

LOWER CARBONIFEROUS PELECYPODS OF THE NORTHWEST
WING OF THE MOSCOW BASIN

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[p. 67]

Family Amussiidae Ridewood

Genus *PROTOENTOLIUM* nov. gen.

Diagnosis. The shell is oval, slightly convex, equivalved; auricles are small, triangular. The anterior auricle of the left valve is larger than the posterior and is slightly raised upward, which is why the hinge margin forms not a straight, but rather an angular-concave line. Beaks are small, sharp-angled, and occupy a middle position. The main part of the shell is of triangular outline, and is delimited by two depressions widely diverging from expanded anterior and posterior margins of the shell. There is no hollow for the byssus on the anterior auricle. Both valves, by and large, are smooth, with slight concavity. The external surface of the left valve is smooth, with numerous, very fine concentric growth lines. The external surface of the right valve, however, also has, in addition, coarser concentric traces of growth, especially closer to the outer margin.

Internal characters. On the steinkerns, impressions of two oblique ribs, proceeding from the beak to the anterior and posterior margins and containing bases of the auricles, are visible. "Cardinal ribs," proceeding parallel to this margin, are visible on the hinge margin of the valves.

There apparently is a smooth, narrow groove in the interspace between them. The anterior auricle of the left valve is strongly pushed upward and consists of two parts: the posterior -curved and triangular, tapering upward, with arcuate posterior margin, and the anterior -narrow, curved, lying more deeply from the hinge area and far from the posterior sharp curving projection. This section [part] below fuses with the base of the anterior auricle. The posterior part of the anterior auricle is delimited from below from the anterior part of the auricle by a horizontal groove, which is located on the continuation of the groove between the "cardinal ribs" of the posterior auricle. Apparently, it also serves as housing of the ligament. On the right valve along the entire hinge margin runs a comparatively feebly marked, narrow groove for ligament. On it, near the beak, traces of shallow pits are visible, similar to what has been observed in *Pernopecten*. In addition, on both valves, well marked central triangular pits for housing the internal ligament (resilium) have been observed in the beak section.

Obvious traces of zigzagging ribs, more sharply marked closer to the lower margin, but noticeable as well closer to the auricles and on the auricles themselves, are visible on the steinkern of a left valve. They are not visible on the right valve.

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Genotype — *Pecten sowerbyi* M'Coy. Lower Carboniferous of Ireland.

Among the pelecypod fauna processed, there is a substantial number of forms that belong

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to family Pectinidae, which at first glance ought to be ascribed to *Syncyclonema sowerbyi* M'Coy, as Hind did, having assigned to this species a form that Verneuil described from the Lower Carboniferous of Valday Region under the name *Pecten valdaicus* n. sp.

However, as examination of existing literature indicates the question concerning the generic position of M'Coy's species *Pecten sowerbyi* is confusing and contradictory and hence cannot be resolved in such a simple manner. It is necessary to touch on the history of development of the views of various authors concerning genera *Syncyclonema*, *Entolium*, and *Pernopecten*, in general very similar to each other and related genetically. This analysis leads to the need to distinguish Paleozoic forms that are attributed to *Entolium* under the name *Protoentolium*, because they undoubtedly are in a genus different from the three mentioned.

The differences of *Protoentolium* from *Entolium* and *Syncyclonema* are: 1) outlines of the auricles, which are not identical on the left valve: the anterior one is larger than the posterior and is pushed upward; 2) the presence of zigzagging ribs on the inner surface of the left valve; 3) geological age: *Protoentolium* belongs to the Paleozoic, while *Entolium* and *Syncyclonema* belong to the Mesozoic.

Pecten sowerbyi M'Coy (1844) (genotype), *Syncyclonema sowerbyi* Hind (1901-1905), and *Entolium aviculatum* Swallow (1872) should be placed in genus *Protoentolium*.

Protoentolium sowerbyi (M'Coy)

(Pl. XI, figs. 1-9)

1844. *Pecten sowerbyi* M'Coy. Synopsis Carb. Foss. Ireland, p. 100, pl. XIV, fig. 1.
1845. *Pecten valdaicus* Verneuil. Paleontologie de la Russie, p. 528, pl. XXVII, fig. 9.
1855. *Amusium sowerbyi* M'Coy. Brit. Pal. Fossils, p. 478.
1874. *Pecten sowerbyi* Etheridge. Jun Notes on Carboniferous Lamellibranchiata (Monomyaria), p. 300, pl. XIII, figs. 1-2.
1877. *Pecten (Amusium?) sowerbyi* Etheridge. Jun Further Contributions to British Carboniferous Paläontology, p. 241, pl. XII, figs. 1-3.
1878. *Entolium sowerbyi* Etheridge. Jun. On the Hinge Structure and Generic Affinity of *Pecten sowerbyi* M'Coy, p. 30, pl. I, figs. 4-5.
1901-1905. *Syncyclonema sowerbyi* Hind. A Monograph of the British Carbonif. Lamellibranchiata, p. 118, pl. XVIII, figs. 21-26.
1938. *Syncyclonema sowerbyi* Demanet. La faune des couches de passage du Dinantien au Namurien dans le Synclinorium de Dinant. p. 122, pl. X, figs. 24-32 and fig. in the text.

