. II, fig. 6.
Lectotype: here designated, a left valve figured by J. Barrande (1881) as fig. II, 11—12, on pl. 222. In the present paper figured on pl. VII. as fig. 1.
Stratum typicum: Upper Koněprusy Limestones fβ (Lower Devonian).
Locus typicus: Koněprusy near Beroun.
Material: 4 left valves (Barrande's types) preserved as sculptured casts.

Diagnosis: Only the left valve is known. It is strongly vaulted, inequilateral, the dorsal margin being expressively longer than the dorso-ventral parameter. The beak is situated approximately in the first third of the parameter the anterior—posterior extreme point, being minute, pointed, faintly prosogyrate, moderately raised above the dorsal margin of the valve. The apical portion is more morphologically marked on the anterior side by the depression of the anterior ear. Apical angle about 90^0. The ears extend into a short rostrum, being moderately vaulted, the anterior small, the posterior strongly developed. The surface sculpture of the ears bears fine radial ribs which can be distinguished into two orders on the posterior ear. The surface of the valve body bears expressive, close, considerably broad, faintly convex fasciate first order ribs which bear one to three fine longitudinal ribs. Fila form a prominent superstructure on the radial ribs. The growth folds are rounded and raise the interspaces as well as the ribs, especially in the oldest part of the valve. Muscle scars, pallial line as well as the hinge were not ascertained in our specimens.

Description: Lectotype: A middle sized, vaulted, inequilateral left valve with the ending of the anterior ear incompletely preserved. The outline subquadrate, dorsal line straight, even, longer than the valve height.

The beak situated at about the first third of the parameter the anterior—posterior extreme point, being pointed, faintly prosogyrate, minute, moderately extending over the dorsal margin. The apical portion more morphologically marked in the anterior part by the depression of the anterior ear. The depression of the posterior ear is only little expressive. Apical angle about 90 degrees.

The anterior ear is incomplete, obviously much smaller than the posterior ear. According to the growth lines it seems to have been terminated by a spur. It is moderately vaulted. The posterior ear is considerably large, subtriangular, spur-like terminated, moderately vaulted, separated from the valve body by a shallow depression. The surface sculpture of the ears is on the whole identical with that of the valve body, being different only in having more prominent fila and in bearing weaker radial ribs of two orders. Those ribs, however, are not of fasciate character.

On the surface of the valve body there are expressive, rather regular, close, proportionally broad, moderately convex fasciate first order ribs which bear on their surface additional longitudinal thread-like ribs. In the lower third of the valve height expressive, proportionally broad, moderately convex second order ribs are intercalated in the plane interspaces. The lower orders ribs are only indistinctly marked. Fila which are less distinct on the valve body than on the posterior ear pass over the radial ribs, being morphologically prominent and producing on them a sort of superstructure.

The regular vaulting of the valve is in the upper half interrupted by several rounded morphologically prominent growth folds which raise not only the interspaces but the ribs themselves.

The paratypoid figured on pl. 222, as fig. II, 7—8 is a middle sized left valve with the ending of the ears, the anterior as well as the free margin damaged. The surface ribs of the valve body is rather smoothed off.

The paratype figured on pl. 222, as. fig. II, 9—10 is a considerably large left valve having a portion of the posterior margin covered by rock.

The surface ribs are expressive, the cardinal ribs being broad, bearing two to three longitudinal ribs which are more distinct especially near the free margin. The interspaces are moderately concave. The posterior ear large, only moderately vaulted.

Into the synonymy of this species is also placed the specimen figured on pl. 221 as fig. III, 1, designated by J. Barrande (1881) as *Aviculopecten multiplicans*. It is an incomplete left valve with the surface sculpture corresponding to the above described types.

Biometrical characteristic.

The $\overline{VA} : \overline{VB}$ ratio was studied on four specimens. Diagram of th relation between p and z is designated as fig. 12. The calculation of the correlation coefficient and regression coefficients of the relation between p and z is given on pl. 11.

The equation of the regression line of $p : z$

$$p = 0{,}4998\, z + 1{,}35$$

The equation of the regression line of $z : p$

$$z = 1{,}9608\, p + 1{,}25$$

Then the height/length ratio of the valves was studied. Diagram of the relation between v and s is designated as fig. 13. The calculation of the correlation coefficient and the regression coefficients between v and s is given on pl. 12.

The equation of the regression line of $v : s$

$$v = 0{,}7193\, s - 0{,}90$$

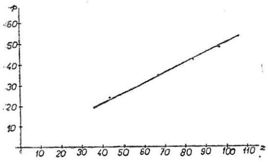
The equation of the regression line of $s : v$

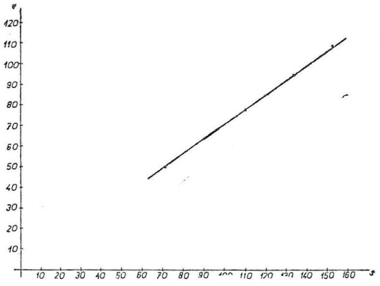
$$s = 1{,}3624\, v - 3{,}74$$

Studies of the outline by means of the graphical integration were made on all specimens. The calculation of the constant k is given on pl. 13. There is evident that the constant k varies from 2,02 to 2,15. The mean constant k = 2,08.

Remarks and Observations: The closely related synchronous and synpatric form *Newellipecten (Fascinewellipecten) multiplicans* (Barrande, 1881) differs from the above described typical form cheefly in the much broader and flatter first order ribs which bear a number of tiny longitudinal ribs.

M. Maillieux (1937, p. 110) cites from the lower Devonian of Belgium (Grauwacke de Hierges) a form which he designates as *Aviculopecten (Pterinopecten) cf. consolans* Barr. The left valve described by this author, however, shows certain differences when compared with the lectotype of Barrande's species. Therefore, the above mentioned paper was not included into the synonymy of the species *Newellipecten (Fascinewellipecten) consolans* (Barrande, 1881).





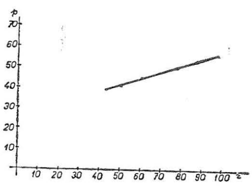


Fig. 12. Diagram of the relation between *p* and *z* in *Newellipecten (Fascinewellipecten) consolans* (B a r r a n d e, 1881). Only one regression line is drawn. Owing to the high degree of correlation both lines are nearly coincident.

Fig. 13. Diagram of the relation between *v* and *s* in *Newellipecten (Fascinewellipecten) consolans* (B a r r a n d e, 1881). Only one regression line is drawn. Owing to the high degree of correlation both lines are nearly coincident.

Fig. 14. Diagram of the relation between *p* and *z* in *Newellipecten (Fascinewellipecten) multiplicans* (B a r r a n d e, 1881). Owing to the high degree of correlation both lines are nearly coincident.

E. F r e c h (1891, p. 25, pl. II, fig. 7) described the species *Aviculopecten (Pterinopecten) wulfi* F r e c h from the Rheinish Lower Devonian and he notes that it is very near to *Aviculopecten consolans* B a r r a n d e. F r e c h's species, however, appears to differ from the compared form in the different placing of the beak, as well as in other accessory features.

O c c u r e n c e : Upper Koněprusy Limestones fβ (Lower Devonian).

L o c a l i t y : Koněprusy near Beroun.

Newellipecten (Fascinewellipecten) multiplicans (B a r r a n d e, 1881).

(Pl. V, fig. 1—3 pl. VI, fig. 1—2)

1881 — *Aviculopecten multiplicans* B a r r a n d e, Système Silurien du Centre de la Bohême, I., vol. VI. Mollusques, pl. 221, fig. III, 2—6 non pl. 221, fig. III, 1.

1881 — *Aviculopecten consolans* B a r r a n d e, ibidem, pl. 222, fig. II., 3—6, non pl. 222, cetera.

L e c t o t y p e: Here designated, a left valve figured by J. B a r r a n d e (1881) as fig. III, 2—3, on pl. 221. In the present report figured on pl. VI. as fig. 1.

S t r a t u m t y p i c u m: Upper Koněprusy Limestones fβ (Lower Devonian).

L o c u s t y p i c u s: Koněprusy near Beroun.

M a t e r i a l: 6 left valves (Barrande's syntypes) preserved as sculptured casts.

D i a g n o s i s : Only the left valve is known. It is moderately vaulted, inequilateral, the dorsal margin being expressively longer than the dorsoventral parameter. The beak situated approximately in the first third of the dorsal line, being minute, pointed, slightly prosogyrate, moderately raised above the dorsal margin.

