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NEOCOMIAN OYSTERS FROM CENTRAL POLAND

Abstract. — Fourteen species of gryphaeas and oysters of seven genera from a section ranging between the Valanginian and Lower Hauterivian have been described and the morphology, development and individual variability of their shells studied.

INTRODUCTION

The oyster pelecypods, described in the present paper, come from the Infravalanginian, Lower and Upper Valanginian and Lower Hauterivian clayey deposits occurring at Wąwał near Tomaszów Mazowiecki. The material, including more than three thousands specimens was collected by the writer in 1970. The data on the Neocomian oyster pelecypods from Wąwał, known so far, mostly come from faunal lists enclosed with geological-stratigraphical works, the most important of them being: Lewiński, 1930, 1932; Kobyłecki, 1948; Kokoszyńska, 1956; Witkowski, 1969; Cieśliński & Pożaryski, 1970. The most extensive of these lists of oysters, presented by Lewiński, includes four determined species: *Exogyra sanctae crucis* Pictet & Campiche, *E. sinuata* Sowerby, *Ostrea tuberculifera* Koch & Dunker, *O. etalloni* Pictet & Campiche and *Ostrea* sp. The present writer has identified further nine species of the genera *Pycnodonte*, *Aeostreon*, *Ceratostreon*, *Rhynchostreon*, *Gryphaeostrea*, *Ostrea* and *Lopha*. She has also conducted morphological studies and, in the majority of cases, also studies on the development of shell and individual variability.

The fauna of oysters here described is relatively variable, including representatives of two families, four subfamilies and seven genera. Most genera are represented by two species each, except for the genus *Pycnodonte*, of which one species and *Rhynchostreon*, of which three species have been described.

Since shells of almost all growth stages were contained in the deposit, the writer was able to observe changes in the development of shell of most species. The systematic of oysters have been adopted by the present writer after Stenzel, 1971.

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The following abbreviations have been used in the descriptions of species: H — height, L — length, H/L — height index, C — convexity. The material described is housed in the collections of the Institute of Palaeozoology (Zakład Paleozoologii) of the Polish Academy of Sciences in Warsaw (abbr. ZPAL).

CHARACTERISTICS OF THE MATERIAL

Most material is in a crumbled state, frequently in the form of a shell detritus, so that of a total number of 3000 specimens only a half was fit for detailed study. Fasial differences in the development of the Infra-valanginian, Valanginian and Lower Hauterivian deposits reflect in the state of preservation of fauna. Complete shells make up an only small percentage of the collection, mostly consisting of single valves, occurring sometimes in considerable quantities. Here belong the valves of *Ostrea sanctae crucis* Pictet & Campiche, *O. germaini* Coquand, *Ceratostreon tuberculiferum* (Koch & Dunker), *C. minos* (Coquand) and of the largest oyster, occurring in this area, *Aetostreon latissimum* (Lamarck). Of the species mentioned above, *C. minos* (Coquand) is represented most abundantly (about 1200 valves). Of the representatives of *Rhynchostreon tombeckianum* (d'Orbigny), *R. etalloni* (Pictet & Campiche) and *R. sp.* only a few or a dozen or so each were collected. The species *Aetostreon neocomiensis* (d'Orbigny), *Gryphaeostrea cf. lateralis* (Nilsson), *G. cf. arduennensis* (d'Orbigny), *Lopha cf. cotteaudi* (Coquand), *L. cf. eos* (Coquand) and *Pycnodonte sp.* occur only sporadically.

The oysters under study mostly attach themselves to small gastropods with high-coiled shells or to pelecypods with a distinct concentric ornamentation (Pl. XI, Figs 3, 10, 13; Pl. XII, Fig. 8a) and, less frequently, to the flat surface of rocks (Pl. XIV, Fig. 11b). Sometimes, after a brief period of attachment, particular individuals detached and continued to live freely, lying on the bottom, mostly resting on their strongly flattened side of shell (Pl. VII, Fig. 1a; Pl. IX, Fig. 4a).

The considerable range of the size of specimens varies from a few to more than 100 mm in height. On the whole, the Neocomian oysters from Wąwał are smaller than those occurring in these same horizons of other regions of the world.

REMARKS ON GEOLOGICAL AND ECOLOGICAL CONDITIONS

The Tomaszów syncline forms a shallow bay of the Łódź Synclorium and makes up part of the north-west Mesozoic margin of the Holy Cross Mountains (Witkowski, 1969). The Neocomian outcrops in the northern limb of this syncline on the Wolborka River west of Tomaszów Mazowiecki and near the village Wąwał east of the Pilica River (Kokoszyńska,

1956). The Neocomian deposits occurring near Wąwał, where they are exploited for the purposes of a local brickyard, were the subject of the writer's studies. In this locality, the Neocomian includes Infravalangianian, Lower and Upper Valangianian and Lower Hauterivian deposits overlaid by Quaternary sediments.

The Infravalangianian is developed in the form of brown-yellow, marly, clayey, ferruginous oolites intercalated by limonite concretions in its lower part and ochroid, sandy loams in its upper part. An ammonite of the genus *Neocomites* is cited (Pruszkowski, 1961) from the lowermost Infravalangianian beds. Higher beds of the Infravalangianian contain a rich fauna of foraminifers and ostracods, which, however, are not of the nature of index fauna (Pozaryski & Cieśliński, 1970). Oyster shells of this horizon are brittle, preserved mostly as a shell detritus. Many shells of cosmopolitan species, *Ceratostreon tuberculiferum* (Koch & Dunker), *Ostrea sanctae crucis* Pictet & Campiche and *Rhynchostreon etalloni* (Pictet & Campiche) were collected in this horizon.

The Valangianian is developed in the form of dark-gray, sandy clays with limonite concretions, ferruginous oolites and timber splinters, along with an admixture of quartziferous clay and fine crystal of gypsum in its lower and in the form of plastic clays and gray shales with siderite concretions in its upper part. *Platylenticeras* cf. *gevrili* d'Orbigny is an ammonite characteristic of the lower and species of the genera *Neocomites*, *Polyptychites*, *Hoplites*, *Saynoceras*, as well as the species *Bachianites neocomiensis* d'Orbigny and *Leopoldia provincialis* Sayn — of the upper horizons. Usually crumbled shells of a large oyster of the species *Ostrea germaini* Coquand abundantly occur in the lower part of these deposits, where they are also accompanied by less numerous and also crumbled shells of *O. sanctae crucis* Pictet & Campiche. The oyster fauna is considerably richer in the upper part, where a mass occurrence is recorded of well preserved shells of a small oyster, *Ceratostreon minos* (Coquand), along with large, thick-walled shells of *Aetostreon latissimum* (Lamarck). Other species as *A. neocomiensis* (d'Orbigny), *Lopha* cf. *eos* (Coquand) or *L.* cf. *cotteaui* (Coquand) are represented in these deposits by single valves only. The Upper Valangianian also contains the remaining oysters described in the present paper, that is, the representatives of the genera *Gryp-haeostrea* and *Pycnodonte*.

A general deepening of the sea, with local shallowings, took place in the Valangianian. In deeper parts of the basin, large oysters of the species *Aetostreon latissimum* (Lamarck) lived freely resting on a loamy-clayey bottom. The shells of this species are usually devoid of an attachment area, but have a strongly flattened lateral surface of the left valve, a usually high, spirally coiled umbo, a high, nodose keel and a high anterior margin of shell. These characters, departing from those typical of the oysters which attach themselves to the substrate, confirm the capabilit-

ies of these pelecypods of adapting themselves to various environmental conditions (Pugaczewska, 1971).

The Lower Hauterivian, documented by the occurrence of *Dichotomites bidichotomus* Leym, is developed mostly in the form of dark-gray, locally steel-colored, clays, sphaerosiderites and gray, locally sandy or fat and dark-gray, shales. A rich assemblage of foraminiferic microfauna, decidedly different from the Valanginian microfauna (Witkowski, 1969) has been determined from these deposits. Of oyster pelecypods, here occur few shells of *Aetostreon latissimum* (Lamarck) of two types, narrow and wide, which are adapted to two, different types of substrate. The oyster are accompanied by many pelecypods of other systematic groups having exceptionally brittle and fragile shells. Mostly, they are representatives of the genera: *Astarte*, *Leda*, *Corbula*, *Oxytoma*, *Pecten*, *Anomia* and *Inoceramus* (Kokoszyńska, 1956). Spines of the echinoids are also recorded. Species of the genera *Terebratula* and *Rhynchonella* occur in the entire Lower Cretaceous of Wąwał.

The fauna of oysters is on the whole cosmopolitan in character, displaying distinct influences of both the Mediterranean Basin (*Aetostreon latissimum*, *Ceratostreon minos*, *C. tuberculiferum*, *Ostrea sanctae crucis*, *Lopha cotteaudi*, etc.) and German Basin (*Rhynchostreon tombeckianium*, *Gryphaeostrea* cf. *lateralis*, *Ceratostreon tuberculiferum*).

DESCRIPTIONS

Suborder **Ostreina** Férrusac, 1822
 Superfamily **Ostreacea** Rafinesque, 1815
 Family **Gryphaeidae** Vyalov, 1936
 Subfamily **Pycnodontinae** Stenzel, 1959
 Genus *Pycnodonte* Fischer de Waldheim, 1835

Type species: P. radiata Fischer de Waldheim, 1835

Diagnosis. — See Stenzel (1971, p. 1105).

Pycnodonte sp.
 (Pl. XV, Fig. 1a—c)

Material. — A fragmentary left valve (Mo.VIII/1).

Dimensions (in mm):

| H | L | C |
|-----|------|-----|
| 8.0 | 11.0 | 3.0 |

Description. — Valve medium-sized. Maximum convexity halfway the height, near anterior margin. Radial sinus poorly developed, occurring

in the posterior part of valve. Valve vacuolar in microstructure (Pl. XV, Fig. 1c).

Occurrence. — Poland: Lower Hauterivian.

Subfamily **Exogyrinae** Vyalov, 1936

Tribe **Exogyrini** Vyalov, 1936

Genus *Aetostreon* Bayle, 1878

Type species: *A. latissimum* (Lamarck, 1801)

Diagnosis. — See Stenzel (1971, p. 1117).

Remarks. — Pervinquière (1912) suggested the assignment of *Aetostreon* Bayle as a subgenus of *Exogyra* Say, while Stenzel (1971) proved it to be an independent genus. The writer agrees with the latter opinion, since, with a similar structure of its hinge and spiral coiling of umbo, *Aetostreon* differs from *Exogyra* in a lack of fine, parallel ribs, separated by pits on the periphery of the inner surface of valves what is known as chomata and in a lamellar ornamentation of valves. Some specimens of *Aetostreon*, devoid of attachment areas might lie with their flattened posterior part of shell turned to the bottom, which resembles the mode of life of the gryphaeas. In contradiction to typical gryphaeas, the spirally coiled umbo of *Aetostreon* is reflexed, while in the former the uncoiled umbo of the left valve is mostly overhanging above the right valve. Since in *Aetostreon* the hinge takes an intermediate position between the lateral, known in *Exogyra* and the dorsal, known in *Gryphaea*, Jourdy's view (1924) on the transitional character of *Aetostreon* between the two genera seems to be correct.

Aetostreon latissimum (Lamarck, 1801)

(Pls. VII—IX)

1931. *Exogyra couloni* (Defrance) d'Orbigny; Ch. E. Weaver, p. 229, Pl. 19, Figs 88—91.
1971. *Aetostreon latissimum* (Lamarck); H. B. Stenzel, p. 1117, Figs J 92, 1a—c.

Material. — About 100 right and left valves, five shells and many fragments.

Dimensions (in mm):

Left valves (Mo.VIII/2—3, 6—11)

| H | L | C | H/L |
|------|------|------|---------|
| 5—95 | 3—55 | 2—45 | 1.3—1.8 |

Right valves (Mo.VIII/12—21)

| H | L | C | H/L |
|------|------|------|---------|
| 9—77 | 6—50 | 2—15 | 1.5—2.3 |

Description. — External morphology of the shells (Pl. VII, Figs 1a—d). Shells inequivalve, inequilateral, thick-walled, large, obliquely triangular, with a deep, keel-like left and flat right valve.

Left valve (Pl. VII, Fig. 1a; Pl. VIII, Figs 1b—3b, 5b; Pl. IX, Figs 2, 4b). Anterior margin arcuate, posterior straight or concave. Umbo high, projecting, spirally coiled posteriorly (Pl. VII, Fig. 1c), sometimes low, sharp (Pl. VIII, Fig. 3b). Attachment area very large, occupying the posterolateral part of valve, sometimes small (Pl. VIII, Fig. 2b) or absent (Pl. IX, Fig. 4b). Posterior margin extended under umbo (Pl. VIII, Figs 2b and 5b), straight or sinusoidal. Posteroventral margin lobate—extended or sharp. An arcuate keel usually occurring in the posterior half of valve or medially. It is usually high, with a nodose upper surface or, sometimes, low, with a smooth surface and accompanied by a shallow furrow (Pl. VIII, Fig. 3b).

