THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

LONDON:

MDCCCCIV—MDCCCCXIII.

MONOGRAPH OF THE CRETACEOUS LAMELLIBRANCHIA OF ENGLAND.

VOL. II.

ORDER OF BINDING AND DATES OF PUBLICATION

PAGES	PLATES	ISSUED IN VOL. FOR YEAR	PUBLISHED
General Title-page and Contents	—	1912	February, 1913
1—56	I—VII	1904	December, 1904
57—96	VIII—XI	1905	November, 1905
97—132	XII—XIX	1906	December, 1906
133—180	XX—XXVII	1907	December, 1907
181—216	XXVIII—XXXIV	1908	December, 1908
217—260	XXXV—XLIV	1909	December, 1909
261—284	XLV—L	1910	January, 1911
285—340	LI—LIV	1911	February, 1912
341—473	LV—LXII	1912	February, 1913

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.,

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. II.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1904—1913.

CONTENTS OF VOL. II.

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1904.

LONDON:

MDCCCCIV.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. II. PART I.

LIMIDÆ.

PAGES 1—56; PLATES I—VII.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY

1904.

DESCRIPTION OF SPECIES.

Family—LIMIDÆ, *d'Orbigny.*

Genus—LIMA, *J. G. Bruguière*, 1797.

('Encyc. méthod.,' Tabl. Vers., pl. ccvi.)

LIMA CANALIFERA, *Goldfuss*, 1836. Plate I.

1836.	LIMA CANALIFERA,	*A. Goldfuss.*	Petref. Germ., vol. ii, p. 89, pl. civ, fig. 1.
1839.	—	— *H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. i, p. 24.
—	— MULTICOSTATA,	*Geinitz.*	Ibid., p. 24, pl. viii, fig. 3.
1841.	— CANALIFERA,	*F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 56.
—	— LATICOSTA,	*Römer.*	Ibid., p. 57, pl. viii, fig. 9.
1843.	— MULTICOSTATA,	*H. B. Geinitz.*	Die Verstein. von Kieslingswalda, p. 23, pl. vi, fig. 10.
1846.	— LATICOSTA,	*A. E. Reuss.*	Die Verstein. der böhm. Kreideformat., pt. 2, p. 34.
—	— MULTICOSTATA,	*Reuss.*	Ibid., p. 34, pl. xxxviii, figs. 7, 8, 18.
—	—	— *H. B. Geinitz.*	Grundr. d. Verstein., p. 472.
1850.	— CANALIFERA,	*Geinitz.*	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 190.
—	— MULTICOSTATA,	*Geinitz.*	Ibid., p. 192.
—	— CANALIFERA,	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 167.
? —	— MULTICOSTATA,	*d'Orbigny.*	Ibid., p. 248.
—	— LATICOSTA,	*d'Orbigny.*	Ibid., p. 249.
1863.	— CANALIFERA,	*A. Kunth.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 726.
—	—	— *R. Drescher.*	Ibid., vol. xv, p. 356.
? 1868.	— MULTICOSTATA,	*E. Eichwald.*	Lethæa Rossica, vol. ii, p. 459.
1870.	— MULTICOSTA,	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 174.
—	— CANALIFERA,	*Pictet and Campiche.*	Ibid., p. 175.
1872.	—	— *H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 38, pl. ix, figs. 6—8.

1876. LIMA CANALIFERA, *D. Brauns.* Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 386.
1877. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: II, Weissenberg. u. Malnitz. Schicht., p. 132, fig. 117.
1893. — cf. CANALIFERA, *R. Michael.* Zeitschr. der deutsch. geol. Gesellsch., vol. xlv, p. 242.
1898. — CANALIFERA, *G. Müller.* Mollusk. Untersenon. v. Braunschweig u. Ilsede (Abhandl. d. k. preussisch. geol. Landesanst. N.F., Heft 25), p. 28.
1901. — — *H. Imkeller.* Kreidebild. am Stallauer Eck (Palæontographica, vol. xlviii), p. 32, pl. iii, fig. 10.
— — — *F. Sturm.* Jahrb. d. k. preussisch. geol. Landesanst. für 1900, vol. xxi, p. 90.

Description.—Shell moderately convex, oval or subtriangular; height a little greater than length; outline rounded, except the antero-dorsal margin, which is nearly straight and rather long. Apical angle from 105° to 110°. Umbones rather small, close together. Anterior area slightly depressed, with small radial ribs. Anterior ears small; posterior larger, with growth-lines and faint radial ribs.

Ornamentation consists usually of 18, but sometimes of as few as 14 or as many as 21 very strong, rounded, straight ribs, which are separated by broader furrows. In well-preserved specimens numerous concentric linear ridges occur on both ribs and furrows, and projecting growth-ridges are seen at regular intervals on the ribs.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	70	56	52	43	32	mm.
Height[1]	76	58	54	44	35	,,

(1—5) Upper Greensand, Ventnor.

Affinities.—An exact comparison of the English specimens with the foreign examples of *Lima canalifera* is rendered difficult owing to the fact that the former have the shell well preserved whilst the latter occur chiefly as casts. In both cases the number and breadth of the ribs show considerable variation. The fine concentric ornamentation is the same in both, as is shown by Goldfuss' figure, but in some of the best preserved English specimens there occur also transverse ridges on the ribs at regular intervals. Somewhat similar ridges are shown in Goldfuss' figure, but they seem to be present chiefly on the sides of the ribs and

[1] In all species of *Lima* (unless otherwise stated) this is measured obliquely to the hinge-line so as to give the greatest height.

in the neighbourhood of the umbo only. With the exception of this character the English specimens agree closely with the foreign examples, and this difference may very well be due to the latter being much less perfectly preserved than the former. Moreover, in some English specimens the ridges mentioned are partly or entirely wanting.

The English examples occur at a lower horizon than those found abroad, namely, in the zone of *Pecten asper*. The foreign specimens are found in the Turonian and Senonian, and possibly also in the Cenomanian, and, like the English examples, they occur chiefly in beds of a sandy nature. This last fact may account for the absence of the species in the English Chalk, during the deposition of which the sea-floor was formed of ooze and was at a greater depth.

Lima Etalloni, Pictet and Campiche,[1] from the Valanginian, presents some resemblance to *L. canalifera*, but has a smaller apical angle; the character of its fine ornamentation is unknown.

Type.—Goldfuss' specimens came from the Senonian of Quedlinburg, Haltern and Regensburg.

Distribution.—Upper Greensand (zone of *Pecten asper*) of Ventnor.

LIMA GALLIENNEI, *d'Orbigny*, 1847. Plate II, figs. 1*a*—*c*.

1847.	LIMA GALLIENNIANA,	*A. d'Orbigny.*		Pal. Franç. Terr. Crét., vol. iii, p. 548, pl. cccxx, figs. 1—3 (*Gallienni* on plate).
1850.	—	—	—	Prodr. de Pal., vol. ii, p. 166.
1854.	—	GALLIENNEI,	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 171.
1867.	—	—	*E. Guéranger.*	Album Paléont. de la Sarthe, p. 18, pl. xxiii, figs. 23, 24.
1869.	—	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 168.
1871.	RADULA GALLIENNEI,		*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 414.

Description.—Shell compressed, more or less oblong with rounded margin; height greater than length. Antero-dorsal margin straight or slightly concave. Apical angle large. Umbones close together. Anterior area only slightly depressed, with sharp borders.

Ornamentation consists of 12 to 15 strong, much elevated ribs with rounded

[1] 'Terr. Crét. Ste. Croix' (1869), p. 141, pl. clxiv, fig. 3.

summits, separated by broader rounded furrows. Both ridges and furrows bear numerous flattened radial ridges separated by linear grooves; the ridges, in well-preserved specimens, are serrate or granular. At distant intervals a few well-marked growth-ridges occur.

Measurements:

	(1)	(2)
Length	49	70 mm.
Height	54	78 ,,

(1, 2) Upper Greensand, Devizes.

Affinities.—This species is distinguished from *L. canalifera* (p. 1) by the valves being more compressed, the ribs fewer in number, the grooves relatively broader, and by the presence of fine radial ornamentation on the ribs and grooves.

Remarks.—This appears to be a rare species in England. The specimens from Devizes are in the Museum of Practical Geology. The specimen from Humble Rocks was collected by Mr. Jukes-Browne, and is now in the Sedgwick Museum.

Type.—From the Cenomanian of Coudrecieux, Sarthe.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Devizes. Base of Chalk Marl (Bed 10) of Humble Rocks, West of Lyme Regis.

LIMA VECTENSIS, sp. nov. Plate II, figs. 2, *a*—*c*.

Description.—Shell large, rather compressed, ovate, height greater than length; antero-dorsal margin straight, the remainder forming a regular curve. Anterior area deeply depressed. Apical angle apparently about 100°. Anterior ear small; posterior ear larger, with a few ribs.

Ornamentation consists of about 40 rather strong, narrow ribs, with rounded summits which, in places, are slightly tubercular. The ribs are closer together on the anterior part of the valves than elsewhere. The interspaces are much broader than the ribs, and are flat or slightly concave; they are marked by numerous fine, concentric ridges.

Affinities.—This species resembles *Lima Dujardini*, Deshayes,[1] from the Senonian, but the interspaces are flat or nearly flat instead of concave, and the well-marked scale-like projections which, in *L. Dujardini*, are placed at intervals on the ribs, but without a concentric arrangement, are not seen.

[1] Dujardin, 'Mém. Soc. géol. de France,' vol. ii (1837), p. 227, pl. xvi, fig. 3. D'Orbigny, 'Terr. Crét.,' vol. iii (1847), p. 569, pl. cccexxvii, figs. 1—4.

Remarks.—I have seen one example only; it consists of both valves, but with the posterior margin imperfect.

Type.—In the Museum of the Ventnor Institute.

Distribution.—Upper Greensand, chert beds (zone of *Pecten asper*) of the Isle of Wight.

LIMA SUBOVALIS, *Sowerby*, 1836. Plate II, figs. 3, 4*a*, *b*, 5*a*, *b*, 6*a*, *b*, 7 *a*, *b*.

1836.	LIMA ? SUBOVALIS, *J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 359, 342, pl. xvii, fig. 21.
1839.	— ASPERA, *H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 23 (*partim*).
? 1847.	— SUBOVALIS, *A. d'Archiac.*	Mém. Soc. géol. de France, ser. 2, vol. ii, p. 309.
—	— ORNATA, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 551, pl. cccexxi, figs. 6—10.
1850.	— — —	Prodr. de Pal., vol. ii, p. 167.
—	— — *H. B. Geinitz.*	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 192.
1867.	— — *E. Guéranger.*	Album Paléont. de la Sarthe, p. 19, pl. xxiv, figs. 7, 12.
1869.	— SUBOVALIS, *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 168.
1870.	— ORNATA, *Pictet and Campiche.*	Ibid., pp. 169, 173.
1871.	RADULA (ACESTA) ORNATA, *F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 414.
1872.	LIMA ORNATA, *H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 205, pl. xlii, figs. 16, 17.
? 1877.	— — *A. Peron.*	Bull. Soc. géol. de France, ser. 3, vol. v, p. 502.
1877.	— RAULINIANA, *A. J. Jukes-Browne.*	Quart. Journ. Geol. Soc., vol. xxxiii, p. 502, pl. xxi, fig. 2.
1893.	— ORNATA, *R. Michael.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 234.
Non 1852.	— — *A. Buvignier.*	Statist. géol., etc., de la Meuse, Atlas, p. 23, pl. xviii, figs. 17—19.

Description.—Shell compressed, ovate or subtrigonal, oblique, considerably higher than long, with the ventral and posterior margins rounded. Apical angle about 74°. Umbones small, close together. Anterior area rather small, depressed, limited by a ridge, ornamented with ribs separated by broader grooves.

Ornamentation consists of numerous (65 to 70) fairly strong, rounded ribs of

nearly equal size, but sometimes (chiefly near the posterior border) with smaller intercalated ribs. The ribs diverge slightly from a nearly median line, and bear short spiny or scaly projections at regular intervals but not usually with a concentric arrangement. The spines are rather nearer the inner than the outer side of each rib. The grooves are narrow near the umbo but become broader in passing ventrally, and at the ventral margin may exceed the ribs in breadth. The grooves are rounded and (in some specimens) show transverse ridges. More or less distinct growth-lines occur at intervals.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)
Length	25	21	20	17	16	14 mm.
Height	34	28	29	23	23	20 ,,

(1, 3) Cambridge Greensand.
(2) Base of Chalk Marl, Folkestone.
(4, 5) Upper Greensand, Warminster.
(6) ,, ,, Haldon.

Affinities.—This species belongs to the same group as the Senonian forms *L. Dunkeri*, Hagenow,[1] and *L. muricata*, Goldfuss.[2] It is distinguished from the former by its smaller apical angle and by the spines on the ribs being placed more closely together. *L. muricata* differs from *L. suboralis* in having fewer ribs with their ornamentation developed into long scale-like projections, and in having oblique grooves in the interspaces.

Remarks.—A comparison of the type of *Lima suboralis* with examples of *L. ornata* leaves no doubt as to their identity. The type-specimen of the former is somewhat worn, but sufficiently well-preserved for identification, and another specimen on the same tablet shows the ornamentation quite clearly; the shell is not silicified, so that it was evidently not obtained from Blackdown—the locality given by Fitton—but it has all the appearance of specimens found at Warminster.

The examples from the Cambridge Greensand were referred to *L. Rauliniana*, d'Orbigny,[3] by Mr. Jukes-Browne. The interior of these is filled with phosphate, and the shell, although in some respects well-preserved, is rather abraded, so that the remains of the spines usually appear as notches on the inner side (that facing the median line) of each rib. The transverse ornamentation in the grooves is often very distinct. Mr. Jukes-Browne has recently re-examined these specimens and agrees with me in thinking that they cannot be separated from *L. suboralis*. I

[1] 'Neues Jahrb. für Min., etc.' (1842), p. 556; Vogel, 'Holländ. Kreide' (1895), p. 17, pl. i, fig. 9; Ravn, 'Mollusk. Danmarks Kridtaflej.' (1902), p. 100, pl. ii, fig. 14.

[2] 'Petref. Germ.,' vol. ii (1836), p. 89, pl. ciii, fig. 4; Vogel, *op. cit.*, p. 17, pl. i, figs. 10, 11.

[3] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 542, pl. cccxvii, figs. 5—8; 'Prodr. de Pal.' (1850), vol. ii, p. 138; Pictet and Campiche, "Foss. Terr. Crét. Ste. Croix" ('Matér. Pal. Suisse,' ser. 5, 1869), p. 154, pl. clxvi, fig. 2.

have not been able to obtain specimens of *L. Rauliniana*, but it seems to differ from *L. subovalis* in having a larger posterior ear and in other characters.

Types.—In the Bristol Museum (No. 1778), from the Upper Greensand, probably of Warminster. The type of *L. ornata* is from the Cenomanian of Le Mans. The specimen from the Cambridge Greensand figured by Jukes-Browne is in the Sedgwick Museum, Cambridge.

Distribution.—Upper Greensand (zone of *Schlenbachia rostrata*) of Haldon. Upper Greensand (zone of *Pecten asper*) of North Dorset, and Warminster. Cambridge Greensand (derived). Rye Hill Sand of Maiden Bradley. Chloritic Marl of Rocken End (Isle of Wight). Base of Chalk Marl (Greensand bed) of Folkestone. Also recorded by the Geological Survey from the Cenomanian of Devon and Chard.

LIMA SCABRISSIMA, sp. nov. Plate II, figs. 8*a*, *b*, 9*a*, *b*.

Description.—Shell compressed, ovate, height greater than length; antero-dorsal margin rather short, straight or slightly concave, ventral and posterior margins forming a regular curve. Anterior area much depressed, sharply limited, nearly smooth or with faint ribs. Apical angle about 92°. Posterior ear of moderate size, with distinct growth-lines; anterior ear small.

Ornamentation consists of a large number of narrow, rounded, more or less undulating ribs separated by broader grooves. The ribs are generally of nearly equal size, but smaller ones may be intercalated in the grooves. At regular intervals the ribs bear scales or lappet-like projections which are arranged concentrically and may become vertical at their ends; these scales are continued across the grooves as laminar projections. On the anterior and posterior ribs the "scales" become more pointed.

Measurements:

	(1)	(2)	(3)
Length	54	52	38 mm.
Height	62	58	42 ,,

(1—3) Upper Greensand, Warminster.

Affinities.—This species is near to *Lima rhotomagensis*, d'Orbigny,[1] from the Cenomanian of Rouen, but is distinguished from it by being much less convex, by having a smaller anterior area and a smaller apical angle, and by the ribs being relatively narrower and the grooves broader.

Types.—In the Museum of Practical Geology.

Distribution.—Upper Greensand (zone of *Pecten asper*) of Warminster.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 557, pl. cccxxii, figs. 8–11.

LIMA ASPERA (*Mantell*) 1822. Plate II, figs. 10, 11; Plate III, figs. 1 *a*, *b*, 2–4.

1822. PLAGIOSTOMA ? ASPERA, *G. Mantell*. Foss. S. Downs, p. 129, pl. xxvi, fig. 18.
1854. LIMA ASPERA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 170.
1870. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 169.
1871. RADULA (? ACESTA) ASPERA, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 415.
1903. LIMA ASPERA, *A. J. Jukes-Browne*. Cret. Rocks of Britain (Mem. Geol. Survey), vol. iii, p. 450.

Non 1836. — — *A. Goldfuss*. Petref. Germ., vol. ii, p. 90, pl. civ, fig. 4.
— 1839. — — *H. B. Geinitz*. Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 23, pl. xxi, fig. 10.
— 1841. — — *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 56.
— 1846. — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 34, pl. xxxviii, fig. 17.
— 1847. — — *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 566, pl. cccexxv, figs. 3–6.
— 1850. — — — Prod. der Pal., vol. ii, p. 248.
— — — — *A. Alth*. Beschreib. d. Umgebung von Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 243.
— 1863. — — *A. v. Strombeck*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 150.
— 1869. — — *E. Favre*. Moll. Foss. de la Craie de Lemberg, p. 135.
— 1870. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 171, 173.
— 1877. — — *A. Fritsch*. Stud. im Gebiete der böhm. Kreideformat.: II, Die Weissenberg. u. Malnitz. Schicht., p. 132, fig. 118.
— 1883. — — — Ibid., III, Die Iserschicht., p. 114.
— 1887. — — *A. Peron*. L'Hist. Terr. de Craie (Bull. Soc. Sci. hist. et nat. de l'Yonne, ser. 3, vol. xii), p. 150.
— 1889. — (PLAGIOSTOMA) ASPERA, *O. Griepenkerl*. Senon. von Königslutter (Palæont. Abhandl., vol. iv), p. 40.
— 1898. — ASPERA, *G. Müller*. Mollusk. Untersen. v. Braunschweig u. Ilsede (Abhandl. d. k. preussisch. geol. Landesanst., N.F., Heft 25), p. 26, pl. iv, fig. 5.
— 1900. — — *C. Gagel and F. Kaunhowen*. Jahrb. d. k. preussisch. geol. Landesanst. für 1899, p. 232.

Description.—Shell ovate, higher than long, outline rounded, with the antero-dorsal and postero-dorsal margins straightened; convexity small. Umbones small, pointed, close together, apical angle 80° to 90°. Anterior area deep, narrow.

Anterior ears triangular, rather small; posterior ears obtusely triangular, elongate, with radial ribs.

Valves ornamented with numerous flattened ribs arranged on either side of a line passing from the umbo to the ventral margin, from which they diverge slightly. The ribs are nearly straight or slightly undulating, but are often bent abruptly where they cross growth-lines. Surface of ribs nearly smooth, but sometimes showing very fine concentric ridges or (when worn) oblique striæ. On the inner edge of each rib—that facing the middle line—there are short, slit-like indentations, above each of which a short spiny projection is seen in perfectly preserved specimens. These slits and spines do not, as a rule, show a concentric arrangement. The grooves separating the ribs are very narrow and are marked with pits near the umbo and with transverse grooves ventrally. Sometimes near the margins of the valves new ribs are intercalated or old ones bifurcate.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Length .	31	30	28	26	24	19	16	mm.
Height . . .	36	33	33	35	26	23	21	,,
Number of ribs .	66	41	60	46	42	41	52	

(1, 2, 3, 7) Totternhoe Stone, Burwell.
(4) ,, ,, Cherry Hinton.
(5, 6) Chalk Marl, Folkestone.

Affinities.—The Senonian form figured as *Lima aspera* by Goldfuss, Reuss, and Fritsch is clearly distinguished from this species by the chevron-like ornamentation on the ribs. Pictet and Campiche suggest that Goldfuss' species may be identical with *Lima Dunkeri*, Hagenow,[1] from Rügen, but this view is not supported by the figures given by Vogel and Ravn. The form figured by d'Orbigny has a larger apical angle than *L. aspera*, Mantell, and does not show the spiny projections on one side of the ribs.

The example figured by Reuss[2] as *Lima plana* is similar in form to *L. aspera*, Mantell, but does not appear to possess the spiny projections on the ribs.

Types.—I have not been able to find the types.[3] They came from the Chalk Marl of Hamsey and Stoneham.

Distribution.—Chloritic Marl of Eastbourne. Chalk Marl of Folkestone, and Blue Bell Hill (Burham). Totternhoe Stone of Arlesey, Burwell, Cherry Hinton, and Stoke Ferry.

[1] 'Neues Jahrb. für Min.,' etc. (1842), p. 556.

[2] 'Verstein. böhmisch. Kreideformat.' (1846), p. 35, pl. xxxviii, fig. 20.

[3] The name *aspera* was used by Chemnitz (1784) for a recent species of *Lima*, but since that has been shown to be a synonym of *Lima scabra* (Born, 1780) there does not appear to be sufficient reason for giving a new name to the Chalk species which, for over eighty years, has been known as *Lima aspera*, Mantell.

Sub-genus—PLAGIOSTOMA, *J. Sowerby*, 1814.

('Min. Conch.,' vol. i, p. 175.)

LIMA (PLAGIOSTOMA) SUBRIGIDA, *Römer*, 1836. Plate III, figs. 5*a*, *b*, 6—9. Text-figs. 1, 2, 3.

1836.	LIMA SUBRIGIDA, *F. A. Römer.*	Verstein. nord-deutsch. Oolithen-geb., p. 79, pl. xiii, fig. 16.
—	— PLANA, *Römer.*	Ibid., p. 80, pl. xiii, fig. 18.
1841.	— SUBRIGIDA, *Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 57.
—	— PLANA, *Römer.*	Ibid., p. 57.
1877.	— SUBRIGIDA, *G. Böhm.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix, p. 235.
1896.	— — *A. Wollemann.*	Ibid., vol. xlviii, p. 836.
1900.	— — *Wollemann.*	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussich. geol. Land., N.F., pt. 31), p. 30.

FIG. 1.—*Lima* (*Plagiostoma*) *subrigida*, Römer. Claxby Ironstone, Lincolnshire. Right valve. Natural size. Sedgwick Museum, Cambridge.

Description.—Shell convex, oval, height slightly greater than length; antero-dorsal margin nearly straight, postero-dorsal much shorter and nearly straight, the remainder rounded and forming a regular curve. Apical angle rather more than a

right angle. Umbones of moderate size. Area large, with a large triangular ligament pit near the middle but bending posteriorly. Anterior area large, deeply depressed, especially near the ears. Ears rather large, the anterior triangular, the posterior rather larger, more elongate; surface with growth-lamellæ only.

