

# TERTIARY BIVALVIA FROM LIBYA

by L. R. COX

ABSTRACT. The paper supplements existing accounts of the Tertiary mollusca of Libya, which are mostly by Italian authors, by describing several species, either new, newly recorded from this area, or imperfectly known previously. The species in question, which belong to the families Ostreidae, Vulsellidae, and Anomiidae, are as follows: *Ostrea syrtica* sp. nov. (Oligocene); *Ostrea (Platygena) asiatica* Romanovsky (Eocene; a Central Asian species now recorded from North Africa for the first time); *Euphenax variolosa* (Oppenheim) (Eocene; transferred from *Plicatula* and previous descriptions supplemented); *Anomia desioi* sp. nov. (Eocene); *Carolia libyca* sp. nov. (Eocene); *Placenta (Indoplacuna) africana* sp. nov. (Miocene).

LOWER Tertiary mollusca from Libya have been the subject of papers by Newton (1911), Stefanini (1921), Desio (1934a, 1939), Negri (1934a, 1934b), Agnesotti (1939), Alberici (1939), Rossi (1942a, 1942b, 1944), and Tavani (1946). Neogene mollusca from the same area have been described by Blanckenhorn (1901), Newton (1911), Migliorini (1920), Stefanini (1921), Desio (1927, 1929, 1933, 1934b), Chiesa (1934), Tavani (1935, 1938-9, 1948), Alberici and Mauroner (1938), and Rossi (1940, 1944). The most comprehensive account of the stratigraphy of the Tertiary rocks of Libya is that given by Desio (1935, pp. 239-355). The faunas are closely related to those of the contemporaneous rocks of Egypt, but include a few species not yet recorded from that country.

The present paper describes four new species (two Eocene, one Oligocene, one Miocene) belonging to the Ostreidae and Anomiidae, places on record the occurrence in Libya of a remarkable oyster, *Ostrea (Platygena) asiatica* Romanovsky, previously known only from the Upper Eocene of Central Asia, and redescribes the Eocene bivalve '*Plicatula*' *variolosa* Oppenheim, which, it is shown, should be included in the genus *Euphenax* (family Vulsellidae), founded in 1931 by the present writer.

The fossils described were collected by geologists of the Bataafse Internationale Petroleum Maatschappij N.V., and the writer is indebted to the authorities of that Company for permission to publish this paper. Most of the specimens have been generously presented by the Company to the Department of Palaeontology of the British Museum (Natural History), and the numbers quoted in connexion with them are their departmental registration numbers.

## SYSTEMATIC DESCRIPTIONS

### Family OSTREIDAE

#### Genus OSTREA Linnaeus 1758

#### *Ostrea syrtica*, sp. nov.

Plates 1, 2

*Material examined.* Twelve specimens. The holotype (Pl. 1, figs. 1a-c) bears the registration number LL 12806, the figured paratypes the numbers LL 12807-10.

*Description.* Of large-medium size, largest specimens about 90 mm. high, suborbicular, ovate or sublunate, strongly inequivalve.

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Left valve thick-shelled, of moderate to considerable depth, very irregular in some specimens, with a large attachment area which in some specimens is almost as large as the interior of the valve, although it is usually smaller; from this attachment area the sides of the shell rise steeply to the valve margins. Surface conspicuously lamellose and with numerous weak, narrow radial riblets. Ligamental area strongly curved in a posterior direction, in some specimens as much as in an *Exogyra*. Adductor scar deep. Margin bordered internally along its entire length by irregularly arranged pits elongated transversely to it.

Right valve moderately thick, flat to feebly convex, with its ligamental area curved in a posterior direction to a varying extent and in extreme cases coiled as in *Exogyra*. Adductor scar deep. Margin bordered internally by conspicuous, irregularly arranged denticulations elongated transversely to it, evidently fitting in the corresponding pits of the other valve. Surface unornamented except for growth-rugae.