Right valve (Pl. VII, Figs 1a and 1d; Pl. VIII, Figs 4b, 6b and 7b). Umbo low, rounded or sharp, coiled posteriorly into a flat spiral not projecting outside the posterior margin of valve. Growth lines sinusoidally bent in the middle of valve or converging at an acute angle (Pl. VIII, Fig. 7b). Sometimes, fine rugae are observed on ventral margins of lamellae (Pl. VIII, Fig. 7b; Pl. IX, Fig. 3a).

Internal morphology. Hinge bent posteriorly, occupying the posterior margin of valve. Ligamental furrow extending anteriorly. Anterior bourrelet long, flattened, posterior short, swollen. Adductor muscle scar large, flat, its transverse diameter usually equalling a quarter of that of valve.

Left valve (Pl. VIII, Figs 1a—3a, 5a). Most strongly concave in the middle part, where its depth reaches 45 mm. A bourrelet-like thickening, which makes up a boundary of the opercular right valve countersinking into the left valve, is visible along the margin.

Right valve (Pl. VIII, Figs 4a, 6a, 7a; Pl. IX, Figs 1b and 3b) greatest concavity is under umbo and along the anterior margin visible. A radial crest, separating the usually concave anterior from convex posterior part (Pl. IX, Fig. 3b), is developed on some valves. Tooth-like process projecting, high and devoid of "chomata" in narrow valves (Pl. VIII, Fig. 7c) and low, wide and provided with "chomata" in wide valves (Pl. IX, Fig. 3c). Insertion pit of Quenstedt muscle occurring under hinge, medial, displaying two to three growth lines and having a transverse diameter equalling one-eighth of the transverse diameter of the adductor muscle scar (Pl. VIII, Figs 4a and 7a).

Development of valve. Prodisoconch asymmetric, with a rounded umbo, biconvex, about 0.25 to 0.30 mm in transverse diameter, covered with concentric growth lines. Neanic stage beginning outside a concentric furrow. Its further development is somewhat different in narrow and wide shells, but it terminates when umbo reaches a twist of 90° and the height of valve amounts to about 30 mm. Differences in the development

of various characters in the morphotypes having narrow and wide valves, increase in the ephebic and gerontic stages. In the ephebic stage, all specific characters of *A. latissimum* are fully developed. In the gerontic stage changes are expressed mostly in an increase in the thickness of valve and in the thickening and a larger prominence of keel on the left valve. A transverse section of a keel displays, over its entire length, empty spaces between growth lamellae, which indicate its rapid increase in height (Pl. X, Fig. 7). During the earlier period, the development of these lamellae was observed only in the most convex, middle part of the keel. Other gerontic changes are expressed in a considerable swelling of the tooth-like process more distinct flattening of the anterior bourrelet, and in a considerably larger protrusion of the posterior bourrelet.

Variability. — *A. latissimum* is marked by an extensive individual variability, mostly concerning the shape of shell, height index, run of growth lamellae on right valves and development of hinge. Extremely varying forms may be considered as morphotypes. Morphotype I includes narrow shells, known in literature under the specific name *Ex. couloni* Defr. (Pls VII and VIII). Morphotype II, including wide shells, has hitherto been assigned to *Ostrea aquila* d'Orbigny (Pl. IX). In addition to the morphotypes distinguished, *A. imbricatum* (Kraus, 1843) from the Neocomian of South Africa may be considered as morphotype III. It corresponds almost completely to morphotype I (Pl. VII), but differs from it in a more central situation of its umbo, which resembles an overhanging umbo in the gryphaeas.

Occurrence. — Poland: Upper — Lower Valanginian to Lower Hauterivian (Wąwał); Tithonian (Kruhel Wielki near Przemyśl); Asia, Europe, North Africa and South America: Valanginian — Albanian.

Aetostreon neocomiensis (d'Orbigny, 1851)
(Pl. XV, Fig. 3a, b)

1924. *Liostrea neocomiensis* d'Orbigny (1851); S. Gillet, p. 68, Pl. 1, Fig. 9.

Material. — A right valve, broken in its upper part (Mo. VIII/135).

Description. — Valve large-sized. The fragment preserved is 70 mm long, its maximum thickness, halfway the height near the anterior margin, amounting to 15 mm. Four vertical folds, terminating at a certain distance from the ventral margin, are visible on the outer surface. Ventral margin also folded, covered with upstanding growth lamellae (Pl. XV, Fig. 3b). A 6 mm-deep depression is visible on the inner surface about 15 mm from the anterior margin. An oval, flat adductor muscle scar 16 mm in transverse and 20 mm in longitudinal diameter is situated near the posterior margin.

Remarks. — The specimen described completely resembles that assign-

ed to *Ostrea neocomiensis* d'Orbigny, a unique one in the collection of d'Orbigny.

Occurrence.—Poland: Valanginian (Wąwał). France: Neocomian and Valanginian.

Ceratostreon Bayle, 1878

Type species: *C. flabellatum* (Goldfuss, 1840)

Diagnosis.—See Stenzel (1971, p. 1119).

Ceratostreon minos (Coquand, 1869).

(Pls X, XI and XVI, Figs 6a—d)

1869. *Ostrea Minos* Coquand; H. Coquand, p. 183, Pl. 64, Figs 1—3; Pl. 74, Figs 14—15 (cf. synonymy).
 1871. *Ostrea Minos* Coquand; F. J. Pictet & C. Campiche, p. 278, Pl. 185.
 1907. *Ostrea (Exogyra) Minos* Coqu.; N. I. Karakaš, p. 181, Pl. 18, Figs 1, 3—5, 7—8; Pl. 21, Figs 28.
 1931. *Ostrea minos* Coquand; Ch. E. Weaver, p. 222, Pl. 18, Figs 32—83.
 1954. *Exogyra minos* (Coquand); L. R. Cox, p. 630, Pl. 65, Fig. 5; Pl. 66, Fig. 2.
 1969. *Ceratostreon minos* (Coquand); N. A. Čelcova, p. 68, Pl. 12, Figs 5—8.

Material.—More than 600 very well preserved valves, mostly right ones, and some entire shells.

Dimensions (in mm):

Left, narrow, elongate valves (Mo.VIII/29—33)

| H | L | H/L |
|------|------|---------|
| 8—17 | 5—10 | 1.6—1.8 |

Left, wide valves (Mo.VIII/34—39)

| H | L | H/L |
|------|------|---------|
| 4—14 | 4—10 | 1.0—1.4 |

Right, narrow valves (Mo.VIII/40—44)

| H | L | H/L |
|------|-----|---------|
| 4—12 | 3—7 | 1.7—2.0 |

Right, wide valves (Mo.VIII/45—49)

| H | L | H/L |
|------|------|---------|
| 5—17 | 4—13 | 1.1—1.3 |

Description.—Shells medium-sized, inequivalve, inequilateral, with a non-projecting, spirally coiled umbo.

External morphology. Valves convex, mostly along the anterior margin, elongate, comma-shaped or rounded. Anterior margin arcuate, smooth (Pl. X, Figs 1b and 2b; Pl. XI, Figs 6b—14b) or more or less folded (Pl. X, Fig. 5b; Pl. XI, Figs 1b—4b). Posterior margin straight (Pl. XI, Figs 2b and 11b), sinusoidal (Pl. XI, Fig. 4b), S-shaped (Pl. XI, Fig. 9b) or convex (Pl. X, Figs 4b and 8b; Pl. XI, Figs 12b and 14b). Ventral margin rounded (Pl. X, Figs 1b and 4b; Pl. XI, Figs 12b—14b), frequently extend-

ed to form more or less sharp posteroventral lobe (Pl. X, Figs 2b, 3b, 5b, 6b; Pl. XI, Figs 1b, 2b, 9b—11b).

Left valve (Pl. X, Figs 1b—6b) nodose, smooth or covered with a few folds, having upstanding growth lamellae. Attachment area extensive, sometimes occupying the posterolateral part of valve, flat or concave, covered with traces of substrate ornamentation.

Right valve (Pl. X, Fig. 8b; Pl. XI, Figs 1b—14b) covered, along the anterior margin, with overlapping growth lamellae, anastomizing with each other.

Internal morphology. Greatest concavity along the anterior margin and under umbo. A round or oval adductor muscle scar usually only slightly concave, sometimes having a straight upper margin (Pl. X, Figs 4a and 5a; Pl. XI, Figs 2a and 7a). It is situated halfway the height of valve, sometimes submedially (Pl. XI, Fig. 14a). Hinge situated postero-dorsally, relatively low, transversally elongate. Inner margins of valves covered with chomata, which, in the lobately extended part, are long, arcuate and known as "vermicular chomata" (Pl. X, Figs 4a and 8a).

Left valve (Pl. X, Figs 1a and 3a—6a). A maximum concavity is 4 to 5 mm deep. Hinge, slightly exceeding 1 mm, in height, is 5 mm long, of typical exogyroid structure. Posterior bourrelet arcuate, convex, anterior faint, sometimes in the form of sigmoidally bent growth lines. Tooth socket covered with chomata.

Right valve (Pl. X, Fig. 8a; Pl. XI, Figs 1a—14a). Maximum depth of depression about 2 mm. Chomata shifted onto the margin, which, consequently, is finely-serrate. They also cover the toothlike process. A small Quenstedt muscle scar, whose transverse diameter equals about one-seventh of the diameter of adductor muscle scar, running medially, is visible below umbo.

Development of valve. The nepionic stage is represented by a convex, subtriangular prodissoconch about 0.25 mm in transverse diameter, covered with about 60 concentric riblets, more closely spaced in the lower half of valve and near its ventral margin. A wide furrow, marking consecutive phases of the growth of prodissoconch (Pl. XVI, Figs 6a and d), occurs below the concentrations of riblets.

The next, neanic stage of growth, starting when the valve is coiled by about 20°, terminates when the twist reaches 90°. In this stage, valve is rounded in outline and covered with few, widely spaced growth lines (Pl. XVI, Fig. 6c).

The ephebic stage is marked by a more and more strongly coiled umbo up to an angle of 180° and by a rapid increment in length of valve and thickening of its walls. All features characteristic of the species are developed in this stage.

No specimens in the gerontic stage have been found in the material under study.

Variability. — An extensive individual variability concerns several characters, closely correlated with each other. The shape of valves is among the most important ones, as it varies from triangular, through oval, and comma-like up to round. It depends in turn on the size and outline of the attachment area and its situation on the valve. Usually, this area occupies the posterolateral part of umbo and sometimes it is situated on it terminally. In the former case, predominant valves are narrow (H/L index fluctuating between 1.6 and 2.0), in the latter — wide (H/L = 1.0 to 1.4).

Remarks. — As follows from literature, the valves of this species may reach 90 mm in height and have strongly serrate margins and umbo sometimes coiled trochoidally. Folds on the surface of the left valves may bifurcate dichotomously and develop irregular swellings and nodes (Weaver, 1931, p. 223; Cox, 1954, p. 630). In the Polish material, the dichotomous division is observed rarely, (Pl. X, Fig. 5b), while the trochoidally coiled umbo and so large valves have never been recorded. The largest of them do not exceed 17 mm in height. Specimens of *C. minos* differ from *C. tuberculiferum* mostly in a different run of their growth lamellae along the anterior margin of the right valve and not only in a different structure of hinge and folding of valve surface, which is emphasized chiefly by French authors. *C. minos* has few lamellae, which anastomize with each other, while in *C. tuberculiferum* they are considerably more numerous and parallel to each other. In *C. minos*, three to four such lamellae occur per 1 mm of height, while in *C. tuberculiferum* there are as many as ten of them. In addition, *C. minos* has very well developed chomata and vermicular chomata, while in *C. tuberculiferum* these elements are poorly developed.

Occurrence. — Poland: Valanginian-Hauterivian (Wąwał). Switzerland: Valanginian-Hauterivian. France: Middle Neocomian. The Crimea: Neocomian-Barremian. Argentina: Neocomian-Barremian. Trinidad: Valanginian-Aptian.

Ceratostreon tuberculiferum (Koch & Dunker, 1837)

(Pl. XII, Figs 2, 4, 5, 7 and 8)

- 1870—1871. *Ostrea tuberculifera* (Koch & Dunker) Coquand; F. J. Pictet & C. Campiche, p. 280, Pl. 186, Figs 1—11 (cf. synonymy).
 1957. *Exogyra tuberculifera* Koch & Dunker; P. Marie & D. Mongin, p. 416, Text-fig. 4 D a—c (cf. synonymy).
 1964. *Ceratostreon tuberculiferum* (Koch & Dunker); W. P. Rengarten, pp. 38, Pl. 5, Figs 2—3 (cf. synonymy).

Material. — Twenty-five specimens, including five left and eighteen right valves and two shells. Many fragmentary valves. The material is brittle.

Dimensions (in mm):

| | | |
|--------------------------------------|-------|---------|
| Left valves (Mo.VIII/78—83) | | |
| H | L | H/L |
| 13—20 | 10—15 | 1.3—1.8 |
| Right, narrow valves (Mo.VIII/92—95) | | |
| H | L | H/L |
| 8—20 | 5—11 | 1.7—1.9 |
| Right, wide valves (Mo.VIII/84—91) | | |
| H | L | H/L |
| 8—16 | 5—11 | 1.1—1.5 |

Description. — Shells inequivalve, inequilateral, medium-sized, variable in shape, thin-walled, with a non-projecting, posteriorly coiled umbo.