Surface ornamented with numerous (43 to 52) radial ribs, which are straight or slightly undulating. The ribs are flattened; near the umbo they are separated by narrow grooves, but in passing ventrally the grooves increase in width and become as wide as or wider than the ribs. The grooves are rather shallow and rounded The anterior and posterior ribs are narrower than the others. Near the umbo the grooves are punctate, but in passing ventrally the pits soon become replaced by

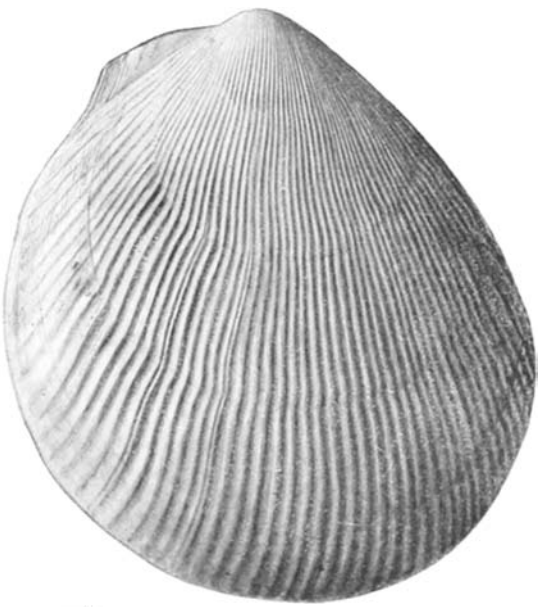


Fig. 2.—*Lima* (*Plagiostoma*) *subrigida*, Romer. Claxby Ironstone, Benniworth Haven. Right valve. Natural size. Sedgwick Museum.

transverse furrows separated by ridges, and the latter may pass on to the ribs. On the anterior area ribs are small or absent, but growth-lines are usually distinct.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Length	109	100	80	73	72	64	63	38	31	mm.
Height	114	108	85	79	76	65	65	36	40	,,
Thickness .	—	63	—	—	—	—	36	—	—	,,
Number of ribs .	48	49	48	51	46	43	52	52	44	

(1—9) Claxby Ironstone, Benniworth Haven.

Affinities.—L. vigueulensis, Pictet and Campiche,[1] is distinguished from *L. subrigida* by its more quadrilateral outline, more numerous ribs and finer

[1] 'Terr. Crét. Ste. Croix' (1869), p. 138, pl. clxii, figs. 5—8.

grooves, and also by the earlier part of the shell being nearly smooth. *L. aubersonensis*, Pictet and Campiche,[1] is relatively longer and has narrower grooves.

Remarks.—On account of the imperfect figures of *L. subrigida* given by Römer, the English specimens have not hitherto been referred to that species; they agree perfectly with the descriptions except in the number of ribs, but Dr. Wollemann informs me that that character is variable. I have sent a specimen from the Claxby Ironstone to Dr. Wollemann, and he is able to confirm my identification of the species. Specimens from the Speeton Clay differ from those found in Lincolnshire in having fewer ribs with relatively fewer grooves, but since this is a very variable character it cannot be regarded as indicative of more than a local variety.

Fig. 3. *Lima* (*Plagiostoma*) *subrigida*, Römer. Claxby Ironstone, Benniworth Haven. Area of right valve. × $\frac{3}{4}$. Sedgwick Museum.

Types.—From the Hilsthon of Brunswick.

Distribution.—Claxby Ironstone (zone of *Belemnites lateralis*) of Benniworth Haven. Upper part of the Speeton Clay of Speeton.

LIMA (PLAGIOSTOMA), sp. cf. ORBIGNYANA, *Matheron*, 1842. Plate III, figs. 10, *a*—*c*.

1842.	LIMA ORBIGNYANA,	*P. Matheron.*	Cat. Foss. des. Bouches-du-Rhone, p. 182, pl. xxix, figs. 3, 4.
1846.	—	—	*A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 530, pl. cccxv, figs. 1—4.
1850.		—	*d'Orbigny.* Prodr. de Pal., vol. ii, p. 107.
1855.	—		*G. Cotteau.* Moll. Foss. de l'Yonne, p. 100.
1865.	—		*H. Coquand.* Mon. Aptien de l'Espagne, p. 149.
1866.			*P. de Loriol.* Foss. Oolith. Corall. Valang. et Urgon. Mt. Salève, p. 82, pl. D, fig. 13.
1867.	—	—	*de Loriol*, in *Favre.* Rech. géol. Sans Savoie, vol. i, p. 387, pl. C, fig. 24.
1869.	—	—	*F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 126, pl. clxi, fig. 4.
1871.	RADULA (ACESTA) ORBIGNYANA,		*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 414.

[1] Loc. cit., p. 140, pl. clxiv, figs. 1, 2.

Description.—Shell moderately convex, oval, higher than long, ventral and posterior margin rounded. Umbones sharp. Apical angle about 83°. Anterior area depressed, limited by a rounded edge, ornamented with ribs. Ears with distinct growth-ridges. Posterior ear higher than long, and larger than the anterior ear.

Ornamentation consists of about 52 flattened ribs, slightly undulating, separated by very narrow grooves with pits. Near the ventral margin the ribs become divided by a median groove. Near the anterior and posterior margins the ribs are rather narrower than elsewhere. A few moderately distinct growth-lines occur.

Measurements:

Length	20 mm.
Height	25·5 „

Affinities.—This is distinguished from *L. villersensis* (see below) by its more numerous and narrower ribs.

Remark.—I have seen one specimen only, which is preserved in the British Museum, No. L 15754.

Distribution.—Lower Greensand (Ferruginous Sands) of Shanklin.

LIMA (PLAGIOSTOMA) VILLERSENSIS? *Pictet and Campiche*, 1869. Plate III, figs. 11*a*, 11*b*, 12*a*, *b*, 13.

? 1869. LIMA VILLERSENSIS, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 127, 162, pl. clxi, fig. 5.

Description.—Shell moderately convex, oval, higher than long, ventral and posterior margins rounded. Umbones sharp. Apical angle about 85°. Anterior area depressed, bounded by a sharp edge. Posterior ear larger than the anterior, higher than long, with the outer angle obtuse, and with a few radial ribs.

Ornamentation consists of from 32 to 36 broad, flattened, nearly straight ribs, separated by linear grooves with distinct pits. Near the anterior, and sometimes near the posterior border, the ribs become narrower. A few well-marked growth-ridges may occur at distant intervals. Near the ventral margin of the valves (ventral to a growth-ridge) the position of the ribs is sometimes slightly shifted, and the number of ribs may increase owing to the fission of some.

Measurements:

	(1)	(2)	(3)	(4)
Length .	20	19	18	14 mm.
Height .	26·5	25	22	17 „

(1–4) Lower Greensand, Faringdon.

Affinities.—I have seen only a few examples of this form. They agree with *L. villersensis* except in having a rather smaller apical angle. In this respect they resemble *L. Orbignyana*, Matheron (see above), but they differ from that species in possessing fewer and straighter ribs. I have not seen any undoubted example of *L. villersensis* and am unable to state whether the apical angle is constantly larger than in the English specimens. Pictet and Campiche say that it is about 95°, but the specimen they figure possesses an apical angle of 90° only. In the English specimens it is about 85°.

This is the form which was referred by Sharpe[1] to *L. consobrina*, d'Orbigny, but it possesses considerably fewer ribs than that species.

Type.—*L. villersensis* is found in the Valanginian of Ste. Croix.

Distribution.—Lower Greensand of Faringdon.

LIMA (PLAGIOSTOMA) SEMIORNATA, *d'Orbigny*, 1847. Plate III, figs. 14, 15, 16*a*, *b*. Plate IV, fig. 1.

1847. LIMA SEMIORNATA. *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 555, pl. cccexxii, figs. 1—3.
1850. — — *d'Orbigny.* Prodr. de Pal., vol. ii, p. 167.
1867. — — *E. Guéranger.* Album Paléont. de la Sarthe, p. 19, pl. xxiv, fig. 13.
1870. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 169.
1871. RADULA (PLAGIOSTOMA) SEMIORNATA, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 414.
? 1885. — — — *F. Nötling.* Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 15, pl. ii, fig. 4.

Description.—Shell compressed, rounded, height and length nearly equal. Antero-dorsal border straight or slightly concave. Umbones close together. Anterior area depressed, with a sharp edge. Apical angle 120°.

Surface nearly smooth, shiny, with numerous, very fine, regular, concentric linear ridges, and with radial punctate grooves near the umbo and near the anterior and posterior margins. The grooves near the anterior margin are fewer and more widely separated than those near the posterior margin.

[1] 'Quart. Journ. Geol. Soc.,' vol. x (1853), p. 193 (*sub-consobrina*, d'Orbigny, 'Prodr. de Paléont.,' (1850), p. 167).

Measurements :

	(1)	(2)	(3)	(4)	(5)
Length	32	31	29	29	23 mm.
Height	33	32	29	26	23 „

(1, 2) Upper Greensand, Potterne.
(3, 5) „ „ Ventnor.
(4) „ „ Blackdown.

Affinities.—This species is distinguished by its compressed valves and rounded outline.

Type.—From the Cenomanian of Le Mans.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Potterne (Devizes) and Blackdown. Upper Greensand (zone of *Pecten asper*) of Ventnor. Chalk Marl of Folkestone.

LIMA (PLAGIOSTOMA) MEYERI, sp. nov. Plate IV, figs. 2,3. Text-fig. 4.

1896. LIMA SIMPLEX, *A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. lii, p. 152.

Description.—Shell ovate or subtrigonal, much compressed, a little higher than long, oblique, considerably inequilateral; antero-dorsal margin long and

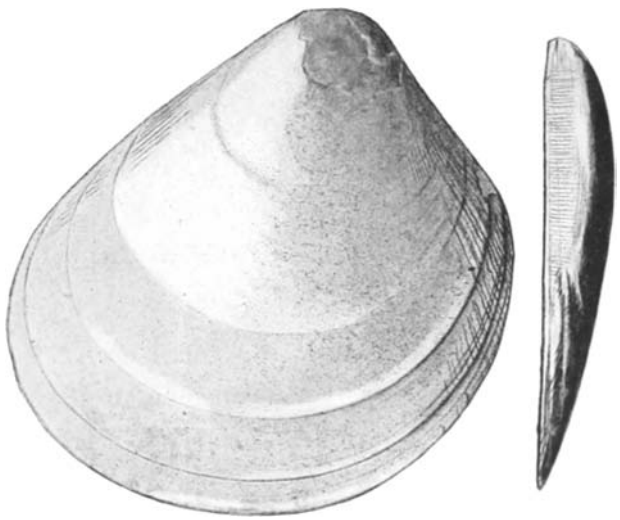


FIG. 4.—*Lima (Plagiostoma) Meyeri*, sp. nov. Upper Greensand, Warminster. Museum of Practical Geology, No. 8838. Left valve and antero-dorsal view. Natural size.

straightened, ventral and postero-ventral margins rounded. Umbones small, close together. Apical angle from 90° to 100°. Anterior area depressed, long and narrow, with a few radial ribs and vertical grooves. Posterior ear small; anterior ear not seen.

Ornamentation consists of narrow, linear, shallow, pitted grooves which may

be confined to the anterior and posterior parts of the valves or may extend over the whole surface. The grooves are somewhat irregular and the interspaces are broad and flattened. At distant intervals a few well-marked growth-rings occur, beyond which, in some cases, the ribs cease.

Measurements:

	(1)	(2)	(3)	(4)	(5)
Length	69	53	48	42	34 mm.
Height	71	56	52	47	37 ,,

(1—5) Upper Greensand, Warminster.

Affinities.—This species differs from *Lima semiornata* (p. 14) in being larger, relatively higher, more trigonal in outline, and in having the radial grooves more extensively developed. It is distinguished from *Lima simplex*, d'Orbigny,[1] in being much less convex, in the height being relatively less, the antero-dorsal margin shorter, the anterior area smaller, and the anterior grooves less prominent.

The shell is relatively longer and the apical angle larger than in *L. sub-consobrina*, d'Orbigny.[2] It is also relatively longer, with a longer antero-dorsal margin and the radial grooves less well developed, than in *L. cretacea* (p. 22).

Types.—From Warminster. In the Museum of Practical Geology.

Distribution.—Upper Greensand (zone of *Pecten asper*) of Warminster. Rye Hill Sands and Chloritic Marl of Maiden Bradley. Cenomanian (Meÿer's Beds 10 and 11) of Hooken and Dunscombe (Devon coast).

LIMA (PLAGIOSTOMA) GLOBOSA (*Sowerby*), 1836. Plate IV, figs. 4 *a*—*c*, 5 *a*, *b*, 6 *a*—*c*.

1836. LUCINA? GLOBOSA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, p. 335, pl. xi, fig. 2 (non *Lucina globosa*, Römer, 1839).
1854. LIMA GLOBOSA. *J. Morris*. Cat. Brit. Foss., ed. 2, p. 171.
1895. — — *E. Tiessen*. Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 473.

Description.—Shell very convex, of moderate size, oval, length considerably greater than height, outline rounded with the antero-dorsal margin long and straightened. Umbones incurved, blunt. Apical angle about 118°. Anterior area large, very deep, limited by a sharp edge, with radial ribs. Ears small.

Surface of valves polished, with faintly-marked growth-lines at intervals;

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 545, pl. cccexviii, figs. 5—7.

[2] Ibid., p. 556, pl. cccexxii, figs. 4—7; *L. sub-consobrina*, d'Orbigny, 'Prodr. de Paléont.,' vol. ii (1850), p. 167.

ornamented with numerous pits having a regular radial and concentric arrangement and giving rise (in some cases) to the appearance of slightly-raised radial and concentric ribs. Near the ventral margin the pits become more elongated (parallel with the margin) and their concentric arrangement may become wavy or irregular. At the anterior and posterior margins the radial arrangement is often more distinct than elsewhere. Sometimes on the median part of the valve the concentric arrangement alone can be recognised.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length	31	27	25	24	22	20	18	12	mm.
Height	25	23	21	21	19	17	16	10	,,

(1—3, 5, 7, 8) Totternhoe Stone, Burwell.
(4) Chalk Marl, Ventnor.
(6) ,, ,, Clevancy.

Affinities.—This species closely resembles *Lima albensis*, d'Orbigny,[1] from the Gault of Ervy (Aube), Machéroménil (Ardennes), the Perte-du-Rhône, etc. I have not seen any specimens of *L. albensis*, but it appears to differ from *L. globosa* in the absence of the punctate ornamentation and in having a smaller apical angle.

L. globosa is distinguished from *L. Hoperi* (see below) by its smaller size, more inflated valves, and by the close-set rows of radial and concentric pits.

Type.—In the Museum of the Geological Society, No. 1538, from the Chloritic Marl of the Isle of Wight.

Distribution.—Gault of Folkestone. Red Limestone of Hunstanton. Upper Greensand of Warminster. Cambridge Greensand (base of Chalk Marl). Chalk Marl of Ventnor, Clevancy, Chilcomb well (Winchester), Burham, Folkestone and Cherry Hinton. Cenomanian of Wilmington. Totternhoe Stone of Burwell. Zone of *H. subglobosus* of Chilcomb and Fulbourn.

LIMA (PLAGIOSTOMA) HOPERI, *Mantell*, 1822. Plate IV, figs. 7, 8*a*, *b*, 9*a*, *b*, 10, 11*a*, *b*, 12*a*, *b*.

1822. PLAGIOSTOMA HOPERI. *G. Mantell.* Foss. S. Downs, p. 204, pl. xxvi. figs. 2, 3, 15.
— — — *J. de C. Sowerby.* Min. Conch., vol. iv, p. 111, pl. cccl.xxx.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 541, pl. cccxvi, figs. 15, 16; 'Prodr. de Paléont.,' vol. ii (1850), p. 138; Pictet and Roux, 'Moll. Foss. Grès verts de Genève' (1852), p. 488, pl. xl, fig. 9; Pictet and Campiche, "Foss. Terr. Crét. Ste. Croix" ('Matér. Pal. Suisse,' ser. 5, 1860), p. 160.

1822. Plagiostoma Mantelli, *A. Brongniart.* Descript. géol. envir. de Paris. In *Cuvier's* Ossem. Foss., vol. ii, pt. 2, p. 600, pl. iv, fig. 3.
1825. Pachytos Hoperi, *M. J. L. Defrance.* Dict. Sci. nat., vol. xxxvii, p. 207.
1827. Plagiostoma punctatum, *S. Nilsson.* Petrif. Suecana, p. 24, pl. ix, fig. 1.
1832. Lima Hoperi, *G. P. Deshayes.* In *J. G. Bruguière*, Hist. nat. des Vers et des Moll. (Encyc. méthod.), vol. ii, p. 349.
1836. — Mantellii, *A. Goldfuss.* Petref. Germ., vol. ii, p. 92, pl. civ, fig. 9.
— — Hoperi, *Goldfuss.* Ibid., p. 91, pl. civ, fig. 8.
— — — *Lamarck.* Anim. sans Vert. (ed. 2 by Deshayes and Milne-Edwards), vol. vii, p. 120.
1837. Plagiostoma punctatum, *W. Hisinger.* Lethæa Suecica, p. 54 (*not* pl. xv, fig. 3).
1838. Lima Hoperi, *H. G. Bronn.* Lethæa Geognost., vol. ii, p. 682, pl. xxxii, fig. 8.
1839. — — *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 24 (? *partim*).
1841. — Mantellii, *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 58.
— — Hoperi, *Römer.* Ibid., p. 58.
— — Nilssoni, *Römer.* Ibid., p. 57.
1842. — Goldfussi, *F. v. Hagenow.* Neues Jahrb. für Min., etc., p. 555.
? 1846. — Mantelli, *H. B. Geinitz.* Grundr. d. Verstein., p. 472, pl. xx, fig. 13.
— — Hoperi, *Geinitz.* Ibid., p. 473, pl. xx, fig. 14.
— — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 34, pl. xxxviii, figs. 11, 12.
1847. — Sowerbyi, *J. Müller.* Petref. der Aachen. Kreidef., pt. 2, p. 67.
1850. — Hoperi, *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 192.
— — Sowerbyi, *Geinitz.* Ibid., p. 192.
— — Hoperi, *A. Alth.* Geogn.-palæont. Beschreib. von Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 240.
? — — Mantelli, *R. Kner.* Verstein. v. Lemberg (Haidinger's Naturwissensch. Abhandl., vol. iii, pt. 2), p. 29.
— Plagiostoma Hoperi, var., *J. de C. Sowerby*, in *F. Dixon.* Geol. Sussex, pp. 348, 356 (p. 383, ed. 2), pl. xxviii, fig. 21.
1851-2. Lima Sowerbyi, *H. G. Bronn.* Lethæa Geogn., ed. 3, vol. ii, pt. 5, p. 278, pl. xxxii, fig. 8.
? 1852. — Hoperi, *R. Kner.* Denkschr. d. k. Akad. d. Wissensch. Wien, Math.-nat. Cl., vol. iii, p. 318.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 171 (*partim*).
1863. — — *S. Placketko.* Das Becken von Lemberg (Jahresber. d. k. k. zweit. Ober-gymnas. in Lemberg, 1863), p. 19.
— — — *A. von Strombeck.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 148.
— — — *R. Drescher.* Ibid., p. 355.
1869. *E. Favre.* Moll. Foss. de la Craie de Lemberg, p. 137, pl. xii, fig. 19.

1870. LIMA HOPERI, *F. Römer.* Geol. von Oberschles., p. 315, pl. xxxiv, fig. 10.
— — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér Pal. Suisse, ser. 5), pp. 171, 173.
— — SOWERBYI, *Pictet and Campiche.* Ibid., p. 173.
1872. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 41, pl. ix, figs. 13, 14.
1877. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: II, Weissenberg. u. Malnitz. Schicht., p. 133, fig. 120.
1882. — HOPERI, *H. Schröder.* Zeitschr. der deutsch. geol. Gesellsch., vol. xxxiv, p. 263.
1883. — SOWERBYI, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: III, Iserschicht., p. 115, fig. 87.
1888. — HOPERI, *A. Peron.* L'Hist. Terr. de Craie, p. 149.
1889. — (PLAGIOSTOMA) HOPERI. *O. Griepenkerl.* Senon. v. Königslutter (Palæont. Abhandl., vol. iv), p. 40.
— — HOPERI, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: IV, Teplitz. Schicht., p. 84, fig. 78.
— — — *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 240, pl. xxvii, fig. 5.
1892. — (PLAGIOSTOMA) HOPERI, *E. Stolley.* Die Kreide Schleswig-Holsteins (Mittheil. a. d. Mineralog. Instit. Univ. Kiel, vol. i), p. 237.
1893. — HOPERI, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: V, Priesener Schicht., p. 100.
1894. — — *B. Lundgren.* Mollusk. i *Mammillatus-* och *Mucronata-*zonerna (K. Svenska Vet. Akad. Handl. N. F., vol. xxvi, No. 6), p. 42.
1897. — — *R. Leonhard.* Kreideformat. in Oberschles. (Palæontographica, vol. xliv), p. 46.
— — — *A. Hennig.* Revis. Lamellibr. i Nilsson's 'Petrific. Suecana,' (K. Fysiogr. Sällsk. i Lund. Handl., N. F., vol. viii), p. 30, pl. ii, fig. 13.
— — (PLAGIOSTOMA) HOPERI, *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 383.
1898. — HOPERI, *G. Müller.* Mollusk. Untersen. v. Braunschweig u. Ilsede, p. 24, pl. iv, fig. 12.
1901. — — *A. Wollemann.* Jahrb. d. k. preussisch. geol. Landesanst. für 1900, vol. xxi, p. 15.
1902. — — *A. Wollemann.* Lüneburg. Kreide (Abhandl. d. k. preussisch. geol. Landesanst., N. F., Heft 37), p. 58.
— — — *J. P. J. Ravn.* Mollusk. Danmarks Kridtaflej.: I, Lamellibr. (K. Danske Vid. Selsk. Skrift. 6 Rakke, nat. og math. Afd., vol. xi), p. 99, pl. ii fig. 18.

Non	1847.	—	—	*A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 564, pl. cccxxiv, figs. 10—13.
—	1847.	—	Mantelli, *d'Orbigny.*	Ibid., p. 568, pl. cccxxvi, figs. 3—5.
—	1850.	—	Hoperi, *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 248.
—	—	—	Mantelli, *d'Orbigny.*	Ibid., p. 248.
—	1877.	—	Hoperi, *A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat.: II, Weissenberg. u. Malnitz. Schicht., p. 134, fig. 121.
—	—	—	Mantelli, *Fritsch.*	Ibid., p. 134, fig. 122.
—	1872.	—	Hoperi, *H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 40, pl. ix, figs. 11, 12.
—	1881.	—	— *J. Kiesow.*	Cenomanverstein. a. d. Diluvium d. Umgeg. Danzig's (Schrift d. naturf. Gesellsch. in Danzig, N. F., vol. v), p. 414, figs. 9, 10.
? —	1893.	—	sp., cf. Hoperi, *R. Michael.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 234.

Description.—Shell convex, oval, rounded, considerably inequilateral, longer than high. Antero-dorsal margin rather long, slightly convex or nearly straight; postero-dorsal margin rather short; the remainder forming a regular curve. Umbones close together. Apical angle 115° to 117°. Ears rather small, with growth-lines; the posterior longer than high and larger than the anterior ear. Anterior area large, deep, with a more or less sharp border, often with radial grooves which vary in number and are more distinct near the umbo than anteriorly.

