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SOME JURASSIC SPECIES OF *PLICATULA* (PELECYPODA)  
OF POLAND

*Abstract.*—Four species of plicatulas from the Middle and Upper Jurassic have been described. Their external and internal morphology, variability and ontogenetic development have been studied and their systematic and stratigraphic positions — discussed.

## INTRODUCTION

As part of the studies on Pelecypoda from Jurassic of Poland, about 70 specimens of representing genus *Plicatula* Lamarck were collected in 1965-1966. This genus is represented in the Jurassic deposits by the following four species: *Plicatula pateroides* Rollier, *P. semiarmata* Étallon, *P. kobyi* de Loriol and *P. cheiroides* Deslongchamps. Most of the material comes from the Upper Callovian of Kłobuck near Częstochowa and was found in what is known as a "concretionary horizon". This unequally cemented layer consists of sandy phosphoritic-calcareous concretions, and a clayey glauconitic marl which forms their matrix. The material collected from this layer is represented by one species only, i.e. *P. pateroides* Rollier. The remaining three species come from the Lower Kimeridgian clayey-sandy marls, mostly from the Czarnogłowy and Świętoszewo quarries in Western Pomerania and from Sobków (Holy Cross Mountains). The material from Western Pomerania has — together with oysterlike Pelecypoda — been placed at my disposal by Dr. W. Szymańska to whom I express my thanks.

The preservation state of the material varies to a considerable extent. The specimens coming from the "concretionary horizon" form, excepting very few of them, internal moulds of valves. The Lower Kimeridgian specimens are preserved together with their valves which, however, in many cases are damaged. No single complete valves have been found. To study the internal morphology of valves of *Plicatula pateroides* Rollier, latex casts were prepared.

The present paper has been prepared at the Palaeozoological Laboratory of the University of Warsaw. The collection described is housed at the Palaeozoological Institute of the Polish Academy of Sciences in Warsaw where it has been given the following symbols: Z. Pal. PAN Mo.IV/1 to Mo.IV/43.

The present author is indebted to Miss L. Łuszczewska and Miss M. Czarnocka for taking photographs.

#### DESCRIPTIONS

Order **Dysodonta** Neumayr, 1883

Family **Spondylidae** Gray, 1826

Genus *Plicatula* Lamarck, 1801

*Plicatula pateroides* Rollier, 1917

(Pl. I; Pl. II; Pl. III, Figs. 1-4)

1899. *Plicatula Quenstedti* P. de Loriol; P. de Loriol, Étude..., p. 172, Pl. 10, Figs. 38, 39.
1901. *Plicatula Quenstedti* P. de Loriol; P. de Loriol & E. Koby, Étude sur les mollusques... p. 110.
1904. *Plicatula Quenstedti* P. de Loriol; P. de Loriol & A. Girardot, Étude sur... p. 242, Pl. 25, Figs. 3-7 (non Fig. 4a).
1904. *Plicatula Ogerieni* P. de Loriol; P. de Loriol & A. Girardot, *Ibid.*, pp. 244-245, Pl. 24, Fig. 13.
1917. *Plicatula pateroides* Rollier; L. Rollier, Fossiles nouveaux... pp. 524-525.

*Material.* — Fifty specimens, including 10 with preserved valves, the rest in the form of internal moulds.

Dimensions of a few specimens differing in individual age (in mm):

Z. Pal. PAN No.	Mo. IV/33	Mo. IV/1	Mo IV/6	Mo. IV/36	Mo. IV/37	Mo. IV/3
Height . . . . .	18.0	15.0	17.0	19.0	22.0	24.5
Length . . . . .	16.0	18.0	18.0	21.0	23.0	24.0
Width . . . . .	4.0	4.0	5.5	4.5	6.5	7.0

*Description.* — *External morphology* of the shell (Pl. I, Figs. 1-7; Pl. II, Figs. 6,8; Pl. III, Figs. 2,3). Shells inequilateral, inequivalve, middle-sized, varying in shape from rounded, through subtriangular to oval, cemented to the substratum by the right valve. External ornamentation consists of numerous, fine growth lines, concentric lamellae and radial ribs. Shell margin finely denticulate.

The *right valve* (Pl. I, Figs. 1a-4a; 5,6a,7; Pl. II, Figs. 6,8; Pl. III, Figs. 2,3) convex, the greatest convexity being recorded at 1/3 of the distance from the ventral margin. Umbo not prominent, narrow, with a small, terminally situated attachment area or wide, straight, with a large area which occupies smaller or larger subumbonal part of valve. Ribs numerous, their number increases, both by bifurcation and intercalation,

from 12 to more than 30. The height and thickness of ribs increase with the growth of valve from 0.5 to 1.5 mm. On some valves ribs are more numerous but thinner and lower and on some others less numerous but thicker and higher. The surface of ribs is uneven and slightly knobby. Usually, thicker swellings occur at intersections of ribs with concentric growth lines (Pl. I, Fig. 1a). The intervals between ribs are usually twice as wide as ribs. According to differences in ornamentation of valves, the following two types of forms may be distinguished: in one of them, valves have well-developed ribs and slightly marked growth lines, in the other, valves have low, fine ribs and thick, sometimes scaly, concentric lamellae. Few valves have a combined, costate-lamellar ornamentation. In the latter case, both ribs and lamellae are equally developed (Pl. I, Figs. 3a, 5).

The *left valve* (Pl. I, Figs. 1b-4b,6b) convex the most so at a 1/3 of a distance from the ventral margin, in the subumbonal part slightly convex or flattened. Sometimes, the umbonal margin is narrow and rounded but, more frequently, wide and straight. Radial ribs are about 3 mm in width, low and with a smooth surface. The intercostal spaces, developed in the form of shallow furrows, do not exceed 0.5 mm in width (Pl. I, Figs. 2b,3b). The number of ribs increases, mostly by bifurcation, from 12 to more than 20 (Pl. I, Fig. 6b). Sometimes, the ribs originate near the umbonal margin (Pl. I, Fig. 6b) and sometimes half-way the distance from it (Pl. I, Fig. 2b). Growth lines are fine and densely arranged, particularly so near the ventral margin of the valve. The external ornamentation of the left valve does not display the differentiation into two types as is the case in the right valve.

*Internal morphology* (Pl. II, Figs. 1-5,7; Pl. III, Figs. 1,4). In view of the lack of single valves, the internal morphology has been studied in better preserved moulds and their latex casts.