Holotype is kept in the Griffiths collection in Dublin. Lower Carboniferous of Ireland.

D e s c r i p t i o n . The shell is of average dimensions, oval, elliptical or almost of round outline, by and large equivalved and equilateral. The shell has a central pyriform convex section, separated anteriorly and posteriorly by oblique depressions from wide, flattened blades in the form of borders or rims. The free margin of the shell on the largest part of the extension is curved in an arc and convex, but above the shell, anteriorly and posteriorly, it immediately curves at an obtuse angle in the direction of the central line, then goes upward and inside to the junction with the auricles. The auricles are small, triangular, the anterior auricle sometimes is better delimited from the valve itself than the posterior one. The auricles are continuation of the hinge margin; in the right valve with straight upper margin, but on the left valve, [p. 69] the anterior auricle projects upward, and the upper margin of the valve is formed of two lines which come together at an angle. Beaks are not large, are flattened, triangular, pointed and central.

The internal characters are given in the description of genus *Protoentolium*. The muscle impression is not deep, round, and situated in the upper part of the shell posterior to the central line.

External characters. The surface, for the most part, is smooth, but under a microscope densely situated, fine, concentric growth lines are observed. When the outer layer of the shell is absent, the valve seems to be covered by densely situated, parallel, zigzagging marks.

Such is the brief description given by Hind. The large quantity of specimens of this species available to us allows perfectly observing the characters mentioned by this author. The specimens consist of steinkerns and impressions, partly with preserved remains of valves themselves, on which the characteristic zigzag marks are distinctly visible, being observed in the instances when the surface layer of the valves is missing. However, these marks are observed exclusively on the left valve.

Demant described in detail the nature of the sculpture of the outer and inner surfaces of the valves. He noted fine, concentric, thread-like striae divided by flat intervals. Concerning the zigzag marks, he mentioned that they are observed in the central part of the left valve, but our observations indicate that they have been observed on the entire surface of the left valve.

D i m e n s i o n s . The specimen from limestone b₉ at the village of Rovnoye on the Msta River. Impression of left valve: height 28 mm, length 27 mm, length of hinge margin 7.5 mm; steinkern of right valve: height: 26 mm, length 26 mm, length of hinge margin 8 mm; steinkern of left valve: height 29 mm, length 28 mm, length of hinge margin: 7.5 mm; steinkern of right valve: height 20 mm, length 16 mm, length of hinge margin 8 mm; from the Okhomlya River—steinkern of left valve: height 33 mm, length 33 mm. Outline of valves symmetrical.

S i m i l a r i t y a n d D i f f e r e n c e s . Both in dimensions and outline, they come very close to *Entolium sowerbyi* as M'Coy understood it; in addition, they are not different from those representatives of *Entolium sowerbyi* that Hind illustrated, but they are smaller than those that Etheridge illustrated.

Some authors are inclined to unite *Protoentolium (Entolium) sowerbyi* with *Entolium aviculatum* Swall. Indeed, the differences between these species, undoubtedly very close, are so insignificant that there is a basis for uniting them. The sole difference seemingly consists in the fact that the zigzagging ribs on the inner surface of the left valve in M'Coy's species are developed more sharply than in Swallow's species.

L o c a l i t y . There is a substantial number of representatives of this species in the Serpukhovian formations on the Msta River, village of Rovnoye, in limestone 9, terrane b₉—18 specimens (M. Ya. and Z. B.); Pustoshka: 2 specimens (K. M.); on the Okhomlya River: 1 specimen (K. M.); in the Okskaya [Oka] Formations: on the Ragusha River, marl a₆—1 specimen (M. Ya.); the same place: 1 specimen (R. G.); on the Msta River, in marl a₆—1 specimen (H. F.).

R a n g e . The species is found in the Lower Carboniferous of England and Ireland. In Belgium, it has been indicated in the Visean (V_{1a}) and in transitional strata from the Visean to Namurian (V_{3c}).

Within the existing material it is possible to distinguish two new varieties: var. *obliqua* and var. *regularis*.

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Protoentolium sowerbyi (M'Coy) var. *obliqua* n. var.

(Plate XI, Figs. 11, 12)

Holotype. Serpukhovian formations. Msta River, Rovnoye.