External morphology. Valves usually convex along the anterior margin. Dorsal and anterior margins rounded, posterior margin straight (Pl. XII, Fig. 5a), depressed or lobately extended (Pl. XII, Figs 2a, 4b, 8a), a lobe being sometimes formed near the posteroventral margin. Umbo strongly coiled posteriorly, forming a spiral of about 360°. An arcuate keel divides the valve into two, differently ornamented parts.

Left valve (Pl. XII, Figs 4b, 8a) has an extensive attachment area, occupying umbo or the posterior, subumbonal part of valve. Low folds (Pl. XII, Fig. 8a), covered with undulate growth lines, run radially from keel towards the anterior margin.

Right valve (Pl. XII, Figs 2a, 4a, 5a, 7a). The anterior margin, sometimes bounded posteriorly by a high keel, is covered with very numerous and fine growth lamellae, which do not anastomize with each other and usually run in an undulating manner.

Internal morphology. Valves most strongly concave along the anterior margin and under umbo. A large, rounded or oval adductor muscle scar is situated halfway the height of valve and submedially (Pl. XII, Figs 2b, 5b). It is covered by concentric growth lines and its transverse diameter makes up about one-third of the transverse diameter of valve. Hinge exogyroid in structure, occupying the posterodorsal margin of valve, low (1 mm), transversally elongate and arcuate. Its elements are poorly developed. The inner margin of valve covered with fine chomata, most distinct near hinge (Pl. XII, Fig. 8b).

Development of valve. The nepionic stage is represented by a convex prodissoconch about one-third mm in diameter. The first growth lines are formed in the next, neanic stage, except for a transverse furrow which delimits the prodissoconch. The angle of umbonal spiral rapidly reaches a value of 90° while valve is about 4 to 5 mm high. Valve is narrow and high. Its further development (in ephebic stage) consists in an increase in transverse growth. A distinct lobe is formed under umbo and the umbonal spiral reaches 180°. At the end of this stage, a few fine lamellae are formed along the anterior margin on the right valves. Muscle scar is at first oval and nearer the posterior margin than in the subsequ-

ent developmental periods. Valves are about 10 mm high. Umbonal spiral continues to increase its angle, reaching a value of 360° , while muscle scar considerably increases its area, becomes rounder and rounder and takes a more medial position. The anterior and dorsal margins become higher and thicker.

Variability. — It is considerable and mostly concerns the outline and convexity of valves, depending chiefly on the size and situation of attachment area on the valve. Narrow and wide valves, whose height indexes are presented in the table of dimensions, may here be distinguished.

Remarks. — Specimens of this species reach 50 mm in height (Pictet & Campiche, 1870). The species under study differs from the closely related *C. minos*, in addition to those mentioned in its description, in a few fundamental characters. The umbonal spiral in *C. minos* reaches 180° and in *T. tuberculiferum* 360° . The similarity in the two species' ornamentation is also only seeming, since in the species described the margins of valves have never been serrate and folds on its left valve are low and nontypical, so what we can rather take into account folded valves. The hinge of *C. tuberculiferum* is exceptionally low, while its valves are sometimes of a considerable height.

Occurrence. — Poland: Infravalanginian (Wąwał). The Crimea, the Caucasus, England, France, Germany, Spain: Valanginian-Aptian. Switzerland: Lower-Middle Neocomian, Lower-Upper Urgo-Aptian.

Genus *Rhynchostreon* Bayle, 1878

Type species: *Rh. chaperi* Bayle, 1878

Diagnosis. — see Stenzel (1971, p. 1122—1124).

Rhynchostreon tombeckianum (d'Orbigny, 1846)

(Pl. XIII, Figs 1—4)

1869. *Ostrea Tombeckiana* Orbigny, 1843; H. Coquand, p. 182, Pl. 66, Figs. 8—12. non 1917. *Ostrea* (*D.*) *Tombeckiana* Rollier; L. Rollier, p. 589.

Material. — Six, well preserved right and a few fragmentary left valves.

Dimension (in mm): (Mo.VIII/97—102)

| H | L | H/L |
|------|--------|---------|
| 7—21 | 4.5—16 | 1.6—1.3 |

External morphology. — Valves slightly convex along the anterior margin, where they reach 4 mm in convexity. Margins uniformly rounded on the entire periphery, except under umbo, where a faint sinus occurs sometimes. Valves rounded or oval in outline. Surface covered with many, concentric growth lamellae, which, only along the elevated anterior margin, run parallel to each other and are arranged imbricately. This margin

is sloping steeply towards the periphery at a constant angle of about 45° . Umbo forms a flat spiral reaching 200° . The thickness of valves increases to 2 mm.

Internal morphology (Pl. XIII, Figs 1b—4b). Valve surface smooth, lustrous, sometimes transparent. Scars of gill lamellae (Pl. XIII, Fig. 4b) are sometimes visible along the anterior margin. A maximum concavity, occurring in the anterodorsal part of valve, amounts to about 2.5 mm in depth. An oval adductor muscle scar is situated obliquely near the posterior margin. Its transverse diameter of about 4 to 5 mm makes up a little more than one-third of the transverse diameter of valve. Sometimes it is depressed along periphery or along a truncate dorsal margin (Pl. XIII, Fig. 2b) and displays on its surface fine, radial striae intersecting growth lines. Hinge situated in a posterodorsal position and its structure is typical of the exogyras. Anterior bourrelet not marked, posterior thickened, arcuate and relatively high. Ligamental furrow not exceeding 1.5 mm in width and tapering under umbo. Toothlike process swollen convex. Inner surfaces of margins rounded and smooth, faint chomata marked only on a lobately extended subumbonal part of valve (Pl. XIII, Fig. 4b).

Development of valve. Prodissoconch, representing the nepionic stage, is spherical and about 0.25 mm in diameter. In the neanic stage, valves are narrower and elongate, with a flat, round muscle scar. In the ephebic stage, the umbonal whorl reaches its maximum. Further growth changes take place gradually and consist in the equalization of the two diameters of valve, in the change in the outline of muscle scar, and in the elevation and extension of a laminar ornamentation of the anterior margin of valves. Growth index, decreasing with individual age, depicts a larger longitudinal growth of valves, which enables the supposition that in the gerontic stage the rate of the growth of valves in height and length would probably be equalized and growth index would be equal to one.

The variability in specimens of *Rh. tombeckianum* is rather insignificant and mostly concerns the size, shape and situation of the adductor muscle scar.

Remarks.—Specimens from Poland are in a complete conformity with French ones (Coquand, 1869). Specimens were separated from *Lio-strea unciformis* (non Buvignier) by Rollier (1917), who erected for them a new species called *O. tombeckiana*, not related in any of its characters to the species here described. *Rh. tombeckiana* is included by some authors in the synonymy of *Ex. exogyroides* Roemer (Gillet, 1924), but such a standpoint seems to be unjustified. A specimen, illustrated from the outer side of the left valve, is presented by Roemer (1836). It displays an extensive attachment area, which would probably be reflected in the right valves, but non such deformations are observed, however, in Polish specimens.

Occurrence. — Poland: Valanginian-Lower Hauterivian (Wąwał). France and Germany: Neocomian.

Rhynchostreon etalloni (Pictet & Campiche, 1870)

(Pl. XII, Figs 1, 3, 6)

1870. *Ostrea Etalloni* Pictet & Campiche; F. J. Pictet & C. Campiche, p. 286, Pl. 186, Figs 12—15.

Material. — A dozen or so right valves.

Dimensions of right valves (in mm): (Mo.VIII/67—76)

| H | L | H/L |
|-------|------|---------|
| 11—30 | 9—17 | 1.2—1.8 |

Description. — Shells inequivalve, inequilateral, thin-walled, medium-sized, variable in outline.

External morphology. Valves smooth, with growth lines more strongly marked at certain intervals. Left valve having a nodose, convex keel, right flattened or slightly, but uniformly convex (Pl. XII, Fig. 3a). A few lamellae, sometimes anastomosing with each other, are marked near the anterior margin of some of the right valves. Anterior margin convex, connected with the dorsal one by an arcuate edge. Posterior margin lobately extended or slightly depressed under umbo. Umbo forming a spiral, not exceeding and angle of 220° , mostly amounting to 180° (Pl. XII, Fig. 3a).

Internal morphology. The deepest depression occurs along the anterior margin on the right and in the middle of valve, where the keel runs, on the left valves. Muscle scar large, reaching 6 mm in transverse section, obliquely oval in outline and situated submedially (Pl. XII, Figs 1b, 3b, 6b). Hinge in the posterodorsal position, about 1.5 mm high and about 5 mm long, with a well-visible arcuate posterior bourrelet and a short ligamental furrow.

Remarks. — The largest specimen of this species is 75 mm in transverse diameter (Pictet & Campiche, 1870). Prodissoconch not preserved.

Occurrence. — Poland: Infravalanginian (Wąwał). France, Switzerland: Valanginian-Hauterivian.

Rhynchostreon sp.

(Pl. XVI, Figs 1—5)

Material. — Ten, mostly right valves, most frequently broken in the ventral part.

Dimensions (in mm): (Mo.VIII/103—110)

| H | L | H/L |
|--------|------|---------|
| 8.5—17 | 5—12 | 1.3—1.9 |

Description.— Shells inequivalves, inequilateral, obliquely oval, thin-walled, narrow and elongate.

External morphology. Valve surface uneven, corrugate, sometimes nodose and sometimes smooth. Anterior margin widely arcuate, posterior lobately extended (Pl. XVI, Figs 1b—3b), straight or slightly depressed. Umbonal spiral small, usually not exceeding an angle of 180° . Prodissoconch spherical, about one-third mm in diameter. Walls reaching 1 mm in thickness.

Left valve (Pl. XVI, Figs 1b, 5b). Umbo projecting, strongly twisted posteriorly, occupying the posterodorsal margin of valve, usually covered by a small, terminal attachment area. The largest convexity (5 mm) occurs around an arcuate protuberance running from umbo towards the ventral margin.

Right valve (Pl. XVI, Figs 2b—4b) flat, sometimes with fine, radial striae on its surface. A few thickened growth lines run along the anterior margin, sometimes passing also on the dorsal margin.

Internal morphology. Valve surface smooth. Muscle scar ovally elongate, usually flat, 1.5 to 2.0 mm in transverse, smaller diameter, which corresponds to about one-third of the transverse diameter of the valve. Posterodorsal margin of valve is occupied by a hinge, whose structure is of the exogyric type.

Left valve (Pl. XVI, Figs 1a, 5a). Tooth socket relatively deep. A roller-like thickening, which limits the countersinking of the right, opercular valve into the left one, is visible along the margin. The deepest depression of valve (about 3 mm) occurs in the subumbonal part.

Right valve (Pl. XVI, Figs 2a—4a) slightly depressed along the anterior margin. Margins smooth, deflected, without any traces of chomata. A small "Quenstedt muscle scar" is visible in the middle, subumbonal part. It is semilunar in outline, with a straight and somewhat depressed dorsal and convex ventral margin. Its transverse diameter amounts to about 0.5 mm. Toothlike process convex, swollen.

Remarks.— The specimens described do not resemble those, known from literature, to such an extent as to enable assigning them to an separate species.

Occurrence.— Poland: Valanginian — Lower Hauterivian (Wąwał).

Tribe **Gryphaeistreini** Stenzel, 1971

Genus *Gryphaeostrea* Conrad, 1865

Type species: *Gryphaea eversa* Milleville, 1843

Diagnosis: see Stenzel (1971, p. 1125).

Gryphaeostrea cf. *lateralis* (Nilsson, 1827)

(Pl. XIII, Figs 7—11)

1834—40. *Ostrea lateralis* Nilsson; A. Goldfuss, p. 24, Pl. 82, Fig. 1.

1869. *Ostrea lateralis* Nilsson; H. Coquand, p. 96, Pl. 18, Fig. 12; Pl. 30, Figs 10—14.

1964. *Amphidonta lateralis* Nilsson; W. P. Rengarten, p. 62, Pl. 9, Figs 4a—b.

1966. *Gryphaeostrea lateralis* Nilsson; H. H. Mirkamalov, p. 44, Pl. 21, Fig. 7.

Material. — Twelve, well preserved right and many fragmentary, both right and left, valves.

Dimensions (in mm): (Mo.VIII/111—115)

| H | L | H/L |
|------|------|---------|
| 9—15 | 6—10 | 1.4—1.5 |

Description. — Shells inequivalves, inequilateral, thin-walled, transparent, triangular-oval, sometimes rounded in outline.

External morphology. Left valve (Pl. XIII, Fig. 8) most convex halfway the height, triangular, with a small umbo slightly overhanging the right valve. Attachment area extensive, occupying the posterolateral part of valve.

Right valve (Pl. XIII, Figs 7a, 9a, 10a, 11) flat or somewhat concave transversally halfway its height. Umbo small, dorsal or shifted posteriorly, umbonal spiral small, reaching an angle of about 180° in the valves of adult developmental stages. Valve surface covered with concentric lamellae, more or less regularly distributed and upstanding near the ventral margin (Pl. XIII, Figs 10a and 11). Lateral margins deflected (Pl. XIII, Figs 9a, 10a).