The *right valve* is more or less strongly concave and has, in particular in the subumbonal part, an uneven surface. Radial ribs, preserved in moulds in the form of narrow furrows, are visible on some specimens. The adductor muscle scar is situated nearer the posterior margin at a variable distance from the umbo. It is oval or rounded and more or less strongly concave. Its diameter varies within limits of 6 and 7 mm. Concentric growth lines are visible on its surface. A distinctly marked pallial line, parallel to the outer margin, is situated at a certain, sometimes considerable distance from the valve margin. The structure of hinges has been reconstructed by the method of latex casts. The hinge of the right valve consists of a central ligament pit, two teeth running divergently on both sides of the latter in the form of small lamellae and dental sockets laterally disposed behind the teeth (Pl. III, Figs. 1,4). All these elements, triangular in outline, have their bases directed towards the middle of the valve. In the vicinity of the ligament pit, teeth reach their

largest heights, i.e. about 1.5 mm. With the growth of a specimen they become lower and lower, passing finally to the surface of the valve in the form of small, longitudinal swellings.

The *left valve* (Pl. II, Figs. 1a, 2a, 3b, 3c, 5b, 7a) is somewhat smaller than the right and usually convex, except for a concave part below the umbo. The disposition of the muscle scar, its shape and size have, like in the right valve, a considerable range of variability. Pallial line runs parallel to the outer margin of valve, sometimes at a considerable distance from it (Pl. II, Fig. 2a). Hinge of the left valve, which makes up a counterpart of that of the right valve, is similarly developed, but all its elements are less strongly marked. Ligament pit is shallower and teeth lower. Numerous, fine ribs covered with short spines are visible on the external surface of the valve (Pl. II, Figs. 3b, 3c).

*Variability.* — *Plicatula pateroides* Rollier is characterized by a considerable variability. This applies to both the external and internal morphology and is particularly strongly manifested in shape and size of valve, size and situation of the attachment area, arrangement and dimensions of muscle scar, trace of the pallial line and external ornamentation of valves.

Shape of shells varies from rounded to oval or triangular with height exceeding length or vice-versa. In the last-named case, shells are obliquely triangular and asymmetric which results from a more or less conspicuous displacement of the largest height of valve towards the posterior margin and a faster growth of shell near its posteroventral margin (Pl. II, Figs. 2,3,5,7). Rounded shells have similar or identical heights and lengths (Pl. I, Figs. 1.5; Pl. II, Fig. 8) which testifies to a uniform growth of shell along its margin.

Attachment area — either situated terminally and, if such is the case, small or very small, not exceeding 4 mm in length, or displaced to the right valve in which it spreads, more or less extensively, over its umbo-nal part. In specimens of about identical age, a longer diameter of this area varies within limits of 6 and 10 mm, now and then reaching even 14 mm. Usually, it is transversely elongated, more or less concave, uneven and sometimes has numerous depressions and swellings marked on it (Pl. I, Fig. 4a). An angle, at which the valve is inclined to the substratum, changes together with a change in the position of the attachment area. Sometimes, it is very small and amounts only to a dozen or so degrees. Most often, however, it equals  $45^{\circ}$  and in extreme cases, with a terminally situated attachment area, may reach even  $75^{\circ}$ . Its size is correlated with the convexity of valve, i.e. the largest the angle, the more convex is the valve and, vice-versa, a small inclination angle is displayed by shells with a large attachment area which are usually only slightly convex. The convexity of shell is also related with the size and situation of the muscle scar, as well as the situation of the pallial line. A large, deeper

muscle scar occurs on strongly convex valves half-way their length and is situated nearer the posterior margin. In such a case, the pallial line recedes to a larger distance from the outer margin of the valve (Pl. I, Figs. 1,2,4,5). A smaller muscle scar, situated near the umbo and shallower, is observed on very slightly convex valves, pallial line considerably approaching the outer margin of the valve (Pl. I, Figs. 3,7). The above analysis of the variability indicates that there occurs a close correlation between the development of particular features and that a change in one of them causes changes in several others. This correlation is shown below in Table 1.

Table 1  
Correlation of shell features of *Plicatula pateroides* Rollier

Features	Flattened valve	Convex valve
Attachment area . . . . .	Large, 6.0—10.0. mm	Small, 2.0—4.0 mm
Inclination angle . . . . .	About 15°	About 45°
Muscle scar . . . . .	Small, to 5.0 mm in diameter, situated nearer the umbo	Large, to 7.0 mm in diameter situated half-way the height of valve
Pallial line . . . . .	Situated nearer the valve margin	Situated at a considerable distance from the valve margin

The ornamentation of right valves is fairly variable. The ribs and lamellae are equally marked on only few valves (Pl. I, Figs. 3a,5). On most valves, either lamellae (Pl. I, Fig. 7; Pl. II, Fig. 6) or ribs (Pl. I, Figs. 1a, 4a; Pl. II, Fig. 8) make up a predominant character.

In the case of the predominance of lamellae, ribs are numerous but low and fine, whereas on valves on which ribs predominate, the number of ribs is smaller but they are thicker and higher. The variability of the ornamentation of left valves is insignificant and consists only in certain differences in their thickness and height.

*Ontogeny* (Pl. I, Figs. 1-4,6). — In the material under study, there are no specimens representing the youngest development stages. However, three categories of specimens may be distinguished different in dimensions and corresponding to successive growth stages as shown in Table 2.

*Remarks.* — Specimens from Poland are to the greatest extent similar to those from Oxfordian of Switzerland and France, described by de Loriol (de Loriol, 1904, pp. 244-245) as *Plicatula quenstedti* de Loriol. The same specific name has already been given earlier to the specimens from the Middle Callovian of Switzerland (Moesch, 1867, p. 105) which differ from the Oxfordian ones in ornamentation, shape and size of shell. In my opinion, the standpoint of Rollier (1917, pp. 524-525) who suggested for

Table 2  
Ontogenetic stages of *Plicatula pateroides* Rollier

Growth stages	Height (in mm)	Characteristics of shell
Youngest	14.0—17.0	Rounded or oval; the right valve convex, the left valve concave, the deepest concavity being observed at 1/3 of the distance from the ventral margin; ornamentation consisting mostly of radial ribs, the number of which increases by bifurcation and intercalation from 14 to 18.
Older	18.0—24.0	Obliquely oval to obliquely triangular; ornamentation consisting mostly of concentric lamellae; ribs lower, their number increasing (identically as in the previous stage) from 18 to 27.
Oldest	20.0—28.0	Obliquely oval; ornamentation consisting of both concentric lamellae and radial ribs, equally developed; the number of ribs increases, more frequently by intercalation, from 20 to about 33.

de Loriol's specimens a new specific name of *Plicatula pateroides* Rollier, 1917 is, therefore, quite correct.