The apical portion is morphologically more marked in the anterior part by the depression of the ear. Apical angle about 90 degrees. Ears extending into a short rostrum, the anterior being minute, notched, moderately vaulted, the posterior large, notched as well. The surface of the ears bears fine radial ribs and fila. On the posterior ear some radial ribs are fasciate, bearing tiny ribs, and there are distinct second order ribs.

The valve body bears flat, broader or narrower first order ribs, each of which bears two to eight fine longitudinal ribs. Interspaces are rather broad and flat. The second order ribs narrow, ribs of the lower orders thread-like. Fila crossing the ribs of all orders as well as the tiny longitudinal ribs, producing small nodes on the points of intersection. The surface sculpture appears reticulate in places. Muscle scars, pallial line and hinge unknown.

D e s c r i p t i o n : Lectotype: Large, moderately vaulted, inequilateral left valve with the outline incompletely preserved. A portion of the anterior ear as well as a great part of the posterior ear wanting. Anterior, posterior and free margin considerably damaged. Dorsal line incomplete.

The apical portion morphologically well marked by the depression of both ears, more in the anterior than in the posterior part. The beak pointed, slightly prosogyrate, raised above the dorsal margin.

Anterior ear deeply depressed with radial sculpture and fila. Posterior ear of great part broken off, bearing radial ribs and fila.

Surface of the valve body bears flat, broader or narrower second order ribs, each of which bears on its surface two to six fine longitudinal ribs. The cardinal ribs terminate at about the upper fourth of the valve height and set in again being shifted a little backwards, which is not due to deformation. Interspaces being proportionally broad, flat, the second order ribs narrow, the lower orders ribs thread-like. Fila cross the ribs of all orders as well as the longitudinal tiny ribs which cover the cardinal ribs, and produce minute nodes in the points of intersection. Consequently, the surface sculpture appears reticulate near the free margin. Growth folds rounded, not very expressive.

The paratype figured on pl. 221 as fig. III, 4 is an incomplete, middle sized, moderately vaulted left valve. The ending of both ears is broken off, the outline considerably damaged. The surface sculpture rather smoothed off; up to seven tiny ribs on one cardinal rib.

The syntype figured on pl. 221 as fig. III, 5 is a considerably damaged, middle sized, moderately vaulted left valve. The beak and the anterior portion of the valve, the ear included, are broken off, the outline being considerably damaged. Posterior ear with a deep notch, spur-like terminated. On its surface the fila are more expressive than the radial ribs. There are up to eight tiny ribs on the cardinal ribs. Nodes, distinct only in places, lie in the points of intersection of fila and radial ribs.

The syntype figured on pl. 221, as fig. III, 6 is a large, moderately vaulted left valve with the ending of the anterior ear broken off. Posterior ear large, moderately vaulted, spur-like terminated, with radial ribs of two orders and fila. Some ribs are also fasciate, bearing tiny ribs. The surface sculpture of the valve body partly smoothed off. The oldest portion of the beak is especially minute in this valve.

Into the synonymy of this species are placed also two specimens designated by J. B a r r a n d e (1881) as *Aviculopecten consolans.*

The syntype figured on pl. 222 as fig. II, 3—4, designated as *Aviculopecten consolans* is a middle sized left valve with the posterior margin, the posterior ear and the lower portion of the free margin damaged. The anterior ear of this valve is small, extending in a rostrum. The surface sculpture of the valve body being rather smoothed off. Growth folds expressive, rounded.

The syntype figured on plate 222, as fig. II, 5—6, designated as *Aviculopecten consolans* is a middle sized left valve with the posterior margin and the posterior ear partly damaged. The anterior ear deeply depressed, spur-like terminated, small. The surface sculpture of the valve body partly smoothed off.

Biometrical characteristic.

The $\overline{VA} : \overline{VB}$ ratio was studied on four specimens. The diagram of the relation between p and z is designated as fig. 14. The calculation of the correlation coefficient and the regression coefficients of the relation between p and z is given on pl. 14.

The equation of the regression line of $p : z$

$$p = 0,3173\, z + 25,48$$

The equation of the regression line of $z : p$

$$z = 3,1399\, p - 79,74$$

From the calculation carried out by means of the equalling calculus (given on pl. 15) it is evident that the $\overline{VA} : \overline{VB}$ ratios follow approximately a straight line according to the formula:

$$p = 0,31739\, z + 25,4$$

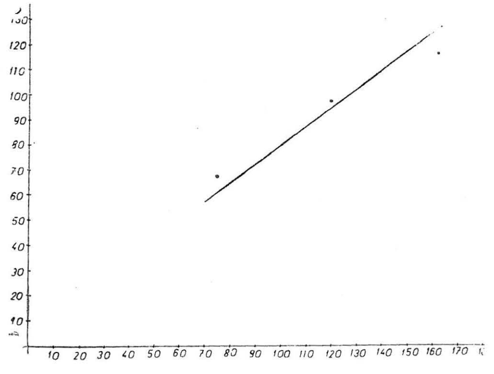


Fig. 15. Diagram of the relation between v and s in *Newellipecten (Fascinewellipecten) multiplicans* (B a r r a n d e, 1881). Only one regression line is drawn. Owing to the high degree of correlation both lines are nearly coincident.

This formula is evidently very close to the equation of the first regression line.

Then we followed the height/length ratios of the valves. Diagram of the relation between v and s is designated as fig. 15. The calculation of the correlation coefficient and regression coefficients of the relation between v and s is given on pl. 16.

The equation of the regression line of $v : s$

$$v = 0{,}7516\, s + 4{,}36$$

The equation of the regression line of $s : v$

$$s = 1{,}3216\, v - 4{,}91$$

From the calculation carried out by means of the equalling calculus (given on pl. 17) it is evident that the $v : s$ ratios follow approximately a straight line according to the formula:

$$v = 0{,}75128\, s + 4{,}4$$

This formula is evidently close to the equation of the first regression line.

The study of the outline by means of the graphical integration was carried out an all specimens. The calculation is given on pl. 18. There is evident that the value k varies from 2,17 to 2,59. The mean value $k = 2{,}36$.

Remarks and Observations: The closely related synchronous and synpatric form *Newellipecten (Fascinewellipecten) consolans* (Barrande, 1881) differs from the above described typical species especially in having narrower, more rounded first order ribs which bear a small number of longitudinal tiny ribs, and in the fila not crossing the radial ribs in nodes.

Occurence: Upper Koněprusy Limestones fβ (Lower Devonian).

Locality: Koněprusy at Beroun.

Anulipecten nov. gen.

Derivatio nominis: The name is derived from *Pecten* by adding the suffix "*anuli*" (*anulus* — the ring) to express the prominent structure of the valve.

Genoholotype: Here designated, *Aviculopecten amicus* Barrande, 1881.

Stratum locusque typicus: Upper Koněprusy Limestones f (Lower Devonian) Bohemia.

Diagnosis: Pectinoid pelecypods with the left valve subquadrate, slightly inequilateral, considerably vaulted, with the beak moderately prosogyrate, situated nearly centrally, slightly raised above the dorsal line, and with subequal ears. The dorsal line being longer than the dorso-ventral parameter. The valve surface is stiffened by lamellous concentric ribs and slightly marked, fine radial ribs. Fila and growth folds present. Muscle scars, pallial line and hinge apparatus unknown.

Remarks and Observations: The relationship of our new genus to the genus *Pterinopecten* Hall and other related genera has been discussed under the remarks on the mentioned genera. The surface sculpture of *Anulipecten nov.* gen. considerably reminds of *Annuliconcha* Newel, 1938. In the latter, however, the dorsal line is shorter than the dorso-ventral parameter, the ears are unequal, with a deep notch, and the lamellous ribs are more regularly spaced than in our new genus.

Both genera are similar in having numerous fila between the lamellous concentric ribs, and in the radial striating marked on the surface of the valves which is, however, coarser in *Annuliconcha* Newell.

N e w e l l's genus is a significant upper Carboniferous and Permian form, and, consequently, is biostratigraphically much younger than the Lower Devonian *Anulipecten nov. gen.* Owing to the above mentioned facts we do not exclude the possibility of *Anulipecten nov. gen.* belonging to the precendents of *Annuliconcha* N e w e l l.

In our conception, *Anulipecten nov. gen.* is a monotypic genus and, besides the genotype, we do not know any other representatives of the genus.