Internal morphology. Right valves (Pl. XIII, Figs 7b, 9b, 10b) having uneven surface, on which concentric, irregular depressions are visible. Margins deflected outwards, smooth, devoid of chomata. Hinge short, exogyric, low. The anterior and posterior bourrelets well developed. An oval or rounded adductor muscle scar situated, sometimes submedially (Pl. XIII, Fig. 9b), near the posterior margin. Its transverse diameter makes up about one-fifth to a quarter of the transverse diameter of the valve.

Remarks. — The specimens here described most strongly resemble those of this same species, described by Goldfuss (1834, 1840). The lack of well preserved left valves and of the representatives of juvenile developmental stages allows one to consider Polish specimens as *Gryphaeostrea cf. lateralis* Nilsson.

Occurrence. — Poland: Valanginian — Lower Hauterivian. The Caucasus, the Crimea, South America: Cretaceous (Grünsand). Africa: Albian — Oligocene.

Gryphaeostrea arduennensis (d'Orbigny, 1846)

(Pl. XIII, Figs 5, 6)

non 1869. *Ostrea Arduennensis* Orbigny; H. Coquand, p. 155, Pl. 60, Figs 5—12.

1870—71. *Ostrea Arduennensis* d'Orbigny; F. J. Pictet & C. Campiche, p. 304, Pl. 193, Fig. 3.

1966. *Amphidonta arduennensis* (d'Orbigny); H. H. Mirkamalov, p. 70, Pl. 8, Figs 10—11 (non Figs 7—9).

Material. — Three complete, well preserved, thin-walled, transparent, longitudinally oval, right valves.

Dimensions (in mm): (Mo.VIII/116—118)

| H | L | H/L |
|---------|-------|---------|
| 6.5—9.5 | 4.5—7 | 1.4—1.6 |

Description. — External morphology (Pl. XIII, Figs 5a, 6a). Valve smooth, except for a part along the two lateral and the ventral margin, there it is deflected and covered with concentric lamellae. Umbo in the dorsomedial position, its spiral small, reaching an angle of about 90° and slightly twisted posteriorly. Prodissoconch large, spherical, about one-third mm in diameter. An auricle-like extension is visible on the posterior side of umbo.

Internal morphology (Pl. XIII, Figs 5b, 6b). Valve irregularly depressed under hinge and in the region of the adductor muscle scar. The scar is obliquely oval, flat and with a transverse diameter equalling about a quarter to one-third of the transverse diameter of the entire valve. Sometimes, it is shifted nearer the ventral margin (Pl. XIII, Fig. 6b). Hinge exogyric, 0.6 mm high and 1 to 1.5 mm long. A nodose, arcuate bourrelet (Pl. XIII, Fig. 6b) is visible on the valve. Valves are S-shaped in lateral view.

Remarks. — Polish specimens are in a complete conformity with French ones (Pictet & Campiche, 1870—71) and quite different than those described by Coquand (1869) under the same specific name and which resemble, in their semilunar form and robust structure, the valves of *O. conica* (Sow.) (Pictet & Campiche, 1870—71).

Occurrence. — Poland: Valanginian — Lower Hauterivian (Wąwał). Switzerland: Lower-Upper Gault. The Caucasus, the Crimea, France: Albian.

Family **Ostreidae** Rafinesque, 1815
Subfamily **Ostreinae** Rafinesque, 1815
Genus *Ostrea* Linné, 1758

Type species: *Ostrea edulis* Linné, 1758

Diagnosis: see Stenzel (1971, p. 1139).

Ostrea sanctae crucis Pictet & Campiche, 1869
(Pl. XIV, Figs 10—11)

1870—71. *Ostrea Sanctae Crucis* Pictet & Campiche; F. J. Pictet & C. Campiche, p. 298, Pl. 191, Figs 4—6.

Material. — A well preserved left and an upper part of right valve.

Description. — Valves (Mo. VIII/132—133) large, robust. Left valve longitudinally oval, with its umbo strongly deflected posteriorly. It is 36 mm high, 28 mm long and completely attached to a substrate, whose surface was uneven and nodose. The margins and the outer surface form an almost right angle. Slightly upstanding lamellae are visible on the margins. Right valve somewhat convex in its upper part. Growth lamellae cover a considerable part of its outer surface. Umbo rounded, somewhat shifted posteriorly. Inner surface of valves uniformly concave, uneven. The largest concavity on the left valve occurs along its lateral margins (to 15 mm) and under hinge. Hinge shaped like a wide triangle with its apex strongly excentric in the left and overhanging slightly the hinge in the right valve. Hinge ostreoid in structure, with two lateral bourrelets and a ligamental furrow, wide at its base, distinguishable in the left valve. In the right valve, it is slightly differentiated and strongly flattened. In the left valve, hinge is 8 mm high and 11 mm long and separated ventrally by a swollen hinge margin, which turns laterally into submarginal bourrelets, limiting the right valve when the shell is closed. Muscle scar, submedially situated, is transversally extended and, in the right valve, has a truncate dorsal margin. In the left valve, it elevated ventrally. Its transverse diameter amounts to 10 mm and longitudinal, measured in the direction of height, to 8 mm. Hinge projecting above valve surface, in the left valve forming a distinct subhinge furrow.

Remarks. — Specimens described from Poland are in a complete conformity with the characters of those from Switzerland (Pictet & Campiche, 1870—71). Its typically ostreoid hinge precludes the possibility of assigning these specimens to the genus *Exogyra*, as it has been done in earlier works (Lewiński, 1930, 1933).

Occurrence. — Poland: Infravalangianian — Lower Hauterivian (Wąwał). Switzerland: Valangianian — Hauterivian.

Ostrea germaini Coquand, 1869

(Pl. XIV, Figs 1—9)

1869. *Ostrea Germaini* Coquand; H. Coquand, p. 191, Pl. 66, Figs 14—16.

1870—71. *Ostrea Germaini* Coquand; F. J. Pictet & C. Campiche, p. 295, Pl. 189, Figs 1—6.

Material. — A dozen or so right and a few left valves in various growth stages. The material is brittle, mostly preserved fragmentarily.

Dimensions of right valves (in mm): (Mo. VIII/122—130)

| H | L | H/L |
|-------|-------|-------|
| 14—35 | 13—30 | 1—1.3 |

External morphology. Valves varying in shape from triangular to rounded (Pl. XIV, Figs 2b, 3b, 5b), sometimes semilunar (Pl. XIV, Fig 7b).

Surface smooth, sometimes uneven, with radial striae (Pl. XIV, Fig. 7b) and many growth lamellae. Umbo small, triangular, slightly projecting, situated medially or deflected posteriorly. Margins mostly turned outwards.

Internal morphology. Surface uneven, with a depression occurring under hinge or in the region of adductor muscle scar. The latter, rounded or oval in outline, is situated nearer the posterior margin, or submedially (Pl. XIV, Figs 5a, 7a). Margins smooth, not serrate, frequently turned outwards. Hinge obliquely triangular, 2 to 5 mm high, usually bent terminally inwards. Hinge margin thickened, convex, varying in length from 6 to 15 mm. Left valve with a more robust, higher and longer hinge (Pl. XIV, Fig. 8).

Remarks. — Specimens from Poland are in conformity with those described in works cited in the synonymy, from which they differ in smaller dimensions only. The largest of those cited in literature reaches 95 mm in length, while the largest of Polish ones reach only 30 mm.

Occurrence. — Poland: Valanginian (Wąwał). Switzerland: Valanginian.

Subfamily **Lophinae** Vyalov, 1936

Genus *Lopha* Röding, 1798

Type species: Mytilus cristagalli Linné, 1758

Diagnosis. — see Stenzel (1971, p. 1157).

Lopha cf. *cotteaui* (Coquand, 1869)

(Pl. XV, Fig. 2)

1869. *Ostrea Cotteaui* Coquand; H. Coquand, p. 185, Pl. 62, Figs 25—27.

1870—71. *Ostrea Cotteaui* Coquand; F. J. Picket & Campiche, p. 285, Pl. 186, Figs 12—15.

Material. — A fragmentary left valve (Mo.VIII/134).

Description. — High ribs, obliquely sloping towards the ventral margin, occur on the surface. They are partly covered with upstanding growth lamellae partly projecting in a spine-like manner. Some of the ribs are geniculately bent and nodose. The fragment preserved is 10 mm long.

Remarks. — Complete valves of this species may reach 40 mm in height (Karakáš, 1907) and 20 mm in length (Pictet & Campiche, 1870—71), are subtriangular in outline and have a narrowed and only slightly projecting umbo. Outer surface is ornamented by seven ribs, which may be dichotomously divided in the region of ventral margin. These specimens are quite unique. The fragmentary specimen described from Poland completely corresponds to the specific characters. Due to the insufficiency of material, the writer assigns it to this species as cf.

Occurrence. — Poland: Upper Valanginian — Lower Hauterivian (Wą-wał). France: Neocomian. Switzerland: Valanginian? Neocomian. The Crimea: Lower Cretaceous.

Lopha cf. eos (Coquand, 1869)
(Pl. XV, Figs 4—5)

1869. *Ostrea Eos* Coquand; H. Coquand, p. 166, Pl. 74, Figs 6—13.

Material. — Two fragmentary, left and right, valves (Mo.VIII/136—137).

Description. — Left valve ornamented by short radial and flat ribs, arranged in concentric, irregular rows. The surfaces of ribs and valve are covered with very fine radial striae, which, intersecting distinct growth lines, form an additional, fine-nodose ornamentation consisting of irregular, flat squamae, arranged in radial rows (Pl. XV, Fig. 5).

Remarks. — As follows from literature cited above, the shells of *L. eos* are small-sized, plicatuliforme and have “planed” ribs. The Polish specimens most strongly resemble *Lopha eos*, but the lack of complete valves allows the writer to consider them only as *Lopha cf. eos*.

Occurrence. — Poland: Upper Valanginian — Lower Hauterivian (Wą-wał). Algeria: Urgo-Aptian.

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REFERENCES

- CIEŚLIŃSKI, S. & POŻARYSKI, W. 1970. Stratygrafia mezozoiku Gór Świętokrzyskich. Kreda. (The stratigraphy of the Mesozoic in the margin of the Góry Świętokrzyskie. Cretaceous). — *Prace I. G.*, **56**, 185—231, Warszawa.
- COQUAND, H. 1869. Monographie du genre *Ostrea*, Terrain crétacé. 1—215, Marseille.
- COX, L. R. 1954. Lower Cretaceous Mollusca from Pointe-a-Pierre, Trinidad. — *J. Palaeont.*, **28**, 5, 622—636, Menasha.
- ČELCOVA, N. A. 1969. Značenie mikrostruktury rakoviny melovych ustric dlja ich sistemati. — *Izd. Nauka*, 1—86, Moskva.
- DEBRENNE, F. 1954. Étude de terrains rattaches au Valanginien dans le département de l'Aube. — *Bull. Soc. Géol. France*, **4**, 7—9, 525—535, Paris.
- EICHWALD, E. 1868. *Lethaea Rossica* ou Paléontologie de la Russie, **2**. 364—406, Stuttgart.
- GILLET, S. 1924. Études sur les Lamellibranches néocomiens. — *Soc. Géol. France*, n. sér., **3**, 1—339, Paris.

- GOLDFUSS, A. 1834—1840. *Petrefacta Germaniae*, 2, 1—312, Düsseldorf.
- JOURDY, E. 1924. Histoire naturelle des Exogyres. — *Ann. Pal.*, 13, 1—104, Paris.
- KARAKAŠ, N. I. 1907. Nižnemelovye otloženiya Kryma i ich fauna (Le crétacé inférieur de la Crimée et sa faune). — *Trav. Soc. Imp. Natur. St. Petersburg*, 32, 5, (sect. géol. minér.), 1—482, Petersburg.
- KOBYŁECKI, M. 1948. Neokomskie rudy żelaza okolic Tomaszowa Mazowieckiego (Neocomian iron ores of the Tomaszów Mazowiecki region). — *Biul. P. I. G.*, 41, 43—51, Warszawa.
- Kredowa niecka tomaszowska (Cretaceous Tomaszów Mazowiecki basin). — *Ibidem*, 41, 52—63.
- KOKOSZYŃSKA, B. 1956. Dolna kreda okolic Tomaszowa Mazowieckiego. Z badań geologicznych regionu Świętokrzyskiego. — *Biul. I. G.*, 1, 113, 1—64, Warszawa.
- MARIE, P. & MONGIN, D. 1957. Le Valanginien du Mont Rose de la Madrague (Massif de Marseilleveyre, Bouches-du-Rhone). — *Bull. Soc. Géol. France*, 6 sér., 7, 401—424, Paris.
- MIRKAMALOV, H. H. 1966. Melovye ekzogiry jugo-zapadnogo Gissara. Ekzogiry, ich sistematika i značenie dlja stratigrafii melovych otloženiij jugo-zapadnykh ostrogov gisarskogo chreβta. — *Ins. Geol. Razv. Neft. Gaz. Mestorožd.*, 1—100, Taškent.
- PERVINQUIÈRE, L. 1912. Études de Paléontologie tunisienne. Gastropodes et Lamellibranches de terrains crétacés. — *Carte géol. Tunisie, Dir. gén. Trav. Publ.*, 1—352, Paris.
- PICTET, F. J. & CAMPICHE, C. 1870—1871. Description des fossiles du terrain crétacé des environs de Sainte-Croix, 4-me pt. — "Famille des Ostracés". — *Mat. Paléont. Suisse*, 273—334, Genève et Bâle.
- PUGACZEWSKA, H. 1971. Jurassic Ostreidae of Poland (Małże ostrygowate z jury Polski). — *Acta Palaeont. Pol.*, 16, 3, 191—347, Warszawa.
- RENGARTEN, W. P. 1964. Predstaviteli semejstva ustričnyh v melovych otloženiach Malogo Kavkaza (Representatives of Ostreidae family in the Cretaceous deposits of Caucasus Minor). — *Tr. geol. Inst.* 96, 1—76, Moskva.
- STENZEL, H. B. 1971. Bivalvia. Oysters in: *Treatise on Invertebrate Paleontology*, pt. N, 3, 953—1224, Kansas.
- WEAVER, CH. E. 1931. Paleontology of the Jurassic and Cretaceous of West Central Argentina. — *Mem. Univ. Washington*, 1, 1—469, Washington.
- WITKOWSKI, A. 1969. Budowa geologiczna Niecki Tomaszowskiej (Geological structure of Tomaszów syncline). — *Prace, I. G.*, 53, 1—123, Warszawa.