Description. The specimens identified under this name have an overall similarity to typical forms but are distinguished by the oblique outline of valves and the somewhat smaller apical angle: the latter is equal to 110° , whereas in typical specimens it is 120° . In addition, rims, which are separated from the main part of the valves by oblique, narrow grooves, are substantially narrower than in typical forms. The angle between these grooves in the type is 70° , but in the variety being described it is 60° .

There are impressions of the outer surface and two steinkerns of left valves. On the outer surface clear traces of fine concentric ribs are visible. In addition, on one of the left valve impressions, besides the concentric ribs, indistinct traces of zigzagging ribs are visible in the deeper layers of the valve.

Dimensions. Steinkerns of left valves: height 33 mm, length 28 mm, length of hinge margin 8 mm; impression of left valve: height 27 mm, length 24 mm, length of hinge margin 7 mm.

Locality. Right bank of the Msta River near Rovnoye, limestone b₉, C₁^{Sepr.} (M. Ya.).

Protoentolium sowerbyi (M'Coy) var. *regularis* n. var.

(Plate XI, Fig. 10)

Holotype. Serpukhovian formations. Msta River, Rovnoye.

Description. The specimens identified under this name are three steinkerns of right valves, which are distinguished by regular, oval, symmetrical outlines (excluding the auricles): equilateral, being broken only by the fact, that the posterior auricle is slightly higher than the anterior; narrow outer borders separate two oblique, gently sloping grooves, going from the beak anteriorly and posteriorly downward. The middle part of the steinkerns is uniformly feebly convex. The auricles with a straight upper margin at the base of the layer are provided with oblique ribs which end below the small protuberance (auricular crura Verrill). A triangular pit for the internal ligament and a small narrow groove along the upper margin for the cord are visible.

The surface of the steinkerns are completely smooth, without traces of any sculpture.

Dimensions. The first specimen: height 23 mm, length 19 mm, length of hinge margin 7 mm; second specimen: height 31 mm, length 28 mm, length of hinge margin 11 mm.

Similarity and Differences. This variety differs from the type in having a regular symmetrical outline and higher and more narrow shape. It recalls *Entolium aviculatum* Swallow, but is distinguished by being larger in size and having a more narrow shape.

Locality. All three specimens were found on the right bank of the Msta River near Rovnoye, in stratum b₉, C₁^{Sepr.} (M. Ya.).

Genus *PSEUDAMUSIUM* H. et A. Adams, 1858

emend. Verrill, 1897

Diagnosis. The valves are almost equal, the right is flatter than the left, oval or almost round; margins are simple. Auricles are well separated, not large, straight and obtuse-angled. Outer surface is smooth or with feebly marked radial strokes or grooves. [p. 71]

Thus is the diagnosis given for this genus by Hind. Of the forms identified by me, *Pseudamusium ellipticum* Phill. and *Pseudamusium* sp. have been attributed to this genus.

Genotype—*Pseudamusium exoticum* Lamarck. Modern.

Pseudoamusium ellipticum (Phillips)

(Plate XI, Figs. 17 & 18)

1836. *Pecten ellipticus* Phillips. Ill. of the Geology of Yorkshire, pt. 11, p. 212, pl. VI, fig. 15.
1845. *Pecten ellipticus* Verneuil. Paléontology de la Russie, p. 329, pl. XXI, fig. 8.
1900. *Streblopteria elliptica* Yanishevsky. Fauna kamennougol'nogo izvestniaka, vystpaiushchego po R. Shartymke [Fauna of Carboniferous limestone cropping out along the Shartymka River], p. 194.
1901–1905. *Pseudamusium ellipticum* Hind. Monogr. of the British Carboniferous Lamellibranciata, p. 203, pl. XX, figs. 11–18.
1910. *Pseudamusium ellipticum*. Yanishevksy. Nizhnekamennougol'nyi uzvestniak okolo pos. Khabamogo [Lower Carboniferous limestone around the village of Khabarnoye], p. 130, pl. XIII, fig. 19 and pl. XV, figs. 14–15.
1938. *Pseudamusium ellipticum* Demanet. La faune des couches de passage du Dinantien au Namurien, p. 126, pl. X, fig. 33–35.

The holotype is kept in the Gilbertson Collection of the British Museum. Lower Carboniferous. Bowland, England.

Description. The steinkern of the left valve is of small size, of sharply oval outline except for the auricles. The Hinge margin is straight. The auricles are small, the anterior is larger than the posterior. The anterior is triangular in outline, with straight anterior margin? which forms with the hinge margin an almost right angle; the posterior auricle is obtusely angled; its posterior margin immediately turns into the posterior margin of the valve. The beak of the valve is slightly pointed, protrudes slightly beyond the anterior margin and occupies the middle of the latter. It passes downward to the uniformly convex part of the valve. The surface of the steinkern is smooth, flat radial ribs which are only very slightly marked are visible.