Surface of shell nearly smooth. In the region of the umbo numerous linear grooves with pits occur; these may also extend on to the anterior and posterior parts of the shell, and in some cases they are present on the middle of shell, reaching a part of the way or even quite to the ventral margin. The grooves are slightly wavy, sometimes discontinuous, and are deeper near the anterior and posterior margins, and often more widely separated near the former. New grooves are introduced at various distances from the umbo.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
Length	57	57	56	52	51	51	47	41	37	34	31	31	mm.
Height	52	50	52	50	47	46	42	39	32	32	28	26	,,

(1) *M. cor-anguinum* zone, Gravesend.
(2) *Uintacrinus* band, Devizes Road, Salisbury.
(3, 6, 12) *A. quadratus* zone, East Harnham.
(4, 7) *M. cor-anguinum* zone, Gravesend.
(5, 10) *M. cor-anguinum* zone, Northfleet.
(8) Chalk Rock, Underwood Hall, Dullingham.
(9, 11) *B. mucronata* zone, Norwich.

Affinities.—This species was described by Brongniart under the name *Plagiostoma Mantelli* from specimens which were sent to him by Mantell from near

Brighton—probably from Lewes. Mantell[1] regarded *Plagiostoma Mantelli* as a synonym of his *Plagiostoma Hoperi*, and I think there can be no doubt as to the correctness of that view.

Geinitz (1872) considered *Lima Hoperi* of Sowerby to be distinct from *L. Hoperi* of Mantell, thinking that the former (which he named *L. Sowerbyi*) was distinguished by being almost smooth, whereas the latter is covered with radial grooves. The smooth and the grooved forms agree exactly in shape, and between these extremes in ornamentation every gradation may be seen. Moreover, although one of the specimens figured by Mantell (fig. 3) is ornamented all over, the others (figs. 2, 15) possess grooves on the sides only. I think, therefore, that there can be no doubt as to the identity of *L. Hoperi* of Sowerby and *L. Hoperi* of Mantell. Further, it should be noted that Sowerby's specimens were sent to him by Mantell as examples of his *L. Hoperi*.

The specimens figured by Geinitz (1872) as *L. Hoperi* (from the Pläner-kalk of Strehlen) are relatively higher (especially fig. 11) than Mantell's species, and are probably examples of *L. cretacea* (see below).

L. Hoperi of d'Orbigny[2] differs in having a smaller apical angle, in being relatively higher, much compressed, and with the grooves more widely separated. It may, however, be only a variety of *L. Hoperi*, Mantell. I have seen undoubted examples of *L. Hoperi*, Mantell, from the Senonian of Marromme (near Rouen), Lillebonne (Seine-Inférieure), and from other French localities. The form described and figured by d'Orbigny as *L. Mantelli* is referred to below (p. 23).

L. Lamberti of Peron,[3] from the zone of *Micraster breviporus* of Joigny, may be only a variety of *L. Hoperi*. It is stated to differ chiefly in its greater length, but in this respect it can, I think, be matched by some undoubted varieties of *L. Hoperi*.

For the relation of *L. Hoperi* to *L. globosa* see page 17, and to *L. cretacea* see page 23.

Remarks.—This species varies considerably in the extent of the ornamentation. Some examples are smooth, save for the pitted grooves near the umbo; in many cases the grooves are continued on to the sides of the shell; less frequently they extend to the middle of the valve, and may even reach the ventral margin. I have not seen sufficient examples, of which the exact horizons are known, to enable me to determine whether any of the varieties are characteristic of certain zones.

Types.—I have not seen the types. The specimens figured by Sowerby are in the British Museum. The types, and also Sowerby's specimens, came from the Upper Chalk (probably from the zone of *Micraster cor-testudinarium* or the zone of

[1] 'Trans. Geol. Soc.,' ser. 2, vol. iii (1835), p. 206.

[2] See Jukes-Browne, 'Quart. Journ. Geol. Soc.,' vol. lii (1896), p. 152.

[3] 'Hist. Terr. de Craie' (1888), p. 151, pl. ii, fig. 1.

M. cor-anguinum) near Lewes. An example from Cambrai is in the d'Orbigny Collection at Paris, but it is probably not the specimen figured in the 'Palæontologie Française.'

Distribution.—(i) Zone of *Terebratulina* of Bevendean, near Brighton.[1]

(ii) Zone of *Holaster planus* of Winchester, Lewes, Dover, Kenley, Cuxton. Chalk Rock of Boxmoor, Luton, Underwood Hall (Dullingham), Westley Waterless.

(iii) Zone of *Micraster cor-testudinarium* of Lewes, Dover, Purley, Strood, Chatham, Swaffham[2] (Norfolk).

(iv) Zone of *Micraster cor-anguinum* of Winchester, Porton, Witherington, Quidhampton, Lewes, the Sussex coast, St. Margaret's, Gravesend, Northfleet, Halling Pit (South Croydon).

(v) Zone of *Marsupites testudinarius* of the coasts of Sussex, Thanet, and Yorkshire. *Uintacrinus* band of Devizes Road, Salisbury.

(vi) Zone of *Actinocamax quadratus* of East Harnham, Hursley (Winchester), the coasts of Sussex and Yorkshire.

(vii) Zone of *Belemnitella mucronata* of the Dorset coast and Norwich.

(viii) Chalk of Trimingham.

LIMA (PLAGIOSTOMA) CRETACEA, nom. nov. Plate IV, figs. 13, 14 *a*—*c*, 15. Plate V, figs. 1*a*, *b*, 2, 3, 4*a*, *b*.

? 1847.	LIMA MANTELLII, *A. d'Orbigny*.	Pal. Franç. Terr. Crét., vol. iii, p. 568, pl. cccexxvi, figs. 3—5 (non *L. Mantelli*, Brongniart).
? 1850.	— — —	Prodr. de Pal., vol. ii, p. 248.
-	— LÆVIUSCULA, *J. de C. Sowerby*, in *F. Dixon*.	Geol. Sussex, p. 347 (p. 382, ed. 2), pl. xxviii, fig. 14, (non *L. læviuscula*, Sowerby, 1822).
? 1872.	- HOPERI, *H. B. Geinitz*.	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 40, pl. ix, figs. 11, 12.
? 1877.	— — *A. Fritsch*.	Stud. im Gebiete der böhm. Kreideformat.: II, Weissenberg. u. Malnitz. Schicht., p. 134, fig. 121.
? —	— MANTELLI, *Fritsch*.	Ibid., p. 134, fig. 122.
? 1888.	— — *A. Peron*.	L'Hist. du Terr. de Craie, p. 151.

Description.—Shell of small convexity, oval, very inequilateral, higher than long. Antero- and postero-dorsal margins nearly straight, the remainder forming a

[1] Also recorded from the *Terebratulina* zone of South Dorset by Dr. Barrois.

[2] This may be from the *M. cor-anguinum* zone.

regular curve. Umbones small, close together. Apical angle usually about 100°, but sometimes only 90°. Ears small, the posterior larger than the anterior. Anterior area of moderate size, very deep, with a sharp edge and numerous radial ribs.

Ornamentation consists of numerous, well-defined, radial grooves with distinct pits, covering the entire surface of the shell. The grooves are straight or slightly wavy, and in some cases are linear, in others broader, the latter giving the appearance of flattened or rounded ribs to the interspaces. The pits in the grooves sometimes extend into the sides of the ribs. New grooves may be introduced near the ventral margin or occasionally near the middle of the valve. In well-preserved specimens very fine concentric ridges are sometimes seen. A few growth-rings are usually present.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Length .	32	32	26	21	21	17	16	12	11	mm.
Height .	37	35	30	24	22	19	19	14	12	,,

(1) *H. planus* zone, Cuxton.
(2) ,, ,, Cheveley.
(3) ,, ,, Borsted.
(4) *A. quadratus* zone, Whaddon railway cutting, near Salisbury.
(5—7) *A. quadratus* zone. East Harnham.
(8) *M. cor-anguinum* zone, Witherington.
(9) *Uintacrinus* band, Devizes Road, Salisbury.

Affinities.—This species is distinguished from *Lima Hoperi* by having a smaller apical angle, by being relatively higher and shorter, with the valves less convex, the anterior area relatively smaller, the entire surface of the shell always ornamented, and the grooves usually deeper.

The specimen figured by d'Orbigny as *Lima Mantelli* is similar in form to some examples of *L. cretacea*, but d'Orbigny states that the furrows are shallow and without pits. A specimen, however, in the d'Orbigny Collection at Paris shows pits in the grooves.

Lima læviuscula, Sowerby (in Dixon) is probably a small example of this species, but its locality and horizon are not stated.

One of the specimens from the Pläner-kalk of Strehlen figured by Geinitz (1872) as *L. Hoperi* (fig. 11) agrees very closely with this species.

Distribution.—Zone of *Terebratulina* of Winchester. Zone of *Holaster planus* of Twyford and Cheveley. Zone of *Micraster cor-testudinarium* of Borstal and Cuxton. Zone of *M. cor-anguinum* of Micheldever, Witherington and Camp Hill (South Wiltshire). Zone of *Marsupites* of Highfield. *Uintacrinus* band of Devizes Road (Salisbury). Zone of *Actinocamax quadratus* of Winchester, East Harnham, West Harnham, and Milford (Salisbury). Zone of *Belemnitella mucronata* of Norwich. Chalk of Trimingham.

LIMA (PLAGIOSTOMA) MARROTIANA, *d'Orbigny*, 1847. Plate V, figs. 6*a*, *b*, 7*a*, *b*.

1847. LIMA MARROTIANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 561, pl. cccexxiv, figs. 1—4.
1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 247.
1889. — (RADULA) MARROTIANA, *O. Griepenkerl*. Senon. von Königslutter (Palæont. Abhandl., vol. iv), p. 39.

Non 1850. — MAROTTIANA, *A. Alth*. Geogn.-pal. Beschreib. v. Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 240, pl. xii, fig. 25. (*L. Althi*, Favre).

Description.—Shell of moderate convexity, oval, more or less trigonal. Antero-dorsal margin rather long, nearly straight; postero-dorsal margin much shorter; the remainder forming a regular curve. Umbones rather small, pointed. Apical angle about 105°. Anterior area large, deeply depressed, sharply limited, ornamented with 10 to 12 strong, rather narrow ribs, which bear, in places, small nodular projections. Ears rather large, with growth-ridges, without ribs; the posterior rather larger than the anterior ear.

Ornamentation consists of 30 to 32 broad ribs with a few smaller ribs near the posterior margin; the ribs are smooth, with flattened or somewhat rounded summits, and are separated by narrow rounded grooves. The grooves show, in places, transverse ridges and grooves which may extend to the sides of the ribs, giving them a notched appearance. Near the ventral margin, especially in old specimens, the ribs become more flattened and the grooves shallower.

Measurements:

	(1)	(2)
Length	59	27 mm.
Height	60	28 „

(1, 2) Upper Chalk (*B. mucronata* zone), Norwich. The measurements of the larger specimen are approximate only.

Affinities.—This is distinguished from other species found in the Chalk by its strong ribs. In *Lima Althi*, Favre, the ribs are more numerous and not so broad.

Lima Marrotiana differs from most of the species which are referred to *Plagiostoma* in having much stronger ribs, but in other respects it agrees closely with that sub-genus.

Remarks.—The only specimens I have seen are from Norwich, where it appears to be rare. The shell is usually more or less crushed, so that its proper outline is distorted.

Types.—D'Orbigny's specimens came from the Lower Senonian of Dordogne, Charente-Inférieure, Cambrai, and Aube.

Distribution.—Zone of *Belemnitella mucronata* of Norwich.

Sub-genus—ACESTA, *H. and A. Adams*, 1858.

('Genera of Recent Mollusca,' vol. ii, p. 558.)

LIMA (ACESTA) LONGA, *Römer*, 1841. Plate V, figs. 8 *a*, *b*, 9—11, 12 *a*, *b*.

1836.	LIMA ELONGATA, *F. A. Römer.*		Die Verstein. d. nord-deutsch. Oolith.-geb., p. 79, pl. xiii, fig. 11 (non *elongata*, Sowerby).
1841.	—	LONGA, *Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 57.
1847.	—	— *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 529, pl. cccexiv, figs. 13—16.
1850.	—	— —	Prodr. de Pal., vol. ii, p. 81.
1865.	—	— *H. Coquand.*	Mon. Aptien de l'Espagne, p. 149.
1868.	—	— *P. de Loriol.*	Valangien d'Arzier. (Matér. Pal. Suisse, ser. 4), p. 41, pl. iii, fig. 11.
1869.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 128, pl. clxi, figs. 6, 7.
1871.	—	— *W. A. Ooster.*	Protozoe Helvetica, vol. ii, pp. 104, 123.
1877.	—	— *G. Böhm.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix, p. 235.
1883.	—	— *W. Keeping.*	Foss., etc., Neoc. Upware and Brickhill, p. 112, pl. v, fig. 6.
1884.	—	n. sp., *O. Weerth.*	Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 51.
? 1895.	—	(PLAGIOSTOMA) cf. ROBINALDINA, *F. Vogel.*	Holländ. Kreide, p. 56.
1896.	—	LONGA, *A. Wollemann.*	Zeitschr. der deutsch. geol. Gesellsch., vol. xlviii, p. 836.
1900.	—	— —	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 27.

Description.—Shell compressed, sub-triangular, rounded, considerably higher than long, of small obliquity. Posterior and ventral margins convex; anterior margin straight. Umbones pointed, close together. Apical angle small—about 70°. Posterior ear large, not separated from the rest of the valve by a depression, ornamented with radial ribs. Anterior ear smaller, much higher than long.

Anterior area lanceolate, depressed, limited by a sharp edge, ornamented with radial ribs.

Ornamentation consists of very numerous, small, somewhat flattened ribs, separated by much narrower grooves. The ribs are usually wavy, and are not all of equal size; posteriorly smaller ribs sometimes alternate with larger. The grooves are punctate and vary somewhat in width. A few distinct growth-lines are seen, below which the direction of the ribs may undergo some deflection.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length .	37	35	31	23	21	20	mm.
Height . .	62	58	56	37	35	32	,,

(1, 2, 3, 5) Lower Greensand, Upware.
(4) Tealby Limestone, North Willingham.
(6) Speeton Clay, Speeton.

Affinities.—*Lima longa* has a smaller apical angle and is relatively shorter than *L. undata*, Deshayes[1]; it is also clearly distinguished by the absence of the prominent concentric scales, and by the occurrence of pits in the grooves.

Remarks.—In some cases, especially when the specimens are not perfectly preserved, the ribs (as remarked by Wollemann) become indistinct on the middle of the shell. This is the case in specimens from the Tealby Limestone, and in some from the Speeton Clay, in which the middle part of the shell is almost smooth. The outline of the shell and the relative size of the posterior ear are rather variable.

A specimen from West Dereham (Plate V, fig. 13) possesses finer ribs, but may perhaps be only a variety of this species.

Types.—From the Hilsthon of Elligser Brink. A specimen from the same locality (imperfect on the posterior side of the umbo) is figured by d'Orbigny and is preserved in the Museum of Palæontology at Paris. Two of the specimens from Upware figured by Keeping are in the Sedgwick Museum, Cambridge, and another is in the collection of Mr. J. F. Walker.

Distribution.—Lower Greensand of Upware, Potton, and Brickhill. Tealby Limestone (zone of *Belemnites brunsicensis*) of North Willingham. Upper part of Speeton Series of Speeton.

LIMA (ACESTA) CLYPEIFORMIS, *d'Orbigny*, 1847. Text-figure 5.

1847. LIMA CLYPEIFORMIS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 543, pl. cccxvii, figs. 9, 10.
1850. -- — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 166.

[1] See d'Orbigny, p. 528, pl. cccxiv, figs. 9—12; Pictet and Campiche, p. 133, pl. clxii, fig. 1.

1869. Lima clypeiformis, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse ser. 5), p. 168.

1871. Radula (Acesta) clypeiformis, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 414.

Description.—Shell very large, compressed, oval, rounded, only slightly oblique. Height equal to or slightly greater than length. Antero-dorsal margin more or less

Fig. 5.—*Lima (Acesta) clypeiformis*, d'Orbigny. Upper Greensand, Chard. Right valve. Taunton Museum. × ⅔.

straightened and relatively short. Ears rather small, the anterior larger than the posterior. Surface of shell smooth, except for growth-lamellæ at intervals.

Measurements :

Length	160 mm.
Height	168 „

Upper Greensand, Chard.

Affinities.—*Lima subclypeiformis*, Futterer,[1] is stated to be related to *L. clypeiformis*.

Remarks.—This is the largest species of *Lima* known in the Cretaceous of England. I have seen two specimens only, one of which is in the Museum of the Somersetshire Archæological and Natural History Society at Taunton, and the other in the Exeter Museum. The occurrence of this species in England was first recorded by Mr. Jukes-Browne.[2]

Type.—D'Orbigny's specimens came from the Cenomanian of Le Mans, etc.

Distribution.—Topmost bed of the Upper Greensand of Chard.

Sub-genus—MANTELLUM, *J. F. Bolten*, 1798.

('Mus. Bolten.,' 2, p. 160.)

LIMA (MANTELLUM) PARALLELA (*Sowerby*) 1812. Plate V, figs. 14, 15 *a*—*d*.

1812.	MODIOLA PARALLELA, *J. de C. Sowerby*.	Min. Conch., vol. i, p. 31, pl. ix (right-hand top figure).
1842.	LIMA ELEGANS, *A. Leymerie*.	Mém. Soc. géol. de France, vol. v, p. 27, pl. vi, fig. 6. (*Non* Dujardin, *non* Nilsson.)
1845.	— ELONGATA, *E. Forbes*.	Quart. Journ. Geol. Soc., vol. i, p. 248.
1846.	— ELEGANS, *A. Leymerie*.	Statist. géol. et min. de l'Aube, pl. vi, fig. 7.
1847.	— COTTALDINA, *A. d'Orbigny*.	Pal. Franç. Terr. Crét., vol. iii, p. 537, pl. cccxvi, figs. 1—5.
1850.	— — *d'Orbigny*.	Prodr. de Pal., vol. ii, p. 119.
1854.	— PARALLELA, *J. Morris*.	Cat. Brit. Foss., ed. 2, p. 171.
1855.	— COTTALDINA, *G. Cotteau*.	Moll. Foss. de l'Yonne, p. 101.
1858.	— — *J. Vilanova-y-Piera*.	Mem. geog.-agric. de Castellon, pl. ii, fig. 15.
—	— PARALLELA, *F. J. Pictet and E. Renevier*.	Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 126, pl. xix, fig. 1.
1865.	— — *H. Coquand*.	Mon. Aptien de l'Espagne, p. 148.
1869.	— COTTALDINA, *F. J. Pictet and G. Campiche*.	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 151, pl. clxvi, fig. 1.
1883.	— FARRINGDONENSIS, *W. Keeping*.	Foss., etc., Neoc. Upware and Brickhill, p. 112, pl. v, fig. 12.
1884.	— COTTALDINA, *O. Weerth*.	Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 52.

[1] 'Kreidebild. d. Santa Croce in den Venetianer Alpen' (Palæont. Abhandl., vol. vi, 1892), p. 78, fig. 23.

[2] 'Proc. Somerset Archæol. and Nat. Hist. Soc.,' vol. xlix, 1903.

1895. LIMA COTTALDINA, *G. Maas.* Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 267.
— — (RADULA) COTTALDINA, *F. Vogel.* Holländisch. Kreide., p. 56.
1900. — COTTALDINA, *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 35, pl. ii, figs. 2, 3.

Non 1847. — PARALLELA, *d'Orbigny.* (See p. 31).

Description.—Shell moderately convex, oblique, oval or rounded-oblong, higher than long. Antero-dorsal margin long, nearly straight, more or less parallel with the postero-ventral margin; postero-dorsal margin short, more or less nearly straight. Anterior margin regularly rounded. Umbones sharp, only slightly curved; apical angle about 90°. Ears of moderate size. Anterior area rather large, slightly convex ventrally, depressed near the umbo, usually smooth except for growth-lines.

Ornamentation consists of 18 to 20 principal ribs, and sometimes of a few smaller ribs near the posterior margin. The principal ribs are roof-like with sharp summits; they are strongest on the antero-dorsal part of the valve and become less elevated and rather more widely separated in passing posteriorly; the two or three anterior ribs (near the anterior area) are rather smaller and closer together. A small rib occurs at the bottom of the furrows between the main ribs; smaller linear ribs may occur on the sides of the principal ribs, especially on the posterior part of the shell. Fine concentric growth-lines are seen on the ribs and furrows.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length	26	26	25	23	23	22	19	14	mm.
Height	21	22	20	19	18	17	16	11	,,

(1, 4) *Perna*-bed, Atherfield.
(2, 5) Hythe Beds, Lympne.
(3) Lower Greensand, Upware.
(6, 7) Hythe Beds, Hythe.
(8) Ferruginous Sands, Shanklin.

Affinities.—This species is closely allied to *L. Rogeriana*, d'Orbigny,[1] but in the latter the ribs do not decrease in size nor become more widely separated on the posterior part of the shell, and the small rib in the furrows is absent or indistinct.

L. parallela is distinguished from *L. gaultina* (p. 31) by being relatively shorter and less compressed, by the ribs on the posterior part of the shell being

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 527, pl. cccexiv, figs. 5—8; Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1869), p. 142, pl. clxiv, figs. 4, 5.

more distinctly smaller than those on the anterior part, and by the presence of the small rib at the bottom of each groove. See also *L. farringdonensis* (below).

L. expansa, Forbes,[1] from the Hythe Beds of Hythe, is known to me only from the type specimen which is preserved in the Museum of the Geological Society (No. 2056). It is an internal cast in clay, somewhat crushed, and shows the ribbing only imperfectly. I think it is probably an example of *L. parallela*, but more specimens from the same horizon are needed before a confident opinion can be given. Similar remarks apply to *L. lingua*, Forbes,[2] which comes from the same horizon and locality, and is likewise preserved in the Museum of the Geological Society (No. 2058).

This and the following eight species are provisionally referred to the sub-genus *Mantellum*, with which they agree in the form of the shell and, in many cases, in the general character of the ornamentation. They differ, however, from the type of *Mantellum* in having the valves closed or almost closed, but there is, as Phillipi has pointed out, every transition from the species in which the valves gape widely to others in which they are closed.

Remarks.—This species shows a fair amount of variation in the proportions of length and height, and also in the obliquity of the shell.

The type-specimen of *L. parallela* is an internal cast, and consequently all writers have found it practically impossible to make out the characters of the species from Sowerby's figure. A comparison of the type with better preserved specimens leaves no doubt in my mind that Sowerby's species is really identical with the form described by d'Orbigny as *L. Cottaldina*. The latter author referred a species found in the Gault (*L. gaultina*, p. 31) to *L. parallela*, Sowerby.

Types.—The type is from the Hythe Beds of Maidstone and is preserved in the British Museum (No. 43,292). The specimen from Upware figured as *L. farringdonensis* by Keeping is in the Sedgwick Museum, Cambridge.

Distribution.—*Perna*-bed and Atherfield Clay of Atherfield. Ferruginous Sands of Shanklin. Hythe Beds of Hythe, Lympne, and Maidstone. Sandgate Beds of Sevenoaks. Folkestone Beds of Folkestone. Lower Greensand of Faringdon and Upware. Speeton Clay of Speeton.

LIMA (MANTELLUM) FARRINGDONENSIS, *Sharpe*, 1853.

1853. LIMA FARRINGDONENSIS, *D. Sharpe*. Quart. Journ. Geol. Soc., vol. x, p. 198, pl. vi, fig. 2.

Non 1883. — — *W. Keeping*. Foss., etc., Neoc. Upware and Brickhill, p. 112, pl. v, fig. 12.

[1] 'Quart. Journ. Geol. Soc.,' vol. i (1845), p. 249, pl. iii, fig. 11.

[2] Ibid., p. 249, pl. iii, fig. 10.

Remarks.—The chief character in which *Lima faringdonensis* differs from *L. parallela* seems to be in the possession of well-marked ribs over the whole of the anterior area. It also differs from the majority of examples of *L. parallela* in that the ribs only decrease in size to a very small extent in passing from the anterior to the posterior part of the shell; and further, the shell is less inequilateral than is usual in *L. parallela*.