HALINA PUGACZEWSKA

NEOKOMSKIE OSTRYGI Z POLSKI CENTRALNEJ

Streszczenie

W pracy opisano małże ostrygowate (gryfee i ostrygi) z utworów neokomu koło wsi Wąwał pow. Tomaszów Mazowiecki. Materiał zebrany liczył ponad 3000 okazów, z czego połowa nadawała się do badań. Wyróżniono 14 gatunków z 7 rodzajów (*Pycnodonta*, *Aetostreon*, *Ceratostreon*, *Rhynchostreon*, *Gryphaeostrea*, *Ostrea*, *Lop-
na*).

Prace terenowe prowadzone były w 1970 roku. Zbadany wycinek profilu geologicznego obejmuje infrawalanżyn, walanżyn i dolny hoteryw, różniące się tak facjalnie jak i faunistycznie.

Infrawalanżyn wykształcony jest w postaci marglisto-ilastych oolitów żelazistych i piaszczystych glin. Zawiera on źle zachowaną faunę, pokruszoną, przesyconą tlenkami żelaza. Głównym składnikiem małżów ostrygowatych tych osadów są licznie występujące okazy gatunków: *Ceratostreon tuberculiferum* (Koch & Dunker, 1837), *Ostrea sanctae crucis* Pictet & Campiche, 1869, *Rhynchostreon etalloni* (Pictet & Campiche, 1870). Z najniższych warstw infrawalanżynu cytowany jest amonit *Neocomites* (Pruszkowski, 1962).

Walanżyn wykształcony jest w postaci ciemnoszarych, piaszczystych ilów z konkrecjami limonitowymi, oolitami żelazistymi, ułatkami drewna, z drobnymi kryształkami gipsu i w wyższych poziomach głównie w postaci plastycznych ilów i szarych łupków z konkrecjami syderytowymi. W dolnej części walanżynu występują liczne, pokruszone skorupki *Ostrea germaini* Coquand, 1869. W górnej również liczne skorupki m. innymi *Ceratostreon minos* (Coquand, 1869), *Aetostreon latissimum* (Lamarck, 1801) — największej ostrygi z neokomu Wąwału. Utwory walanżynu datowane są poziomami amonitowymi rodzajów: *Platylenticeras* w dolnej części oraz *Neocomites*, *Polyptychites*, *Hoplites*, *Saynoceras* — w części górnej.

Dolny hoteryw wykształcony w postaci stalowo-czarnych ilów przewarstwionych miejscami piaszczystymi łupkami zawiera z fauny ostrygowej nieliczne okazy *Aetostreon latissimum* (Lamarck, 1801). Charakterystycznym amonitem dla utworów dolnego hoterywu jest *Dichotomites bidichotomus* Leym.

W basenie sedymentacyjnym w Wąwale stwierdza się ścisłą zależność stanu zachowania fauny i różnic w morfologii skorupki od środowiska. Zbiornik wodny w Wąwale miał charakter płytkiego, niestabilnego zbiornika. W przegłębionych jego częściach żyły ostrygi o zredukowanej powierzchni przytwierdzenia muszli, zapewne leżąc na dnie. W płytszych jego częściach występują ostrygi o dużej powierzchni przytwierdzenia.

Fauna ostrygowa w Wąwale ma charakter kosmopolityczny z wyraźnymi wpływami zarówno basenu śródziemnomorskiego (*Aetostreon latissimum*, *Ceratostreon minos*, *Ostrea sanctae crucis*, *Lopha cotteau* i inne) jak i basenu niemieckiego (*Rhynchostreon tombeckianum*, *Gryphaeostrea* cf. *lateralis*, *Ceratostreon tuberculiferum*).

ГАЛИНА ПУГАЧЕВСКА

НЕОКОМСКИЕ УСТРИЦЫ ЦЕНТРАЛЬНОЙ ПОЛЬШИ

Резюме

В работе описаны устричные моллюски (*Gryphaea* и *Ostrea*) из неокомских отложений окрестностей с. Вонвал, в районе г. Томашув-Мазовецки. В собранном

материале насчитывалось свыше 3000 экземпляров, половина из которых была пригодна для исследований. Определено 14 видов причисленных до 7 родов (*Pseudonoda*, *Aetostreon*, *Ceratostreon*, *Rhynchostreon*, *Gryphaeostrea*, *Ostrea*, *Lopha*).

Полевые работы проводились в 1970 г. Изученный интервал геологического разреза охватывает инфраваланжин, валанжин и нижний готерив, которые отличаются друг от друга как фаціальным обликом, так и фаунистическим содержанием.

Инфраваланжин сложен мергелисто-глинистыми железистыми оолитами и суглинками, заключающими раздробленную фауну, сильно пропитанную скислами железа. Основным компонентом устричных в отложениях этого яруса являются многочисленные экземпляры видов: *Ceratostreon tuberculiferum* (Koch & Dunker, 1837), *Ostrea sanctae crucis* Pictet & Campiche, 1869, *Rhynchostreon etalloni* (Pictet & Campiche, 1870). В низах инфраваланжина был найден аммонит *Neocomites* (Прушковски, 1962).

Валанжин представлен темносерыми суглинками, содержащими лимонитовые конкреции, железистые оолиты, обломки древесины и мелкие кристаллики гипса, а в верхнем интервале преимущественно пластическими глинами и серыми сланцами с сидеритовыми конкрециями. В нижнем интервале валанжина наблюдаются многочисленные раздробленные створки *Ostrea germaini* Coquand, 1869, а в верхнем, также многочисленные, створки *Ceratostreon minos* (Coquand, 1869), *Aetostreon latissimum* (Lamarck, 1801) — самой крупной устрицы в неокме района с. Вонвал. Датировка валанжина основывается на аммонитовых зонах: *Platylenticeras* в нижнем интервале и *Neocomites*, *Polyptychites*, *Hoplites*, *Saynoceras* — в верхнем.

Нижний готерив сложен глинами серовато-черного цвета, переслоенными местами песчанистыми сланцами. Устричная фауна представлена здесь редкими экземплярами *Aetostreon latissimum* (Lamarck, 1801). Характерным аммонитом в отложениях нижнего готерива является *Dichotomites bidichotomus* Leym.

В местонахождении района с. Вонвал наблюдается четкая зависимость состояния сохранности и морфологических особенностей фауны от условий, господствовавших в бассейне. Бассейн в этом районе был мелководный, нестабильный. В более глубоких местах обитали устрицы с сокращенной поверхностью прикрепления раковины, вероятно лежащие на дне. В мелководных местах встречаются устрицы с крупной поверхностью прикрепления.

Устричная фауна местонахождения Вонвал имеет космополитический характер с явными признаками влияния как средиземноморского (*Aetostreon latissimum*, *Ceratostreon minos*, *Ostrea sanctae crucis*, *Lopha cotteaui* и др.), так и германского (*Rhynchostreon tombeckianum*, *Gryphaeostrea* cf. *lateralis*, *Ceratostreon tuberculiferum*) бассейнов.

EXPLANATION OF PLATES

All specimens represented in Plates VII—XVI become from Wąwał near Tomaszów Mazowiecki

Plate VII

Aetostreon latissimum (Lamarck)
(morfotyp III)

Figs 1 *a-d*. Shell viewed from: *a* right valve, *b* left valve, *c* posterior side, *d* anterior side, (ZPAL. Mo(VIII/11), $\times 1$).

Valanginian-Hauterivian

Plate VIII

Aetostreon latissimum (Lamarck)
(morfotyp I)

Figs 1—3, 5. Four left valves of different individual age in: *a* internal, *b* external views, (ZPAL. Mo(VIII) 5, 25, 26, 28).

Figs 4, 6—7. Three right valves of different individual age in: *a* internal, *b* external views, *c* the hinge viewed from dorsal side of right valve, (ZPAL. Mo(VIII/15, 18, 27). Figs 1—6 $\times 2.5$; Fig. 7 *a-b* $\times 1.5$; Fig. 7 *c* $\times 3$).

Valanginian-Hauterivian

Plate IX

Aetostreon latissimum (Lamarck)

Figs 1, 3. Two right valves of different individual age in: *a* external, *b* internal views, *c* hinge of right valve viewed from dorsal side of the valve, (ZPAL. Mo(VIII/22, 24),

Figs 2, 4. Two left valves of different individual age in: *a* internal *b* external views, (ZPAL. Mo(VIII/9, 23). Figs. 1, 4 $\times 1$; Figs. 2—3 $\times 2$).

Valanginian-Hauterivian

Plate X

Ceratostreon minos (Coquand)

Figs 1, 3—6. Five left valves of different individual age in: *a* internal, *b* external views, (ZPAL. Mo(VIII/39, 50, 52—54).

Fig. 2. Shell viewed from: *a* right valve, *b* left valve, (ZPAL. Mo(VIII/51).

Fig. 8. Right valve in: *a* internal, *b* external views, (ZPAL. Mo(VIII/48).

Aetostreon latissimum (Lamarck)

Fig. 7. Cross section of the keel of the left valve, (ZPAL Mo(VIII/55), $\times 1$. Figs 1—7 ca 3.5.

Valanginian-Hauterivian

Plate XI

Ceratostreon minos (Coquand)

Figs 1—14. Fourteen right valves of different individual age in: *a* internal, *b* external views, (ZPAL Mo/VIII/40, 41, 44, 45, 47, 57—65), \times ca 3.5.

Valanginian-Hauterivian

Plate XII

Rhynchostreon etalloni (Pictet & Campiche)

Figs 1, 3. Two right valves of different individual age in: *a* external, *b* internal views (ZPAL Mo/VIII/66, 69), \times ca 3.5.

Fig. 6. Left valve in: *a* external, *b* internal views (ZPAL Mo/VIII/77),

Ceratostreon tuberculiferum (Koch & Dunker)

Figs 2, 5, 7. Three right valves of different individual age in: *a* external, *b* internal views, (ZPAL Mo/VIII/90, 92, 95).

Fig. 4. Shell viewed from: *a* right valve, *b* left valve, (ZPAL Mo/VIII/96).

Fig. 8. Left valve in: *a* external, *b* internal view (ZPAL Mo/VIII/83), Figs 2, 4—8 \times 3.

Infravalanginian

Plate XIII

Rhynchostreon tombeckianum (d'Orbigny)

Figs 1—4. Four right valves in: *a* external, *b* internal views, (ZPAL Mo/VIII/98—99, 101—102), \times ca 2.

Gryphaeostrea arduennensis (d'Orbigny)

Figs 5—6. Two right valves in: *a* external, *b* internal views, (ZPAL Mo/VIII/117—118), \times 3.

Gryphaeostrea cf. *lateralis* (Nilsson)

Figs 7, 9—11. Four right valves of different individual age in: *a* external, *b* internal views (ZPAL Mo/VIII/113, 115, 119—120), \times 3.

Fig. 8. Left valve in external view (ZPAL Mo/VIII/21, \times 4).

Valanginian-Hauterivian

Plate XIV

Ostrea germaini Coquand

Figs 1—7, 9. Eight right valves of different individual age in: *a* internal, *b* external views (ZPAL Mo/VIII/122—129).

Fig. 8. Left valve in: *a* external, *b* internal views (ZPAL Mo/VIII/131).

Ostrea sanctae crucis Pictet & Campiche

Fig. 10. Right valve of adult specimen: *a* internal, *b* external views (ZPAL Mo/VIII/132).

Fig. 11. Left valve of adult specimen: *a* internal, *b* external views, (ZPAL Mo/VIII/133), Figs 1—3, 5—6 \times 1.5; all others Figs nat. size.

Ostrea germaini — Valanginian; *O. sanctae crucis* — Infravalanginian-Hauterivian.