Anulipecten amicus (B a r r a n d e, 1881)

(Pl. VII, fig. 2, pl. VIII, fig. 3.)

1881 — *Aviculopecten amicus* B a r r a n d e, Système Silurien du Centre de la Bohême, I. vol. VI. Mollusques, pl. 219, fig. IX, 1—5.

L e c t o t y p e: Here designated, a left valve figured by J. Barrande (1881) as fig. IX, 4—5, on pl. 219. In the present report it is figured on. pl. VII. as fig. 2.

S t r a t u m t y p i c u m: Upper Koněprusy Limestones f (Lower Devonian).

L o c u s t y p i c u s: Koněprusy near Beroun.

M a t e r i a l: Two left valves.

D i a g n o s i s : We know only the left valve. It is vaulted, subrhomboidal, with a straight, even dorsal margin which is expressively longer than the dorso-ventral parameter. The beak is nearly central, small, moderately prosogyrate, slightly raised above the dorsal margin. Apical angle about 120 degrees. The ears are sharply terminated, the anterior being somewhat smaller and more depressed than the posterior. The surface bears fine concentric ledges, in places also fila and thread-like radial ribs.

D e s c r i p t i o n : Lectotype is a small, well preserved vaulted left valve with subrhomboidal outline. The dorsal line is expressively longer than the dorso-ventral parameter.

The beak is situated close before the centre of the dorsal line, being small, vaulted, moderately prosogyrate, slightly raised above the dorsal margin. The apical portion is morphologically clearly marked by the depression of the ears, more in the anterior part than posteriorly. Apical angle about 120 degrees.

The anterior ear narrowly subtriangular, moderately vaulted, separated by a deep furrow from the apical portion of the valve. The posterior ear a little larger, separated from the apical portion by a less expressive, shallow furrow. The termination of both ears is sharp, rostrate.

The original surface of the valve is incompletely preserved. For the most part there are revealed different deeper structural layers of the valve. On the fragments of the original surface only sparse, fine concentric ledges are visible which are bent also on the surface of the ears. In places, fine fila are distinct between the individual concentric ledges. Only rarely there are faintly marked, threadlike radial ribs.

The paratype of the species, figured by J. B a r r a n d e (1881, pl. 219, fig. IX, 1—3) is an incomplete left valve with a part of the anterior ear and the posterior portion of the valve broken off. The preserved part of the valve agrees with the lectotype. The surface of the valve body bears exprcssive concentric ledges, the fila being marked in places. Radial ribs are indistinct.

Biometrical characteristic.

Knowing the species only of two valves, we carried out the graphical integration in both valves and calculated the constant k. The latter varies between 2,59 and 2,84, the mean value $k = 2,71$.

Remarks and Observations: The relations of this species to the distantly related forms have been discussed under the description of the genus.

Occurence: Upper Koněprusy Limestones f (Lower Devonian).

Locality: Koněprusy near Beroun.

CONCLUSION:

The present revision of the Silurian and Devonian pectinoid forms of Central Bohemia, designated by J. Barrande (1881) as *Aviculopecten*, has proved that they are not closely related with the pectinoid species of approximately the same age from other areals. *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) which strongly reminds of the type of the genus seems to be the only exception.

From the biostrationomic point of view there is necessary to stress that the forms from the organodetritic limestones of Koněprusy are in our collection represented only by the vaulted left valves. So far, right valves have not been found. This fact, along with the lumachellic character of the thin layers in which the valves were found, proves, that their occurence represents a mechanical thanatocoenosis formed by transportation and redeposition of dead shells. The right valves, different in shape and of minor specific weight, were transported to other places of the Devonian sedimentation area of Bohemia.

Both valves are known only in the Silurian species *P. (Pterinopecten) cybele* (Barrande, 1881). Those valves, however, come from the calcareous graptolites shales which undoubtedly were deposited during much quieter and stabler sedimentary conditions than those having influenced the sedimentation of the above mentioned Koněprusy limestones.

The biometrical methods introduced in the present paper have proved to be especially well applicable for the representatives of the order *Pectinacea,* even in those cases when only a limited number of material is available.

PL. 1.

n	z	p	ξ	η	$\xi \cdot \eta$	ξ^2	η^2	Type designated by J. Barrande as: figured as:
								Aviculopecten cybele
1	46,50	25,00	- 6,93	- 3,39	23,4927	48,0249	11,4921	fig. 2
2	31,00	16,00	8,57	5,61	48,0777	73,4449	31,4721	1
3	34,00	18,00	5,57	3,61	20,1077	31,0249	13,0321	3
4	31,20	16,50	8,37	5,11	42,7707	70,0569	26,1121	7
5	40,00	22,50	- 0,43	- 0,89	0,3827	0,1849	0,7921	8
6	44,00	24,00	- 4,43	- 2,39	10,5877	19,6249	5,7121	9
								Our own collection
7	57,00	30,00	-17,43	- 8,39	146,2377	303,8049	70,3921	type No: 20
8	40,00	22,00	- 0,43	- 0,39	0,1677	0,1849	0,1521	26
9	40,50	22,00	- 0,93	- 0,39	0,3627	0,8649	0,1521	32
10	25,30	18,00	14,27	3,61	51,5147	203,6329	13,0321	36
11	38,00	21,00	1,57	0,61	0,9577	2,4649	0,3721	38
12	54,00	29,00	-14,43	- 7,39	106,6377	208,2249	54,6121	40
13	33,00	17,00	6,57	4,61	30,2877	43,1649	21,2521	41
Σ	514,50	281,00			481,5851	1004,7037	248,5773	
$\frac{\Sigma}{n} = A$	39,57	21,61				77,2849	19,1213	

$$\sigma_z = 8{,}79 \quad ; \quad \sigma_p = 4{,}37$$

$$K_{zp} = \frac{\Sigma \, \xi \, \eta}{n \cdot \sigma_z \cdot \sigma_p} = \frac{481{,}5351}{499{,}3599} = 0{,}9644$$

$$b_{pz} = K_{zp} \cdot \frac{\sigma_z}{\sigma_p} = 1{,}9398$$

$$b_{zp} = K_{zp} \cdot \frac{\sigma_p}{\sigma_z} = 0{,}4794$$

Equations of the regression lines:

$$p - A_p = b_{zp} \cdot (z - A_z)$$
$$p - 21{,}61 = 0{,}4794\, z - 18{,}96$$
$$\underline{p = 0{,}4794\, z + 2{,}65}$$

$$z - A_z = b_{pz} \cdot (p - A_p)$$
$$z - 39{,}57 = 1{,}9398\, p - 41{,}91$$
$$\underline{z = 1{,}9398\, p - 2{,}34}$$

PL. 2.

Type designated by J. Barrande as: figured as:	Measured values 5 times enlarged			
	z	p	z^2	$z \cdot p$
Aviculopecten cybele				
fig. 2	46,50	25,00	2 162,25	1 162,50
1	31,00	16,00	961,00	496,00
3	34,00	18,00	1 156,00	612,00
7	31,20	16,50	973,44	514,80
8	40,00	22,50	1 600,00	900,00
9	44,00	24,00	1 936,00	1 056,00
Our own collection				
type No: 20	57,00	30,00	3 249,00	1 710,00
26	40,00	22,00	1 600,00	880,00
32	40,50	22,00	1 640,25	891,00
36	25,30	18,00	640,09	455,40
38	38,00	21,00	1 440,00	798,00
40	54,00	29,00	2 916,00	1 566,00
41	33,00	17,00	1 089,00	561,00

$[z \cdot z]$	21 367,03
$[z \cdot p]$	11 602,70
$[p]$	281,00
$[z]$	514,50
$[z]^2$	264 710,25
$[z \cdot z] \cdot [p]$	6 004 135,43
$[z] \cdot [z \cdot p]$	5 969 589,15
$n\,[z \cdot z]$	277 771,39
$n \cdot [z \cdot p]$	150 835,10
$[z] \cdot [p]$	144 574,50

$$b = \frac{34\,546{,}28}{13\,061{,}14} = 2{,}6449$$

$$k = \frac{6\,250{,}60}{13\,061{,}14} = 0{,}47856 = \operatorname{tg} \alpha$$

$$\alpha = 25°32'$$

$$p = 0{,}47856\, v + 2{,}6$$

PL. 3.