*Remarks.* This species appears to be related to the well-known Oligocene species *Ostrea cyathula* Lamarck, illustrations and a full description of which are given by Cossmann (1922, p. 200, pl. 11, figs. 40–45; pl. 12, figs. 5, 6). In both species the left valve is strongly convex, has a large attachment area and an umbo more or less curved in a posterior direction, and is ornamented with weak radial riblets; in both the right valve is flat or feebly convex and has its umbo curved in a similar manner, so that some specimens are lunate in shape. The species now described differs from *O. cyathula* in its much larger size, as in that species the height of the shell seldom exceeds 50 mm. and is usually much less. The internal marginal denticulations are much stronger in the new species and not confined to the dorsal parts of the margins, as in *O. cyathula*.

*Occurrence.* Oligocene, Dor El Muelah (29° 42' N., 17° 10' E.), and track from Nofilia to Dahra (30° 15' N., 17° 50' E.), north of El Gifa, Libya (type locality).

Subgenus PLATYGENA Romanovsky 1882  
*Ostrea (Platygena) asiatica* Romanovsky

Plate 3

1879 *Ostrea asiatica* Romanovsky, p. 150, text-figs. 1a–c.  
1882 *Platygena asiatica* Romanovsky, p. 59, pls. 6–8.

EXPLANATION OF PLATE 1

Figs. 1–3. *Ostrea syrtica* sp. nov.; Oligocene, track from Nofilia to Dahra, north of El Gifa. (All figures are of natural size.) 1a, b, c, Holotype (LL 12806), a left valve: a, exterior, showing attachment area; b, exterior, side view showing inflation; c, interior. 2a, b, Paratype (LL 12807), a left valve: a, exterior, showing large attachment area at top of figure; b, interior. 3, Paratype (LL 12809), a right valve. (See also Plate 2, fig. 1.)

EXPLANATION OF PLATE 2

Figs. 1–3. *Ostrea syrtica* sp. nov. (All figures are of natural size.) 1, Paratype (LL 12809), a right valve; interior. (See also Plate 1, fig. 3.) Oligocene, track from Nofilia to Dahra, north of El Gifa. 2a, b, Paratype (LL 12810), consisting of a right valve (fig. b) to the surface of which a left valve (fig. a) is cemented, so that the interiors of both valves are exposed. The left valve shows well the posteriorly coiled ligamental area, suggestive of the genus *Exogyra*. Oligocene, Dor El Muelah. 3a, b, Paratype (LL 12808), a right valve: a, exterior, showing *Exogyra*-like coiling; b, interior. Oligocene, track from Nofilia to Dahra.

1884 *Platygena asiatica* Romanovsky, p. 77.

1937 *Ostrea (Platygena) asiatica* Romanovsky, Vyalov, p. 29, pls. 22-25.

*Material examined.* About seven specimens. The one now illustrated bears the registration number LL 12812.

*Description.* The specimens show well the characteristics of this well-defined species, namely, its large size (they are 150 mm. or more in diameter), its circular outline, the flatness of its valves, and the peculiar pyriform shape of the visceral cavity. Above the middle of the height of the shell the anterior and posterior margins of this cavity converge rapidly and almost symmetrically, and then curve round so as to become almost parallel as they approach the lower margin of the ligamental area. The dorsal part of the visceral cavity thus forms a relatively narrow neck which is bordered above by the margin of the extended, almost parallel-sided ligamental area. The reniform adductor scar lies below the base of this neck. On either side of the neck of the visceral cavity and the ligamental area the successive layers of the shell project more and more so that the outline of the outermost layer conforms with the circular shape of the valve as a whole. The specimens which are left valves are fairly thick and have a foliaceous surface on which there are traces of radial ribbing. The ribs are broader and not so well defined as in the figures of Romanovsky, but in view of the very close agreement which the Libyan specimens otherwise display with those from Turkestan it seems probable that this difference is merely due to local variation.

*Occurrence.* Wadi Negaai (26° 50' N., 16° 25' E.), 120 km. south of El Fog'ana, Libya. This is the first record of the species from outside Central Asia, where it is the most characteristic oyster of the Rishtan stage of the Palaeogene, now considered to be of Upper Eocene (Bartonian) age (Vyalov 1947, p. 133). It is presumed that the beds in Libya in which it occurs are of the same age.

Family VULSELLIDAE

Genus EUPHENAX Cox 1931

*Euphenax variolosa* (Oppenheim)

Plate 4, figs. 1-3

1903 *Plicatula Schweinfurthi* Oppenheim, p. 61, pl. 7, figs. 17, 17a.