I also assign *P. ogerieni* de Loriol (de Loriol, 1904, p. 244) to *P. pateroides* Rollier. *P. ogerieni* de Loriol was erected on the basis of a single valve, coming from the same layers and from the same locality in which some of the specimens of *P. quenstedti* de Loriol were found. A small height of this valve (20 mm), numerous, fine and not very prominent ribs, a large attachment area and the convexity of the valve are features which are also characteristic of *P. pateroides* Rollier. I exclude from this species a single specimen of de Loriol (de Loriol, 1904, Pl. 25, Fig. 4a) which has a convex left valve. No biconvex shell has ever been found in a rich material from Poland. This is probably the valve of some other species of pelecypod which incidentally was found together with the right valve of *P. pateroides* Rollier.

*Occurrence.*—Poland: environs of Częstochowa (Kłobuck, Łazy, Skrzyszów, Kromolów), Upper Callovian. France, Switzerland: the Ledon and Bern Jurassic, Oxfordian.

*Plicatula semiarmata* Étallon, 1862  
(Pl. III, Figs. 5-10; Pl. IV, Fig. 1)

1862. *Plicatula semiarmata* Étallon; J. Thurmann & A. Étallon, *Lethea bruntrutana*, p. 268, Pl. 38, Fig. 2.  
1874. *Plicatula horrida* Deslongchamps; P. de Loriol & E. Pellat, *Monographie...*, pp. 207-208, Pl. 23, Figs. 6-7.  
1894. *Plicatula semiarmata* Étallon; P. de Loriol & E. Koby, *Étude...*, p. 69, Pl. 8, Figs. 4-5.

- non 1897. *Spondylus semiarmatus* Étallon; P. de Loriol & E. Koby, Étude..., p. 130, Pl. 16, Figs. 7-8.
- non 1901. *Spondylus semiarmatus* Étallon; P. de Loriol & E. Koby, Étude..., (Supplement), p. 108, Pl. 6, Figs. 9-10.
1917. *Plicatula semiarmata* Étallon; L. Rollier, Fossiles nouveaux..., pp. 525-527.

*Material.* — Eight well-preserved shells representing different development stages.

Dimensions (in mm) of a few specimens varying in individual age:

Z. Pal. PAN	Mo. VI/18	Mo. IV/1	Mo. IV/20	Mo. IV/21	Mo. IV/22	Mo. IV/23	Mo. IV/24
Height . . . . .	5.0	9.0	10.0	10.0	13.0	20.0	30.0
Length . . . . .	4.5	9.5	9.0	10.0	11.0	17.0	24.0
Width . . . . .	1.8	4.5	9.0	3.0	4.5	5.5	6.0

*Description.* — Shells middle-sized, inequilateral and inequivalve. Rounded to obliquely oval in shape. Umbo slightly prominent, in adult growth stage — narrow. A slight sinus deepening with the individual age (Pl. IV, Fig. 1 *a-b*) is marked near the posterior margin of shell. In the vicinity of umbo, shell margin smooth, on the remaining part of surface unequally denticulate. External ornamentation consisting of numerous, fine, concentric growth lines and numerous, radial ribs. Rib surface covered with tubuliform spines. A trace of the concrescence of growth lamellae in the form of a line is visible on the lower side of spines.

The *right valve* more convex and somewhat larger than the left one, attached to substratum terminally or with a more or less extensive subumbonal surface (Pl. III, Figs. 5*a*, 8*a*, 10*a*). The shape of valve depends on the size, shape and position of this surface. If this surface is rounded, symmetrical and situated in the subumbonal part of valve, the valve is rounded; if — on the other hand — it is situated terminally, the valve is triangular. A lateral situation of the attachment area on the umbo of the valve causes its obliquely-triangular or obliquely-oval shape (Pl. III, Figs. 5*a*, 8*a*, 9*b*; Pl. IV, Fig. 1*a*). Ribs are unequal in height and width. The longest of them and, at the same time, the widest and the highest, run through the middle part of valve, whereas the shortest, which also are the lowest and the narrowest, occur in the anterior part. Their height varies from 0.4 to 1.0 mm and width — from 0.5 to 3.5 mm. The number of ribs increases, by both bifurcation and intercalation, from a few to more than 20 (Pl. III, Fig. 7*a*; Pl. IV, Fig. 1*a*). Intervals between ribs, usually narrow, do not exceed 1.5 mm in width. Rib surface is covered with tubuliform spines spaced at 4 mm intervals. They rise above the ribs at an angle which does not exceed 45°. Swollen at the base, they grow thinner and thinner together with the growth and reach at most 2 mm in length. The spines occur at the intersection of growth lamellae and ribs, thus forming vertical and horizontal ranges characteristic of this species.

The *left valve*, slightly smaller than the right one, is flattened or con-

cave (Pl. III, Figs. 5b, 10b). In its subumbonal part, the valve is usually strongly deformed, uneven and covered with bosses and furrows (Pl. III, Fig. 8b). This part of the left valve makes up a counterpart of the attachment area of the right valve. Ribs are lower than those on the right valve, their height varying within limits of 0.2 and 0.8 mm and their number increasing, by bifurcation and intercalation, from a few to 18-19. Spines, covering ribs and frequently developed in the form of bosses, seldom reach a length of 2 mm. Their arrangement in vertical and horizontal rows is visible only on well-preserved specimens (Pl. III, Fig. 10b). Other characters of the left valve are developed similarly as in the right valve.

*Ontogeny* (Pl. III, Figs. 5-10; Pl. IV, Fig. 1). — No specimens representing the youngest ontogenetic stages occur in the material under study. The smallest specimen is 5 mm high, 4.5 mm long and 1.8 mm wide. The most numerous occurring specimens are 10 mm high, 9.5 mm long and 3 mm wide. The growth of shell is accompanied by changes in its other characters such as, shape, size of attachment area and ornamentation. These changes are shown below in Table 3.

Table 3  
Ontogenetic stages of *Plicatula semiarmata* Étallon

Growth stages	Height (in mm)	Characteristics of shell
Youngest	5.0—6.0	Rounded; umbo not prominent; attachment area occupies 1/2 of the valve surface; ornamentation consists of fine concentric growth lines; 2 radial ribs are marked on the margin of the right valve.
Older	9.0—13.0	Subtriangular; umbo scarcely prominent; attachment area occupies 1/3 to 1/2 of the valve surface; 6—9 well-developed ribs; spines not numerous, short, bossy.
Oldest	20.0—30.0	Oval or obliquely oval, with height being the largest dimension; attachment area small, occupying about 1/5 of the subumbonal surface of valve; 18—20 ribs; tubuliform spines arranged in horizontal and vertical rows.