Plate XV

- Fig. 1. *Pycnodonte* sp.: *a* internal, *b* external views of the left valve, *c* vesicular structure of the dorsal valve margin is visible, (ZPAL Mo/VIII/1), Hauterivian, *a* \times 5, *b* \times 4, *c* \times 7.
- Fig. 2. *Lopha* cf. *cotteaui* (Coquand). Fragment of the left valve, (ZPAL Mo/VIII/134), Valanginian-Hauterivian, \times 3.
- Fig. 3. *Aetostreon neocomiensis* (d'Orbigny): *a* internal, *b* external views, (ZPAL Mo/VIII/135), Valanginian, \times 1.
- Fig. 4. *Lopha* cf. *eos* (Coquand). Fragment of the left valve in external view, (ZPAL Mo/VIII/136), Valanginian-Hauterivian, \times 4.
- Fig. 5. The same species. Fragment of the right valve in external view, (ZPAL Mo/VIII/137), \times 3.

Plate XVI

Rhynchostreon sp.

- Figs 1, 5. Two left valves of different individual age in: *a* internal, *b* external views (ZPAL Mo/VIII/109—110), \times 3.
- Figs 2—4. Three right valves of different individual age in: *a* internal, *b* external views (ZPAL Mo/VIII/103, 105—106), \times 3.

Ceratostreon minus (Coquand)

- Fig. 6. Prodissoconch of the left valve, (ZPAL. Mo/VIII/138), *a* \times 150, *b* \times 24, *c* \times 70, *d* \times 500.

Valanginian-Hauterivian

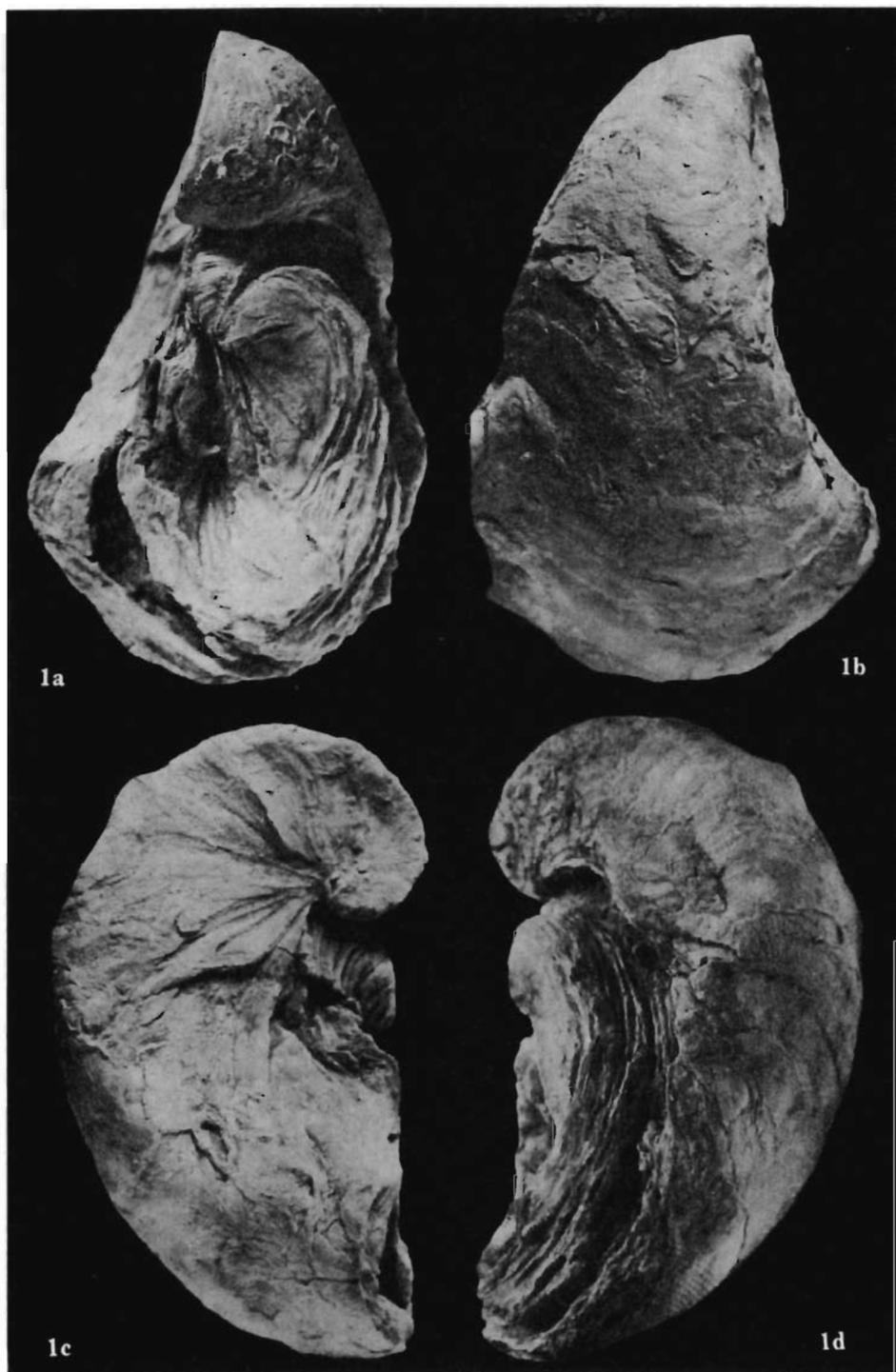


Photo: M. Czarnocka

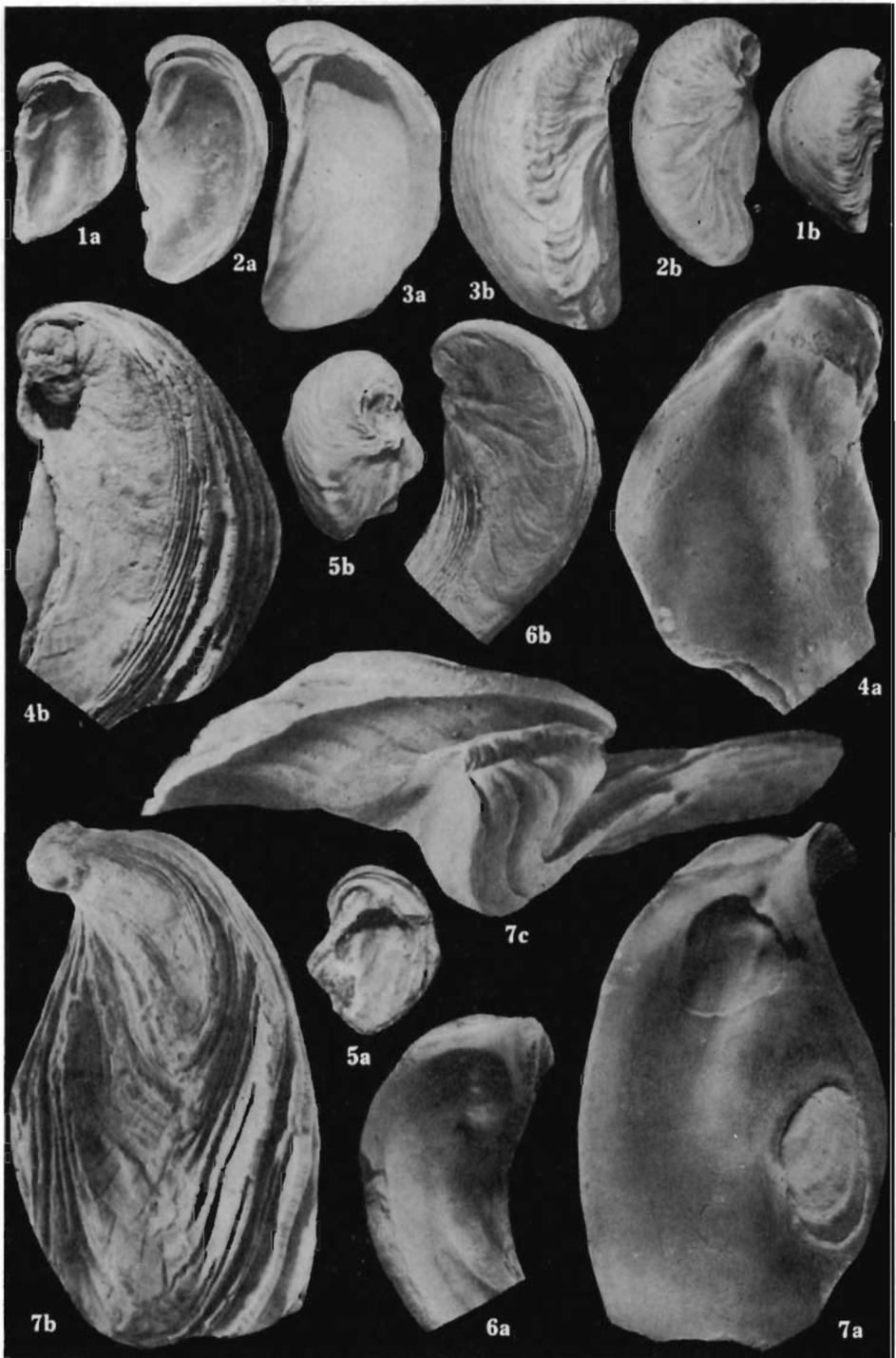


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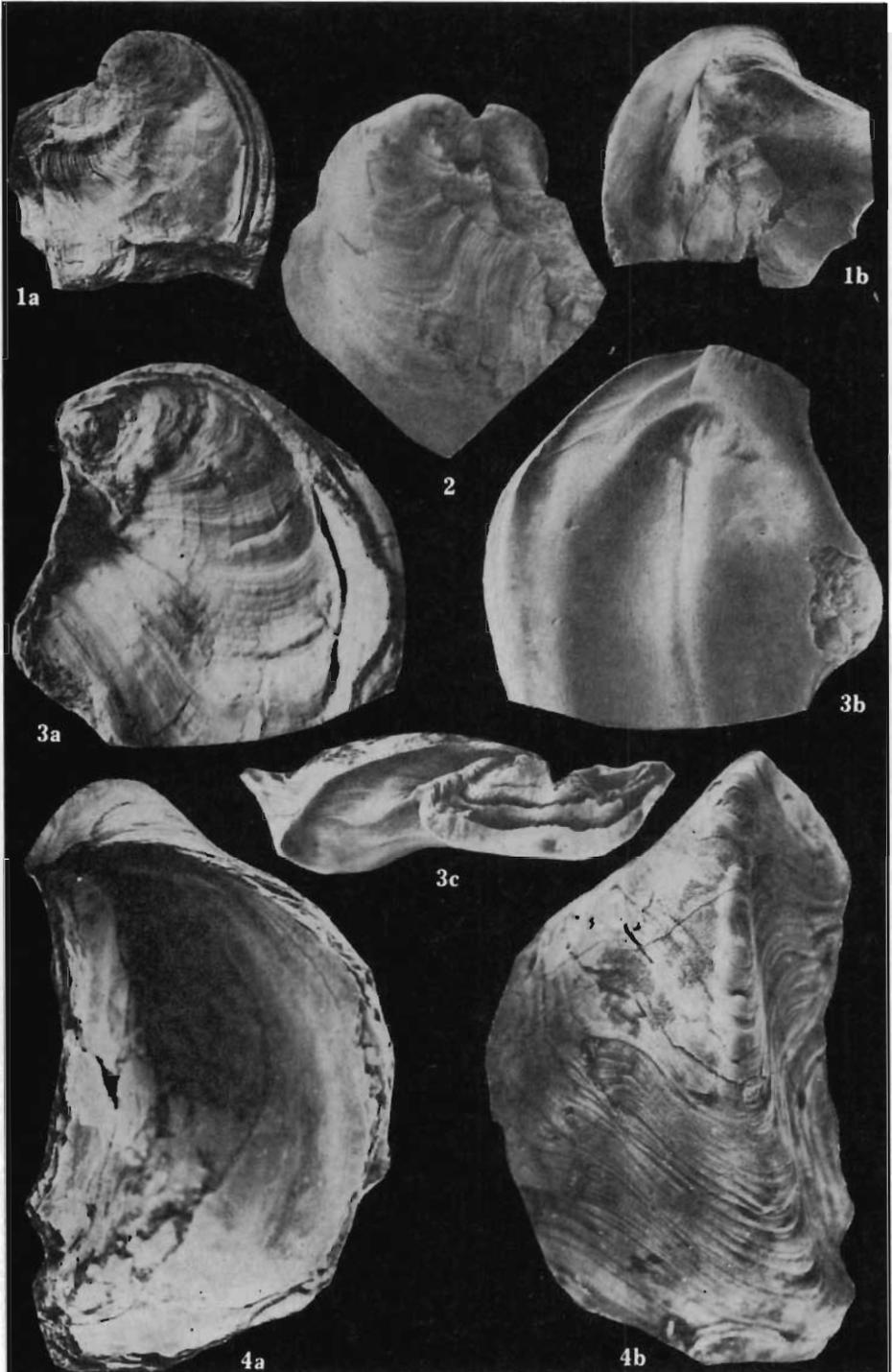