I am inclined to regard *Lima faringdonensis* as not more than a variety of *L. parallela*, but without better material it is impossible to express a confident opinion. Almost all the specimens seen are in the condition of internal casts in a brownish ferruginous sandstone.

Type.—The figure given by Sharpe is taken from a gutta-percha cast of an external mould. It was obtained from Seende and is preserved in the Museum of the Geological Society.

Distribution.—Lower Greensand of Seende and Faringdon.

LIMA (MANTELLUM) GAULTINA, nom. nov. Plate V, figs. 16—20.

? 1827. PLAGIOSTOMA ELONGATA, *J. de C. Sowerby.* Min. Conch., vol. vi, p. 113, pl. dlix, fig. 2 (upper figure only).

1847. LIMA PARALLELA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 539, pl. cccexvi, figs. 11—14.

1850. — — *d'Orbigny.* Prodr. de Pal., vol. ii, p. 138.

1855. — — *G. Cotteau.* Moll. Foss. de l'Yonne, p. 101.

1854. — ELONGATA, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 171 (*partim*).

1875. — — *A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. xxxi, p. 296.

1897. — PARALLELA, *R. B. Newton.* Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xvii, p. 88, pl. iii, fig. 11.

1900. — — *E. T. Newton* and *A. J. Jukes-Browne.* Cret. Rocks of Britain, vol. i, p. 449.

Non 1850. PLAGIOSTOMA PARALLELUS, *J. de C. Sowerby* in *F. Dixon.* Geol. Sussex, p. 356 (p. 386, ed. 2), pl. xxviii, fig. 16 (=*L. elongata*, Sowerby).

Description.—Shell rather compressed, sub-quadrangular or nearly oblong, very oblique, much longer than high, rounded posteriorly; antero-dorsal margin long and nearly straight, almost parallel with the postero-ventral margin. Apical angle about 100°. Umbones pointed, close together. Ears of moderate size, the anterior larger than the posterior. Anterior area large, slightly concave dorsally, ornamented with fine radial ribs.

Ornamentation consists of 18 to 20 main ribs with a few smaller ribs posteriorly. The ribs are strong, with sharp summits, but become somewhat

weaker posteriorly. The sides of the ribs are ornamented with fine radial ribs, and at the summit there is sometimes a rib with pointed projections. Concentric growth-lines are present.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	39	34	29	29	28	17	mm.
Height[1]	28	23	20	18	20	12	,,

(1, 4) Gault, Black Ven.
(2, 3, 5, 6) Gault, Folkestone.

Affinities.—*Lima Iteriana*, Pictet and Roux,[2] appears to differ from this species in having a small rib at the bottom of the groove, and in being relatively shorter. Pictet and Campiche state that the small rib is not always present. I have seen no trace of such a rib in even the best preserved examples of *L. gaultina*. See also *Lima elongata* (p. 36).

Remarks.—One of the specimens figured by Sowerby as *Plagiostoma elongata* (the upper figure 2 of Plate DLIX) is probably an example of this species, but since it is an internal cast only, it is difficult to be sure of its identity without seeing other specimens from the same horizon. The specimen in question, however, agrees in form and in the characters of the ribs with other internal casts which undoubtedly belong to this species. D'Orbigny referred this species to *Lima parallela* (Sowerby) and also included with it *L. elongata*, Sowerby (p. 34).

Types.—The specimen figured by Sowerby, mentioned above, is stated to come from the "Greensand of Folkestone." D'Orbigny's specimens of *Lima parallela*, d'Orbigny *non* Sowerby, came from the Gault of Gérodot and Dienville (Aube).

Distribution.—Gault of Folkestone (zones ii, vii, ix). Gault of Ventnor and Black Ven. Cambridge Greensand (derived). Upper Greensand (zone of *Schlœnbachia rostrata*) of Devizes. Internal casts from the Specton Clay (zone of *Belemnites jaculum*, C 11) seem to be indistinguishable from this species.

LIMA (MANTELLUM) INTERLINEATA, *Jukes-Browne*, 1877. Plate VI, figs. 1*a*, *b*.

1877. LIMA INTERLINEATA, *A. J. Jukes-Browne*. Quart. Journ. Geol. Soc., vol. xxxiii, p. 502, pl. xxi, fig. 10.

Description.—Shell moderately convex, rounded-oblong. Umbones and ears not seen.

[1] Measured perpendicular to the hinge-line.

[2] 'Moll. Foss. Grès verts de Genève' (1852), p. 484, pl. xl, fig. 5; F. J. Pictet and G. Campiche, 'Foss. Terr. Crét. Ste. Croix' (Matér. Pal. Suisse, ser. 5, 1869), p. 156, pl. clxvi, figs. 4, 5.

Ornamentation consists of 10 to 12 strong ribs with broad interspaces. On the posterior part of the shell the ribs are more widely separated and the interspaces flatter than on the anterior part. In the interspaces there are small radial ribs separated by broad spaces.

Remarks.—The only specimens seen are a few imperfect internal moulds with very small portions of the shell preserved. *L. interlineata* appears to be allied to *L. gaultina* (see above) but is distinguished by possessing fewer ribs with broader and flatter interspaces. The smaller radial ribs are perhaps also better developed than in *L. gaultina*.

Type.—In the Sedgwick Museum, Cambridge.

Distribution.—Cambridge Greensand (derived from the Gault).

LIMA (MANTELLUM) INTERMEDIA, *d'Orbigny*, 1847. Plate VI, figs. 2*a*, *b*, 3, 4*a*—*c*.

1847.	LIMA INTERMEDIA,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 550, pl. cccexxi, figs. 1—5.
1850.	—	— *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 167.
1869.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 168.
? 1877.	—	— *A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat.: II, Weissenberg. u. Malnitz. Schicht., p. 134, fig. 123.

Description.—Shell moderately compressed, oblique, oval or rounded-oblong, higher than long. Antero-dorsal border rather long and roughly parallel to the slightly curving postero-ventral border; both curve gradually and regularly to join the posterior border. Postero-dorsal shorter than the antero-dorsal border. Umbones inconspicuous, close together. Apical angle about 100°. Ears small, of nearly equal size, the posterior with three or four small radial ribs and with growth-ridges. Anterior area moderately large, slightly convex except near the umbones, smooth or with a few small ribs at the sides.

Ornamentation consists of 20 to 23 ribs. Those on the antero-ventral region are strong and roof-like, and, in old specimens, bear a smaller rib on each side; posterior to this region the ribs become much smaller and less elevated, some being almost linear and with broad and nearly flat interspaces. At the bottom of the furrows and in the middle of the flat interspaces there is a linear rib. In well-preserved specimens very fine radial ribs and concentric lines are seen.

Measurements:

	(1)	(2)	(3)
Length	35	30	30 mm.
Height	31	28	26 „
Thickness	18	17	16 „

(1, 2) Rye Hill Sands, Warminster.
(3) Upper Greensand, Longbridge, Devizes.

Affinities.—This species is closely allied to *Lima parallela*, but is distinguished by being less convex (especially in the region of the umbones), by being rather shorter and higher, and by the ribs decreasing in size rather more rapidly when traced from the antero-ventral region to the posterior region. The fine radial ornamentation is also perhaps rather better marked than in *L. parallela*.

L. intermedia differs from *L. elongata* (see below) in being less convex, relatively shorter, in the ribs being less elevated and decreasing in size posteriorly, and in the absence or indistinct character of the ribs on the anterior area.

It is also relatively shorter and higher than *Lima gaultina*, and the ribs on the posterior half are much smaller and have broader and flatter interspaces. The intermediate rib is distinct in *L. intermedia*, but is absent or indistinct in *L. gaultina*.

Type.—From the Cenomanian of Le Mans.

Distribution.—Upper Greensand (zone of *Pecten asper*) of Longbridge, near Devizes. Rye Hill Sands of Warminster.

LIMA (MANTELLUM) ELONGATA (*Sowerby*), 1827. Plate VI, figs. 5, 6*a*—*c*, 7*a*, *b*.

1822. PLAGIOSTOMA, *G. Mantell.* Foss. S. Downs, p. 129, pl. xix, fig. 1.
1827. — ELONGATA, *J. de C. Sowerby.* Min. Conch., vol. vi, p. 113, pl. dlix, fig. 2 (lower figure).
? 1847. LIMA ASTIERIANA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 549, pl. cccxx, figs. 4—7.
1850. PLAGIOSTOMA PARALLELUS, *J. de C. Sowerby* in *F. Dixon.* Geol. Sussex, p. 356 (p. 386, ed. 2), pl. xxviii, fig. 16.
1854. LIMA ELONGATA, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 171 (*partim*).
1869. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 168.
1870. — — *F. Römer.* Geol. von Oberschles., p. 343, pl. xxix, fig. 1.
? 1876. — — *H. Deicke.* Tourtia von Mülheim a. d. Ruhr, p. 27.
? 1877. — — *G. Böhm.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix p. 234.
1897. — — *R. Leonhard.* Kreideformat. in Oberschles. (Palæontographica, vol. xliv), p. 47.
1904. — — *E. T. Newton* and *A. J. Jukes-Browne.* Cret. Rocks of Britain, vol. iii, p. 451.

Non 1836. LIMA ELONGATA, *A. Goldfuss.* Petref. Germ., vol. ii, p. 87, pl. cii, fig. 13 (*L. Münsteriana*, d'Orbigny).

— — — — *F. A. Römer.* Verstein. nord-deutsch. Oolith.-geb., p. 79, pl. xiii, fig. 11 (*L. longa*, Römer, 1841).

? — 1841. — — *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 56.

— 1845. — — *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 248 (*L. parallela*, Sowerby).

? — 1846. — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 33, pl. xxxviii, fig. 6, non 9 (= *L. Reussi*, d'Orb.).

— 1863. — — *A. v. Strombeck.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 104 (*L. Schmeisseri*, Wollemann).

? — 1872. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 40, pl. ix, figs. 9, 10.

? — 1877. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: II, Weissenberg. u. Malnitz. Schicht., p. 132, fig. 116.

Description.—Shell of moderate convexity, subquadrangular or nearly oblong, rounded anteriorly, much longer than high. Antero-dorsal margin long, nearly straight, and nearly parallel with the postero-ventral margin; postero-dorsal margin short, nearly straight. Apical angle about 100°. Umbones sharp, close together. Ears of moderate size. Anterior area large, the dorsal part slightly concave, ornamented with from five to seven fairly strong ribs which are crossed by fine growth-ridges.

Ornamentation consists of 19 or 20 very strong ribs, with sharp, and sometimes (especially on the dorsal part of the shell) slightly serrate summits. The ribs have usually at their summits a distinct ridge with a shallow furrow on each side, which sometimes gives rise to the appearance of a ridge on each side of the rib. The grooves between the main ribs are deep, rounded, distinctly limited, and of about the same width as the ribs. On the dorsal portions of the shell fine radial ribs occur on both ribs and grooves; on the ventral portions they are not seen. Fine concentric growth-lines cross both ribs and grooves, and some few (at intervals) are more distinct.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	34	27	26	25	24	24	mm.
Height	24	18	20	20	18	17	,,

(1, 3, 5, 6) Chalk Marl, Folkestone.
(2) *H. subglobosus* zone, Stoke Ferry.
(4) Chalk Marl, Ventnor.

Affinities.—This species agrees in form with *Lima gaultina* (p. 31), but is distinguished (1) by the stronger ribs on the anterior area, (2) by the grooves being relatively broader and more distinctly limited, (3) by the ribs being more elevated, (4) by the fine radial ribs being usually indistinct except on the dorsal portions of the shell.

The form from the Pläner-kalk (Turonian) of Saxony figured as *Lima elongata* by Geinitz seems to differ from this species in having fewer and more rounded ribs, and in the ribs being more widely separated on the posterior part of the shell than elsewhere. Similar remarks apply to the specimen figured by Fritsch. Without the opportunity of comparing specimens I am unable to give a definite opinion as to the Turonian form being distinct from *L. elongata*.

Lima Astieriana, d'Orbigny, is perhaps identical with *L. elongata*, but the summits of the ribs appear to be somewhat more rounded.

Lima Reussi, d'Orbigny (*L. elongata* of Reuss) seems to differ from *L. elongata* in having a smaller apical angle.

Remarks.—Under the name *Plagiostoma elongata* Sowerby figured two species. It seems advisable to retain the name *elongata* for the one shown in the lower of his two figures, since that form had been previously figured and described (but without a specific name) by Mantell, and Sowerby refers to Mantell's figure as an example of *Plagiostoma elongata*.

Types.—I have not seen the specimen figured by Mantell. Sowerby's type, from the Chalk Marl of Hamsey, and also the specimen figured in Dixon's work are in the British Museum.

Distribution.—The range is from the Chloritic Marl to the zone of *Holaster subglobosus*. Chloritic Marl of Eastbourne and the Isle of Wight. Chalk Marl of Ventnor, Folkestone, and Prince's Risborough. Totternhoe Stone of Arlesey. Zone of *Holaster subglobosus* of Blue Bell Hill (Burham), Stoke Ferry, and Hunstanton.

LIMA (MANTELLUM) ELONGATA, var. ECHINATA, *Etheridge*, 1881. Plate VI, figs. 8, 9 *a*—*c*.

1881. LIMA ECHINATA, *R. Etheridge*. In *Penning and Jukes-Browne*, Geol. Cambridge, p. 144, pl. ii, fig. 2.

Remarks.—The examples described by Etheridge as *Lima echinata* agree perfectly in form, in size, and in the number and character of the ribs with *L. elongata*, but on the ridge at the summit of each rib there is a row of short spines which are frequently rounded and stumpy, and on each side of the rib (outside the

shallow groove mentioned in the description of *L. elongata*) there is another row of similar, but slightly smaller spines. In the furrows between the main ribs there are transverse ridges.

On account of the close resemblance in the form and ribbing of *L. echinata* to *L. elongata*, and also from the fact that in some specimens of the former the ornamentation of the ribs is absent from a part of the shell and the ribs are then indistinguishable from those of *L. elongata*, I am led to consider *L. echinata* as not more than a variety of *L. elongata*. Further, in some specimens of *L. elongata* the summits of the ribs are serrate.

L. elongata var. *echinata* presents some resemblance to *L. Schmeisseri*, Wollemann,[1] from the *Rhotomagensis*-Pläner of Lüneburg.

Types.—In the Sedgwick Museum, from Burwell.

Distribution.—Totternhoe Stone (*Holaster subglobosus* zone) of Burwell and Cherry Hinton. Also recorded in the 'Geological Survey Memoirs' from the zone of *Schlœnbachia varians*.

LIMA (MANTELLUM) CANTABRIGIENSIS, nom. nov. Plate VI, figs. 10*a*, *b*, 11, 12.

1881. LIMA ORNATA. *R. Etheridge.* In *Penning and Jukes-Browne*, Geol. Cambridge, p. 144, pl. iii, fig. 2 (non *ornata*, d'Orbigny, 1847; non *ornata*, Buvignier, 1852).

Description.—Shell moderately convex, oval or rounded-oblong. Anterior margin rounded. Umbones and ears not seen.

Ornamentation consists of 16 or 17 main ribs with a few small ribs at the posterior end. The anterior ribs are strong, roof-like, with ridged summits; posteriorly the ribs become less prominent and the interspaces less depressed. Both ribs and grooves are ornamented with fine, well-developed ribs, which are closer together on the ribs than in the grooves; usually three or four occur on each side of a main rib and three in each groove. Numerous concentric ridges occur and give rise to spiny projections where they cross the fine radial ribs.

Affinities.—In form this appears to be similar to *L. parallela* (p. 28), but has fewer ribs and is much more highly ornamented. The small rib at the bottom of the groove is not distinguishable from the other ribs.

It is more convex, has fewer ribs, and has the fine ornamentation better developed than in *L. intermedia*.

Remarks.—This species is known by three specimens only. All are imperfect near the umbo, but the fine ornamentation is well-preserved.

[1] 'Abhandl. d. k. preussisch. geol. Landesanst., N. F.,' Heft 37 (1902), p. 55, pl. vii, fig. 9.

On account of the name *ornata* having been previously used by d'Orbigny and by Buvignier for other species it is necessary to substitute some other name.

Types.—From the Cambridge Greensand (indigenous), preserved in the Sedgwick Museum, Cambridge.

Distribution.—Cambridge Greensand (indigenous). Lower Chalk of Burwell.

LIMA (MANTELLUM) BRITANNICA, sp. nov. Plate VI, figs. 13 *a*—*d*.

1857. LIMA ELEGANS, *J. W. Salter*. Quart. Journ. Geol. Soc., vol. xiii, p. 85, pl. ii, fig. 3 (non *elegans*, Nilsson).

Description.—Shell moderately convex, sub-quadrate or nearly oblong, very oblique. Antero-dorsal and postero-ventral margins more or less parallel; posterior margin rounded. Ears of moderate size, with a few ribs on the inner portions, and with distinct growth-lines; the anterior larger than the posterior ear. Anterior area not distinctly limited, covered with ribs similar to those on the rest of the valve but of nearly uniform size.

Ornamentation consists of eighteen main ribs, which are strong on the anterior part of the shell, but become smaller in passing to the posterior end. At the summit of each main rib is a narrow, elevated, secondary rib, and on each side of a main rib are two or three similar but rather small ribs. The secondary ribs are separated by broad and rounded furrows. The summits of the secondary ribs are usually sharp and even, but occasionally slightly serrate.

Measurements:

Length	19 mm.
Height	24 „

Affinities.—This form, of which I have seen one example only, agrees with the specimen preserved in flint from Moreseat (Aberdeenshire) which was described and figured by Salter as *Lima elegans* (Nilsson). That specimen is now in the Museum of Practical Geology. Nilsson's[1] figure is scarcely sufficient to enable one to determine the species, but from the recent illustrations given by Hennig[2] it is seen that the British specimens differ from *Lima elegans* in being more distinctly oblong and especially in having more numerous secondary ribs.

[1] 'Petrif. Suecana' (1827), p. 26, pl. ix, fig. 7; Hisinger, 'Lethæa Suecica' (1837), p. 55, pl. xv, fig. 10.

[2] Revis. Lamellibr. i Nilsson's 'Petrif. Suecana' (1897), p. 33, pl. ii, figs. 9, 10, 11, 24; *Lima elegans*, Dujardin ('Mém. Soc. géol. de France,' vol. ii, 1837, p. 226, pl. xvi, fig. 1), is apparently distinct from Nilsson's species.

Type.—In the collection of Mr. R. M. Brydone.

Distribution.—Lower part of the zone of *Micraster cor-anguinum* of Seaford.

LIMA (MANTELLUM) REICHENBACHI, *Geinitz*, 1839. Plate VI, figs. 14*a*, *b*, 15.

1839.	LIMA	REICHENBACHI, *H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 24, pl. viii, fig. 4.
1841.	—	REICHENBACHII, *F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 57.
1843.	—	REICHENBACHI, *H. B. Geinitz.*	Die Verstein. von Kieslingswalda, p. 23, pl. v, fig. 9.
1846.	—	— *A. E. Reuss.*	Die Verstein. der böhm. Kreideformat., pt. 2, p. 34.
1847.	—	REICHENBACHII, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 544, pl. cccexviii, figs. 1–4.
1850.	—	REICHENBACHI, *H. B. Geinitz.*	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 190.
—	—	REICHENBACHII, *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 166.
1855.	—	— *G. Cotteau.*	Moll. Foss. de l'Yonne, p. 101.
1867.	—	— *E. Guéranger.*	Album Paléont. de la Sarthe, p. 19, pl. xxiv, fig. 5.
1869.	—	REICHENBACHII, *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 168.
1872.	—	— *H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 203, pl. xliii, figs. 1, 2.
1876.	—	REICHENBACHI, *H. Deicke.*	Tourtia v. Mülheim a. d. Ruhr, p. 27.
1882.	—	REICHENBACHII, *P. de Loriol.*	Gault de Cosne, p. 101, pl. xiii, fig. 5.

Description.—Shell convex, oblong, oblique, rounded ventrally; antero-dorsal margin long, nearly straight and almost parallel with the opposite margin. Height considerably greater than length. Anterior area large, smooth, not depressed. Ears rather small, the anterior somewhat larger than the posterior.

Shell ornamented with from seven to ten very strong ribs, which have rounded summits and are separated by rounded grooves of about the same width as the ribs. Small and narrow radial ribs are present on both ribs and grooves.

Measurements :

	(1)	(2)	(3)
Length .	29	25	21 mm.
Height .	35	34	27 ,,
Thickness .	19	16	— ,,

(1–3) Cenomanian, Wilmington.

Remarks.—This species is easily distinguished by the very strong radial ribs. The English specimens, which at present are known from three localities only, are not well-preserved, so that the details of the ornamentation cannot be seen clearly.

The occurrence of *L. Reichenbachi* in England (from Wilmington) was first noted by Mr. Jukes-Browne in 1898. The only specimens which I have seen are now in the Museum of Practical Geology and the Sedgwick Museum.

Types.—From the Lower Pläner (Cenomanian) of Plauen near Dresden.

Distribution.—Upper Greensand (zone of *Pecten asper*) of Warminster. Chloritic Marl of Chard. Cenomanian Sandstone of Wilmington.

LIMA (MANTELLUM), sp. Plate VI, fig. 16 *a*, *b*.

Remarks.—A small specimen in the Museum of Practical Geology (No. 7896) is similar in form and in the general character of its ornamentation to *L. cantabrigiensis* (see p. 37), but the main ribs are not so strongly developed, the interspaces are flatter, and the intermediate ribs are more prominent. It differs from *L. intermedia* in its more distinctly oblong form and in the occurrence of well-developed intermediate ribs.

This specimen resembles closely the lowest of the three figures referred to *Lima elegans* by Guéranger.[1]

Distribution.—Chloritic Marl of Chardstock.

Sub-genus—CTENOIDES, *H. and A. Adams*, 1858 (ex *Klein*, 1753).

('Genera of Recent Mollusca,' vol. ii, p. 557).

LIMA (CTENOIDES) RAPA, *d'Orbigny*, 1847. Plate VI, figs. 17*a*—*c*. Plate VII, fig. 1. Text-fig. 6.

1847.	LIMA RAPA,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 546, pl. cccxix, figs. 1—4.
1850.	—	— *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 166.
—	—	— *H. B. Geinitz.*	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 188.
1855.	—	— *G. Cotteau.*	Moll. Foss. de l'Yonne, p. 101.
1867.	—	— *E. Guéranger.*	Album Paléont. de la Sarthe, p. 19, pl. xxiv, figs. 16, 17.

[1] 'Album Paléont. de la Sarthe' (1867), p. 18, pl. xxiv, fig. 1.

1869. Lima rapa, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 168.

1871. Radula (Ctenoides) rapa, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 414.

1872. Lima rapa, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 206, pl. xliii, fig. 4.

Description.—Shell moderately and regularly convex, with ovate outline, nearly equilateral, considerably higher than long, margins evenly rounded. Umbones small, pointed, close together. Apical angle about 85°. Ears rather large, much

Fig. 6.—*Lima (Ctenoides) rapa*, d'Orbigny. Upper Greensand, Haldon. British Museum, No. L. 15616. Interior of right valve. Natural size.

higher than long, with fine radial ribs; the anterior ear larger than the posterior, the latter with its outer angle obtuse.

Ornamentation consists of numerous fine radial ribs which diverge slightly from a median or nearly median line or sometimes in places from two lines. These ribs are slightly raised and rounded, and are separated by very narrow grooves; near the anterior and posterior margins the ribs become much narrower and sharper, and may bear small pointed projections. The ribs are slightly wavy and their course is often more or less sharply deflected where they pass the growth-lamellæ. Numerous fine linear concentric ridges occur, and also some growth-lamellæ.