1903 *Plicatula variolosa* Oppenheim, p. 62, pl. 7, figs. 18, 18a.

1934 *Plicatula Schweinfurthi* Oppenheim, Desio, p. 16.

1942 *Plicatula variolosa* Oppenheim, Rossi, p. 158, pl. 8, figs. 7a-c.

*Material examined.* Nine specimens. Those now illustrated bear the registration numbers LL 12814-16.

*Remarks.* With the material now available from Libya it is possible to supplement existing information on this interesting species, which was originally described from the Eocene of Egypt and proves to belong to the genus *Euphenax* Cox. Rossi, the first author to decide that *Plicatula schweinfurthi* and *P. variolosa* are synonymous, chose the second name for the species and her choice must be accepted.

*Description.* The two valves of the shell are equally and strongly convex and the umbo of each is strongly curved in a direction which is assumed, by analogy with oysters, to be posterior. Unfortunately, the position of the adductor scar cannot be located, as the

innermost layer of the shell has partly flaked away in the available specimens. The umbonal region is slightly flattened or excavated in specimens which would be left valves on this assumption, but no unmistakable attachment area can be seen and the shell, unlike *Plicatula* and *Ostrea*, may not have grown cemented to other objects. The ligamental area of each valve is very similar to that of *Ostrea* and hinge-teeth are absent.

As in *Euphenax jamaicensis* (Trechmann), the type species of the genus, the wall of the shell consists of a cellular outer layer, formed of radially aligned cells, and a more compact middle layer. In the present species narrow radial ribs separate the rows of cells of the outer layer, while the surface of the middle layer, from which most or all of the outer layer has broken away in the specimens studied, bears narrow, rounded radial ribs, which increase by bifurcation, and irregular concentric rugae. In Oppenheim's type specimen of *Plicatula schweinfurthi* the outer layer seems to have disappeared, exposing the surface of the middle layer, on which the radial ribbing is less pronounced than in the specimens from Libya. The type specimen of *Plicatula variolosa*, however, apparently retained the outer layer. Like *E. jamaicensis*, *E. variolosa* appears to have had a number of thin-walled chambers on the inner side of the wall of the shell, so that the actual inner surface of each valve, at least in the more dorsal region, belonged to a fragile partition.

The specimens now described display a feature not found in *E. jamaicensis* or noted previously in *E. variolosa*. Under the beak in both valves is a depression resembling a lunule (except in its presumed posterior position). A deep, irregularly curved groove or slit originates at the base of this depression and runs down the interior of the valve, its length and position varying in different specimens. It does not penetrate to the outer surface of the middle layer of the shell wall except in the depression mentioned, as nowhere else is it visible from the exterior of the shell even where the outer layer has disappeared. This groove seems to be of the same nature as the marginal indentations found in *Eligmus* and other Vulsellidae, although it occupies a different position. All the specimens have numerous small perforations due to boring sponges.

*Occurrence.* Wadi Abu Naim (29° 05' N., 18° 28' E.), Central Sirtica, Libya. In Egypt

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EXPLANATION OF PLATE 3

*Ostrea (Platygena) asiatica* Romanovsky. Left valve (LL 12812), exterior and interior ( $\times 0.67$ ). Eocene, Wadi Negaai, 120 km. south of El Fog'ana.

EXPLANATION OF PLATE 4

Figs. 1-3. *Euphenax variolosa* (Oppenheim); Eocene, Wadi Abu Naim, central Sirtica. 1a, b, Left valve (LL 12814): a, exterior; b, interior (both  $\times 1$ ). 2a, b, Left valve (LL 12815): a, exterior; b, interior, showing groove (both  $\times 1$ ). 3a, b, Right valve (LL 12816): a, interior, showing groove; b, exterior (both  $\times 1$ ).