n	s	v	ξ	η	$\xi \cdot \eta$	ξ^2	η^2	Type designated by J. Barrande as: figured as:
								Aviculopecten cybele
1	56,50	51,00	17,31	14,43	249,7833	299,6361	208,2249	fig. 7
2	76,00	68,00	- 2,19	- 2,57	5,6283	4,7961	6,6049	8
3	81,00	71,00	- 7,28	- 5,57	40,5496	52,9984	31,0249	9
								Our own collection
4	99,00	85,50	-25,19	-20,07	505,5633	634,5361	402,8049	type No: 20
5	68,00	60,00	5,81	5,43	31,5483	33,7561	29,4849	26
6	72,50	65,00	1,31	0,43	0,5633	1,7161	0,1849	32
7	73,00	65,00	0,81	0,43	0,3483	0,6561	0,1849	38
8	64,50	58,00	9,31	7,43	69,1733	86,6761	55,2049	41
Σ	590,50	523,50			903,1577	1114,7711	733,7192	
$\frac{\Sigma}{n} = A$	73,81	65,43				139,3463	91,7149	

$$\sigma_s = 11{,}80 \quad ; \quad \sigma_v = 9{,}57$$

$$K_{sv} = \frac{\Sigma\, \xi\, \eta}{n\, \sigma_s \,.\, \sigma_v} = \frac{903{,}1577}{903{,}4088} = 0{,}9997$$

$$b_{vs} = K_{sv} \,.\, \frac{\sigma_s}{\sigma_v} = 1{,}2326$$

$$b_{sv} = K_{sv} \,.\, \frac{\sigma_v}{\sigma_s} = 0{,}8107$$

Equations of the regression lines:

$$v - A_v = b_{sv}(s - A_s)$$
$$v - 65{,}43 = 0{,}8107\, s - 59{,}83$$
$$\underline{v = 0{,}8107\, s + 5{,}60}$$

$$s - A_s = b_{vs}(v - A_v)$$
$$s - 73{,}81 = 1{,}2326\, v - 80{,}64$$
$$\underline{s = 1{,}2326\, v - 6{,}83}$$

PL. 4.

Type designated by J. Barrande as: figured as:	Measured values 5 times enlarged s	v	s^2	$s . v$
Aviculopecten cybele				
fig. 7	56,50	51,00	3 192,25	2 881,50
8	76,00	68,00	5 776,00	5 168,00
9	81,00	71,00	6 561,00	5 751,00
Our own collection				
type No: 20	99,00	85,50	9 801,00	8 464,50
26	68,00	60,00	4 624,00	4 080,00
32	72,50	65,00	5 265,25	4 712,50
38	73,00	65,00	5 329,00	4 745,00
41	64,50	58,00	4 160,25	3 741,00

$[s . s]$	44 699,75
$[s . v]$	39 543,50
$[v]$	523,50
$[s]$	590,50
$[s]^2$	348 690,25
$[s.s] . [v]$	23 400 319,125
$[s] . [s.v]$	23 350 436,75
$n . [s.s]$	357 598,00
$n . [s.v]$	316 348,00
$[s] . [v]$	309 126,75

$$b = \frac{49\,882,375}{8\,907,75} = 5,59988$$

$$k = \frac{7\,221,25}{8\,907,75} = 0,810670 = \operatorname{tg} \alpha$$

$$\alpha = 39°8'$$

$$v = 0,810670\, s + 5,6$$

PL. 5.

n	s	v	ξ	η	$\xi \cdot \eta$	ξ^2	η^2	Type designated by J. Barrande as: figured as:
								Aviculopecten cybele
1	54,00	42,00	14,25	11,37	162,0225	203,0625	129,2769	fig. 1
2	79,00	62,00	-10,75	- 8,63	92,7725	115,5625	74,4769	2
3	55,00	43,00	13,25	10,37	137,4025	175,5625	107,5369	3
4	85,00	66,50	-16,75	-13,13	219,9275	280,5625	172,3969	Our own collection type No: 40
Σ	273,00	213,50			612,1250	774,7501	483,6876	
$\frac{\Sigma}{n} = A$	68,25	53,37				193,6875	120,9219	

$$\sigma_s = 13{,}92 \quad ; \quad \sigma_v = 11{,}00$$

$$K_{sv} = \frac{\Sigma \xi \cdot \eta}{n \cdot \sigma_s \cdot \sigma_v} = \frac{612{,}1250}{612{,}48} = 0{,}9994$$

$$b_{vs} = K_{sv} \cdot \frac{\sigma_s}{\sigma_v} = 1{,}2646$$

$$b_{sv} = K_{sv} \cdot \frac{\sigma_v}{\sigma_s} = 0{,}7897$$

Equations of the regression lines:

$$v - A_v = b_{sv} \cdot (s - A_s)$$
$$v - 53{,}37 = 0{,}7897\, s - 53{,}89$$
$$\underline{v = 0{,}7897\, s - 0{,}52}$$
$$s - A_s = b_{vs}(v - A_v)$$
$$s - 68{,}25 = 1{,}2646\, v - 67{,}49$$
$$\underline{s = 1{,}2646\, v + 0{,}76}$$

PL. 6.

In Barrande *Aviculopecten cybele* (left valves). Figured as:	V		$\frac{x_v}{y_v}$	N		$\frac{y_n}{x_n}$	Pl.	k
	x	y		x	y			
fig. 7	78,00	21,00	3,714	8,00	51,50	6,437	5,10	4,68
8	79,00	22,50	3,511	7,80	55,00	7,051	5,58	4,43
9	79,00	23,00	3,434	8,00	55,00	6,875	5,30	4,45
Our own collection type No: 20	78,00	22,00	3,545	8,00	54,20	6,775	5,30	4,53
26	78,00	22,00	3,545	8,00	54,00	6,750	5,30	4,51
32	79,00	26,00	3,038	7,00	56,50	8,071	5,58	4,39
38	79,00	23,00	3,434	8,00	55,50	6,937	5,41	4,40
41	79,00	22,00	3,590	7,80	55,00	7,051	5,60	4,52
In Barrande *A. cybele* (right valves). Figured as:								
fig. 1	80,00	26,00	3,076	8,00	64,20	8,025	6,28	3,93
2	78,00	15,00	5,200	14,00	55,50	3,964	5,41	3,81
3	80,50	26,00	3,095	8,00	64,00	8,000	6,23	3,97
Our own collection type No: 40	79,00	26,00	3,038	8,00	64,00	8,000	6,20	3,92

PL. 7.

n	z	p	ξ	η	$\xi \cdot \eta$	ξ^2	η^2	Type designated by J. Barrande as: figured as:
								Aviculopecten niobe
1	15,00	13,00	29,50	15,10	445,45	870,25	228,01	fig. 1— 2
2	26,50	19,00	18,00	9,10	163,80	324,00	82,81	3— 4
3	37,90	25,00	6,60	3,10	20,46	43,56	9,61	7— 8
4	39,50	25,00	5,00	3,10	15,50	25,00	9,61	15—16
5	45,00	27,80	- 0,50	0,30	0,15	0,25	0,09	13—14
6	45,00	28,20	- 0,50	- 0,10	0,05	0,25	0,01	9—10
7	52,00	31,50	- 7,50	- 3,40	25,50	56,25	11,56	5— 6
8	82,00	46,00	-37,50	-17,90	671,25	1406,25	320,41	17—18
								Aviculopecten fossulosus
9	43,00	27,00	- 1,50	1,10	1,65	2,25	1,21	fig. 1— 2
10	33,00	22,00	11,50	6,10	70,15	132,25	37,21	3— 5
								Aviculopecten consolans
11	25,00	19,00	19,50	9,10	177,45	380,25	82,81	fig. 1— 2
12	90,00	54,00	-45,50	-25,90	1178,45	2070,25	670,81	13—14
Σ	533,90	337,50			2766,86	5310,71	1454,15	
$\frac{\Sigma}{n} = A$	44,50	28,10				442,55	121,17	

$$\sigma_z = 21{,}03 \quad ; \quad \sigma_p = 11{,}00$$

$$K_{zp} = \frac{\Sigma\, \xi \cdot \eta}{n \cdot \sigma_z \cdot \sigma_p} = \frac{2766{,}86}{2775{,}96} = 0{,}9967$$

$$b_{pz} = K_{zp} \cdot \frac{\sigma_z}{\sigma_p} = 1{,}8927$$

$$b_{zp} = K_{zp} \cdot \frac{\sigma_p}{\sigma_z} = 0{,}5178$$

Equations of the regression lines:

$$p - A_p = b_{zp}(z - A_z)$$

$$p - 28{,}1 = 0{,}5178\, z - 23{,}14$$

$$\underline{p = 0{,}5178\, z + 4{,}96}$$

$$z - A_z = b_{pz}(p - A_p)$$

$$z - 44{,}5 = 1{,}8927\, p - 53{,}10$$

$$\underline{z = 1{,}8927\, p - 8{,}60}$$

PL. 8.