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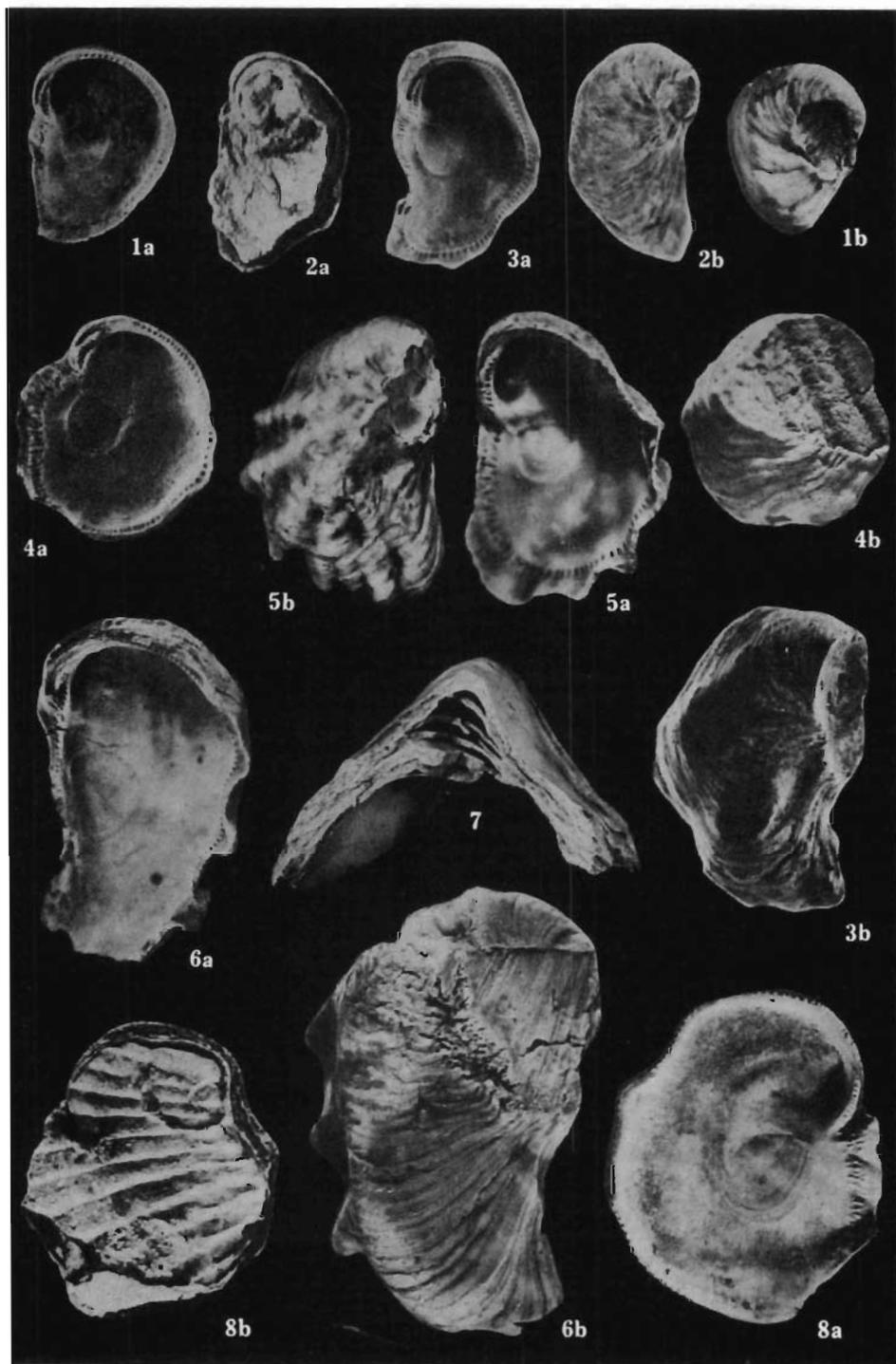


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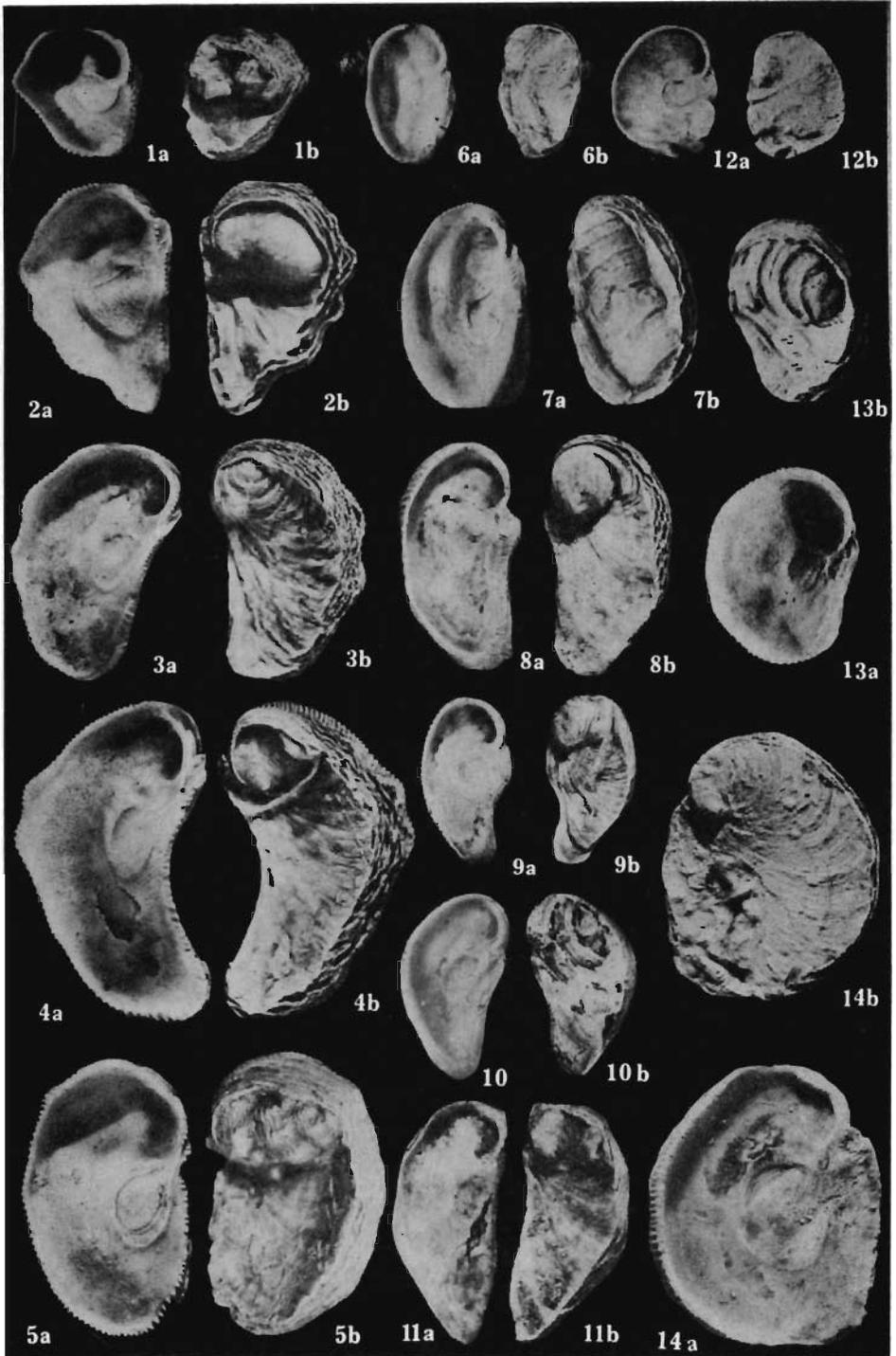


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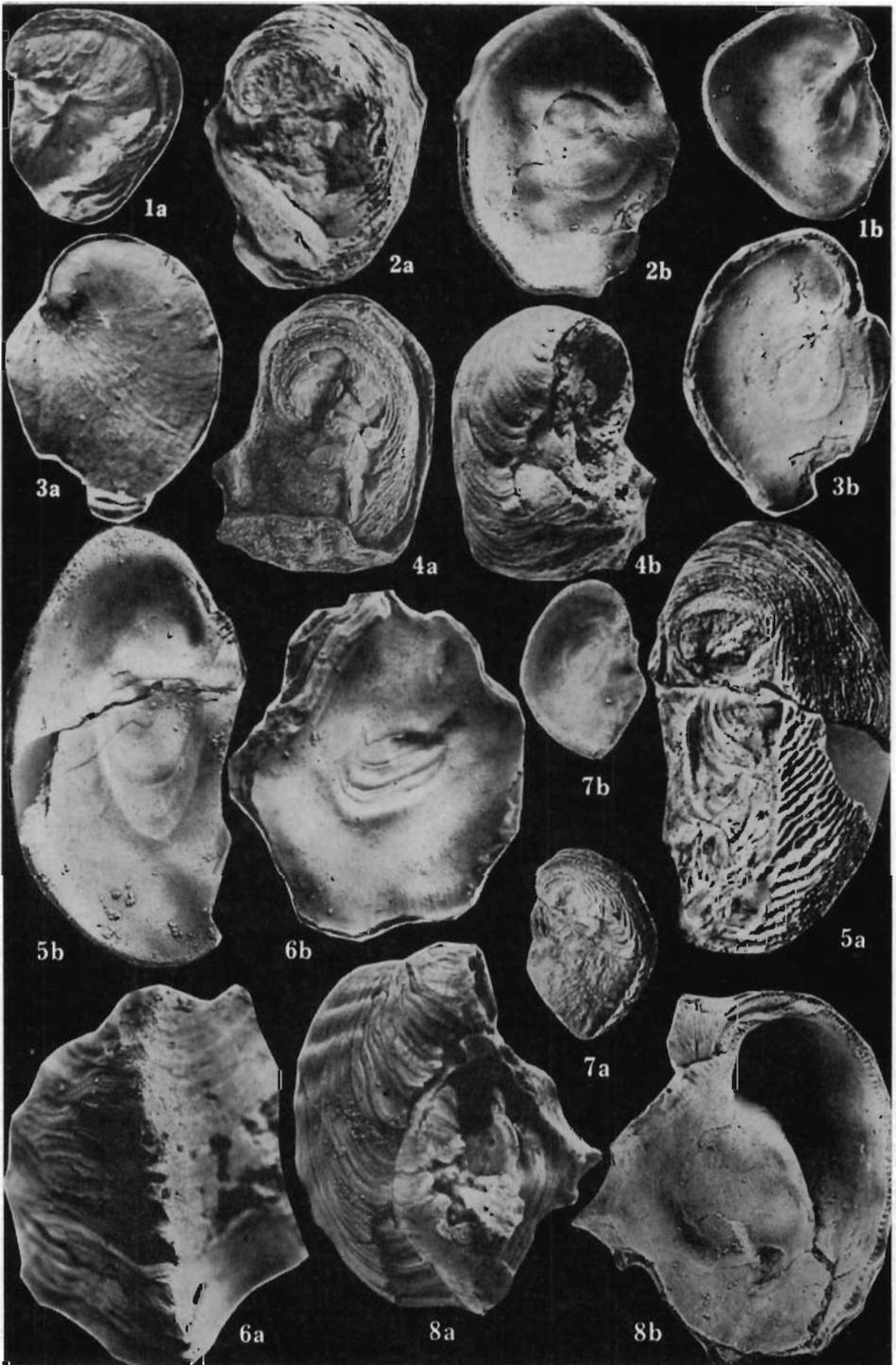


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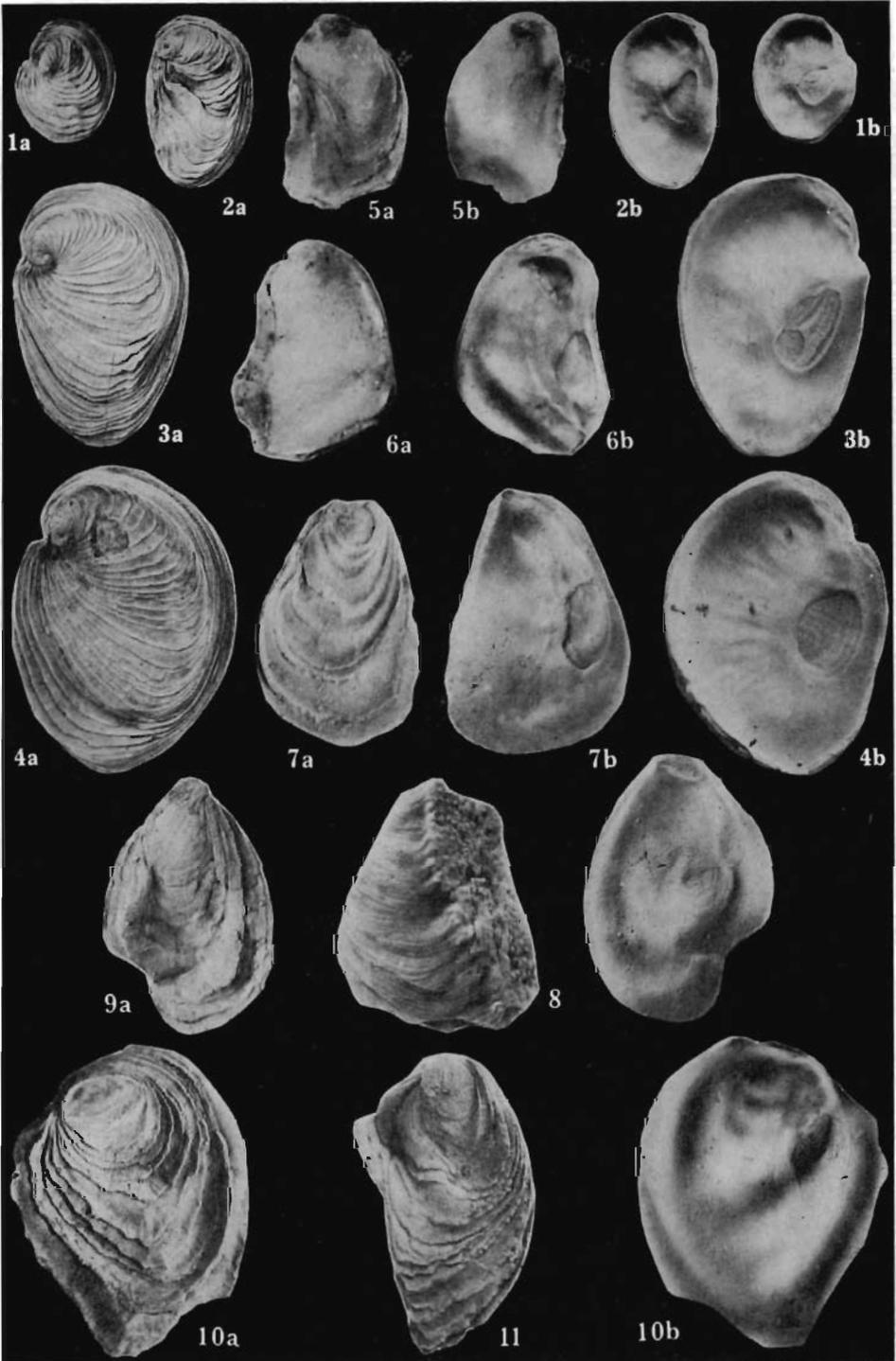