Figs. 4-6. *Carolia libyca* sp. nov.; Eocene, Garet Rag'uba. 4a, b, Holotype (LL 12825), a right valve: a, exterior, showing small opening of byssal foramen; b, interior, showing last-like chondrophore apophysis (both  $\times 1$ ). 5a, b, Paratype (LL 12827), a right valve: a, exterior, earlier growth stages, showing foramen and surface ornament ( $\times 3$ ); b, interior, showing chondrophore apophysis ( $\times 1$ ). 6a, b, Paratype (LL 12828), a left valve: a, exterior; b, interior, showing chondrophore ridges (both  $\times 1$ ).

Figs. 7-9. *Anomia desioi* sp. nov.; Eocene, Dor El Chraib. 7, Paratype (LL 12821), a right valve ( $\times 1$ ). 8a, b, Holotype (LL 12820), a right valve: a,  $\times 1$ ; b, enlarged ( $\times 2.1$ ), showing ornament. 9a, b, Paratype (LL 12818), a right valve: a, interior; b, exterior (both  $\times 1$ ).

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this species occurs in the Lower Mokattam Stage (Lutetian), and it is assumed that the beds in Libya in which it occurs are of the same age.

Family ANOMIIDAE  
Genus ANOMIA Linnaeus 1758  
*Anomia desioi* sp. nov.

Plate 4, figs. 7-9

*Material examined.* Twenty-five specimens. The holotype (figs. 8a, b) bears the registration number LL 12820, the figured paratypes the numbers LL 12818, 12821.

*Description.* Trigonally ovate, with the height slightly exceeding the length, of small-medium size for the genus, height of largest specimen *c.* 24 mm.; subequivalve, both valves of moderately strong but somewhat variable convexity. Surface of shell bearing growth imbrications at irregular intervals and a delicate pattern of weak, irregular, sinuous radial riblets which are relatively broad for a species of *Anomia*.

*Remarks.* Desio (1934, p. 18, pl. 12, fig. 8) has recorded from Libya the widespread European Middle Eocene species *Anomia tenuistriata* Deshayes, together with a second form which he describes (p. 18, pl. 12, fig. 9) as a new variety *libyca* of *A. tenuistriata*. In the shells now described the radial riblets are very much broader than in typical Paris Basin specimens of *A. tenuistriata* (in which they would be more correctly described as fine threads), and they are also more sinuous. The nature of their ornament similarly distinguishes them from Desio's var. *libyca*, which resembles them in size and shape. No species of *Anomia* is described in Oppenheim's (1903-6) monograph on the Eocene mollusca of Egypt.

*Occurrence.* Dor El Chraib (29° 48' N., 17° 22' E.), Libya. Associated species suggest that the specimens are Upper Eocene in age.

Genus CAROLIA Cantraine, 1838  
*Carolia libyca* sp. nov.

Plate 4, figs. 4-6

1934 *Carolia placunoides* Cantraine, Desio, p. 19, pl. 8, figs. 2a, b (*non* Cantraine).

*Material examined.* About twenty-five specimens. The holotype (figs. 4a, b) bears the registration number LL 12825, the figured paratypes the numbers LL 12827, 12828.

*Description.* Small for the genus, most specimens about 45-50 mm. in diameter, orbicular, left valve feebly convex, right valve flat in earlier growth stages, later feebly convex; valve margins plane or slightly plicated. Both valves thick in proportion to their size and with a concentrically lamellose surface bearing very fine, discontinuous, slightly sinuous radial threads. Right valve with a foramen of varying size which is open to the interior of the shell, where its margins project prominently, forming a short tube in some specimens; the foramen is closed or reduced to a very small orifice externally. Chondrophore apophysis relatively heavy, last-like in some specimens and extending across a visible foramen groove from its posterior side, mushroom-shaped in others, with the foramen groove obliterated by shelly matter. Left valve with a pair of

thin, broadly divergent chondrophore ridges, each very close to the adjacent shell margin. Adductor scars deep, circular.

*Remarks.* The shells upon which this new species has been founded have been compared with a considerable series of specimens of the well-known Egyptian Eocene species *Carolia placunoides* Cantraine, and show several points of difference which justify their recognition as a distinct species. The shell is very much smaller, the usual diameter of specimens of *C. placunoides* being about 90 mm. At the same time, it is relatively much thicker and less fragile, the thickness of the wall of the right valve, which appears to exceed that of the left, being as much as 6 mm. in some specimens. Whereas, moreover, the right valve of *C. placunoides* remains flat even in late stages of growth, in the new species this valve becomes very distinctly convex when full-grown. The chondrophore apophysis is relatively stouter in the new species than in *C. placunoides*.