Measurements :

	(1)	(2)	(3)
Length	66	43	30 mm.
Height	90	59	41 „

(1–3) Upper Greensand, Haldon.

Affinities.—*L. rapa* is closely related to *L. divaricata* (p. 44) but the valves are less flattened and the anterior part slopes gradually to the margin; the outline is more regularly ovate, and the anterior and posterior ribs are much narrower than the others. *L. rapa* is usually considerably larger than *L. divaricata*.

Types.—From the Cenomanian of Coudrecieux and Le Mans.

Remarks.—The presence of this species in English deposits appears to have been recognised first by the late Mr. C. J. A. Meÿer; it was recorded by Mr. Jukes-Browne in 1896.

Distribution.—Upper Greensand of Haldon. Cenomanian (Meÿer's Bed 10) of Dunscombe.

LIMA (CTENOIDES) TECTA, *Goldfuss*, 1836. Plate VII, figs. 2, 3.

1836.	LIMA TECTA,	*A. Goldfuss.*	Petref. Germ., vol. ii, p. 91, pl. civ, fig. 7.
1837.	—	FRONDOSA, *F. Dujardin.*	Mém. Soc. géol. de France, vol. ii, pp. 216, 227, pl. xvi, fig. 10.
1839.	—	LAMELLOSA, *H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 23.
1841.	—	TECTA, *F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 58.
1847.	—	— *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 547, pl. cccexix, figs. 5—8.
1850.	—	— *H. B. Geinitz.*	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 188.
—	—	— *A. d'Orbigny.*	Prodr. de Pal., vol. ii, pp. 166, 247.
—	—	— ?, *A. Alth.*	Geogn.-pal. Beschreib. Umgeb. v. Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 243.
? 1852.	—	— ?, *R. Kner.*	Denkschr. d. k. Akad. Wissensch. Math.-nat. Cl., vol. iii, p. 318, pl. xvii, fig. 7.
1867.	—	— *E. Guéranger.*	Album Paléont. de la Sarthe, p. 19, pl. xxiv, fig. 11.
1869.	—	— *E. Favre.*	Moll. Foss. de la Craie de Lemberg, p. 135.
1869–70.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 168, 170, 173.
1871.	RADULA (CTENOIDES) TECTA,	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 420, pl. xxx, fig. 12.

1872. LIMA TECTA, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 206, pl. xliii, fig. 3.
1877. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: II, Weissenberg. u. Malnitz. Schicht., p. 130, fig. 113.
1894. — — *B. Lundgren.* Mollusk-faunan i *Mammillatus* och *Mucronata* zonerna (K. Svenska Vet.-Akad. Handl., vol. xxvi, No. 6), p. 43.
1895. — — *F. Vogel.* Holländisch. Kreide, p. 18.
— — cf. TECTA, *E. Tiessen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 474.
1898. — TECTA, *G. Müller.* Mollusk. Untersen. v. Braunschweig u. Ilsede, p. 27.
1902. — — *M. v. Pálfy.* Mittheil. a. d. Jahrb. d. k. ungarisch. geol. Anstalt, vol. xiii, p. 275, pl. xx, fig. 5.

Description.—Shell convex, much flattened, sub-ovate, slightly oblique, considerably higher than long; antero-dorsal part sloping steeply to the antero-dorsal margin which is rather long and straightened. Umbones small, only slightly incurved. Ears rather large, relatively high, the anterior larger than the posterior.

Ornamentation consists of numerous small radial ribs, which are rounded, and smooth or nearly smooth. At fairly regular intervals the course of the ribs is interrupted by strong growth-lamellæ, ventrally to which the direction of the ribs is sometimes deflected. Growth-lamellæ, and sometimes ribs, are present on the ears.

Measurements:

Length	27 mm.
Height	39 „

From the Cenomanian (Bed 11) of Dunscombe.

Affinities.—This species is related to *L. divaricata* (see p. 44), but is distinguished by the growth-lamellæ, by the ribs not diverging from a median line, and by the absence of the fine concentric ridges. *Lima essertensis*, de Loriol,[1] from the Urgonian, is a similar form but is distinguished by the growth-lamellæ being more closely placed.

Remarks.—This species has a considerable stratigraphical range, extending from Lower Cenomanian to Senonian. It has been recognised in France, Holland, Scandinavia, Saxony, Bohemia, Hungary, etc. In England it has been found in the Cenomanian of Devon only, having been discovered and identified by the late Mr. C. J. A. Meÿer, and first recorded by Mr. Jukes-Browne. The examples from the Arrialoor Group, described by Stoliczka, seem quite indistinguishable from the European forms.

[1] 'Foss. Corall. Valang. et Urgonien de Mt. Salève' (1866), p. 83, pl. d, fig. 12; also in A. Favre, 'Recherch. géol. Savoie,' vol. i (1867), p. 388, pl. c, fig. 23; Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1869), p. 139, pl. clxiii, fig. 7.

Types.—From the Senonian of Maestricht. D'Orbigny's specimens came from the Cenomanian of Le Mans and from the Senonian of Tours and Loir-et-Cher.

Distribution.—Cenomanian (Bed 11) of Dunscombe.

LIMA (CTENOIDES) DIVARICATA, *Dujardin*, 1837. Plate VII, figs. 4*a*—*d*, 5, 6*a*, *b*.

1837. LIMA DIVARICATA, *F. Dujardin.* Mém. Soc. géol. de France, vol. ii, p. 227, pl. xvi, fig. 7.
1840. — ARCUATA, *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 2, p. 57, pl. ix, fig. 7.
1841. — DIVARICATA, *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 58.
1850. — — *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 248.
— — GRANOSA, *J. de C. Sowerby* in *F. Dixon.* Geol. Sussex, p. 347 (p. 382, ed. 2), pl. xxviii, figs. 24, 25.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 171.
1859. MYTILUS? SPECTABILIS, *J. Müller.* Petref. der Aachen. Kreidef., supplement., p. 10, pl. vii, fig. 10.
1870. LIMA GRANOSA, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix. (Matér. Pal. Suisse, ser. 5), p. 169.
— — DIVARICATA, *Pictet and Campiche.* Ibid., pp. 171, 173.
1871. RADULA (CTENOIDES) GRANOSA, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 415.
— — — DIVARICATA, *Stoliczka.* Ibid., p. 415.
1872. LIMA DIVARICATA, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 205, pl. xlii, fig. 18.
1889. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: IV, Teplitz. Schicht., p. 83, fig. 77.
— — — *E. Holzapfel.* Die Mollusk. Aachen Kreide (Palæontographica, vol. xxxv), p. 241, pl. xxvii, fig. 7.
1897. — GRANOSA, *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 383.
1902. — DIVARICATA, *M. v. Pálfy.* Mittheil. Jahrb. d. k. ungarisch. geol. Anstalt, vol. xiii, p. 274, pl. xx, fig. 4.

Description.—Shell convex, flattened, the anterior marginal part sloping steeply, the posterior part more gradually; outline rather variable, more or less ovate or approaching to oblong, considerably higher than long, only slightly unsymmetrical. Umbones rather small, not much incurved. Ears relatively short and high, not sharply limited; the anterior larger than the posterior.

Ornamentation consists of numerous small radial ribs which diverge from a median or nearly median line or sometimes in part from two lines forming an

inverted **W**. The ribs are slightly raised and often somewhat wavy or irregular, especially near the growth-ridges. The ribs and grooves are crossed by numerous concentric linear ridges. The ribs are sometimes nodular, the nodules having a concentric arrangement. At intervals, usually rather distant and fairly regular, distinct growth-lamellæ are seen.

Measurements :

	(1)	(2)	(3)
Length	37	20	22 mm.
Height	51	37	32 ,,

(1) Chalk, Newtimber.
(2) *B. mucronata* zone, Norwich.
(3) *H. planus* zone, Dover.

Affinities.—See *L.* (*Ctenoides*) *rapa* (p. 42) and *L.* (*Ctenoides*) *tecta* (p. 43). *L. divaricata* also presents some resemblance to *Lima Holzapfeli*, Hennig,[1] found in the Danian of Faxe.

Remarks.—This species has hitherto been known in England as *Lima granosa*, Sowerby. After making a careful comparison I feel no hesitation in regarding it as identical with the widely-distributed *L. divaricata*, Dujardin. This form is comparatively rare in England, and the part of the shell near the umbo is usually wanting or imperfectly preserved.

Type.—From the Chalk (? Lower Senonian) of Touraine. Sowerby does not mention the locality or the horizon from which he obtained *Lima granosa*, and I have not succeeded in finding the type.

Distribution.—Zone of *Terebratulina* of Hitchin. Zone of *Holaster planus* of Winchester, Dover, and Cheveley, Blue Bell Hill, Burham (? *H. planus* zone). Chalk Rock of Cuckhamsley. Zone of *Micraster cor-anguinum* of Micheldever. Zone of *Actinocamax quadratus* of Salisbury. Zone of *Belemnitella mucronata* of Salisbury and Norwich.

Sub-genus—Limatula, *S. V. Wood*, 1839.

('Mag. Nat. Hist.,' new series, vol. iii, p. 233.)

Lima (Limatula) Tombeckiana, *d'Orbigny*, 1847. Plate VII, figs. 7*a*, *b*, 8*a*—*c*, 9*a*, *b*.

1847. Lima Tombeckiana, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 534. pl. cccxv, figs. 13—17.
1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 82.

[1] 'Bih. K. Svenska Vet. Akad. Handl.,' vol. xxiv, No. 7 (1899), p. 10, pl. i, figs. 1, 2; Ravn. 'Mollusk. Danmarks Kridtaft I. Lamellibr.' (1902), p. 100, pl. ii, fig. 15.

? 1854. Lima semisulcata, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 172 (*partim*).
1855. — Tombeckiana, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 100.
1861. — — *P. de Loriol*. Anim. Invert. Foss. Mt. Salève, p. 95, pl. xi, fig. 11.
1869. — — *P. de Loriol and F. Gilliéron*. Urgon. infér. de Landeron, p. 19, pl. i, fig. 17.
— — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 148.
1871. Radula (Limatula) Tombeckiana, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 414.
— Lima Tombeckiana, *W. A. Ooster*. Protozoe Helvetica, vol. ii, pp. 104, 123, 140.
1883. — — *W. Keeping*. Foss., etc., Neoc. Upware and Brickhill, p. 111.

Description.—Shell oval, inflated, higher than long, produced a little more anteriorly than posteriorly. Umbones rather small, close together. Ears equal. Margins of valves rounded, the posterior with a greater curvature than the anterior.

Ornamentation consists of from 13 to 16 strong, rounded or slightly keeled ribs separated by narrow grooves. The ribs are confined to the median part of the shell, and the anterior and posterior parts are without ribs. The ribbed portion is not quite symmetrically placed, the anterior smooth portion being rather larger than the posterior smooth portion. Very fine concentric ridges are present on the shell, and may form scale-like projections where they cross the ribs.

Measurements:

	(1)	(2)		(4)	(5)	(6)	
Length	9	9	8	8	7	11	mm.
Height	12	11	12·5	13	10	15·5	,,

(1—5) Hythe Beds, Court-at-Street.
(6) Lower Greensand, Brickhill.

Affinities.—Some specimens of *L. Tombeckiana* approach very closely *L. Fittoni* from Blackdown and Haldon (see p. 48), and it is quite possible that the latter is only a local variety of the former since some examples found in the Upper Greensand of Charmouth and Potterne (Plate VII, fig. 10) seem indistinguishable from *L. Tombeckiana*. As a rule *L. Tombeckiana* differs from *L. Fittoni* in having the ribbed part of the shell more nearly symmetrical in position, in the shell being rather longer and rather more convex with the umbonal part more pointed, and in the ribs being more rounded.

L. Tombeckiana differs from *L. semisulcata*, Nilsson, in being smaller, relatively longer, less symmetrical, and with the umbonal part more pointed. In this connection, however, it should be noted that Hennig[1] considers that specimens which

[1] Revis. Lamellibr. i Nilsson's 'Petrific. Suecana' (1897), p. 29.

he has seen from the Lower Greensand of Atherfield and Blackgang belong to *L. semisulcata*. *L. Tombeckiana* also resembles *L. suprajurensis*, Contejean,[1] found in the Upper Jurassic.

Types.—D'Orbigny does not give the locality of the type, but says that he obtained specimens from the Neocomian of Neuchâtel, Auxerre, Saint Sauveur, etc.

Distribution.—Hythe Beds of Court-at-Street near Lympne. Lower Greensand of Brickhill. Tealby Limestone (zone of *B. brunsricensis*) of North Willingham.

LIMA (LIMATULA) DUPINIANA, *d'Orbigny*, 1847. Plate VII, figs. 11 *a*—*c*.

? 1845. LIMA SEMISULCATA, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 248 (non *semisulcata*, Nilsson).

1847. LIMA DUPINIANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 535, pl. cccexv, figs. 18—22.

1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 81.

1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 171.

1855. — — *G. Cotteau*. Moll. Foss. de l'Yonne, p. 100.

1865. — — *H. Coquand*. Mon. Aptien de l'Espagne, p. 151.

1869. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 150.

1871. RADULA (LIMATULA) DUPINIANA, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 414.

Non 1883. LIMA DUPINIANA, *A. Fritsch*. Stud. im Gebiete der böhm. Kreideformat.: III, Iserschichten, p. 112, fig. 81.

Description.—Shell oval, moderately convex, much higher than long, nearly equilateral, with the posterior margin more convex than the anterior. Umbones very small, pointed, close together. Ears unequal.

Ornamentation consists of from ten to fourteen very narrow radial ribs, usually with sharp summits, separated by broad rounded grooves. The anterior and posterior parts of the shell are without ribs, and the posterior part is considerably larger than the anterior. Very fine concentric ridges are present.

Measurements:

	(1)	(2)	
Length	11	8	mm.
Height	21	14·5	,,

(1) Tealby Limestone, North Willingham.

(2) Ferruginous Sands, Shanklin.

[1] 'Kimmérid. de Montbéliard' (1859), p. 351, pl. xxvii, fig. 9; de Loriol and Cotteau, 'Portland de l'Yonne' (1868), p. 205, pl. xiv, figs. 1, 2.

Affinities.—This species is easily distinguished from *L. Tombeckiana* (see p. 45) by its relatively higher and less inflated form, by the narrow ribs, and by the less symmetrically placed ribbed area.

In its narrow ribs *L. Dupiniana* resembles *L. subæquilateralis*, d'Orbigny (see page 49) but the ribs in the latter are distributed over the greater part of the shell and are more widely separated and more numerous.

The specimens referred to *L. semisulcata* by Forbes are poorly preserved, but probably belong to this species.

Types.—From the Neocomian of Marolles (Aube) and Saint Sauveur (Yonne).

Distribution.—Tealby Limestone (zone of *B. brunsvicensis*) of North Willingham. Ferruginous Sands of Shanklin. Atherfield Beds of Redhill. Hythe Beds of Hythe (*fide* Topley).

LIMA (LIMATULA) FITTONI, *d'Orbigny*, 1850. Plate VII, figs. 12—14, 15 *a—c*.

1836. LIMA SEMISULCATA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 336, 359 (*not* 129, 158), pl. xi, fig. 10.
1850. — FITTONI, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 82.
1854. — SEMISULCATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 172 (*partim*).
1869. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 166 (*partim*).

Description.—Shell oval, moderately convex, higher than long, slightly inequilateral, with rounded margins, the posterior being more convex than the anterior. Umbones small, close together. Ears equal.

Ornamentation consists of from 13 to 15 radial ribs with sharp summits, separated by narrow grooves. Pointed projections are present on the summits of the ribs, especially near the ventral border of the shell. The anterior and posterior parts of the shell are without ribs. The ribbed area is unsymmetrically placed, and the anterior smooth part of the shell is considerably smaller than the posterior part. Fine concentric ridges are seen on well-preserved specimens.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Length	10	9	8	8	7	7	6	mm.
Height	16	14	14	13	12·5	12	10	,,

(1, 3—7) Upper Greensand, Haldon.
(2) ,, ,, Blackdown.

Affinities.—This form was referred by Sowerby (in Fitton) to the Senonian species *L. semisulcata*, Nilsson,[1] but has been regarded by most later writers as distinct from that species, and was named *L. Fittoni* by d'Orbigny.

L. Fittoni differs, as a rule, from *L. semisulcata* in its smaller size, and in having the ribbed area less extensive and much more asymmetrical in position, though occasionally, however, it is nearly symmetrical. It also appears to differ in having a relatively shorter hinge-line and less equilateral form.

For the relation of *L. Fittoni* to *L. Tombeckiana* see p. 46.

Type.—The type is *Lima semisulcata*, Sowerby (*non* Nilsson) from the Upper Greensand of Blackdown. A specimen in the Bristol Museum is regarded as the type, but does not agree very well with the figure.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown and Haldon. Cenomanian of Axmouth (Bed 12 of Meÿer), Dunscombe (Bed 10), and Pinhay.

LIMA (LIMATULA) SUBÆQUILATERALIS, *d'Orbigny*, 1847. Plate VII, figs. 16*a*, *b*, 17.

1847. LIMA SUBÆQUILATERALIS, *A. d'Orbigny*. Pal. Franç. Terr. Cret., vol. iii, p. 558, pl. cccexxiii, figs. 1—5.
1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 167.
1870. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 169.
1871. RADULA (LIMATULA) SUBÆQUILATERALIS, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 415.

Description.—Shell oval, or rounded oblong, pointed at the umbones, nearly equilateral, about twice as high as long, of moderate convexity. Anterior margin less curved than the posterior. Ears equal, smooth, with pointed ends.

Ornamentation consists of about 20 very narrow ribs separated by broad, slightly concave, interspaces which are crossed by growth-lines. Ribs are absent near the anterior and posterior margins.

Measurements:

Length	10 mm.
Height	19 ,,

Upper Greensand, Warminster.

Affinities.—See *Lima Dupiniana* (p. 48) and *Lima* sp. (p. 52).

Remarks.—I have seen only two English examples of this species, both of

[1] For references, see p. 51, footnote.

which are more or less imperfect, but after an examination of specimens of *L. subæquilateralis* from Le Mans in the Museum of Palæontology at Paris I am inclined to refer them to that species. In the specimens from Le Mans the number of ribs is sometimes greater than is shown in D'Orbigny's figure, also the ears may be less sharply separated from the valve, and in one case the hinge-line was seen to be relatively longer.

Types.—From the Cenomanian of Le Mans. The specimens here figured are in the British Museum.

Distribution.—Upper Greensand (zone of *Pecten asper*) of Warminster.

LIMA (LIMATULA) DECUSSATA, *Goldfuss*, 1836. Plate VII, figs. 18*a*, *b*, 19, 20*a*, *b*.

1836. LIMA DECUSSATA, *A. Goldfuss.* Petref. Germ., vol. ii, p. 91, pl. civ, fig. 5.
1837. PLAGIOSTOMA GRANULATUM, *W. Hisinger.* Lethæa Suecica, pl. xv, fig. 7.
1841. LIMA DECUSSATA, *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 55.
1846. — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 32, pl. xxxviii, fig. 15.
1847. — SEMISULCATA, *J. Müller.* Petref. der Aachen. Kreidef., pt. 1, p. 33.
1850. — DECUSSATA, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 248.
— — SEMISULCATA, *R. Kner.* Verstein. v. Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 29.
— — DECUSSATA, *A. Alth.* Geogn.-palæont. Beschreib. v. Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 241.
— — SEMISULCATA, *Alth.* Ibid., p. 242.
1863. — DECUSSATA, *A. v. Strombeck.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 151.
? — — — *S. Placketko.* Das Becken von Lemberg (Jahresb. d. k. zweite Ober-Gymnas. in Lemberg), p. 20, pl. i, fig. 19.
1866. — — *K. A. Zittel.* Die Bivalven d. Gosaugeb. (Denkschr. d. k. Akad. d. Wissensch. Wien, vol. xxv), pt. ii, p. 105, pl. xvi, fig. 4.
1869. — — *E. Favre.* Moll. Foss. de la Craie de Lemberg, p. 136.
1870. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 174.
1871. RADULA (LIMATULA) DECUSSATA, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 415.
1888. LIMA DECUSSATA, *A. Peron.* L'Hist. du Terr. de Craie, p. 145, pl. i, fig. 18.
1889. — — *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 242, pl. xxvii, fig. 4.

1900. LIMA DECUSSATA, *C. Gagel and F. Kaunhowen.* Jahrb. d. k. preussisch. geol. Landesanst. für 1899, p. 232.

1902. — — *J. P. J. Raen.* Mollusk. i Danmarks Kridtafl.: I. Lamellibr. (K. Danske Vid. Selsk. Skrift., 6 Række, nat. og. math. Afd., vol. xi), p. 96, pl. ii, fig. 11.

— — — *A. Wollemann.* Fauna d. Lüneburg. Kreide (Abhandl. d. k. preussisch. geol. Landesanst., N. F., Heft 37), p. 57.

Description.—Shell inflated, ovate or rounded-oblong, nearly equilateral. Umbones small. Ears rather small, nearly equal.

Ornamentation consists of numerous sharp ribs, separated by narrow grooves. The ribs become less distinct on the anterior and posterior parts of the shell. Numerous fine concentric ridges occur, and sometimes give rise to a tubercular appearance on the summits of the larger ribs.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	10	9	7	7	6·5	mm.
Height .	13·5	12	11	10·5	9·5	,,

(1, 2, 4, 5) *A. quadratus* zone, East Harnham.
(3) *Uintacrinus* band, Devizes Road, Salisbury.

Affinities.—*L. semisulcata*, Nilsson,[1] is distinguished from *L. decussata* by the ribs being limited to the median part of the shell, and by the relatively higher valves.

Peron thinks that *L. pectinata*, d'Orbigny, may be only a variety of *L. decussata*. It appears to differ from the latter in having the ribs more tubercular and usually fewer in number.

Type.—From the Senonian of Rinkerode, near Münster.

Distribution.—*Uintacrinus* band of Devizes Road, Salisbury. Zone of *Actinocamax quadratus* of East Harnham and Ashley Hill. Zone of *Belemnitella mucronata* of Clarendon.

LIMA (LIMATULA) WINTONENSIS, sp. nov. Plate VII, figs. 21 *a*, *b*, 22 *a*—*d*.

Description.—Shell inflated, ovate, nearly equilateral, pointed dorsally.

Ornamentation consists of 15 or 16 strong, rounded ribs on the median part of the valve only. The ribs are separated by very narrow grooves, and bear many

[1] 'Petrif. Suecana' (1827), p. 25, pl. ix, fig. 3; Hennig, Revis. Lamell. i Nilsson's 'Petrif. Suecana' (1897), p. 28, pl. ii, figs. 14, 17.

strong ridges placed concentrically and regularly. Below a growth-ring the ridges are sometimes situated more closely together. One or two ribs at the margins of the ribbed area are rather smaller than the others. The parts between the ribbed area and the anterior and posterior margins of the valve are smooth except for faint growth-lines.

Measurements:

	(1)	(2)	(3)	(4)	(5)
Length	7	6	5·5	5·5	5 mm.
Height	10	8	8	7·5	7 ,,

(1) Chalk, Clayton.

(2—5) *A. quadratus* zone, Winchester.

Affinities.—This species is distinguished from *L. decussata* (p. 50) by being more pointed dorsally, by having fewer ribs, which also are rounded and confined to the median part of the valve, and by the strong ridges which extend across the ribs.

In outline this species resembles *Lima pectinata*, d'Orbigny,[1] but differs in having fewer ribs, in the absence of ribs on the anterior and posterior parts of the valves, and in the ribs not being carinated and having ridges across them instead of tubercles at the summits.

This species resembles closely the form figured by Geinitz[2] as *L. semisulcata*, Nilsson.