*Variability* of *P. semiarmata* Étallon, 1862 is only very slight and mostly consists in small differences in thickness and height of ribs, length and thickness of spines, as well as in changes in shape of shell depending on the situation and size of the attachment area. In few cases, in which this area extends over the entire valve surface, ribs may be marked only on the ventral margin. If the substratum is convex, the right valve, usually convex, becomes concave. In such a case, there takes place an apparent inversion of the convexity of both valves (Pl. III, Fig. 6 a,b).

*Remarks.* — Specimens from Poland are similar in shape and ornamentation to those described and figured by de Loriol (1894) and Étallon



(1862), from which they differ in smaller dimensions and greater number of ribs. In the Polish material, shells of adult individuals are 30 mm high, whereas Étallon (1862) states that the height of this stage amounts to 38 mm and de Loriol (1894) — to 37 and 50 mm. According to both authors, referred to above, the number of ribs amounts to 6-8, but as many as 16-18 ribs may be counted in illustrations enclosed with their works. An account of several similarly developed characters such as, shape, dimensions and ornamentation, displayed by specimens, described by de Loriol as *P. horrida* Deslongchamps (de Loriol, 1875, pp. 207-208; Pl. 23, Figs. 6, 7), I assign these specimens to *P. semiarmata* Étallon, from which I exclude other specimens of de Loriol, described in his two works (de Loriol, 1897, p. 130, Pl. 16, Figs. 7,8; 1901, p. 108, Pl. 6, Figs. 9,10) as *Spondylus semiarmatus* Étallon. Specimens, described in the first work, are flat, with a smooth margin and devoid of ribs, spines being few and long. These characters correspond to *P. hystrix* Desl. De Loriol's other work contains descriptions of specimens displaying thick folds, few spines and more convex valves, features which are characteristic of *P. cheiroides* Desl. My observations are in conformity with Rollier's suggestions (1917, p. 526).

*Occurrence.* — Poland: Świątoszewo and Czarnogłowy, Western Pomerania, Lower Kimeridgian. France: Boulogne, Switzerland: Porrentruy, Lower Kimeridgian.

*Plicatula kobyi* de Loriol, 1897

(Pl. IV, Figs. 2-7)

1897. *Plicatula Kobyi* P. de Loriol; P. de Loriol & E. Koby, *Étude...*, pp. 132-133, Pl. 16, Fig. 10.  
 1901. *Plicatula Kobyi* P. de Loriol; P. de Loriol & E. Koby, *Étude...* (Suppl.), p. 108, Pl. 6, Fig. 11-14.  
 1917. *Plicatula Kobyi* P. de Loriol; L. Rollier, *Fossiles nouveaux...*, p. 525.  
 1955. *Plicatula kobyi* Loriol; P. A. Gerasimov, *Rukovodjašžye...* p. 121, Pl. 34, Fig. 2.  
 1960. *Plicatula Cobyi* Loriol; A. G. Eberžin, *Osnovy Paleontologii*, Pl. 13, Fig. 13.

*Material.* — Six fragments of right valves.

*Description.* — Valves equilateral, oval, larger in length than height or rounded, more or less flattened, middle-sized. Length amounting to about 25 mm and height to about 20 mm or somewhat more. Valves thin, in the region of umbo not exceeding 1.5 mm and near the ventral margin — 1 mm in thickness. External ornamentation consists of concentric undulating growth lines, lamellae and radial ribs uniformly diverging from the umbo. Growth lamellae stick out in a scale-like manner from the valve surface on the side of umbo in the opposite way than those observed in the representatives of other species. Ribs rather low, in the vicinity of umbo their height amounting to 1 mm and near the

ventral margin increasing to 4 mm. Their width increasing in the same direction from 1 mm near umbo to 5 mm near the ventral margin. Intervals between ribs are usually twice as wide as ribs or, sometimes, of an equal width (Pl. IV, Figs. 2, 3, 5). With the growth of shell, the number of ribs increases from a few to 15 or more. Rib surface uneven, bossy and, now and then, with furrowed spines not exceeding 3 mm in length. The occurrence of a furrow on the upper side of a spine is characteristic of this species. This furrow is formed by growth lamellae which are not fused together (Pl. IV, Figs. 6, 7).

*Remarks.* — The specimens of *P. kobyi* de Loriol from Poland fully correspond to those described by de Loriol (1898, 1901).

*Occurrence.* — Poland: Świątoszewo and Czarnogłowy, Western Pomerania, Lower Kimeridgian. Switzerland: St. Ursanne, Upper Oxfordian. U.S.S.R.: Oxfordian.

*Plicatula cheiroides* Deslongchamps, 1858

(Pl. IV, Figs. 8, 9)

1858. *Plicatula cheiroides* Deslongchamps; J. A. Études Deslongchamps, Essai..., pp. 89, 155-156, Pl. 15, Figs. 11-14.

1901. *Spondylus semiarmatus* Étallon; P. de Loriol & E. Koby, Étude... p. 108, Pl. 6, Figs. 9, 10.

1917. *Plicatula cheiroides* Deslongchamps; L. Rollier, Fossiles nouveaux... p. 524.

*Material.* — Two partially damaged specimens.

*Description.* — Shell inequilateral and inequivalve, middle-sized, 26 mm in height and 20 mm in length. The largest thickness of valve near the umbo amounts to about 2.5 mm, decreasing near the ventral margin to 1.5 mm. The right valve is slightly smaller and more convex than the left one. It is attached to the substratum with a small, uneven surface situated besides the umbo. Shell is obliquely oval in shape with height being the largest dimension. Umbo not prominent, narrowed, with a rounded margin. Shell widens gradually towards the ventral margin and more strongly near the anteroventral margin. Valve margin is slightly folded along the posterior and ventral margins and more strongly along the anterior margin, half-way of which height there occurs a relatively deep sinus. Following a stronger folding, the anterior margin is somewhat shorter which increases the degree of asymmetry of shell.

External ornamentation of valves consists of numerous, thick and wide concentric lamellae, more or less sticking out from the surface, as well as of 7-8 vertical, thick folds which run somewhat obliquely, originating at a certain distance from umbo in the posterior part of valve. The longest folds are almost parallel to the posterior margin of valve and the shortest run obliquely to it, terminating on the anteroventral margin. Folds vary in thickness. Shorter ones are usually thicker and strongly

convex and, vice-versa, longer ones are narrower and less convex. Spaces between folds, in the form of more or less shallow and narrow furrows, run — the same as folds — obliquely. The deepest furrow occurs near the anterior margin and makes up a continuation of sinus. It runs over a short distance and does not reach a half of the length of valve.