The specimens from Libya figured under the name *C. placunoides* by Desio (as cited above) seem to belong to this new species.

*Occurrence.* Garet Rag'uba (29° 30' N., 17° 30' E.—type locality) and Wadi Zenad (30° 16' N., 17° 30' E.), north of Umm Meeser, Libya. The age of the specimens is thought to be Upper Lutetian or Bartonian.

Genus PLACENTA Retzius 1788  
Subgenus INDOPLACUNA Vredenburg 1924  
*Placenta (Indoplacuna) africana* sp. nov.

Plate 5

*Material examined.* Eight specimens. The holotype (figs. 3*a*, *b*) bears the registration number LL 12832; the figured paratypes include the numbers LL 12833–4.

*Description.* Rather small for the genus, largest specimen (now broken) originally about 65 mm. high, quadrately suborbicular. Valves almost flat, very thin and fragile. Dorsal margins almost straight apart from the feebly projecting umbonal region, and forming well-marked, very slightly obtuse angles with the anterior and posterior margins; ventral margin semicircular. Surface ornamented with very fine, slightly sinuous, mostly continuous radial threads, those on the anterior and posterior parts of the shell curving outwards towards the margins. Right valve with the chondrophore ridges and shelly matter occupying the space between them forming a structure recalling an arrow-head with slightly concave sides; foramen obliterated. Left valve with a pair of very thin chondrophore ridges which are widely divergent, meeting in an angle of 130° or more. Adductor scars superficial.

EXPLANATION OF PLATE 5

Figs. 1–5. *Placenta (Indoplacuna) africana* sp. nov.; Miocene, south of Dor Zaggut. 1, Paratype (LL 12833), a left valve broken away posteriorly, but showing the well-marked, shoulder-like anterodorsal angle ( $\times 1$ ). 2, Paratype (B.P.M. Coll. no. M 373 (B)); surface ornament ( $\times 3$ ). 3*a*, *b*, Holotype (LL 12832), a left valve: *a*, interior, showing widely divergent chondrophore ridges; *b*, exterior (both  $\times 1$ ). 4, Paratype (B.P.M. Coll. no. M 373 (D)), a left valve: interior ( $\times 1$ ). 5*a*, *b*, Paratype (LL 12834), a right valve: *a*, interior, showing shelly infilling of space between chondrophore ridges; *b*, exterior (both  $\times 1$ ).

*Remarks.* Desio (1929, p. 257) and Stefanini (1929, p. 9) have recorded a species from the Miocene of Libya which they have identified as '*Placuna*' [now *Placenta*] *miocenica* Fuchs (1883, p. 44, pl. 13, figs. 1-4), the type specimens of which came from the Siwa oasis, in western Egypt. No specimens, however, have been figured by either author, and I cannot say if their records refer to the form now described. This species is particularly characterized by the thinness and wide angle of divergence of the chondrophore ridges of its left valve, these ridges being almost at right angles to one another in *P. miocenica*. The threads ornamenting the surface of the shell are, moreover, much finer than in *P. miocenica*, and its dorsal margins form better defined angles with the anterior and posterior margins. *P. miocenica* attains a considerably larger size than any of the specimens upon which the new species has been founded.

*P. miocenica* and *P. africana* both belong to the subgenus *Indoplacuna* Vredenburg (1924, p. 117), characterized by the partial or almost complete infilling of the angle between the chondrophore ridges of the right valve by a mass of shelly material. The subgenus is now known from the Oligocene (?) and Lower Miocene of Burma, the Lower Miocene (Gaj Beds) of Sind, the Miocene of Oman, Arabia (unrecorded specimens in the British Museum (Natural History)), and the Miocene of western Egypt and Libya. The absence of both *Placenta* s. str. and *Indoplacuna* from the Miocene of Europe is noteworthy.

*Occurrence.* Miocene, south of Dor Zaggut (28° 55' N., 19° 48' E.), Libya.