Distribution.—Zone of *Actinocamax quadratus* of Winchester. Upper Chalk (probably zone of *Micraster cor-testudinarium*) of Kenley.

LIMA (LIMATULA), sp. Plate VII, fig. 23 *a*, *b*.

Description.—Shell inflated, oval, nearly equilateral. Umbones small. Hinge-line relatively long. Ears not sharply limited, nearly equal.

Ornamentation consists of about 20 narrow ribs, separated by very broad and shallow interspaces in which very fine radial ribs may be seen. The ribs anterior to the median line are closer together and rather stronger than the others. On the parts of the valves next to the ears ribs appear to be absent.

Measurements:

Length	6·5 mm.
Height	9 ,,

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 572, pl. cccxxvii, figs. 15—19.

[2] 'Das Elbthalgeb. in Sachsen,' pt. 2 (1873), p. 53, pl. xvi, fig. 14.

Affinities.—In the character of its ornamentation this form resembles *Lima subæquilateralis*, d'Orbigny (see p. 49), from the Cenomanian of Le Mans, but the shell is not so high, is less pointed in the umbonal region, and has a longer hinge-line.

In outline this form resembles the example figured by Ravn[1] as *Lima Forchhammeri*, von Hagenow, but possesses a much larger number of ribs.

Remarks.—I have seen one specimen only, which is in Dr. Blackmore's collection.

Distribution.—Zone of *Belemnitella mucronata* of Clarendon (Salisbury).

Sub-genus—Limea, *H. G. Bronn*, 1831.

('Italiens Tertiär-Gebilde und deren Organische Einschlüsse,' p. 115.)

Lima (Limea?) composita (*Sowerby*), 1836. Plate VII, figs. 24*a*, *b*, 25*a*, *b*, 26.

1836.	Pecten compositus,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 241, 342, pl. xvii, fig. 20.
1847.	Lima cenomanensis,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 552, pl. cccexxi, figs. 11—15.
1850.	—	*d'Orbigny.*	Prodr. de Pal., vol. ii, p. 167.
1867.	—	*E. Guéranger.*	Album Paléont. de la Sarthe, p. 19, pl. xxiv, figs. 4, 9.
1870.	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 161, 168.
1871.	Limea	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 416.
1882.	Lima	*R. Windmöller.*	Jahrb. d. k. preussisch. geol. Landesanst. für 1881, pp. 24, 29.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	12·5	11	10	9	9	8	mm.
Height	15	13	11·5	10·25	10	9·5	,,

(1, 3—6) Upper Greensand, Warminster.
(2) Rye Hill Sand, Maiden Bradley.

Affinities.—This form is closely related to *Lima granulata* (see below). The ornamentation appears to have been similar in both cases, but in *L. composita* the scale-like spines on the ribs are much less perfectly preserved and usually appear as tubercles only. In *L. composita* the shell appears to be rather less oblique and

[1] 'Molluskerne i Danmarks Kridtaflej. I. Lamellibr.' (1902), p. 97, pl. ii, fig. 12.

more nearly equilateral than in *L. granulata*; the height is also slightly greater and the umbones rather more prominent; the ribs appear to be narrower and to have sharper summits. The smaller convexity of *L. composita* mentioned by d'Orbigny does not seem to be constant.

Remarks.—An examination of the type of *Pecten compositus*, Sowerby, shows that it is an example of this species (see Vol. I, p. 188, footnote), and consequently the specific name *composita* must take the place of *cenomanensis*.

The French examples which I have seen are, on the average, larger than the English.

Types.—The type of *L. cenomanensis* came from the Cenomanian of Le Mans. The type of *Pecten compositus* is in the Bristol Museum; it is labelled "Blackdown" but is not siliceous and is more probably from Warminster.

Distribution.—Upper Greensand (zone of *Pecten asper*) of Warminster. Rye Hill Sand of Maiden Bradley. I have not seen the specimens recorded in the Memoirs of the Geological Survey from the zones of *Schlœnbachia varians* and *Holaster subglobosus* of Hunstanton.

LIMA (LIMEA?) GRANULATA (*Nilsson*), 1827. Plate VII, figs. 27*a*—*c*, 28, 29*a*, *b*.

1827. PLAGIOSTOMA GRANULATUM, *S. Nilsson*. Petrif. Suecana, p. 26, pl. fig. 4.
1833. — GRANULOSUM, *S. Woodward*. Geol. Norfolk, pp. 48, 51, pl. v, fig. 26.
1836. LIMA GRANULATA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 89, pl. ciii, fig. 5.
1837. PLAGIOSTOMA GRANULATUM, *W. Hisinger*. Lethæa Suecica, p. 54 (*not* the figure, pl. xv, fig. 7).
1841. LIMA MURICATA, *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 55.
1842. — GRANULATA, *F. v. Hagenow*. Neues Jahrb. für Min., etc., p. 555.
1846. — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 32, pl. xxxviii, fig. 21.
1847. — — *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 570, pl. cccexxvii, figs. 5—9. (Named *L. granosa* on plate.)
1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 248.
1851. — PSEUDOCARDIUM, INFLATA ET DENTATA, *J. Müller*. Petref. der Aachen. Kreidef., pt. 2, pp. 67, 68.
1855. — GRANULATA, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 102.
1870. — — *C. Schlüter*. Neues Jahrb. für Min., etc., p 950.
— — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 170.

1876. LIMÆA GRANULATA, *D. Brauns.* Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 386.

? — LIMA GRANULATA, *H. Deicke.* Die Tourtia von Mülheim a. d. Ruhr, p. 27.

1881. LIMEA GRANULATA, *K. A. Zittel.* Handb. d. Palæont., vol. ii, p. 27.

1888. LIMA GRANULATA, *A. Peron.* L'Hist. Terr. de Craie, p. 147.

1889. LIMEA GRANULATA, *O. Griepenkerl.* Senon. von Königslutter (Palæont. Abhandl., vol. iv), p. 41.

— LIMA GRANULOSA, *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 239, pl. xxvii, fig. 6.

— — GRANULATA, *A. Fritsch.* Stud. im Gebiete der böhm Kreideformat.: IV, Teplitz. Schicht., p. 83, fig. 76.

1893. — — *Fritsch.* Ibid., V, Priesener Schicht., p. 100.

1894. — — *B. Lundgren.* Mollusk-faunan i *Mammill.* och *Mucron.* zonerna (K. Svenska Vet.-Akad. Handl., N. F., vol. xxvi, No. 6), p. 42.

1897. — — *A. Hennig.* Revis. Lamell. i Nilsson's 'Petrific. Suecana' (K. Fys. Sällsk. i Lund. Handl., N. F., vol. viii), p. 26, pl. ii, figs. 6—8.

1898. — — *G. Müller.* Mollusk. d. Untersen. v. Braunschweig u. Ilsede (Abhandl. d. k. preussisch. geol. Landesanst., N. F., Heft 25), p. 29, pl. iv, fig. 6.

1901. — — *A. Wollemann.* Jahrb. d. k. preussisch. geol. Landesanst. für 1900, vol. xxi, p. 16.

1902. — — *Wollemann.* Lüneburg. Kreide (Abhandl. d. k. preussisch. geol. Landesanst., N. F., Heft 37), p. 57.

— — — *J. P. J. Ravn.* Mollusk i Danmarks Kridtaflej. I. (K. Danske Vid. Selsk. Skrift., 6 Række, nat. og. math. Afd., vol. xi), p. 101.

Non 1837. — — *F. Dujardin.* Mém. Soc. géol. de France, vol. ii, p. 226, pl. xvi, fig. 4 (= *L. Meslei*, Peron, 1888).

Description.—Shell very convex, oval, slightly oblique, with rounded outline; height a little greater than length. Apical angle very large. Umbones small, incurved, close together. Ears of moderate size, nearly equal, rather low and long, with a few spiny ribs.

Ornamentation consists of numerous (usually from 22 to 24) strong ribs with sharp summits, separated by narrow furrows. Each rib bears three rows of scale-like spines, one row being at the summit and one on each side. The spines are placed near together, at regular intervals, and curve upwards from the surface of the shell, the terminal parts sometimes becoming quite erect. The middle row is rather larger than the rows on the sides. In some cases the spines are represented by granules. On the anterior and posterior parts of the shell the ribs may be

smaller than elsewhere, but the middle rows of spines are here often relatively larger.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Length	19	16	15	11	10	10	10	8	9·5	16	21	mm.
Height	21	18	16	12·5	11	10·5	11	9	10	18	24	,,

(1–5) *B. mucronata* zone, Norwich.
(6) ,, ,, Alderbury.
(7) *A. quadratus* zone, East Harnham.
(8) *B. mucronata* zone, Clarendon.
(9—11) Chalk of Trimingham.

Affinities.—The form from the Lower Senonian of Touraine described and figured as *Lima granulata* by Dujardin, is regarded by Peron[1] as belonging to another species which he names *Lima Meslei*. Peron states that *L. Meslei* differs from *L. granulata* in having more numerous ribs ornamented with fine granules of which the middle row is not larger than the lateral rows; further, the ribs disappear on the anterior and posterior parts of the shell, and the ears are without ornamentation.

Radula scabricula, Stoliczka,[2] from the Arrialoor Group, is closely related to *Lima granulata*, but owing to the imperfect preservation of the single valve on which the species is founded, an exact comparison is not possible. The ornamentation, however, seems to differ, since it apparently consists of small tubercles of nearly equal size. It has been suggested by Holzapfel and Hennig that *Lima pseudocardium*, Reuss,[3] may be identical with *L. granulata*, but the ornamentation on the ribs of that species appears to be unknown.

Remarks.—This species has been referred to *Limea* by Brauns, Zittel, and Griepenkerl, but later writers—Holzapfel, Hennig, and Ravn—retain it in the genus *Lima* since they find no evidence of the existence of a taxodont hinge. The specimens which I have seen do not show the hinge.

The outline of the shell varies to some extent in *L. granulata*, depending mainly on the obliquity of the valves. The appearance of the ribs varies considerably and is probably due chiefly to the state of preservation; in the more perfect specimens the terminations of the scale-like spines become erect, in others the spines are in the form of sloping scales, whilst in some cases they are represented by tubercles only. The number of ribs also shows variation.

[1] 'L'Hist. du Terr. de Craie' (1888), p. 148, pl. i, figs. 21—24.

[2] 'Palæont. Indica, Cret. Fauna S. India' (1871), vol. iii, p. 419, pl. xxx, fig. 8.

[3] 'Die Verstein. der böhm. Kreideformat.' (1846), pt. 2, p. 33, pl. xxxviii, figs. 2, 3; Geinitz, "Das Elbthalgeb. in Sachsen" ('Palæontographica,' vol. xx, pt. 1, 1872), p. 204, pl. xlii, figs. 14, 15: see also Brauns (1876), Fritsch (1877, 1883), Michael (1893), Leonhard (1897).

Palæontographical Society, 1905.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. II. PART II.

Pages 57—96; Plates VIII—XI.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1905.

This species was figured from the Norwich Chalk by S. Woodward (1833) as *Plagiostoma granulosum*, but apparently he was unaware that it had been previously described and figured by Nilsson under the similar name *P. granulatum*. Woodward's figure seems to have been overlooked by later writers.

Distribution.—*Actinocamax quadratus* zone of East Harnham, Salisbury. *Belemnitella mucronata* zone of Alderbury, Clarendon (near Salisbury), and various localities near Norwich. Chalk of Trimingham.

Family—PTERIIDÆ, *Meek*.

Genus—PTERIA, *J. A. Scopoli*, 1777.[1]

('Introd. Hist. Nat.,' p. 397.)

Sub-genus—OXYTOMA, *Meek*, 1864.

('Check List Invert. Foss., N. America,' p. 39; *Meek and Hayden*, 'Palæont. U. Missouri,' 1864, Part I, p. 79.)

PTERIA (OXYTOMA) CORNUELIANA (*d'Orbigny*), 1846. Plate VIII, figs. 1, 2, 3 *a*, *b*, 4–7.

1836.	AVICULA MACROPTERA, *F. A. Römer*.		Die Verstein. nord-deutsch. Oolith.-geb., p. 86, pl. iv, fig. 5 (non *Avicula macroptera*, Lamarck, 1819).
1841.	—	—	Die Verstein. d. nord-deutsch. Kreide-geb., p. 64.
1846.	—	CORNUELIANA, *A. d'Orbigny*.	Pal. Franç. Terr. Crét., vol. iii, p. 471, pl. cccIxxxix, figs. 3, 4.
1846.	—	PECTINATA, *d'Orbigny*.	Ibid., p. 473, pl. cccxci, figs. 1–3.
1850.	—	CORNUELIANA, —	Prodr. de Pal., vol. ii, p. 82.
1850.	—	PECTINATA, —	Ibid., p. 82.
? 1868.	—	CORNUELIANA, *E. Eichwald*.	Lethæa Rossica, vol. ii, p. 508, pl. xxii, fig. 1.
1869.	—	*F. J. Pictet and G. Campiche*.	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 66, pl. clii, figs. 1–4.
1877.	—	*G. Böhm*.	Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix, p. 237.
? 1883.	—	*W. Keeping*.	Foss., etc., Neoc. Upware and Brickhill, p. 109, pl. v, fig. 2.
1884.	—	*O. Weerth*.	Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 50.

[1] Syn. *Avicula*, Bruguière, 1791.

1889. Avicula inæquivalvis, *G. W. Lamplugh*. Quart. Journ. Geol. Soc., vol. xlv, p. 615.
1895. Cornueliana, *G. Maas*. Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 267.
1895. — *F. Vogel*. Holländisch. Kreide, p. 55.
1896. — *A. Wollemann*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 842.
1900. — Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 52.
1901. Oxytoma inæquivalve *var.* macroptera, *L. Waagen*. Jahrb. d. k.-k. geol. Reichsanst., vol. li, pp. 12, 15, pl. i, figs. 7, 14, 15.

Description.—Shell obliquely oval, rounded. Height a little greater than length. Left valve moderately convex. Anterior ear triangular. Posterior ear larger and longer than the anterior. Surface of valve with from 12 to 21 main ribs which are rounded, and form projections on the margin of the valve. Between the main ribs are broad flat interspaces in the middle of each of which a smaller rib occurs, and between these secondary ribs and the main ribs one or more still smaller ribs are found. On the middle and posterior parts of the valve the ribs are nearly straight, but on the anterior part they curve forward. Similar ribs occur on the anterior ear; on the posterior ear much smaller ribs are present, and growth lines are seen. Fine concentric ridges cross both ribs and interspaces.

Right valve nearly flat, with many small, sometimes irregular ribs, which may be alternately large and small. Anterior ear rather small, with a well-marked byssal sinus. Posterior ear large, pointed, with small radial ribs.

Measurements:

	(1)	(2)	(3)
Length	26	24	13 mm.
Height	27	25	15 ,,

(1, 2) Speeton Clay (D 1), Speeton.
(3) Claxby Ironstone, Claxby.

Affinities.—*P.* (*Oxytoma*) *Cornueliana* is distinguished from the other Cretaceous species of *Oxytoma* by the broad interspaces on which several smaller ribs occur. It belongs to the persistent and variable series of forms, ranging from the Rhætic to the Chalk, of which *Pteria inæquivalvis* (Sowerby) is the type, and it is regarded by L. Waagen as only a variety of that species.

In most of the English specimens the main ribs are more numerous but less prominent than in the examples figured by d'Orbigny and by Pictet and Campiche.

But the number of those ribs varies considerably, and our specimens agree perfectly with the figures given by Waagen. The specimens from Faringdon are smaller than those found in the Speeton Clay, and they present some resemblance to *P. pectinata* (see below), but the presence of several smaller ribs in the interspaces connects them with *P. Cornueliana*.

Types.—From the Hils-thon of Elligser Brink. The specimen from Upware figured by Keeping is in the Sedgwick Museum; it is imperfectly preserved, but is probably an example of this species.

Distribution.—Speeton Clay (zone of *Belemnites lateralis*, D 1) of Speeton. Claxby Ironstone (zone of *B. lateralis*) of Claxby. Tealby Clay (zone of *B. jaculum*) of Claxby. Lower Greensand of Faringdon. Gault of Folkestone.[1]

PTERIA (OXYTOMA) PECTINATA (*Sowerby*), 1836. Plate VIII, figs. 8*a*, *b*, 9, 10*a*, *b*, 11–13, 14*a*, *b*.

1836.	AVICULA PECTINATA,		*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 128, 338, pl. xiv, fig. 3.
1854.	—	—	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 163.
1869.	—	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 70.
Non 1846.	—	—	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 473, pl. cccxci, figs. 1—3.

Description.—Shell small, obliquely oval, with evenly rounded margin. Height a little greater than length.

Left valve convex, ornamented with numerous slender ribs often having sharp summits. Frequently the ribs are of two sizes—larger and smaller, alternating in a more or less regular manner. But in some cases the ribs near the margin of the valve are of equal or nearly equal size. The interspaces are flattened and considerably broader than the ribs. Anterior ear moderately large, triangular, the outer angle nearly a right angle; surface with ribs similar to those on the rest of the valve. Posterior ear much longer than the anterior, wing-like, with concave growth-lines; on the dorsal part a few slender ribs occur but are often indistinct or absent near the valve.

Right valve moderately convex dorsally, flattened ventrally, surface smooth or with very fine radial and concentric ribs. Posterior ear large, not distinctly limited. Anterior ear small.

[1] The only specimen seen from this horizon is in the British Museum, No. L. 16,880.

Measurements:

	(1)	(2)	(3)	(4)	(5)
Length	16	10	9·5	9	8 mm.
Height[1]	17	12	10	11	9 „

(1) Hythe Beds (Bargate Stone), St. Katherine's Chapel, Guildford.
(2—5) Folkestone Beds, Folkestone.

Affinities.—The shell in this species is smaller than in *P. Cornueliana* (see above); also the main ribs on the left valve are closer together, more numerous, and between them not more than one small rib is found. The ornamentation on the right valve is very much finer than in *P. Cornueliana*. See also *Pteria* (*Oxytoma*) *tenuicostata* (below).

Type.—The type came from the Folkestone Beds of Risborough, but appears to have been lost. Another specimen, however, from the same locality is in the Fitton Collection in the Museum of the Geological Society.

Distribution.—Hythe Beds (Bargate Stone) of St. Katherine's Chapel, Guildford. Sandgate Beds of Parham. Folkestone Beds of Folkestone. Recorded by Topley from the Hythe Beds of Hythe. Gault of Folkestone (British Museum, No. L, 4926).[2] Upper Greensand of Ventnor, and Crook Hill, Cheddington (Dorset).

PTERIA (OXYTOMA) sp. Plate VIII, fig. 15 *a*, *b*.

Some very small examples of a *Pteria* similar to *P. pectinata* are found in the Totternhoe Stone of Hitchin. They are not well preserved, but appear to be distinguished from *P. pectinata* by the presence of transverse ribs placed at regular distances in the spaces between the radial ribs.

PTERIA (OXYTOMA) DUBIA (*Etheridge*), 1881. Plate VIII, fig. 16 *a*, *b*.

1881. AVICULA DUBIA, *R. Etheridge*. In Penning and Jukes-Browne, Geol. Cambridge, p. 145, pl. ii, figs. 4, 4 *a*.

Remarks.—This is known only by the two type specimens—one being a right valve separated from the matrix, the other a left showing the interior only. The surface of the right valve is smooth. Since the exterior of the left valve is un-

[1] Measured obliquely to the hinge-line.

[2] The species recorded from the Gault of Folkestone as *Avicula Rauliniana*, d'Orbigny (see Jukes-Browne, 'Cretaceous Rocks of Britain,' vol. i, p. 465), is probably *Pteria pectinata*.

known, the characters and affinities of this "species" cannot be determined. The left valve has a length of 6 mm.

Types.—In the Sedgwick Museum, Cambridge.

Distribution.—Totternhoe Stone (zone of *Holaster subglobosus*) of Burwell.[1]

PTERIA (OXYTOMA) TENUICOSTATA (*Römer*), 1841. Plate VIII, figs. 17 *a–d*, 18, 19 *a*, *b*, 20 *a*, *b*, 21 *a*, *b*, 22, 23.

1841.	AVICULA LINEATA, *F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 64, pl. viii, fig. 15 (*A. tenuicostata* on pl. viii).
1850.	— SUBLINEATA, *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 249.
1869.	— TENUICOSTA, *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 73.
1878.	— TENUICOSTATA, *J. F. Blake.*	Proc. Geol. Assoc., vol. v, p. 259.
1882.	— — *H. Schröder.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 271.
1888.	— — *A. Peron.*	L'Hist. du Terr. de Craie, p. 153, pl. i, figs. 11, 12.
1904.	— — *A. W. Rowe.*	Proc. Geol. Assoc., vol. xviii, p. 266.
Non 1845.	— — *A. d'Orbigny*, in *Murchison, de Verneuil*, and *Keyserling.*	Géol. de la Russie d'Europe, vol. ii, p. 490, pl. xliii, figs. 5—7.
— 1854.	— LINEATA, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 163.

Description.—Shell obliquely oval, usually longer than high.

Left valve moderately convex; with evenly convex margins, except the postero-dorsal, which is slightly concave. Ears large, the anterior indistinctly limited, and with its outer angle rectangular or slightly obtuse. Posterior ear longer and more distinctly limited than the anterior, with the dorsal portion extended and wing-like.

Ornamentation of left valve consists of numerous (sometimes as many as 100) narrow, well-marked, evenly rounded ribs separated by broad, flat interspaces. The anterior ribs are slightly less prominent than the others; those near the posterior border are often closer together. At the margin of the valve the ribs usually

[1] Another specimen from the same locality and horizon was described by Etheridge as *Avicula filata* (Penning and Jukes-Browne, 'Geol. Camb.,' p. 144, pl. ii, fig. 3). I am unable to accept the generic position assigned to this species by Etheridge; it may be an *Ostrea*, but appears to be closely allied to the shell described as *Anomia subradiata* by Reuss ('Die Verstein. der böhm. Kreideformat.,' pt. 2, 1846, p. 45, pl. xxxi, figs. 18, 19). The type and three other specimens of *Avicula filata* are in the Sedgwick Museum, Cambridge.

show a more or less regular alternation in size, but sometimes two or three of the larger ribs occur in proximity without the intervention of smaller ribs. In some cases between the large and small ribs a rib of still smaller size is found. Some of the large ribs start from near the umbo; others start at some little distance from it but soon reach the same size as the primary ribs; still other ribs are intercalated at a greater distance from the umbo and do not attain the same size as the earlier ribs. The anterior and posterior ribs have a slight curvature; the others are more nearly straight. Occasionally the anterior and posterior ribs have a faintly marked nodose appearance. The interspaces are smooth, or have a very faintly marked radial ribbing. The anterior ear is ornamented with ribs similar to those on the remainder of the valve, but they are of uniform or nearly uniform size. The posterior ear is marked with growth-lines parallel to its posterior concave border; radial ribs also occur, and are rather larger and more widely separated on the dorsal portion than on the part near the junction with the rest of the valve.

Right valve much smaller than the left; flattened, but convex in the median dorsal part. Anterior ear with a deep sinus. Posterior ear much larger, but not marked off from the rest of the valve. Surface smooth, or with very faint concentric lines.

Measurements of left valves:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length .	27	26	26	20·5	19	19	13·5	12	mm.
Height (oblique)	25·5	23	22	19	18	17	14·75	11·25	,,

(1, 8) *A. quadratus* zone, West Harnham.
(2, 5) ,, ,, Coddenham.
(4) Upper Chalk, Ruston Parva.
(3, 6, 7) ,, Wells.

Affinities.—*Pteria danica* (Ravn)[1] is similar in outline and the general character of its ornamentation to *Pteria tenuicostata*, but appears to be distinguished by the possession of fewer ribs and by their absence in the neighbourhood of the umbo.