The surface of folds is covered with few, irregularly scattered spines which do not exceed 2 mm in length. They stick out from folds at an angle of less than 45° and sometimes they flatly lay on folds. Usually they are tubuliform and sometimes furrowed, in the latter case the furrow occurs on their lower side. The number of folds does not increase with the growth of valve. Instead, they only widen the same as furrows which separate them.

Obliquely running radial folds are visible on the internal surface of valve. The hinge of the right valve consists of a central, triangular ligament pit, two large teeth situated on both sides of this pit, as well as of narrow and long sockets, separating teeth from the external margin of valve. Upper surface of teeth is smooth and rounded. The initial height of teeth is 1.5 mm, but increases with growth to about 4.0 mm (Pl. IV, Fig. 9).

*Remarks.* — Specimens from Poland completely correspond to those described by Rollier (1917, p. 524). I assign the forms described by de Loriol (1901, p. 108, Pl. 6, Figs. 9, 10) as *Spondylus semiarmatus* Étallon to *P. cheiroides* Deslongchamps. *P. cheiroides* Desl. differ from *Spondylus semiarmatus* Étallon in a coarsely folded, lamellate shell and in few, irregularly distributed spines. *P. semiarmata* Étallon has radially costate valves and its numerous, regularly running spines never display a lamellate structure of valves. De Loriol's description and illustrations are in a full conformity with the diagnosis of *P. cheiroides* Desl.

*Occurrence.* — Poland: Sobków (south-western slopes of the Holy Cross Mountains), Lower Kimeridgian (*Katroliceras divisum* zone). France: Dives, Bourrignon, Lower and Middle Oxfordian.

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September, 1967*

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HALINA PUGACZEWSKA

## KILKA GATUNKÓW RODZAJU *PLICATULA* (PELECYPODA) Z JURY POLSKI

### *Streszczenie*

Zbadany materiał pochodzi w większości z górnego keloweju Kłobucka (koło Częstochowy), natomiast mniej licznie reprezentowany z dolnego kimerydu okolic Sobkowa (południowo-zachodnie obrzeżenie Gór Świętokrzyskich) i z kamieniołomów w Czarnogłowach i Świętoszewie na Pomorzu Zachodnim. Zbiór liczy ponad 70 okazów, zachowanych głównie w postaci wewnętrznych ośródek muszli. Stosując metodę odlewów lateksowych zbadano budowę wewnętrzną muszli. Różnica w budowie wewnętrznej poszczególnych gatunków polega głównie na odmiennej budowie zawiasów. U *Plicatula pateroides* Rollier zęby otaczające jamkę wiązadłową są długie, listewkowate i niskie; wysokość ich zmniejsza się w miarę wzrostu skorupki. Natomiast u *P. cheiroides* Deslongchamps zęby są wyższe i krótsze, w miarę zaś wzrostu skorupki wysokość ich także wzrasta.

Ornamentacja zewnętrzna muszli składa się z promienistych żeberek, pokrytych mniej lub bardziej licznymi kolcami oraz z koncentrycznych, drobnych linii przyrostu i mniej lub bardziej szerokich, łuskowato odstających blaszek przyrostowych. U różnych gatunków kolce powstają w różny sposób. Częściej spotyka się kolce rurkowate, powstałe przez zagięcie ku dołowi wydłużających się na żeberkach blaszek przyrostowych. Blaszkki te z reguły zrastają się po dolnej stronie kolca (*P. semiarmata* Étallon, *P. cheiroides* Deslongchamps). Jeżeli blaszkki przyrostowe zaginają się ku górze, powstają kolce rynienkowate. Zwykle blaszkki te nie zrastają się i na górnej stronie kolca pozostaje mniej lub bardziej szeroka rynienka (*P. kobyi* de Loriol).

Małże należące do rodzaju *Plicatula* przytwierdzają się do podłoża prawą skorupką. W związku z osiadłym trybem życia, różnym położeniem i wielkością płaszczyny przytwierdzenia, obserwuje się szeroką zmienność indywidualną. Analiza zmienności poszczególnych cech muszli pozwoliła stwierdzić zależność w ich wykształceniu od sposobu przytwierdzenia się muszli. Terminalnie leżąca płaszczyna przytwierdzenia wpływa na większą wypukłość prawej skorupki. Jednocześnie zmianom ulegają i inne jej cechy: odcisk mięśnia powiększa się i przesuwa się na środek skorupki, zaś linia płaszczowa oddala się znacznie od jej krawędzi. Natomiast muszle przytwierdzające się dużą powierzchnią, leżącą przy tym poniżej wierzchołka, są mniej lub bardziej spłaszczone, odcisk mięśnia jest mniejszy, przesuwany się bliżej brzegu zawiasowego, zaś linia płaszczowa znacznie się zbliża do krawędzi zewnętrznej skorupki. W pierwszym przypadku dominuje ornamentacja żeberkowa, w drugim zaś blaszkowa.

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ГАЛИНА ПУГАЧЕВСКА

НЕСКОЛЬКО ВИДОВ РОДА *PLICATULA* (PELECYPODA) ИЗ ЮРСКИХ  
ОТЛОЖЕНИЙ ПОЛЬШИ

Резюме

Изученный материал преимущественно происходит из верхнего келловя Клобуцка (около Ченстоховы), менее обильно представлен он из нижнего кимериджа окрестностей Собкова (юго-западное обрамление Свентокржиских Гор) и из каменеломней в Чарногловах и Свентошеве на Западном Поморжу. Коллекция состоит из больше чем 70 образцов, сохраненных главным образом в виде внутренних ядер раковины. Применяя метод латексных отливок, изучено внутреннее строение раковины. Разница во внутреннем строении отдельных видов заключается главным образом в строении замка. У *Plicatula pateroides* Rollier

зубы, окружающие связочную бороздку, длинные, в виде планки, и низкие; их высота уменьшается по мере возраста створки. У *P. cheiroides* Deslongchamps зубы более высокие и короче, а по мере возраста створки их высота тоже увеличивается.

Внешняя скульптура раковины состоит из радиальных ребер, покрытых менее или более частыми шипами, и из концентрических мелких линий нарастания, а также из менее или более широких, чешуйчато отстающих пластинок нарастания. У разных видов шипы возникают по разному способу. Чаще всего встречаются шипы трубчатые, которые возникают в результате изгиба книзу удлиняющихся на ребрышках пластинок нарастания. Эти пластинки, как правило, срстаются вдоль нижней стороны шипа (*Plicatula semiarmata* Étallon, *P. cheiroides* Deslongchamps). Если пластинки нарастания изгибаются кверху, возникают желобчатые шипы. Обычно пластинки не срстаются и на верхней стороне шипа остается менее или более широкий желобок.