Type designated by J. Barrande as: figured as:	Measured values 5 times enlarged z	p	z^2	$z . p$
Aviculopecten niobe				
fig. 1— 2	15,00	13,00	225,00	195,00
3— 4	26,50	19,00	702,25	503,50
7— 8	37,90	25,00	1 436,41	947,50
15—16	39,50	25,00	1 560,25	987,50
13—14	45,00	27,80	2 025,00	1 251,00
9—10	45,00	28,20	2 025,00	1 269,00
5— 6	52 00	31,50	2 704,00	1 638,00
17—18	82,00	46,00	6 724,00	3 772,00
Aviculopecten fossulossus				
fig. 1— 2	43,00	27,00	1 849,00	1 161,00
3— 5	33,00	22,00	1 089,00	726,00
Aviculopecten consolans				
fig. 1— 2	25,00	19,00	625,00	475,00
13—14	90,00	54,00	8 100,00	4 860,00

$[z . z]$	29 064,91
$[z . p]$	17 785,50
$[p]$	337,50
$[z]$	533,90
$[z]^2$	285 049,21
$[z . z] . [p]$	9 809 407,125
$[z] . [z . p]$	9 495 678,45
$n . [z . z]$	348 778,92
$n . [z . p]$	213 426,00
$[z] . [p]$	180 191,25

$$b = \frac{313\,728{,}67}{63\,729{,}71} = 4{,}92280$$

$$k = \frac{33\,234{,}75}{63\,729{,}71} = 0{,}52149 = \mathrm{tg}\, a$$

$$a = 27°32'$$

$$p = 0{,}52149\, z + 4{,}9$$

PL. 9.

n	s	v	ξ	η	$\xi . \eta$	ξ^2	η^2	Type designated by J. Barrande as: figured as:
								Aviculopecten niobe
1	27,00	21,00	49,28	40,39	1 990,4192	2 428,5184	1 631,3521	fig. 1— 2
2	46,00	36,30	30,28	25,09	759,7252	916,8784	629,5081	3— 4
3	68,80	56,00	7,48	5,39	40,3172	55,9504	29,0521	7— 8
4	67,00	54,00	9,28	7,39	68,5792	86,1184	54,6121	15—16
5	80,10	64,00	- 3,82	- 2,61	9,9702	14,5924	6,8121	13—14
6	74,00	60,00	2,28	1,39	3,1692	5,1984	1,9321	9—10
7	89,00	72,80	- 12,72	-11,41	145,1352	161,7984	130,1881	5— 6
8	139,00	111,60	-62,72	-50,21	3 149,1712	3 933,7984	2 521,0441	17—18
								Aviculopecten fossulosus
9	71,00	56,00	5,28	5,39	28,4592	27,8784	29,0521	fig. 1— 2
10	61,00	48,00	15,28	13,39	204,5992	233,4784	179,2921	3— 5
								Aviculopecten consolans
11	41,50	33,00	34,78	28,39	987,4042	1 209,6484	805,9921	fig. 1— 2
12	151,00	124,00	-74,72	-62,61	4 678,2192	5 583,0784	3 920,0121	13—14
Σ	915,40	736,70			12 065,1684	14 656,9368	9 938,8492	
$\frac{\Sigma}{n} = A$	76,28	61,39				1 221,41	828,24	

$$\sigma_s = 34{,}95 \quad ; \quad \sigma_v = 28{,}78$$

$$K_{sv} = \frac{\Sigma\, \xi . \eta}{n . \sigma_s . \sigma_v} = \frac{12\,065{,}17}{12\,070{,}33} = 0{,}9996$$

$$b_{vs} = K_{sv} . \frac{\sigma_s}{\sigma_v} = 1{,}2022$$

$$b_{sv} = K_{sv} . \frac{\sigma_v}{\sigma_s} = 0{,}8152$$

Equations of the regression lines:

$$v - A_v = b_{sv} . (s - A_s)$$
$$v - 61{,}39 = 0{,}8152\, s - 61{,}78$$
$$\underline{v = 0{,}8152\, s - 0{,}39}$$

$$s - A_s = b_{vs}(v - A_v)$$
$$s - 76{,}28 = 1{,}2022\, v - 73{,}67$$
$$\underline{s = 1{,}2022\, v + 2{,}61}$$

PL. 10.

Type designated by J. Barrande as: figured as:	V		$\frac{x_v}{y_v}$	N		$\frac{y_n}{x_n}$	Pl.	k
	x	y		x	y			
Aviculopecten niobe								
fig. 1—2	77,50	21,20	3,655	15,00	58,00	3,866	5,55	2,54
3—4	79,50	20,00	3,975	15,00	57,00	3,800	6,00	2,51
7—9	79,00	20,00	3,951	15,50	58,00	3,740	5,61	2,63
15—16	78,00	19,00	4,105	15,00	57,00	3,800	6,20	2,51
13—14	79,00	22,50	3,511	15,00	62,00	4,133	5,81	2,49
9—10	80,00	21,50	3,720	16,00	61,00	3,812	5,82	2,44
5—6	79,00	18,00	4,388	19,00	65,00	3,421	6,16	2,44
17—18	79,00	15,00	5,266	23,00	58,00	2,521	5,41	2,45
Aviculopecten fossulosus								
fig. 3—5	78,00	21,50	3,627	14,00	61,00	4,206	5,88	2,59
1—2	79,50	20,00	3,975	15,00	57,00	3,800	6,00	2,51
Aviculopecten consolans								
fig. 1—2	79,00	20,00	3,951	15,50	58,00	3,740	5,61	2,63
13—14	78,00	19,00	4,105	15,00	57,00	3,800	6,20	2,51

PL. 11.

n	z	p	ξ	η	$\xi . \eta$	ξ^2	η^2	Type designated by J. Barrande as: figured as:
								Aviculopecten consolans
1	67,00	34,50	6,00	2,62	2 311,50	4 489,00	1 190,25	fig. 7—8
2	84,00	42,00	-11,00	- 4,88	3 528,00	7 056,00	1 764,00	9—10
3	97,00	48,00	-24,00	-10,88	4 656,00	9 409,00	2 304,00	11—12
								Aviculopecten multiplicans
4	44,00	24,00	29,00	13,21	1 056,00	1 936,00	576,00	fig. 1
Σ	292,00	148,50			11 551,50	22 890,00	5 834,25	
$\frac{\Sigma}{n} = A$	73,00	37,12				5 722,50	1 458,56	

$$\sigma_z = 75,64 \quad ; \quad \sigma_p = 38,19$$

$$K_{zp} = \frac{\Sigma \xi . \eta}{n . \sigma_z . \sigma_p} = \frac{11\,551,50}{11\,554,76} = 0,9997$$

$$b_{pz} = K_{zp} . \frac{\sigma_z}{\sigma_p} = 1,9608$$

$$b_{zp} = K_{zp} . \frac{\sigma_p}{\sigma_z} = 0,4998$$

Equations of the regression lines:

$$p - A_p = b_{zp}(z - A_z)$$
$$p - 37,12 = 0,4998\, z - 35,77$$
$$\underline{p = 0,4998\, z + 1,35}$$

$$z - A_z = b_{pz} . (p - A_p)$$
$$z - 73,00 = 1,9608\, p - 72,75$$
$$\underline{z = 1,9608\, p + 1,25}$$

PL. 12.

n	s	v	ξ	η	$\xi \cdot \eta$	ξ^2	η^2	Type designated by J. Barrande as: figured as:
								Aviculopecten consolans
1	110,00	78,00	6,62	5,00	31,25	43,8244	25,00	fig. 7— 8
2	133,50	95,00	-16,88	-12,00	202,56	284,9344	144,00	9—10
3	152,00	109,00	-35,38	26,00	919,88	1 251,7444	676,00	11—12
								Aviculopecten multiplicans
4	71,00	50,00	45,62	33,00	1 505,46	2 081,1844	1 089,00	fig. 1
Σ	466,50	332,00			2 659,15	3 661,6876	1 934,00	
$\frac{\Sigma}{n} = A$	116,62	83,00				915,42	483,50	

$$\sigma_s = 30{,}25 \quad ; \quad \sigma_v = 21{,}98$$

$$K_{sv} = \frac{\Sigma\, \xi \cdot \eta}{n \cdot \sigma_s \cdot \sigma_v} = \frac{2\,659{,}15}{2\,659{,}58} = 0{,}9998$$

$$b_{vs} = K_{sv} \cdot \frac{\sigma_v}{\sigma_s} = 1{,}3624$$

$$b_{sv} = K_{sv} \cdot \frac{\sigma_s}{\sigma_v} = 0{,}7193$$

Equations of the regression lines:

$$v - A_v = b_{sv} \cdot (s - A_s)$$
$$v - 83{,}00 = 0{,}7193\, s - 83{,}96$$
$$\underline{v = 0{,}7193\, s - 0{,}96}$$
$$s - A_s = b_{vs} \cdot (v - A_v)$$
$$s - 116{,}62 = 1{,}3624\, v - 112{,}88$$
$$\underline{s = 1{,}3624\, v - 3{,}74}$$

PL. 13.