Dimensions. Height of steinkern is 8 mm, length 7.5 mm, length of hinge margin 4 mm.

Similarity and Differences. In outward appearance and in the nature of the hinge margin, the form being described comes most closely to *Pseudamusium ellipticum* Phill., as this species is understood by Hind.

Locality. Prospecting shaft at Vesen'ye, clay under limestone a₁, C₁^{Ok}. (S. R.). The impression of a small left valve from the right bank of the Msta River at the village of Rovnoye, limestone b₉ (Z.B.) is ascribed to this species with some doubt.

Range. This species is known from limestone of the Shartymka River and environs of Khabarnoye (S. Urals). It has been indicated as well for the Lower Carboniferous limestone of the Moscow Basin (see list of fossils in Struve's work, p. 104). It is known from the Lower Carboniferous of England and Belgium.

Pseudamusium sp.

(Pl. XI, fig. 13)

Description. Small, left valve of oval outline, moderately convex, with beak, which slightly protrudes beyond the short straight hinge margin. Only a small posterior auricle of triangular shape was preserved. The surface of the valve is smooth, with very feebly marked radial folds, visible only under magnification. Dense concentric growth lines are more sharply expressed. In addition, [p. 72] the surface of the valve is covered by sparsely situated radial rows of roundish brown spots, which, apparently, are traces of coloration which existed in this

form. There are seven rows of these spots. Only two or three spots are in each row, and they are observed around the lower margin.

D i m e n s i o n s . Height 6 mm, length 5.5 mm, apical angle is around 100°.

S i m i l a r i t y a n d d i f f e r e n c e s . In outer appearance, the valve is similar to *Pseudamusium ellipticum* Phill., but the sculpture and unique coloration forces one to consider the valve as belonging to a special species which cannot be established only from incomplete material.

L o c a l i t y . Right bank of the Ragusha River, dolomitized marl a 6 (base of limestone terrane), C₁^{Ok}, c in layer with *Productus wischnjakowi* n. sp. (M. Ya.).

Captions to Plate XI

Fig. 1. *Protoentolium sowerbyi* (M'Coy), p. 68. Specimen No. 92, Right bank of Msta River at village of Rovnoye. C₁Serp. Steinkern of left valve.

Fig. 2. *Protoentolium sowerbyi* (M'Coy), p. 68. Specimen No. 93. Right bank of Msta River at village of Rovnoye. C₁Serp. Impression of right valve.

Fig. 3. *Protoentolium sowerbyi* (M'Coy), p. 68. Specimen No. 94. Same place. Steinkern of left valve: 3a; 3b -2/1. Characteristic sculpture is easily seen.

Fig. 4. *Protoentolium sowerbyi* (M'Coy), p. 68. Specimen No. 94a. Same place. Impression of left valve.

Fig. 5. *Protoentolium sowerbyi* (M'Coy), p. 68. Specimen No. 94b. Same place. Right valve from the inner side.

Fig. 6. *Protoentolium sowerbyi* (M'Coy), p. 68. Specimen No. 94c. Same place. Steinkern of right valve.

Fig. 7. *Protoentolium sowerbyi* (M'Coy), p. 68. Specimen No. 94d. Same place. Steinkern of right valve. Fig. 8. *Protoentolium sowerbyi* (M'Coy), p. 68. Holotype. From Houth, Dublin area, Griffith Collection.

Dublin. Museum. (Reproduction from Hind's monograph, Brit. Carbon. Lamellibr., vol. II, pl. xviii, fig. 26).

Fig. 9. *Protoentolium sowerbyi* (M'Coy), p. 68. Specimen No. 94e. Right bank of Msta River in village of Rovnoye, C₁^{Serp}. Steinkern of left valve.

Fig. 10. *Protoentolium sowerbyi* (M'Coy) var. *regularis* n. var. P. 70. Holotype. Specimen No. 59. Same place. Steinkern of right valve.

Fig. 11. *Protoentolium sowerbyi* (M'Coy) var. *obliqua* n. var. P. 70. Holotype. Specimen No. 58. Same place. Steinkern of right valve.

Fig. 12. *Protoentolium sowerbyi* (M'Coy) var. *obliqua* n. var. P. 70. Specimen No. 58a. Same place. Impression of left valve.

Fig. 13. *Pseudamusium* sp. P. 71. Specimen No. 61. Right bank of Ragusha River, C₁^{Ok}. Steinkern of left valve.

Fig. 17. *Pseudamusium ellipticum* (Phill.). P. 71. Specimen No. 91. Prospecting shaft at Vesen'ye, C₁^{Ok}. Steinkern of left valve.

Fig. 18. *Pseudamusium ellipticum* Phill. P. 71. Holotype. From Bowland, England. Gilbertson Coll., Kensington Museum, England. (Reproduction from Hind's monograph, "British Carbon. Lamellibr.").