In the character of its ornamentation *P. tenuicostata* closely resembles *P. pectinata* (see p. 59), but is distinguished by its larger size, relatively greater length, and smaller convexity; also the ribs are more numerous, the ears are relatively larger, and the anterior left ear is less distinctly limited.

The specimen from Simbirsk figured by d'Orbigny (1845) as *Avicula tenuicostata* differs from that species in the possession of fewer and stronger ribs. It was subsequently regarded by d'Orbigny[2] as an example of *Avicula laripes*, Morton.[3]

[1] 'Mollusk. i. Danmarks Kridtaflej,' i. (1902), p. 79, pl. i, figs. 1, 2.
[2] 'Prodr. de Pal.,' vol. ii (1850), p. 249.
[3] 'Synopsis Org. Remains Cret., U.S.' (1834), p. 63, pl. xvii, fig. 5.

Remarks.—In England this species has, up to the present time, been definitely recognised in the *Actinocamax quadratus* zone only.

The specimen figured by Römer is relatively higher than most of the English examples, but in other characters there is close agreement.

Pteria seminuda (Dames)[1] resembles *Pteria tenuicostata*, but appears to differ in the ribs on the left valve being of more nearly uniform size, and in the presence of distinct ornamentation on the right valve.

Type.—The type is stated by Römer to have come from the Lower Chalk of Lindner Berg, near Hanover, but according to Dr. J. Böhm the horizon is really the *quadratus* Chalk.

Distribution.—Zone of *Actinocamax quadratus* of West Harnham, near Salisbury, and Sewerby (Yorkshire). Upper Chalk (? *A. quadratus* zone) of Coddenham (Suffolk), Wells (Norfolk), and Ruston Parva (Yorkshire).

Sub-genus—PSEUDOPTERA, *F. B. Meek*, 1873.

('6th Ann. Rep. U.S. Geol. Survey of the Territories,' p. 489; *Meek*, 'Invert. Cret. and Tert. Foss. U. Missouri' (Rep. U.S. Geol. Survey, vol. ix, 1876), p. 29.)

PTERIA (PSEUDOPTERA) SUBDEPRESSA (*d'Orbigny*), 1850. Plate IX, fig. 1*a*, *b*.

1845.	AVICULA DEPRESSA, *E. Forbes*.		Quart. Journ. Geol. Soc., vol. i, p. 247, pl. iii, fig. 7 (non *A. depressa*, Münster, 1841).
1850.	-	SUBDEPRESSA, *A. d'Orbigny*.	Prodr. de Pal., vol. ii, p. 119.
1854.	—	DEPRESSA, *J. Morris*.	Cat. Brit. Foss., ed. 2, p. 163.
1855.	—	SUBDEPRESSA, *G. Cotteau*.	Moll. Foss. de l'Yonne, p. 104.
1869.	—	—	*F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 70.
1871.	—	—	*F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 398.

Remarks.—This species is very imperfectly known at present. It resembles *P. haldonensis* from the Upper Greensand of Haldon (see below) but is easily distinguished by the strong concentric ridges; it also appears to be relatively longer and less convex.

Type.—In the Museum of the Geological Society (No. 2050).

Distribution.—Lower Greensand (Crackers) of Atherfield. Recorded by Topley from the Atherfield Clay of Peasmarsh and Shalford.

[1] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xxvi (1874), p. 765, pl. xxi, fig. 3; Nötling, 'Die Fauna d. baltisch. Cenoman.' (Palæont. Abhandl., vol. ii, 1885), p. 21, pl. iii, figs. 7, 8.

PTERIA (PSEUDOPTERA) ANOMALA (*Sowerby*), 1836. Plate IX, figs. 2*a–d*, 3*a*, *b*, 4*a*, *b*.

1836.	AVICULA ANOMALA,		*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 240, 342, pl. xvii, fig. 18.
? 1846.	—	—	*A. E. Reuss.*	Die Verstein. der böhm. Kreideformat., pt. 2, p. 22, pl. xxxii, figs. 1—3.
? 1842.	GERVILLIA	—	*H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 3, p. 80, pl. xx, fig. 38.
? 1845–6.	AVICULA	—	—	Grundriss d. Verstein., p. 459, pl. xx, fig. 5.
? 1850.	—	—	—	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 170 (*partim*).
1854.	—	—	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 163.
1868.	—	—	*A. Briart and F. L. Cornet.*	Descript. Mineralog. Géol. et Pal. de la Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 52, pl. iv, fig. 7.
1869.	—	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 71.
1871.	—	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 398.
? 1873.	—	—	*H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 207, pl. xlvi, figs. 5, 6.
1893.	—	—	*R. Michael.*	Zeitschr. der deutsch. geol. Gesellsch., vol. xlv, p. 233.
Non 1846.	—	—	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 478, pl. cccxcii, figs. 1—3.
— 1850.	—	—	*d'Orbigny.*	Prodr. de Pal., vol. ii, p. 167.
? — 1877.	—	—	*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat.: II, Weissenberg. u. Malnitz. Schicht., p. 128, fig. 108.
— 1883.	—	—	—	Ibid., III, Iserschicht., p. 109.

Description.—Shell rather large; outline (without the ears) triangular, very oblique; anterior margin convex, forming a rounded angle with the sinuous postero-ventral margin. Umbo of left valve pointed, acute, near the anterior extremity. Apical angle about 45°.

Left valve very convex, with a strong, rounded ridge extending from the umbo to the postero-ventral extremity. In front of this ridge the shell curves rapidly downwards, and becomes nearly vertical to the plane of the valves near the anterior margin and near the anterior ear. Behind the ridge the valve is flattened and slopes dorsally (fig. 2 *a*); but this part is sometimes divided into two

by a median step-like fold (fig. 3 *a*). A narrow part adjoining the posterior ear slopes rather rapidly.

Anterior ear of moderate size, convex, much higher than long. Posterior ear large, united to the whole of the postero-dorsal margin of the valve; posterior margin of ear slightly concave or sinuous, forming an obtuse angle with the hinge-line and also with the postero-ventral margin.

Ornamentation consists of numerous radial ribs which are straight or slightly undulating, and extend over the larger part of the valve. On the posterior ear the ribs are narrow and separated by broad, flat or slightly concave interspaces. On the flattened part of the valve the ribs are rather more rounded and become less distinct towards the postero-ventral margin in large specimens. In front of the main ridge the ribs are closer together and the interspaces very narrow; on the anterior part of the valve and on the anterior ear, ribs are either absent or indistinct. Numerous, close-set, regular, concentric linear ridges cross both ribs and interspaces.

In small specimens (figs. 4 *a*, *b*) having the ornamentation well preserved, the ribs on the flattened part of the valve are narrow, rounded, distinctly limited, and separated by broad interspaces; new ribs are introduced in the middle of some of the interspaces. The ribs and interspaces are crossed at regular intervals by concentric ridges which form squares or oblongs with the ribs. On the posterior ear similar ornamentation occurs, but the concentric ridges cut the ribs obliquely.

Right valve not seen.

Measurements:

	(1)	(2)
Umbo to postero-ventral extremity	86	75 mm.
Length of hinge-line . .	49	54 ,,

(1, 2) Blackdown.

Affinities.—The specimen from the Cenomanian of Le Mans figured by d'Orbigny as *Avicula anomala* appears to be distinct from Sowerby's species on account of its larger apical angle and its fewer, stronger, and more spiny ribs. See also *P.* (*Pseudoptera*) *haldonensis* (below).

The character of the hinge in this and the other species here included in the sub-genus *Pseudoptera* is unknown; consequently their systematic position cannot be regarded as definitely determined.

Remarks.—The only examples which I have seen are the type specimen, six specimens in the British Museum, and two in the Museum of Practical Geology. Those from Haldon have the ornamentation very perfectly preserved.

Type.—In the Bristol Museum, from Blackdown.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown and Haldon.

PTERIA (PSEUDOPTERA) HALDONENSIS, sp. nov. Plate IX, figs. 5, 6 *a*, *b*, 7, 8 *a*–*c*, 9, 10.

Description.—Shell of moderate size, triangular, very oblique. Anterior margin slightly convex, forming a rounded angle with the postero-ventral margin. Umbo pointed, acute, near the anterior extremity. Apical angle about 43°.

Left valve very convex, with a sharp carina extending from the umbo to the postero-ventral angle. The part of the valve in front of the carina is bent sharply downwards along its whole length, and is ornamented with from ten to eighteen slender, linear ribs, which are separated by broad flat interspaces. The number of ribs increases with age owing to the intercalation of new ribs in the interspaces. The space between the carina and the first rib, and sometimes also between the first and second rib, is greater than the space between the ribs near the middle of the anterior part of the valve. Minute spiny projections are present on the ribs in well-preserved specimens. A similar but rather stronger rib, also with spiny projections, occurs on the carina. Behind the carina two short ribs, extending from near the middle to the margin of the valve, are sometimes seen. The larger part of the valve behind the carina is flattened and smooth except for numerous, slightly curving growth-ridges, which are continued on to the posterior ear, and are sometimes seen in front of the carina, where they may become more prominent.

Anterior ear small, with rounded margin, indistinctly separated from the remainder of the valve, ornamented with radial ribs similar to those on the adjoining part of the valve.

Posterior ear compressed, very large, separated from the remainder of the valve by a very shallow depression. Growth-ridges concave and parallel with the posterior margin.

Right valve not seen.

Measurements:

	(1)	(2)	(3)	(4)	(5)
Height (oblique) .	28	26	25	23	18 mm.
Length of hinge-line[1]	19	16	18	15	12 „

(1–5) Upper Greensand, Haldon.

Affinities.—This species is closely allied to *Pteria* (*Pseudoptera*) *varicosta* (Reuss),[2] from the Gosau Beds of St. Wolfgang (Salzburg), but is distinguished by the smaller obliquity of the shell, by the angle formed by the anterior and postero-

[1] This measurement is approximate only, since the posterior wing is usually imperfectly preserved.

[2] Reuss, 'Char. d. Kreideschicht. in den Ostalpen,' etc. (Denkschr. d. k. Akad. Wissensch. Wien, Math.-nat. Cl., vol. vii, 1854), p. 147, pl. xxviii, fig. 16; K. A. Zittel, 'Die Bivalven d. Gosaugeb.' (Ibid., vol. xxv, pt. ii, 1866), p. 90, pl. xiii, fig. 6; *A. glabra*, Geinitz, 'Das Elbthalgeb. in Sachsen' (Palæontographica, vol. xx, pt. i, 1873), p. 208, pl. xlvi, fig. 7, and pt. ii, pl. xi, fig. 2?; Nötling, 'Die Fauna d. baltisch. Cenoman.' (Palæont. Abhandl., vol. ii, 1885), p. 22, pl. iii, fig. 9.

ventral margins being smaller, and by the shorter postero-ventral margin. It also resembles *P.* (*Pseudoptera*) *ignabergensis* (Lundgren),[1] from the Senonian of Ignaberga.

P. (*Pseudoptera*) *haldonensis* is distinguished from the young of *P.* (*Pseudoptera*) *anomala* (see above) by its sharp carina; by the part of the valve behind the carina, and the posterior wing, being smooth; also by the strong and more widely separated ribs in front of the carina.

Types.—In the British Museum and the Sedgwick Museum.

Distribution.—Upper Greensand (zone of *Pecten asper*) of Haldon.

PTERIA (PSEUDOPTERA) GAULTINA, sp. nov. Plate IX, figs. 11 *a*, *b*, 12 *a*, *b*.

Description.—Shell small, very oblique. Umbo acute, near the anterior extremity. Apical angle 26° to 32°.

Left valve moderately convex, with the median triangular part raised but flattened; in front of this the valve bends sharply to the anterior margin; behind, it bends rather sharply to join the posterior ear, which is distinctly demarcated. Anterior ear small. Posterior ear moderately large, united to the greater part of the postero-dorsal margin of the valve; its posterior margin concave.

A few narrow, well-defined radial ribs occur on the anterior part of the raised triangular portion and just in front of it. In some cases less distinct ribs with spiny projections are present on the whole of the triangular part of the valve. Growth-ridges are often well-marked, and are continued on to the posterior ear.

Measurements:

Hinge-line .	11 mm.
Height (oblique) .	21 ,,

Black Ven.

Affinities.—This species is distinguished from *Pteria* (*Pseudoptera*) *haldonensis* (see above) by (1) the greater obliquity of the shell, (2) the smaller apical angle, (3) the absence of the sharp carina, (4) the distinctly limited posterior ear.

Types.—In the Museum of Practical Geology (No. 10,780) and the Sedgwick Museum.

Distribution.—Gault of Black Ven.

PTERIA (PSEUDOPTERA) CŒRULESCENS (*Nilsson*), 1827. Plate IX, figs. 13–16, 17 *a*, *b*, 18, 19 *a*, *b*.

1827. AVICULA CŒRULESCENS, *S. Nilsson*. Petrif. Suecana, p. 18, pl. iii, fig. 19.
? 1836. — *A. Goldfuss*. Petref. Germ., vol. ii, p. 132, pl. cxviii, fig. 6.

[1] 'Mollusk. i *Mammilatus* och *Mucronata* Zonerna i Nordöstra Skåne' (1894), p. 44, pl. i, fig. 2.

? 1841.	Avicula cœrulescens,		*F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 64.
1850.	—	—	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 249.
1888.	—	cærulescens	*A. Peron.*	Hist. Terr. de Craie, p. 155, pl. i, fig. 14.
? 1889.	—	cœrulescens	*E. Holzapfel.*	Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 227.
1897.	—	—	*A. Heaniy.*	Revis. Lamell. i Nilsson's 'Petrif. Suecana,' p. 54, pl. iii, figs. 25—27.

Description.—Shell rather small, oblique, triangular. Anterior margin slightly convex or nearly straight. Umbo rather near the anterior extremity, sometimes curved slightly backwards. Anterior ear small, not distinctly marked off from the rest of the valve. Posterior ear large, triangular, its inner margin not limited, its posterior margin slightly concave and continuous with the postero-ventral margin of the valve. Median part of the valve raised, extending obliquely backwards, sometimes subcarinate anteriorly. In front of this raised part the valve is bent more or less sharply; behind, it is compressed gradually. Surface with weak radial ribs, which are straight or slightly undulating, and bear small spiny or scaly projections sometimes close together, sometimes more or less widely separated. The ribs may occur on the anterior part only, or may be present over the entire shell, including the ears. Often on the anterior part they are closer together than elsewhere. The number of ribs and the width of the flat interspaces vary in different specimens. New ribs may be introduced in the interspaces at varying distances from the umbo. In some specimens numerous fine concentric lines are seen.

Measurements:

	(1)	(2)	(3)	
Length	11	11	10	mm.
Height	13	12	10·5	,,

(1) *A. quadratus* zone, East Harnham.
(2) *B. mucronata* zone, Norwich.
(3) ,, ,, Clarendon.

Affinities.—The imperfect specimen from the Lower Senonian of Brunswick figured by G. Müller[1] as *Avicula sp.* may perhaps be an example of *P. cærulescens.*

Avicula glabra, Reuss,[2] resembles in form *P. cærulescens*, but is distinguished by the absence of radial ribs.

Avicula subnodosa, Hagenow,[3] from the Senonian of Rügen, is perhaps identical with *P. cœrulescens*, but in the absence of a figure of the former I am unable to make a comparison.

[1] 'Mollusk. d. Untersen. v. Braunschweig u. Ilsede' (1898), p. 39, pl. v, fig. 10.
[2] 'Die Verstein. der böhm. Kreideformat.' (1846), pt. 2, p. 22, pl. xxxii, figs. 4, 5.
[3] 'Neues Jahrb. für Min.,' etc. (1842), p. 559.

Remarks.—The English specimens have the median part of the valve apparently less sharply marked off from the anterior and posterior parts than it is in the examples figured by Hennig, but they agree in this respect with the figure given by Peron.

The specimens show some variation in obliquity and in their relative height and length. The differences seen in the ornamentation are probably due, in part, at any rate, to imperfections in the preservation of the surface layer of the shell. Like Peron, I have seen no specimen of the right valve.

Examples of this species are preserved in the Norwich Museum, in Dr. Blackmore's collection, and in Mr. Brydone's collection.

Distribution.—Zone of *Actinocamax quadratus* of East and West Harnham (Salisbury). Zone of *Belemnitella mucronata* of Clarendon (Salisbury) and Norwich. Chalk of Trimingham.

Genus—AUCELLA, *A. Keyserling*, 1846.

('Reise in das Petschora-Land,' p. 297.)

AUCELLA VOLGENSIS, *Lahusen*, 1888. Plate X, figs. 1 *a–c*, 2 *a–c*.

1888.	AUCELLA VOLGENSIS,	*J. Lahusen.*	Ueber die russischen Aucellen (Mém. du Comité géol. Russ., vol. viii, No. 1), p. 38, pl. iii, figs. 1–17.
1896.	—	—	*A. P. Pavlow.*	Quart. Journ. Geol. Soc., vol. lii, p. 549, pl. xxvii, fig. 1.
1896.	—	—	*var.* RADIOLATA, *Pavlow.*	Ibid., p. 550, pl. xxvii, fig. 2.

Description.—Shell large, obliquely ovate, much higher than long, moderately inflated, with regularly curving margin.

Right valve of moderate convexity, flattened. Umbo relatively small, and curving only slightly. Anterior ear triangular, with a deep, narrow byssal sinus. Posterior ear indistinctly limited.

Left valve very convex and rounded, the dorsal portion continued into a large and prominent umbo which curves anteriorly. Postero-ventral part of valve produced and somewhat compressed.

Surface of valves with concentric growth-ridges, sometimes produced into lamellæ, and forming regular curves.

Measurements:

	(1)	(2)	
Length	45 .	36	mm.
Height of left valve (oblique)	66 .	55	,,
Thickness (both valves) .	32 .	22	,,

(1, 2) Spilsby Sandstone, Donnington.

Affinities.—The shell in this species is larger, relatively higher, more oblique, and less inflated than in *A. Keyserlingiana* (see below). The right valve is more flattened, and its umbo is only slightly curved. The umbo of the left valve is larger and more prominent.

Remarks.—The only specimens I have seen are internal casts from the Spilsby Sandstone. The example of this species described by Pavlow as var. *radiolata* shows faint radial ribs on the internal cast of the right valve, and a slight depression on the left valve extending from the umbo to the postero-ventral margin (Plate X, fig. 2).

Types.—From the Upper Volga beds of Kaschpur (Simbirsk), Staraja-Rjasan, and Olenek. The specimens figured by Pavlow are in the Sedgwick Museum and are here re-figured.

Distribution.—Spilsby Sandstone (zone of *Belemnites lateralis*) of Donnington.

AUCELLA KEYSERLINGIANA, *Trautschold*, 1868. Plate X, figs. 3*a*—*d*, 4*a*, *b*, 5.

1837. INOCERAMUS CONCENTRICUS, *G. Fischer de Waldheim.* Oryctographie du gouvernm. de Moscou, p. 177, pl. xx, figs. 1—3.

1846. AUCELLA CONCENTRICA, *var.* RUGOSA, *A. Keyserling.* Reise in das Petschora-Land, p. 300, pl. xvi, fig. 16.

1850. AVICULA (BUCHIA) n. sp., *F. Römer.* Neues Jahrb. für Min., etc., p. 393.

1868. AUCELLA KEYSERLINGIANA, *H. Trautschold.* Verhandl. d. russisch-kaiserlich. mineral. Gesellsch. in Petersburg, ser. 2, vol. iii, p. 250.

1874. — CONCENTRICA, *var.* RUGOSA, *F. Toula.* Mesozoisch. Verstein. v. d. Kuhn-Insel (Die zweite deutsch. Nordpolf., in 1869, 1870, unter Kapitän K. Koldewey), vol. ii, p. 503, pl. ii, figs. 2, 3.

1874. — — *var.* RUGOSISSIMA, *F. Toula.* Ibid., p. 504, pl. ii, fig. 4.

1875. PERNA IMBRICATUS [Bean MS.], *J. Phillips*, Geol. Yorks., pt. i, ed. 3, p. 247.

— — VENUSTULUS [Bean MS.], *Phillips.* Ibid., p. 247.

1884. AVICULA? TEUTOBURGIENSIS, *O. Weerth.* Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 50, pl. ix, fig. 9.

1886. AUCELLA KEYSERLINGIANA, *J. Lahusen.* Mém. Acad. Imp. St. Pétersbourg, ser. vii, vol. xxxiii, No. 7, p. 4.

1888. — KEYSERLINGI, *J. Lahusen.* Ueber die russischen Aucellen (Mém. Comité géol. Russ., vol. viii, No. 1), pp. 21, 40, pl. iv, figs. 18—23.

1889. INOCERAMUS VENUSTULUS *et* IMBRICATUS, *G. W. Lamplugh.* Quart. Journ. Geol. Soc., vol. xlv, p. 615.

1896. Aucella Keyserlingi, *A. P. Pavlow.* Ibid., vol. lii, p. 550, pl. xxvii, fig. 3.
1899. — — *G. Maas.* Zeitschr. d. deutsch. geol. Gesellsch., vol. li, p. 249.
1900. — — *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 56, pl. ii, figs. 6—9.
1901. — — *J. F. Pompeckj.* Neues Jahrb. für Min., etc., Beil.-Bd. xiv, p. 319, pl. xv, figs. 3, 6, 8—10, 13, 14, 17, 18, 20, 21.
1903. — — *A. Wollemann.* Zeitschr. d. deutsch. geol. Gesellsch., vol. lv, p. 34 (Briefl. Mitteil.).

Description.—Shell of moderate size, oblique, with more or less triangular outline and rounded margins, higher than long, inflated. Umbones prominent, at the anterior end of the hinge-line, almost touching, curved inwards and forwards.

Right valve convex in the neighbourhood of the umbo, but usually flattened elsewhere. Anterior ear close to the umbones, triangular, convex, narrow where united to the rest of the valve, with a deep and narrow byssal sinus. Posterior ear longer, but indistinctly limited.

Left valve much more convex than the right valve, especially in the dorsal part, somewhat compressed posteriorly; greatest convexity between the umbo and the postero-ventral extremity. Umbo more prominent than in the right valve. Ears indistinctly limited.

Both valves ornamented with many narrow, concentric lamellæ which are placed more or less vertically to the surface and are separated by broad, flat interspaces. The lamellæ occur at fairly regular intervals, but the distance between them varies on different parts of the shell. They curve gently on the median part of the valve, but bend more sharply in passing on to the anterior and posterior parts, where they become closer to one another. The lamellæ have often disappeared from the parts near the umbones.

Measurements:

	(1)	(2)	(3)	(4)	
Length .	31	28	24	18	mm.
Height .	39	32	30	24	,,
Thickness	—	16	16	12	,,

(1—4) Claxby Ironstone, Claxby.

Affinities.—See *Aucella rolgensis* (p. 69).

Type.—The specimens figured by Pavlow are in the Sedgwick Museum.

Distribution.—Claxby Ironstone (zone of *Belemnites lateralis*) of Claxby. Speeton Clay (zone of *Belemnites jaculum*) of Speeton.

Genus—AUCELLINA, *J. F. Pompeckj*, 1901.

('Neues Jahrb. für Min.,' etc., Beil.-Bd. xiv, p. 365.)

AUCELLINA GRYPHÆOIDES (*Sowerby*), 1836. Plate X, figs. 6 *a*—*d*, 7 *a*—*c*, 8 *a*, *b*, 9 *a*—*c*, 10—13.

1836. AVICULA GRYPHÆOIDES, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv. pp. 156, 335, pl. xi, fig. 3.

1841. — — *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 64, pl. viii, fig. 16.