Type designated by J. Barrande as: figured as:	V		$\frac{x_v}{y_v}$	N		$\frac{y_n}{x_n}$	Pl.	k
	x	y		x	y			
Aviculopecten consolans								
fig. 7— 8	77,80	18,80	4,158	20,00	56,50	2,825	5,50	2,12
9—10	78,00	18,00	4,333	23,00	68,00	2,956	6,35	2,02
11—12	77,80	18,00	4,322	22,80	68,00	2,982	6,32	2,04
Aviculopecten multiplicans								
fig. 1	78,00	19,00	4,105	19,80	55,00	2,777	5,30	2,15

PL. 14.

n	z	p	ξ	η	$\xi \cdot \eta$	ξ^2	η^2	Type designated by J. Barrande as: figured as:
								Aviculopecten multiplicans
1	77,50	50,00	- 8,88	- 2,75	24,3375	78,8544	7,5625	fig, 2—3
2	60,00	45,00	8,62	2,25	19,3950	74,3044	5,0625	4
3	87,00	53,00	-18,38	- 5,75	105,6850	337,8244	33,0625	6
								Aviculopecten consolans
4	50,00	41,00	18,62	6,25	116,3750	346,7044	39,0625	fig. 5—6
Σ	274,50	189,00			265,7925	837,6876	84,7500	
$\frac{\Sigma}{n} = A$	68,62	47,25				209,42	21,18	

$$\sigma_z = 14{,}47 \quad ; \quad \sigma_p = 4{,}60$$

$$K_{zp} = \frac{\Sigma\, \xi \cdot \eta}{n \cdot \sigma_z \cdot \sigma_p} = \frac{265{,}7925}{266{,}2480} = 0{,}9982$$

$$b_{pz} = K_{zp} \cdot \frac{\sigma_z}{\sigma_p} = 3{,}1399$$

$$b_{zp} = K_{zp} \cdot \frac{\sigma_p}{\sigma_z} = 0{,}3173$$

Equations of the regression lines:

$$p - A_p = b_{zp} \cdot (z - A_z)$$
$$p - 47{,}25 = 0{,}3173\, z - 21{,}77$$
$$\underline{p = 0{,}3173\, z + 25{,}48}$$
$$z - A_z = b_{pz}(p - A_p)$$
$$z - 68{,}62 = 3{,}1399\, p - 148{,}36$$
$$\underline{z = 3{,}1399\, p - 79{,}74}$$

PL. 15.

Type designated by J. Barrande as: figured as:	Measured values 5 times enlarged z	p	z^2	$z \cdot p$
Aviculopecten multiplicans				
fig. 2—3	77,50	50,00	6 006,25	3 875,00
4	60,00	45,00	3 600,00	2 700,00
6	87,00	53,00	7 569,00	4 611,00
Aviculopecten consolans				
fig. 5—6	50,00	41,00	2 500,00	2 050,00

$[z \cdot z]$	19 675,25
$[z \cdot p]$	13 236,00
$[p]$	189,00
$[z]$	274,50
$[z]^2$	75 350,25
$[z \cdot z] \cdot [p]$	3 718 622,25
$[z] \cdot [z \cdot p]$	3 633 282,00
$n \cdot [z \cdot z]$	78 701,00
$n \cdot [z \cdot p]$	52 944,00
$[z] \cdot [p]$	51 880,50

$$b = \frac{85\,340{,}25}{3\,350{,}75} = 25{,}46899$$

$$k = \frac{1\,063{,}50}{3\,350{,}75} = 0{,}31739 = \mathrm{tg}a$$

$$a = 17°36'$$

$$p — 0{,}31739\, z + 25{,}4$$

PL. 16.

n	s	v	ξ	η	$\xi . \eta$	ξ^2	η^2	Type designated by J. Barrande as: figured as:
								Aviculopecten multiplicans
1	150,00	118,00	-22,75	-18,00	409,50	517,5625	324,00	fig. 2—3
2	120,00	97,00	7,25	3,00	21,75	52,5625	9,00	4
3	154,00	118,00	-26,75	-18,00	481,50	715,5625	324,00	6
								Aviculopecten consolans
4	85,00	67,00	42,25	33,00	1 394,25	1 785,0625	1 089,00	fig. 5—6
Σ	509,00	400,00			2 307,00	3 070,75	1 746,00	
$\frac{\Sigma}{n} = A$	127,25	100,00				767,6875	436,50	

$$\sigma_s = 27,70 \quad ; \quad \sigma_v = 20,89$$

$$K_{sv} = \frac{\Sigma\, \xi . \eta}{n . \sigma_s . \sigma_v} = \frac{2\,307,00}{2\,314,6120} = 0,9967$$

$$b_{vs} = K_{sv} . \frac{\sigma_s}{\sigma_v} = 1,3216$$

$$b_{sv} = K_{sv} . \frac{\sigma_v}{\sigma_s} = 0,7516$$

Equations of the regression lines:

$$v - A_v = b_{sv} . (s - A_s)$$
$$v - 100,00 = 0,7516\, s - 95,64$$
$$\underline{v = 0,7516\, s + 4,36}$$
$$s - A_s = b_{vs}(v - A_v)$$
$$s - 127,25 = 1,3216\, v - 132,16$$
$$\underline{s = 1,3216\, v - 4,91}$$

PL. 17.

Type designated by J. Barrande as: figured as:	Measured values 5 times enlarged s	v	s^2	$s \cdot v$
Aviculopecten multiplicans				
fig. 2—3	150,00	118,00	22 500,00	17 700,00
4	120,00	97,00	14 400,00	11 640,00
6	154,00	118,00	23 716,00	18 172,00
Aviculopecten consolans				
fig. 5—6	85,00	67,00	7 225,00	5 695,00

$[s \cdot s]$	67 841,00
$[s \cdot v]$	53 207,00
$[v]$	400,00
$[s]$	509,00
$[s]^2$	259 081,00
$[s \cdot s] \cdot [v]$	27 136 400,00
$[s] \cdot [s \cdot v]$	27 082 363,00
$n \cdot [s \cdot s]$	271 364,00
$n \cdot [s \cdot v]$	212 828,00
$[s] \cdot [v]$	203 600,00

$$b = \frac{54\,037{,}00}{12\,283{,}00} = 4{,}39933$$

$$k = \frac{9\,228{,}00}{12\,283{,}00} = 0{,}75128 = \operatorname{tg} \alpha$$

$$\alpha = 36°55'$$

$$v = 0{,}75128\, s + 4{,}4$$

PL. 18.

Type designated by J. Barrande as: figured as:	V x	V y	$\frac{x_v}{y_v}$	N x	N y	$\frac{y_n}{x_n}$	Pl.	k
Aviculopecten multiplicans								
fig. 2—3	79,00	20,10	3,930	17,80	63,00	3,539	6,01	2,17
4	78,00	24,00	3,250	13,00	59,00	4,538	5,68	2,59
6	79,00	20,00	3,950	18,00	62,80	3,488	6,00	2,29
Aviculopecten consolans								
fig. 5—6	79,00	19,00	4,157	18,40	62,00	3,369	5,81	2,40

Použitá literatura

Literature

BARRANDE, J. (1881): Système silurien du centre de la Bohême, vol. VI, 3, Acephalés. — Prague—Paris.