Пластинчатожаберные принадлежащие к роду *Plicatula* прикрепляются к субстрату правой створкой. В связи с сидячим образом жизни, разным положением и величиной плоскости прикрепления, наблюдается большую индивидуальную изменчивость. Анализ изменчивости отдельных признаков раковины разрешил констатировать зависимость в их развитии от способа прикрепления раковины. Терминально расположенная плоскость прикрепления имеет влияние на увеличение выпуклости правой створки. Одновременно меняются и иные ее признаки: мускульный отпечаток увеличивается и перемещается по направлению к центру створки, а мантийная линия значительно удаляется от ее края. Зато раковины, которые прикрепляются большой поверхностью, расположенной притом ниже макушки, есть менее или более плоские, мускульный отпечаток у них меньший, перемещающийся ближе к замочному краю, а мантийная линия значительно приближается к внешнему краю створки. В первом случае преобладает скульптура ребристая, во втором пластинчатая.

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## PLATES

Plate I

*Plicatula pateroides* Rollier

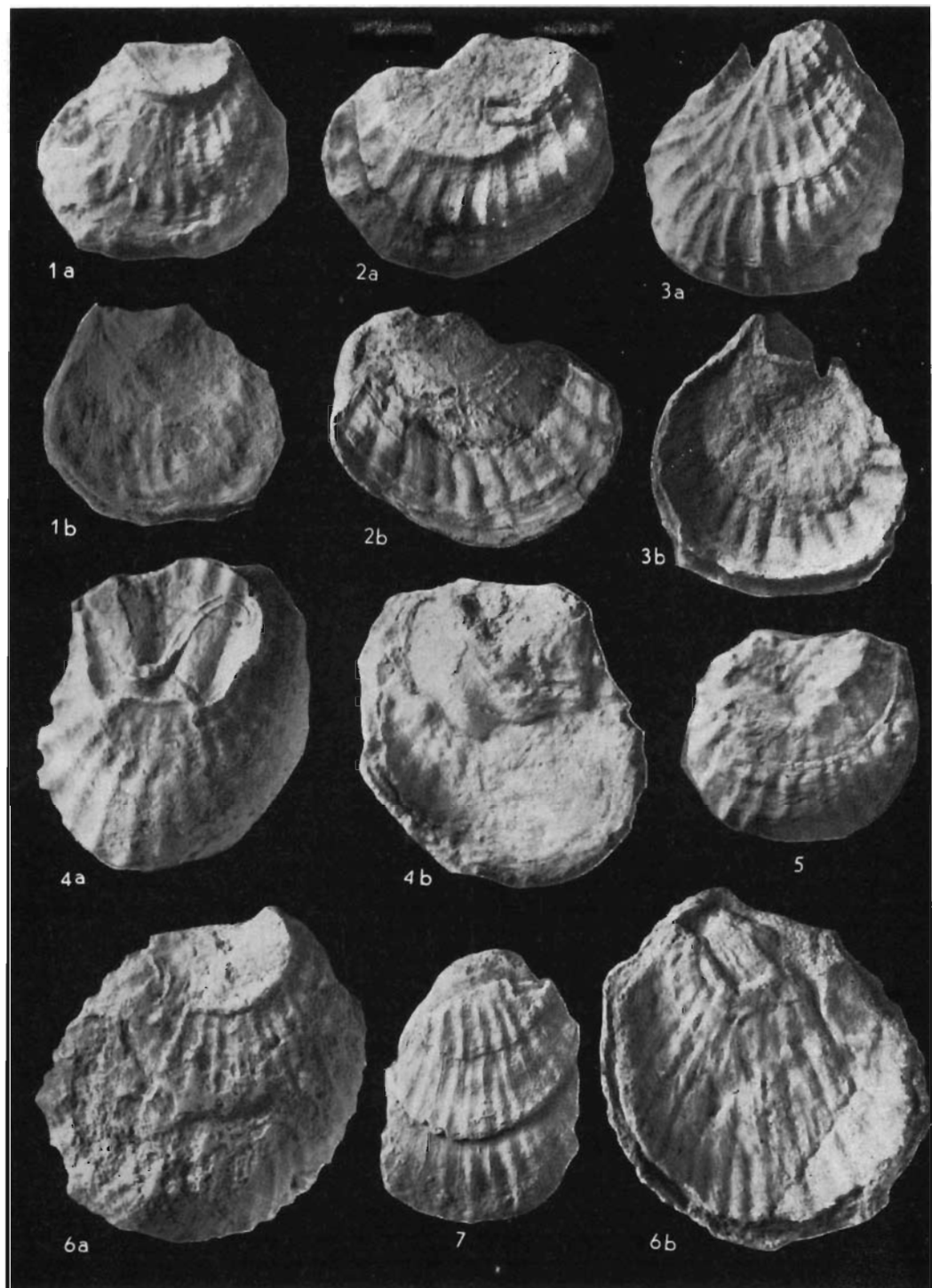
Figs. 1-4, 6. Five shells of different individual age: *a* right valve; *b* left valve (Mo.IV/1—Mo.IV/5).

Fig. 5. Right valve with a mixed rib-lamellate ornamentation (Mo.IV/6).

Fig. 7. Right valve with a lamellate ornamentation (Mo.IV/7)