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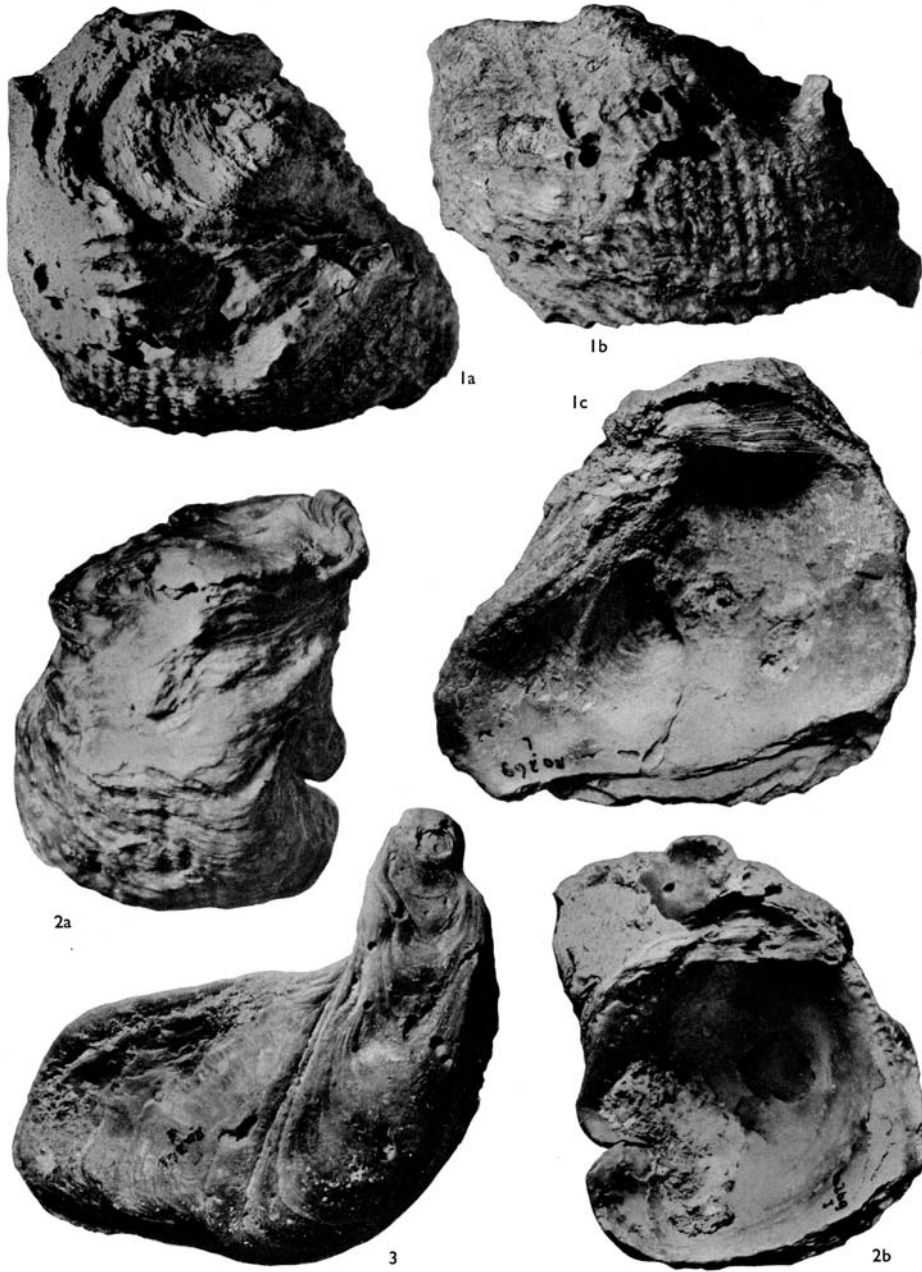