BEUSHAUSEN, L. (1895): Die Lamellibranchiata des rheinischen Devon etc. — Abh. preuss. geol. L.—A., N. F. 17. Berlin.

BEYRICH, E. (1862): Über zwei neue Formengruppen aus der Familie der Aviculiden. — Deutsche geol. Gesell., Zeitschr., Bd. 14. Berlin.

CRAMER, R. (1913): Die Fauna von Golonog. -Jahrb. d. Kgl. preuss. geol. L.—A. für 1910, Bd. 31, teil. 2, Hft. 1. Berlin.

CHAO, Y. T. (1927): Fauna of the Taiyuan Formation on North China-Pelecypoda. — Palaeontologica Sinica, ser. B, vol. 9, fasc. 3. Nanking.

DEMANET, F. (1929): Les Lamellibranches du Marbre Noir de Dinant. — Mém. Mus. roy. d'Hist. nat. Belg., No. 40. Bruxelles.

DEMANET, F. (1936): Les Pectenidés du Terrain Houiller de la Belgique. — Mém. Inst. Géol. Univ. Louvain, t. X, 1936. Louvain.

DEMANET, F. (1938): Le Faune des couches de passage du Dinantien au Namurien dans le syncl. de Dinant. — Mém. Mus. roy. Hist. nat. Belg., No. 84. Bruxelles.

DEMANET, F. (1941): Faune et Stratigraphie de l'étage Namurien de la Belgique. — ibid., No. 97. Bruxelles.

DEMANET, F. (1943): Les Horizons marins du Westphalien de la Belgique. — ibid., No. 101. Bruxelles.

DORSMAN, L. (1945): The marine fauna of the Carboniferous in the Netherlands. — Mededeelingen van de Geolog. Stichting, Ser. C-IV-3. Maastricht.

ELIAS, M. K. (1957): Late Mississippian Fauna from the Redoak Hollow Formation etc. Pt. 3. Pelecypoda. — Jour. Paleont. 31, No. 4. Menaska.

ETHERIDGE, R. jr. & DUN, W. S. (1906): Monograph of the Carboniferous and Permo-Carboniferous invertebrata of New Youth Wales, vol. 2. — New South Wales Geol. Surv., Mem. No. 5.

FEDOTOV, D. M. (1932): The Carboniferous Pelecypods of the Donetz Basin. — Unit. Geol. Prosp. Service USSR, Trans., fesc. 103. Leningrad—Moskva.

FRECH, F. (1891): Die devonischen Aviculiden Deutschlands. — Abh. Preuss. u. Thür. Staaten, 9, nr. 3. Berlin.

GIRTY, G. H. (1904): New molluscan genera from the Carboniferous. — U. S. Nat. Mus., Proc. vol. 27. Washington.

GIRTY, G. H.: (1904a): Typical species and generic characters of Aviculopecten McCoy. — Am. Geologist, vol. 33. New Haven.

GIRTY, G. H. (1940b): The type of Aviculopecten. — Am. Geologist, vol. 34. New Haven.

GIRTY, G. H. (1908): The Guadalupian fauna. — U. S. Geol. Surv. Prof. Paper 58. Washington.

GIRTY, G. H. (1915): Fauna of the Wewoka Formation of Oklahoma. — U. S. Geol. Surv., Bull. 436. Washington.

HALL, J. (1883): Lamellibranchiata I, plates and explanations, Monomyaria of the upper Helderberg, Hamilton, and Chemung groups. — New York Geol. Surv., Paleontology, vol. 5, pt. 1. New York.

HALL, J. (1884): Lamellibranchiata I, Descriptions and figures of the Monomyaria of the upper Helderberg, Hamilton, und Chemung groups.-ibid. New York.

HALL, J. (1885): Lamellibranchiata II, Descriptions and figures of the Dimyaria of the upper Helderberg, Hamilton, Portage, and Chemung groups. — ibid., vol. 5, pt. 1. New York.

HIND, Wh. (1896—1905): Monograph of the British Carboniferous Lamellibranchiata, vol. 1 (1896—1900), vol. 2 (1901—1905). — Monographs of the Paleontogr. Soc. London.

JACKSON, R. T. (1890): Phylogeny of the Pelecypoda, the Aviculidae and their allies. — Boston Soc. Nat. Hist., Mem., vol. 4. Boston.

JAKOWLEW, N. (1903): Die fauna der oberen Abtheilung der Palaeozoischen Ablagerungen im Donetz-Bassin. I. Die Lamellibranchiaten. — Mém. du Com. Géol., n. ser., liv. 4. Pétersbourg.

KATZER, F. (1902): Geologie von Böhmen. 2. Auflage. Prag (Praha).

KEGEL, W. (1925): Bemerkungen über die obersilurischen Zweischaler-Gattung Rhombopteria und ihre Verwandten. — Centralbl. Mineralogie, Abt. B, No. 9. Stuttgart.

KONINCK, L. G. (1885): Faune du Calcaire Carbonifère, Lamellibranches. — Mus. roy. Hist. nat. Belgique, Annales, vol. 11. Bruxelles.
LICHAREV, B. K. (1927): Upper Carboniferous Pelecypoda of Ural and Timan. — Comité Géol., Mém., liv. 164. Leningrad.
MAILLIEUX, E. (1935): Contribution à la connaissance de quelques Brachiopodes et Pélecypodes dévoniens. — Mém. Musée roy. Hist. Nat. Belg., No. 70, Bruxelles.
MAILLIEUX, E. (1937): Les Lamellibranches du Dévonien inférieur de l'Ardenne. — ibid., No. 81. Bruxelles.
MAILLIEUX, E. (1938): Le Couvinien de l'Ardenne et ses faunes. — ibid., No. 83. Bruxelles.
MC COY, F. (1851): Annals and Mag. Nat. History, 2d ser. vol. 7. London.
MC COY, F. (1855): Systematic Descriptions of the British Palaeozoic Fossils in the Geological Museum of the University of Cambridge (in: SEDGWICK, A. Synopsis of the Classification of the British Palaeozoic Rocks).
MEEK, F. B. (1864): Remarks on the family Pteriidae (= Aviculidae) with descriptions of some new fossil genera. — Amer. Jour., Sci., 2d ser., vol. 37. New Haven.
MILLER, S. A. (1877): The American Palaeozoic fossils, a catalogue of the genera and species. Cincinnati.
MILLER, S. A. (1889): North American geology and paleontology. — Cincinnati.
MILLER, S. A. (1891): Paleontology. — Indiana Geol. Surv. 17th Ann. Rept., advance sheets. Indiana.
NEWELL, N. D. (1935): Morphology of Upper Paleozoic Pectinacea (abstract). — Geol. Soc. Amer., Pr. 1934: 365, 1935. New York.
NEWELL, N. D. (1938): Late Paleozoic pelecypods: Pectinacea. — Kansas Geol. Surv., v. 10 (1), 1937. Lawrence.
PAUL, H. (1939): Eine festgeheftete Muschel des Kulm-Meeres, Posidonia becheri. — Natur und Volk, 1939, Heft. 8. Frankfurt a. M.
PAUL, H. (1941): Lamellibranchiata infracarbonica (Fossilium catalogus, I, Animalia, pars 91). Berlin.
PHILIPPI, E. (1900): Beiträge zur Morphologie und Phylogenie der Lamellibranchien. — Zeitschr. d. deutsch. geol. Ges., vol. 52. Berlin.
POHL, E. R. (1929): The Devonian of Wisconsin. Pt. I, Lamellibranchiata. — Bull. Publ. Mus. Milwaukee, vol. 11, No. 1. Milwaukee.
PŘIBYL, A. (1953): Pectinacea ostravských vrstev (Namur.) a jejich stratigrafický význam. — Rozpr. II. tř. Čes. akad., r. LXII, č. 10, Praha.
RENIER, A., STOCKMANS, F., DEMANET, F. et STRAELEN v. V. (1938): Flore et Faune Houillères de la Belgique (Introduction à l'Étude Paléontologique de Terrain Houiller). — Musée roy. Hist. nat. Belgique (text et planche). Bruxelles.
REIS, O. (1902): Das Ligament der Bivalven. — Jahreshefte des Ver. für Vaterl. Naturk. in Württenberg, Bd. 58. München.
RŮŽIČKA, B. (1951): Pectinidae Lam. českého siluru a devonu. — Sbor. Slezského stud. úst. Opava.
SHIMER, H. W. et SHROCK, R. R. (1944—1947): Index Fossils of North America. — Publ. Techn. Press Inst. of Technology. New York—London.
SPRIESTERSBACH, J. (1934): Beitrag zur Kenntnis der Fauna des rheinischen Devon., Jahrb. preuss. geol. L.-A., f. 1934, Bd. 55. Berlin.
STOLICZKA, F. (1871): Cretaceous fauna of southern India; the Pelecypoda. — India geol. Surv., Mem. Palaeont. Indica, ser. 6, vol. 3. Calcutta.
ŠULGA, P. L. (1956): Molluski in: Fauna i flora kamenougolnych otloženij Galicijsko-volynskoj vpadliny. — Trudy Inst. geol. nauk, ser. stratigr. i paleont., vyp. 10, Akad. nauk Ukr. SSR. Kiev.
VERRILL, A. E. (1897): A study of the family Pectinidae, with a revision of the genera and subgenera. — Connecticut Acad. Sci., Trans., vol. 10.
WHIDBORNE, G. F. (1892—1907): A Monograph of the Devonian Fauna of South England. I. etc. — Palaeontogr. Soc. London.
YONGE, C. M. (1936): The evolution of the swimming habit in the Lamellibranchia. — Mus. roy. Hist. nat. Belgique, Mém., ser. 12, fasc. 3. Bruxelles.
ŻAKOWA, H. (1953): Fauna kulmowa z Jabłowa na Dolnym Śląsku. — Inst. Geol., Biul. 72. Warszawa.