Kłobuck, Upper Callovian, × 2





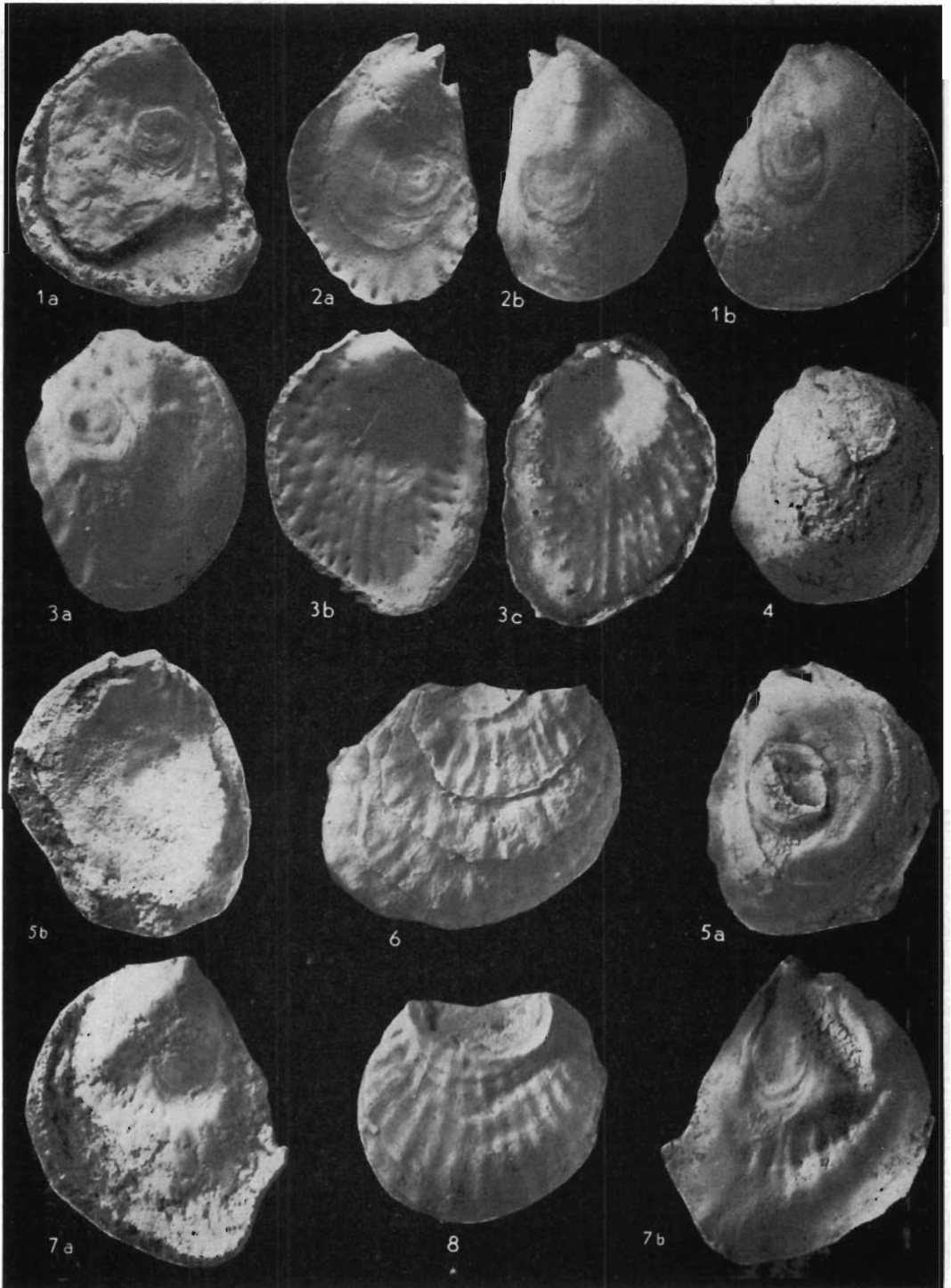


Plate II

*Plicatula pateroides* Rollier

Figs. 1, 2, 5, 7. Four internal moulds: *a* viewed from the left valve; *b* viewed from the right valve (Mo.IV/8—Mo.IV/11).

Figs. 3 *a-c*. An internal mould: *a* viewed from the right valve; *b* viewed from the left valve; *c* latex cast of the left valve (Mo.IV/12, Mo.IV/13).

Fig. 4. An internal mould of a strongly convex right valve (Mo.IV/14).

Fig. 6. Right valve with a lamellate ornamentation (Mo.IV/14a).

Fig. 8. Right valve with a costate ornamentation (Mo.IV/15).

Kłobuck, Upper Callovian,  $\times 2$

Plate III

*Plicatula pateroides* Rollier

Figs. 1, 4. Latex casts of the external surface of the right valve (Mo.IV/16, Mo.IV/17).

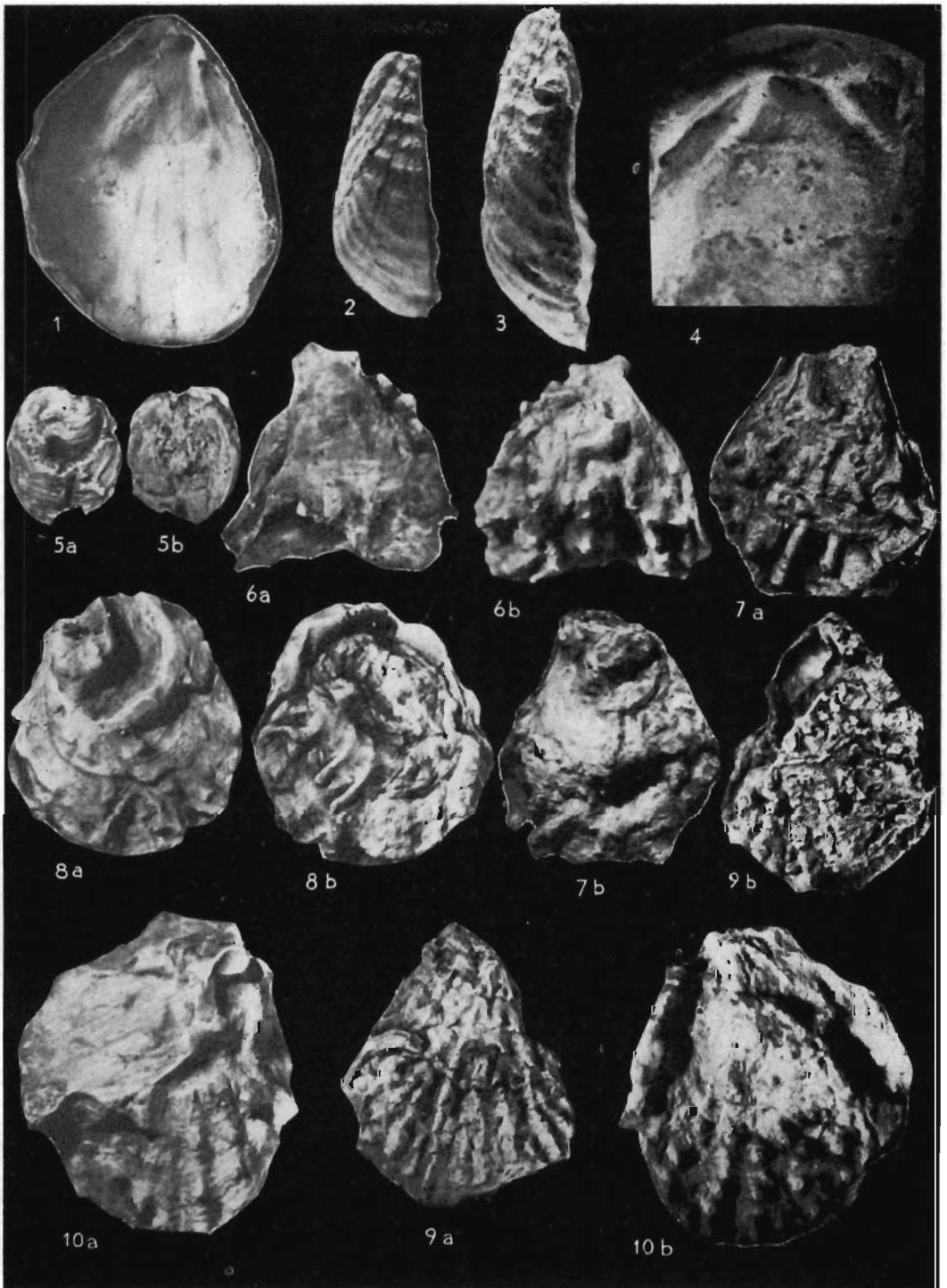
Figs. 2, 3. Two right valves viewed laterally (Mo.IV/3—Mo.IV/5).