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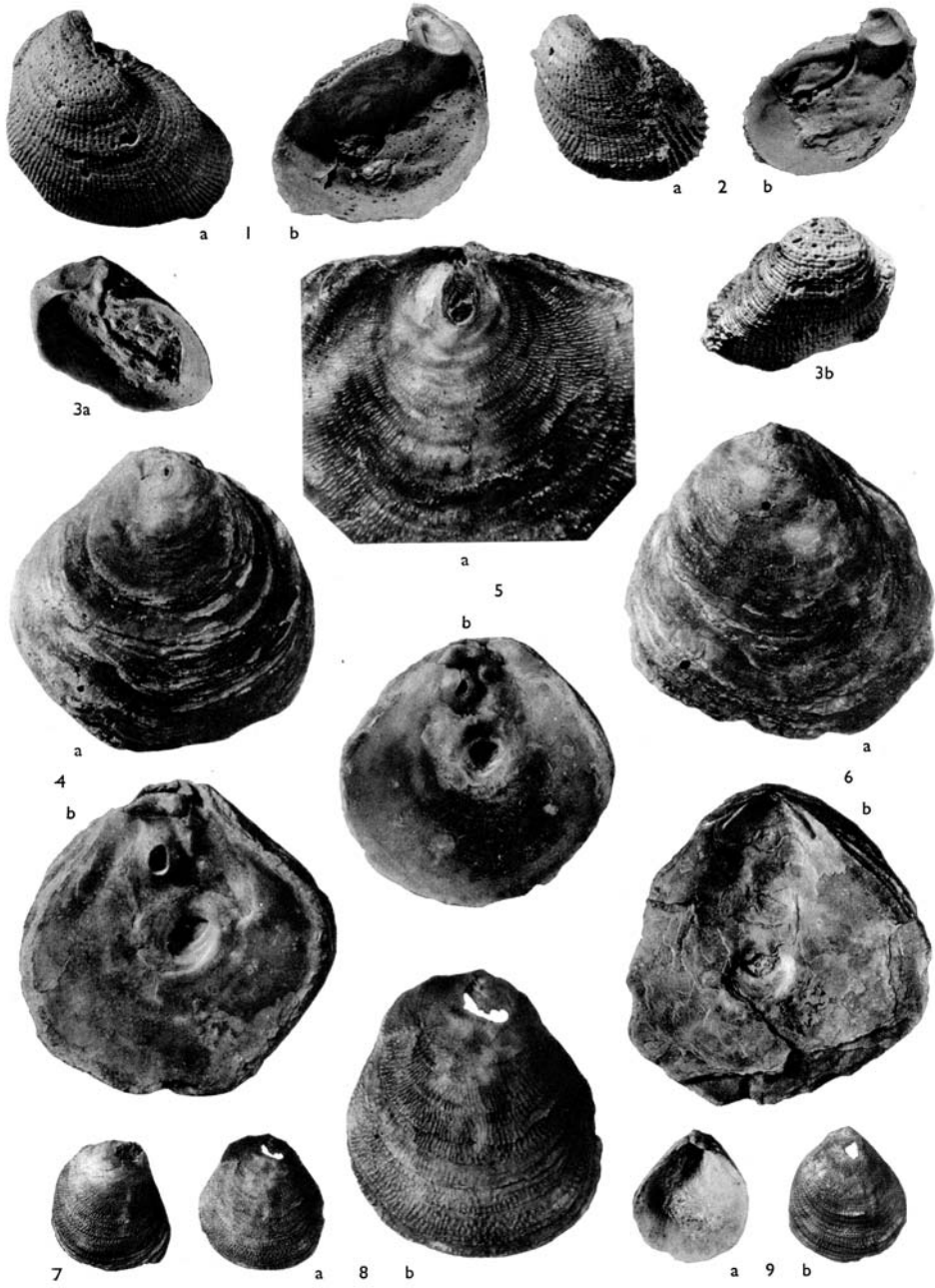
COX, Oligocene Bivalvia



COX, Oligocene Bivalvia



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COX, Eocene Bivalvia



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a

3



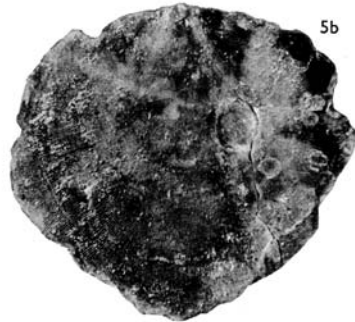
b



4



5a



5b

COX, Miocene Bivalvia