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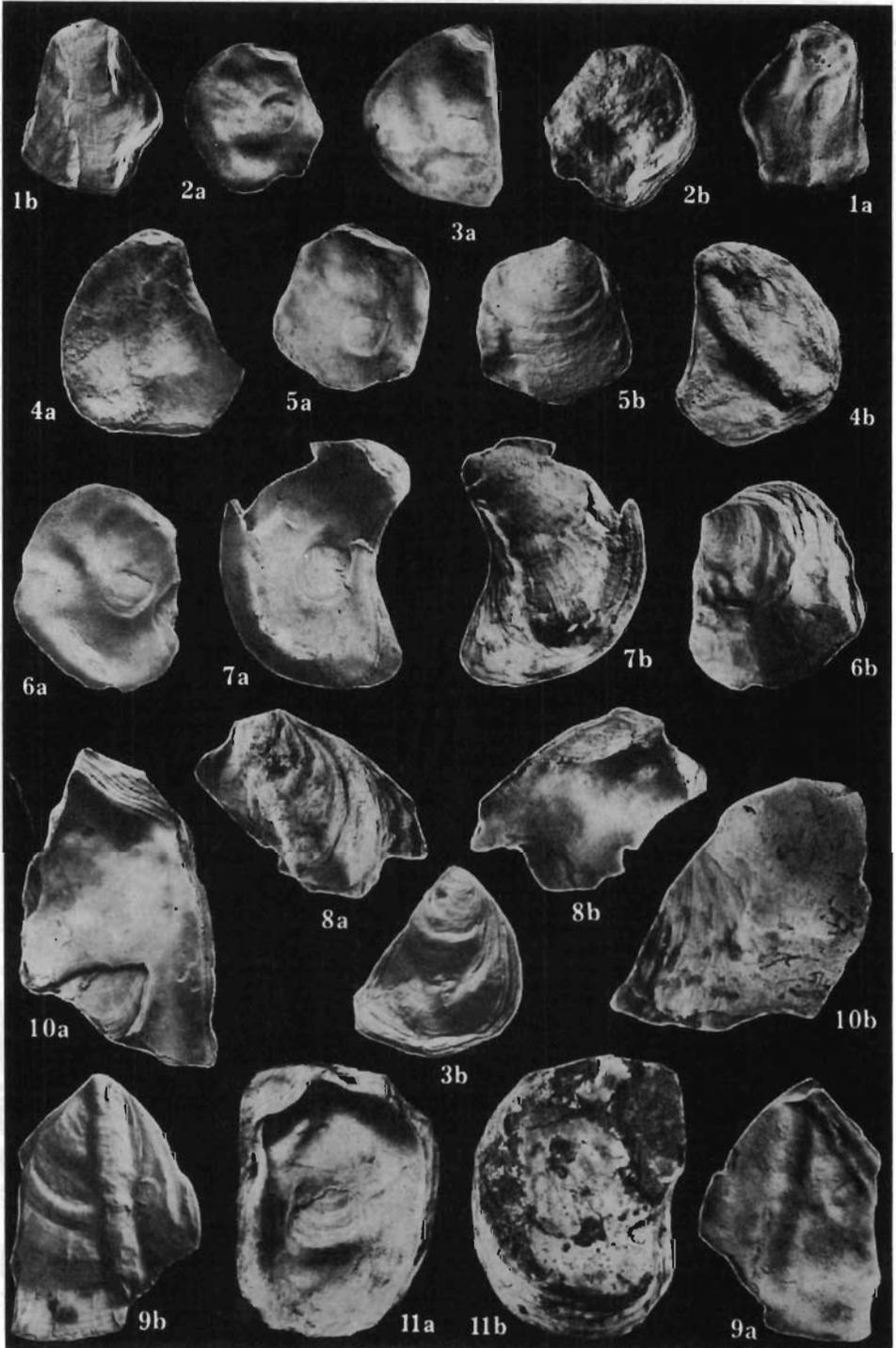


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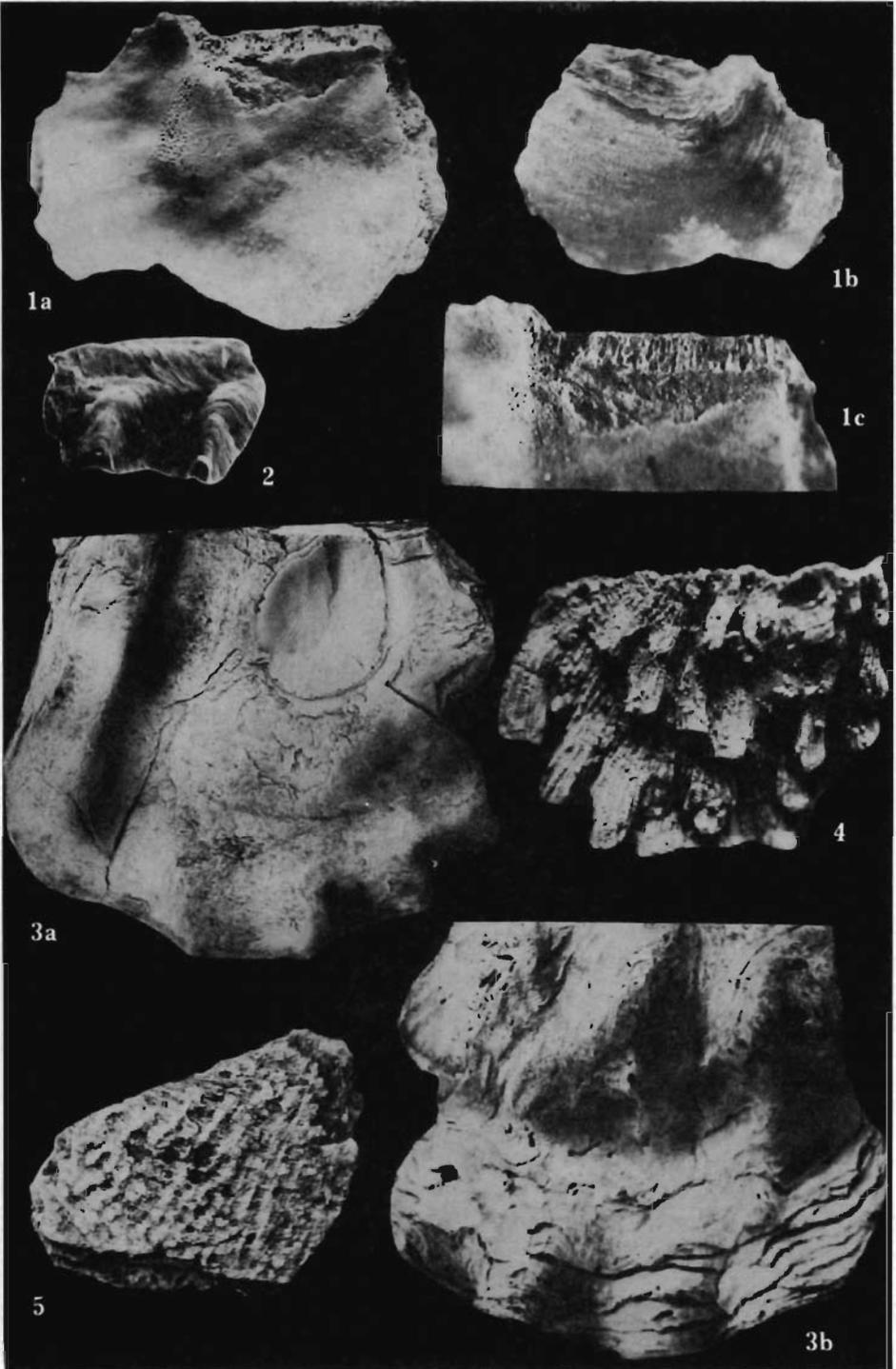


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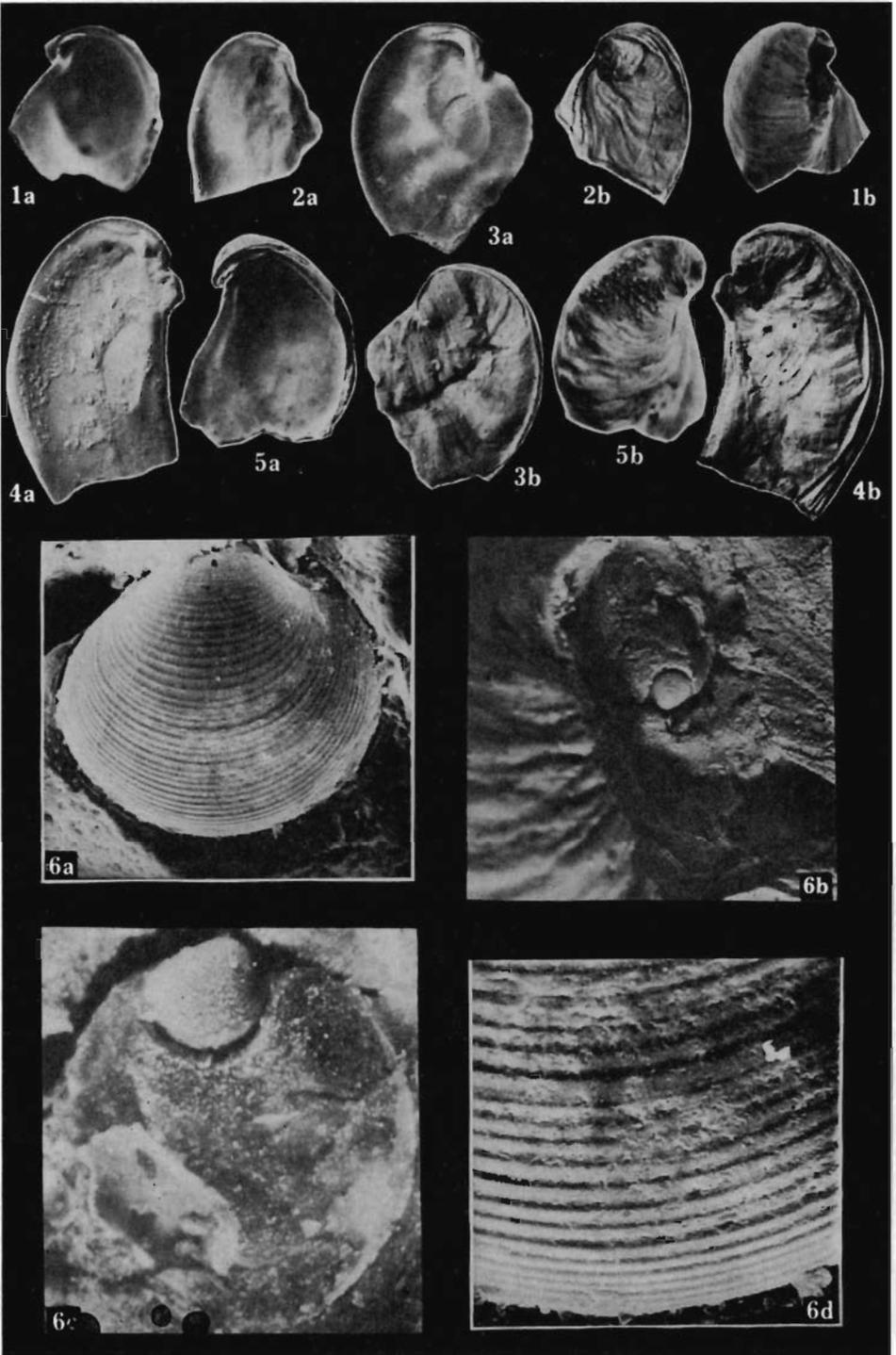


Photo: M. Czarnocka