EXPLANATIONS OF PLATES

Plate I.

Fig. 1 — *Pterinopecten (Pterinopecten) cybele* (Barrande 1881) X 3,3 (In Barrande vol. VI, pl. 228, fig. II, 1).
Fig. 2 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 3,9 (Our own collection, type No. 40).
Fig. 3 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4,4 (Our own collection, type No. 20).
Fig. 4 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 5,8 (In Barrande vol. VI, pl. 225, fig. I, 1—2).
Fig. 5 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4 (Our own collection, type No. 19).

Plate II.

Fig. 1 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 3,5 (In Barrande vol. VI, pl. 228, fig. II, 5).
Fig. 2 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4,7 (In Barrande vol. VI, pl. 228, fig. II, 7).
Fig. 3 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4,5 (In Barrande vol. VI, pl. 228, fig. II, 2).
Fig. 4 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4,7 (Our own collection, type No. 32).
Fig. 5 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 3,8 Lectotype. (In Barrande vol. VI, pl. 228, fig. II, 9).
Fig. 6 — detto — detail of the central part.

Plate III.

Fig. 1 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4,6 (Our own collection, type No. 26).
Fig. 2 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4,7 (Our own collection, type No. 28).
Fig. 3 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4,5 (Our own collection, type No. 37)
Fig. 4 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4 (Our own collection, No 42).
Fig. 5 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4,9 (In Barrande vol. VI, pl. 228, fig. II, 3).

Plate IV.

Fig. 1 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 4,3 (In Barrande vol. VI, pl. 228, fig. II, 4).
Fig. 2 — detto — detail of the surface near to the beak.
Fig. 3 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881 X 5 (In Barrande vol. VI, pl. 228, fig. II, 8).
Fig. 4 — detto — detail of the central part.
Fig. 5 — *Pterinopecten (Pterinopecten) cybele* (Barrande, 1881) X 3 (Our own collection, type No. 41).

Plate V.

Fig. 1 — *Newellipecten (Fascinewellipecten) multiplicans* (Barrande, 1881) X 4,2 (In Barrande vol VI, pl. 222, fig. II, 3—4).
Fig. 2 — detto — detail of the central part.
Fig. 3 — *Newellipecten (Fascinewellipecten) multiplicans* (Barrande, 1881) X 3,8 (In Barrande vol. VI, pl. 222, fig. II, 5—6).
Fig. 4 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 7 (In Barrande vol. VI, pl. 221, fig. II, 1—2).
Fig. 5 — *Newellipecten (Newellipecten) niobe* (Barrande, 1181) X 2,2 (In Barrande vol. VI, pl. 221. fig. II, 17—18).
Fig. 6 — detto — detail of the central part.

Plate VI.

Fig. 1 — *Newellipecten (Fascinewellipecten) multiplicans* (Barrande, 1881) X 2,1 Lectotype. (In Barrande vol. VI, pl. 221, fig. III, 2—3).
Fig. 2 — detto — detail of the surface near to the lower margin.
Fig. 3 — *Newellipecten (Fascinewellipecten) consolans* (Barrande, 1881) X 2,4 (In Barrande vol. VI, pl. 221, fig. III, 4)
Fig. 4 — detto — detail of the surface near to the lower margin.
Fig. 5 — *Newellipecten (Fascinewellipecten) consolans* (Barrande, 1881) X 3 (In Barrande vol. VI, pl. 222, fig. II, 7—8).
Fig. 6 — detto — detail of the surface near to the lower margin.

Plate VII.

Fig. 1 — *Newellipecten (Fascinewellipecten) consolans* (Barrande, 1881) X 2,5 Lectotype. (In Barrande vol. VI, pl. 222, fig. II, 11—12).
Fig. 2 — *Anulipecten amicus* (Barrande, 1881) X 4,7 (In Barrande vol. VI, pl. 219, fig. IX, 4—5).
Fig. 3 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 1,9 (In Barrande vol. VI, pl. 221, fig. II, 23—24).
Fig. 4 — detto — detail of the central part.
Fig. 5 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 7,8 (In Barrande vol. VI, pl. 222, fig. II, 1—2).
Fig. 6 — detto — detail of the central part.

Plate VIII.

Fig. 1 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 4,4 (In Barrande vol. VI, pl. 221, fig. II, 5—6).
Fig. 2 — *Newellipecten (Fascinewellipecten) consolans* (Barrande, 1881) X 2,5 (In Barrande vol. VI, pl. 222, fig. II, 9—10).
Fig. 3 — *Anulipecten amicus* (Barrande, 1881) X 4,3 (In Barrande vol. VI, pl. 219, fig. IX, 1—3).
Fig. 4 — detto — detail of the central part.
Fig. 5 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 5,1 (In Barrande vol. VI, pl. 221, fig. I, 1—2).
Fig. 6 — detto — detail of the central part.

Plate IX.

Fig. 1 — *Newellipecten (Fascinewellipecten) consolans* (Barrande, 1881) X 2,5 (In Barrande vol. VI, pl. 221, fig. III, 5).
Fig. 2 — detto — detail of the surface near the lower part.
Fig. 3 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 5 (In Barrande vol. VI, pl. 221, fig. II, 15—16).
Fig. 4 — detto — detail of the surface near to the free margin.
Fig. 5 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 3,4 (In Barrande vol. VI, pl. 221, fig. II, 13—14).
Fig. 6 — detto — detail of the central part.

Plate X.

Fig. 1 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 5,5 (In Barrande vol. VI, pl. 221, fig. II, 3—4).
Fig. 2 — detto — detail of the surface near to the lower margin.
Fig. 3 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 4,5 (In Barrande vol. VI, pl. 221, fig. II, 7—8).
Fig. 4 — detto — detail of the surface near to the lower margin.
Fig. 5 — *Pterinopecten (Pterinopecten) sp.* X 3,6.
Fig. 6 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 2,1 (In Barrande vol. VI, pl. 222, fig. II, 13—14).

Plate XI.

Fig. 1 — *Newellipecten (Fascinewellipecten) consolans* (Barrande, 1881) X 2 (In Barrande vol. VI, pl. 221, fig. III, 6).

Fig. 2 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 4,5 (In Barrande vol. VI, pl. 221, fig. I, 3—5).

Fig. 3 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 2,3 (In Barrande vol. VI, pl. 221, fig. II, 21—22).

Fig. 4 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 3,4 (In Barrande vol. VI, pl. 221, fig. II, 11—12).

Fig. 5 — *Newellipecten (Fascinewellipecten) consolans* (Barrande, 1881) X 2,4 (In Barrande vol. VI, pl. 221, fig. III, 1).

Fig. 6 — *Newellipecten (Newellipecten) niobe* (Barrande, 1881) X 4 Lectotype. (In Barrande vol. VI, pl. 221, fig. II, 9—10).