Kłobuck, Upper Callovian, × 2

Figs. 5-10. Six shells of different individual age: a right valve; b left valve  
(Mo.IV/18—Mo.IV/23).

Figs. 5-8 and 10: Czarnogłowy, Lower Kimeridgian, × 4

Fig. 9: Świętoszewo, Lower Kimeridgian, × 2



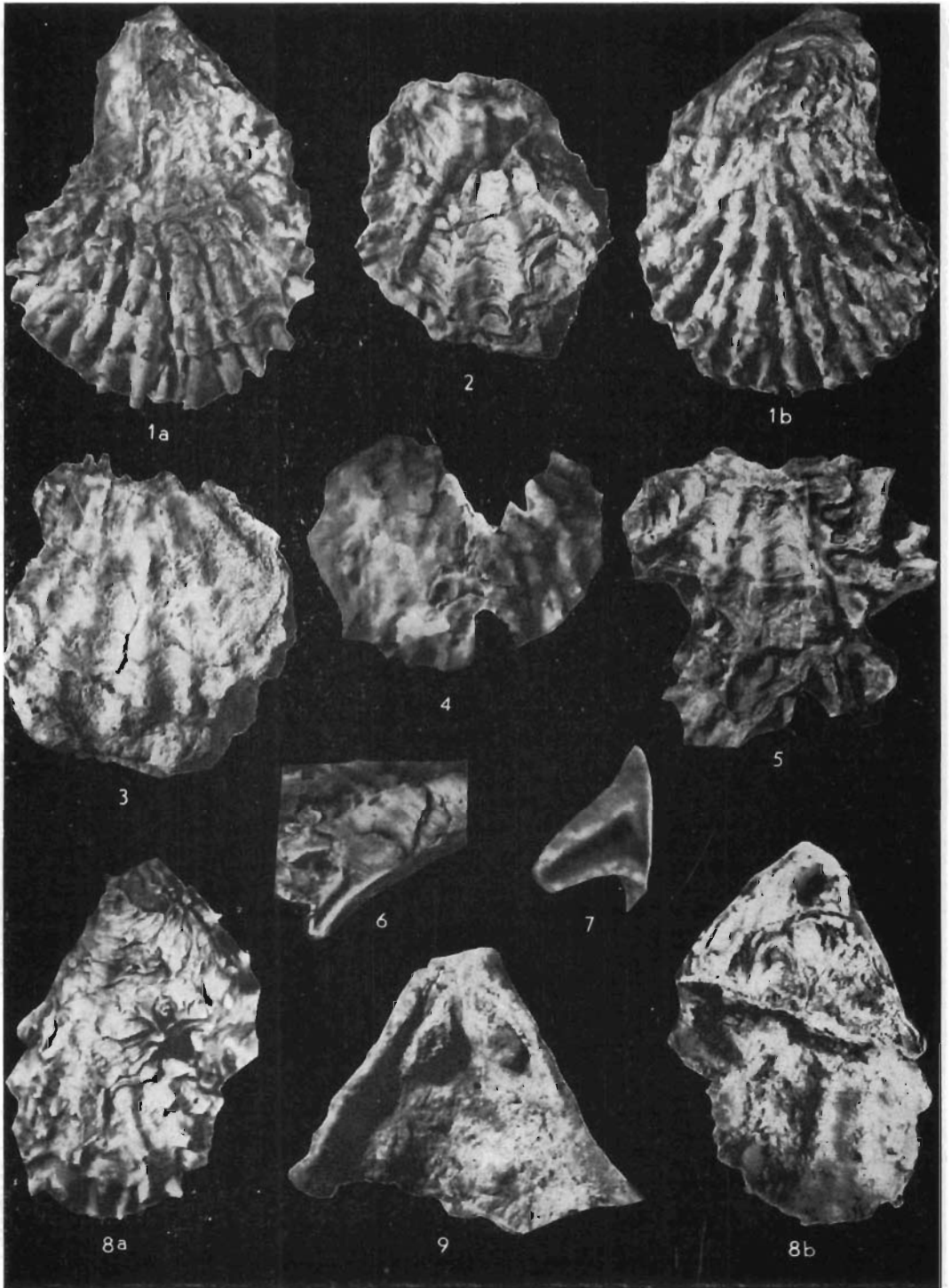


Plate IV

*Plicatula kobyi* de Loriol

Fig. 1. Shell of an adult individual: *a* right valve; *b* left valve (Mo.IV/24). Świętoszewo, Lower Kimeridgian;  $\times 2$

*Plicatula kobyi* de Loriol

Figs. 2-5. Four fragments of right valves (Mo.IV/25—Mo.IV/28).

Figs. 2-4: Czarnogłowy, Lower Kimeridgian;  $\times 2$

Fig. 5: Świętoszewo, Lower Kimeridgian;  $\times 2$

Fig. 6. A fragment of valve with a furrowed spine (Mo.IV/29), Czarnogłowy, Lower Kimeridgian:  $\times 4$

Fig. 7. A separated furrowed spine (Mo.IV/30), Czarnogłowy, Lower Kimeridgian;  $\times 8$ .

*Plicatula cheiroides* Deslongchamps

Fig. 8. Shell of an adult individual: *a* right valve, *b* left valve (M.IV/31), Sobków, Lower Kimeridgian;  $\times 2$ .

Fig. 9. Hinge of the right valve (Mo.IV/32), Sobków, Lower Kimeridgian;  $\times 4$ .

ERRATA

After page 236 (paper of Halina Pugaczewska)

- 1) In explanation of Plate III, before Figs. 5—10, add:

*Plicatula semiarmata* Étallon

- 2) In explanation of Plate IV, line 1, instead of *Plicatula kobyi* de Loriol, should be:

*Plicatula semiarmata* Étallon