1846. INOCERAMUS COQUANDIANUS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 505, pl. cccciii, figs. 6—8.

1850. — — — Prodr. de Pal., vol. ii, p. 139.

1853. AUCELLA GRYPHÆOIDES, *A. v. Strombeck*. Zeitschr. der deutsch. geol. Gesellsch., vol. v, p. 509.

1854. AVICULA — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 163.

1856. AUCELLA *A. v. Strombeck*. Zeitschr. der deutsch. geol. Gesellsch., vol. viii, p. 488.

1864. — *H. Bölsche*. Neues Jahrb. für Min., etc., p. 669.

1869. INOCERAMUS COQUANDIANUS, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 111, pl. clx, figs. 9, 10.

1875. AVICULA GRYPHÆOIDES, *A. J. Jukes-Browne*. Quart. Journ. Geol. Soc., vol. xxxi, p. 298.

1882. — — *R. Windmöller*. Jahrb. d. k. preussisch. geol. Landesanst. für 1881, pp. 20, 21.

1893. — — *A. v. Strombeck*. Zeitschr. der deutsch. geol. Gesellsch., vol. xlv, pp. 490, 493.

1895. — — *E. Tiessen*. Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 478.

1899. AUCELLA COQUANDI, *D. J. Anthula*. Kreidefoss. des Kaukasus (Beitr. z. Paläont. u. Geol. Osterr.-Ungarns u. d. Orients, vol. xii), p. 78.

1901. AUCELLINA GRYPHÆOIDES, *J. F. Pompeckj*. Neues Jahrb. für Min., etc., Beil.-Bd. xiv, pp. 354, 365, pl. xvi, figs. 6—8.

1902. — — *A. Wollemann*. Lüneburg. Kreide (Abhandl. d. k. preussisch. geol. Landesanst., N. F., Heft 37), p. 64, pl. iii, figs. 2, 3.

Non 1829. AVICULA *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iii, p. 119 [*Pseudomonotis speluncaria* (Schlotheim)].

? Non 1847. — *J. Müller*. Petref. der Aachen. Kreidef., pt. 1, p. 29.

Description.—Shell oval, very oblique, very inequivalve; dorsal part of posterior margin more or less straightened, the remaining margins forming a regular curve.

Right valve flattened, but convex near the umbo; height and length nearly equal. Umbo small, near the middle of the hinge-line, curving slightly. Hinge-area obtusely triangular. Anterior ear long, triangular, with a very deep, narrow, curved byssal sinus on each edge of which is a row of tubercles. Posterior ear usually of about the same length as the anterior ear, but indistinctly limited, with the outer angle obtuse.

Left valve convex, especially the dorsal part, more compressed postero-ventrally, sometimes with a shallow sulcus extending from the umbo to the postero-ventral extremity. Dorsal portion of the valve produced into a large, prominent, much curved umbo. Hinge-area obtusely triangular. Posterior ear larger than the anterior, with a rounded depression between it and the umbo; anterior ear short, triangular.

Ornamentation consists of numerous concentric growth-lines which sometimes become lamellar, and are separated by flat interspaces. Small, close-set, radial ribs occur, especially in the neighbourhood of the umbo.

Measurements of left valve:

	(1)	(2)	(3)	(4)	
Length . .	22	21	18	14	mm.
Height (oblique)	29	27	25	17	,,

(1—4) Cambridge Greensand.

Affinities.—The probable relationship of this species to *Aucella* has been pointed out by von Strombeck, Stoliczka, and Jukes-Browne. Recently its affinities to *Pseudomonotis* and *Aucella* have been fully discussed by Prof. Pompeckj, by whom the genus *Aucellina* has been established to include *Avicula aptiensis*, d'Orbigny, and *Avicula gryphaeoides*, Sowerby. *Aucellina* is very closely allied to *Aucella*, but differs from it in the absence of an articulating groove in the hinge-area of the left valve.

Inoceramus Coquandianus, d'Orbigny, was regarded by Jukes-Browne as identical with *Aucellina gryphæoides*, and I agree with that view. The identity is also supported by the fact that Pictet and Campiche referred the specimens found in the Cambridge Greensand to *Inoceramus Coquandianus*.

Types.—I have not seen the types; Fitton stated that they were in the collection of Mrs. Murchison, and came from the Upper Greensand of Nursted and Cambridgeshire (? Cambridge Greensand).

Distribution.—Upper Gault of Folkestone and Eastbourne. Red Limestone of Hunstanton and Speeton. Cambridge Greensand (derived).

Upper Greensand (zone of *Schlænbachia rostrata*) of Hampshire, Devizes, and near Didcot; (zone of *Pecten asper*) of Okeford Fitzpaine and Warminster. Cam-

bridge Greensand (indigenous). Chloritic Marl of Maiden Bradley, Devizes, Isle of Wight, Urchfont (Wilts), Holybourne (Hants), and Eastbourne. Chalk Marl (zone of *Schlœnbachia varians*) of the Isle of Wight, Folkestone, Hunstanton, Lincolnshire, and Yorkshire. Totternhoe Stone of Fulbourn and Burwell. Zone of *Holaster subglobosus* (above Totternhoe Stone) of Eversden (Cambs.).

Family—PERNIDÆ, *Zittel.*

Genus—GERVILLIA, *M. J. L. Defrance*, 1820.
('Dict. Sci. nat.,' vol. xviii, p. 502.)

GERVILLIA SUBLANCEOLATA (*d'Orbigny*), 1850. Plate X, figs. 14—16; Plate XI, fig. 1. Text figures 7, 8.

1826. GERVILLIA AVICULOIDES, *J. de C. Sowerby.* Min. Conch., vol. vi, p. 16, pl. dxi, figs. 1, 2, 3, 5 (not 4), [non *Perna aviculoides*, Sowerby, 1814].
1845. -- -- *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 246.
— AVICULA LANCEOLATA, — Ibid., p. 247, pl. iii, fig. 8.
1850. — SUBLANCEOLATA, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 119.
1853. GERVILIA ALPINA, *F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, p. 496, pl. xli, fig. 3.
1854. GERVILLIA ANCEPS, *J. Morris.* Cat. Brit. Foss., ed. ii, p. 167.
— AVICULA LANCEOLATA, *Morris.* Ibid., p. 163.
1858. GERVILIA ANCEPS, *F. J. Pictet and E. Renevier.* Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 121, pl. xvii.
1865. *H. Coquand.* Mon. Aptien de l'Espagne, p. 145.
1869. ALPINA, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 83, pl. clv, figs. 2—4.
1902. GERVILLEIA ANCEPS, *F. Frech.* Centralb. für Min., etc., p. 612 (text-figure).

Description.—Shell elongate, very oblique, slightly inequivalve, the left valve rather more convex than the right. Posterior extremity lanceolate, but rounded. Postero-dorsal margin slightly sinuous. Antero-ventral marginal parts nearly perpendicular to the plane between the valves and slightly concave. Umbones inconspicuous, almost terminal. Only a very small portion of the valve is seen in front of each umbo; on the left valve this portion is bounded by a linear depression, but on the right valve it is not limited. The median part of each valve is convex, but becomes compressed towards the posterior extremity. Between the convex portion and the hinge-line (posterior to the umbo) is a long, triangular, compressed, wing-like portion, of which the inner boundary is not limited, and the posterior margin

is slightly convex or sometimes almost straight; on this part the growth-lines are convex posteriorly and curve towards the umbo, except in young specimens where they curve posteriorly as they approach the hinge-line.

Hinge-line long, forming rather less than half the greatest length of the valve,

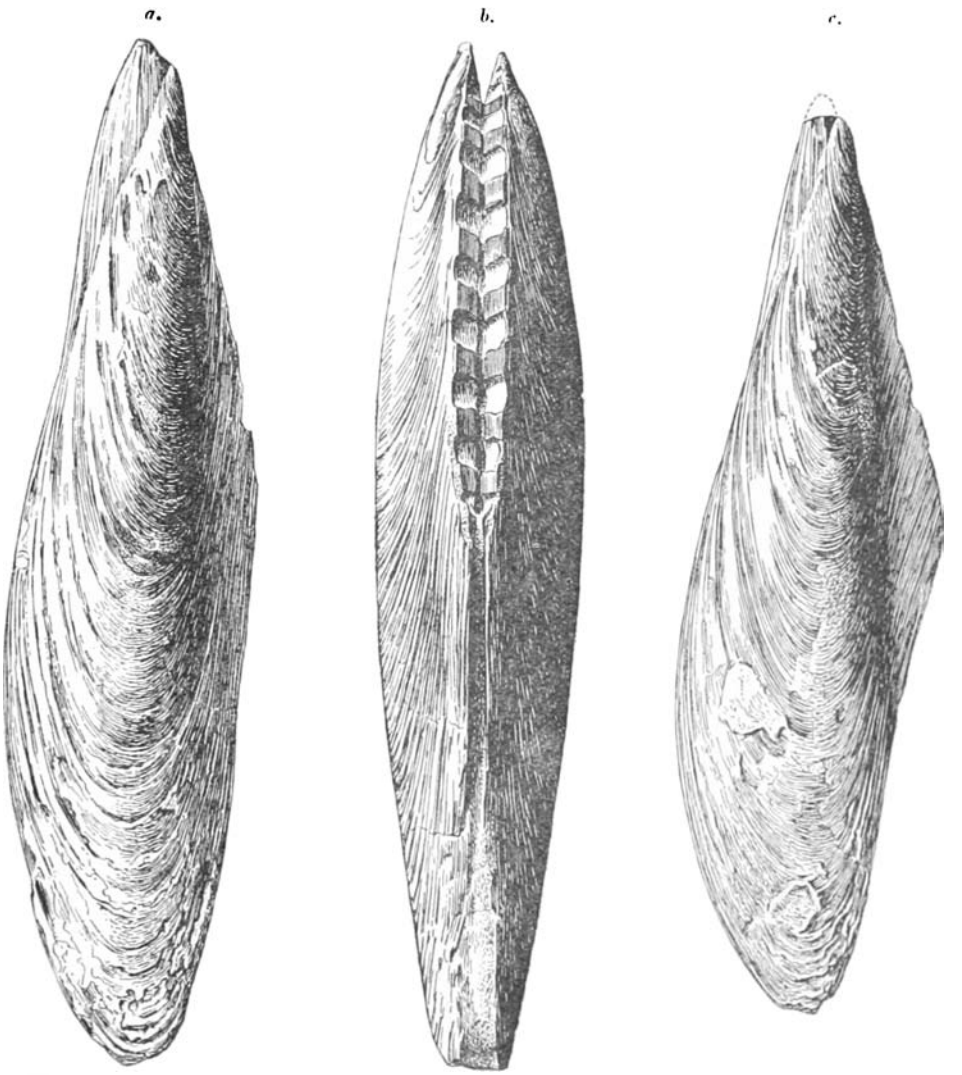


Fig. 7.—*Gervillia sublanceolata* (d'Orbigny.) Lower Greensand (Crackers), Atherfield. Sedgwick Museum. × ½. *a*, left valve; *b*, antero-dorsal view of another specimen; *c*, left valve of another specimen.

and making an obtuse angle with the posterior margin. Ligament pits large, usually from six to nine in number, placed at nearly equal distances, and usually of nearly equal size, except the anterior and posterior, which may be smaller than the others.

Surface of valves ornamented with growth-lamellæ only.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Hinge-line . . .	92	86	86	83	74	66	41	54	41	mm.
Umbo to posterior extremity	182	200	182	163	152	149	89	110	86	,,

(1—7) Crackers, Atherfield.
(8, 9) Greensand, Blackdown.

Affinities.—*Gervillia sublanceolata* is closely allied to *G. anceps*, Deshayes,[1] of which the types are from the Neocomian of Aube. The English specimens have usually been referred to the latter species, but Pictet and Campiche regarded them as distinct.

The characters which separate the two species are (1) the antero-ventral margin is concave in *G. sublanceolata*, whereas in *G. anceps* it is slightly convex or almost straight; (2) the posterior margin of the posterior wing-like part is convex, or in some cases nearly straight, and the growth-lines on this part of the shell are convex, whilst in *G. anceps* the corresponding margin and growth-lines are concave, and the wing-like part is more distinct; (3) the line of greatest convexity—extending from the umbo posteriorly—is near the middle of the valve in *G. sublanceolata*, but near the antero-ventral margin in *G. anceps*; (4) it is possible that *G. sublanceolata* is less inequivalve than *G. anceps*,[2] but at present this point cannot be proved, since only a few specimens of the latter species showing both valves have been found. All the examples known of *G. anceps* appear to be larger and to have thicker shells than *G. sublanceolata*.

Pictet and Campiche thought that *G. anceps* could be distinguished by the second and third ligament pits being close together, whereas in *G. sublanceolata* the pits are nearly equidistant. An examination of specimens of the former shows that the position of the second and third pits, shown in d'Orbigny's figure, is an individual variation,[3] and is not usually found. Pictet and Campiche mention as another distinction the sharp line of separation between the posterior wing and the rest of the valve in *G. anceps*; although this feature is shown in d'Orbigny's figure it is not evident in the specimens.

G. sublanceolata differs from *G. cosnensis*, de Loriol,[4] in the rapid tapering of the shell towards the posterior extremity and in the less extensive development of the posterior wing-like part.

Remarks.—Examples of this species from Atherfield were described and figured as *Gervillia alpina*, Pictet and Roux, by Pictet and Renevier and by Pictet and

[1] 'Mém Soc. géol. de France,' vol. v (1842), p. 9, pl. x, fig. 3; D'Orbigny, 'Terr. Crét.,' vol. iii (1846), p. 482, pl. cccxciv; Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1869), p. 82, pl. clv, fig. 5.

[2] See Deshayes' fig. 3*c*.

[3] The probability of this has been mentioned by E. G. Skeat and V. Madsen, 'Jur. Neoc. and Gault Boulders in Denmark' ('Danmarks geol. Undersog.,' vol. ii, No. 8, 1898), p. 163.

[4] 'Gault de Cosne' (1882), p. 83, pl. ix, figs. 21, 22.

Campiche. The specimen figured by Pictet and Roux is not sufficiently perfect to enable us to state whether it is specifically identical with *G. sublanceolata*, but since Pictet, Renevier, and Campiche were acquainted with the type and other specimens of *G. alpina*, and had also good specimens from Atherfield, we may feel every confidence in their judgment in this matter.

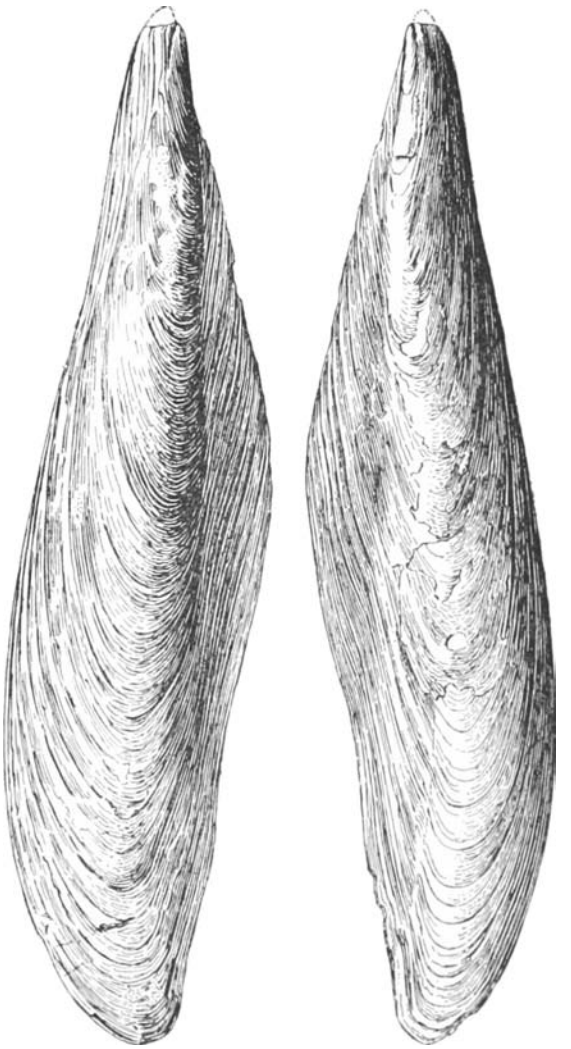


FIG. 8.—*Gervillia sublanceolata* (d'Orbigny). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Right and left valves of the same specimen. × ⅔.

A young individual of this species from Atherfield was described and figured by Forbes as *Avicula lanceolata*. This name, however, had previously been employed by Sowerby (1826) for a species from the Lias, and consequently d'Orbigny altered the name of Forbes' species to *Avicula sublanceolata*. Goldfuss (1836) had also used the name *Gervillia lanceolata* for a species from the Middle Jurassic of Württemberg. Since d'Orbigny's name has priority over *Gervillia alpina* of Pictet

and Roux, the species now under consideration must be known as *Gervillia sublanceolata* (d'Orbigny).

The young individuals of *G. sublanceolata* differ from the adults in that the anterior part of the shell is relatively longer and more wing-like, the posterior ear is more sharply limited and its growth-lines are concave posteriorly, and the valves are more unequal (Plate X, figs. 14, 15).

G. sublanceolata belongs to Frech's 'Group of *G. aviculoides*.' Frech gives a figure of the hinge and interior of a specimen from Atherfield.

I am greatly indebted to Professor Douvillé for the opportunity of seeing a specimen of *Gervillia anceps* from Aube, and also for his kindness in comparing *G. sublanceolata* with the specimens of *G. anceps* in the École des Mines, Paris.

Types.—One of the specimens figured by Sowerby (fig. 5) is in the British Museum; the others (figs. 1—3) cannot be traced. Sowerby's fig. 4 is from the Corallian of Shotover, and does not belong to this species. *Avicula lanceolata*, Forbes, from the Lower Greensand (probably Crackers) of Atherfield, is in the Museum of the Geological Society (No. 2057). The type of *Gervillia alpina* came from the Gault of Saxonet.

Distribution.—Lower Greensand (Crackers and Fitton's Beds 20 and 45) of Atherfield. Atherfield Beds of Sevenoaks.

Recorded by Topley from the Atherfield Beds of Haslemere, Peasmarsh, Shalford, and Redhill; from the Hythe Beds of Hythe, Lympne, Maidstone, and Pulborough; and from the Sandgate Beds of Sandgate, Folkestone, and Parham.

Upper Greensand (zone of *Schlœnbachia rostrata*) of the Isle of Wight, Blackdown, and Haldon.

GERVILLIA LINGULOIDES, *Forbes*, 1845. Plate XI, figs. 2–8.

1845. GERVILLIA LINGULOIDES, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 246, pl. iii, fig. 9.
— AVICULA EPHEMERA, *Forbes*. Ibid., p. 247, pl. iii, fig. 6.
1846. GERVILLIA LINGULOIDES, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 485, pl. cccxcvi, figs. 1—4.
1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 119.
— AVICULA EPHEMERA, — Ibid., p. 119.
1854. GERVILLIA LINGULOIDES, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 167.
— AVICULA EPHEMERA, *Morris*. Ibid., p. 163.
1858. GERVILLIA LINGULOIDES, *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 123, pl. xviii, figs. 3, 4.
1869. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 91.

Description.—Shell small, thin, elongate, compressed, very oblique, angular anteriorly, truncated posteriorly. Left valve more convex than the right. Umbones almost terminal. Ligament area narrow, with four or five pits, one of which is under the umbo. Anterior part of the shell very small, compressed. Median part flattened. Postero-dorsal part relatively large, compressed, wing-like. On the left valve a rounded ridge extends from the umbo to the postero-ventral angle; below this ridge the shell is bent sharply.

Surface smooth, or ornamented with concentric lines.

Measurements:

	(1)	(2)	(3)	
Length of hinge . . .	15·5	15	13	mm.
Umbo to postero-ventral angle	23	29	25	„

(1—3) Crackers, Atherfield.

Affinities.—*G. recta*, Meek and Hayden,[1] from the Fox Hill Beds of the Upper Missouri, is closely allied to this species. The imperfectly known *Gervillia Reichi*, Römer,[2] resembles *G. linguloides*, but appears to have the posterior wing more distinctly limited.

In the form of its shell *G. linguloides* resembles some of the species of *Pteria* which belong to the sub-genus *Pseudoptera* (see p. 63), but the presence of ligament pits proves it to be a *Gervillia*.

Remarks.—Pictet and Renevier showed that *Avicula ephemera*, Forbes, is only an internal cast of *Gervillia linguloides*.

This species occurs commonly in the Crackers of Atherfield and is gregarious.

Types.—From the Crackers of Atherfield, in the Museum of the Geological Society (Nos. 2040, 2054). The types of *Avicula ephemera*, also from Atherfield, are in the same collection (Nos. 2051, 2052).

Distribution.—Lower Greensand (Crackers) of Atherfield. Recorded by Topley from the Atherfield Clay of Peasemarsh and Shalford.

GERVILLIA ALÆFORMIS (*Sowerby*), 1819. Plate XI, figs. 9 *a–d*, 10 *a–d*, 11. Text-figures 9–14.

1819. MODIOLA? ALÆFORMIS, *J. Sowerby*. Min. Conch., vol. iii, p. 93, pl. cclj.
1835. PERNA ALIFORMIS, *Sowerby*. Ibid., vol. vi, systematical index, p. 243.
1845. — ALÆFORMIS, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 246, pl. iii, fig. 2.

[1] 'Proc. Acad. Nat. Sci. Philad.' vol. xiii (1861), p. 441. F. B. Meek, 'Invert. Cret. and Tert. Foss. U. Missouri' (1876), p. 66, pl. xxix, fig. 1 *a*, *b*.

[2] 'Die Verstein. d. nord-deutsch. Kreidegeb.' (1841), p. 64, pl. viii, fig. 14 (named *G. Cotta* on pl. viii).

1846. Gervilia alæformis, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 484, pl. cccxcv, figs. 1—3.
1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 82.
1852. Avicula Rhodani, *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 494, pl. xli, fig. 2.
1854. Gervillia alæformis, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 167.
1853. Gervilia aliformis, *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 120, pl. xviii, figs. 1, 2.
1865. — — *H. Coquand*. Mon. Aptien de l'Espagne, p. 144.
1869. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 86, pl. clvi, fig. 1.
1871. Gervillea — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 399.

Description.—Shell thick, large, much inflated, triangular or rhombic, oblique.

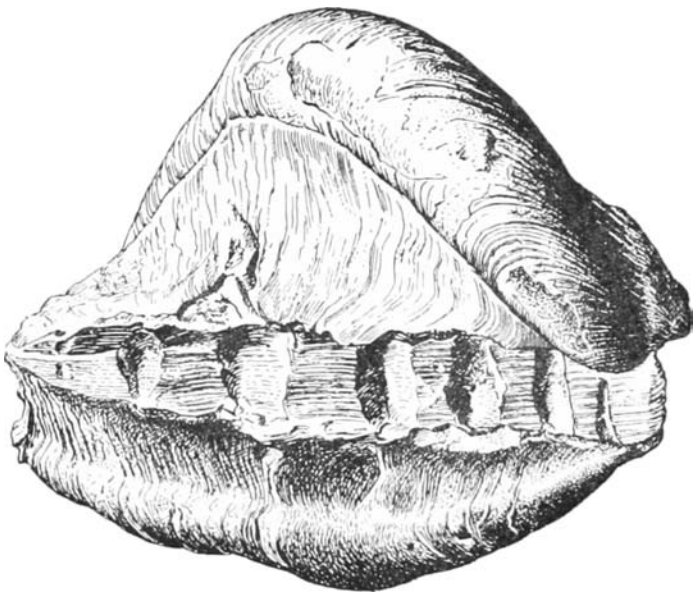


Fig. 9.—*Gervillia alæformis* (Sowerby). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Dorsal view, showing the ligament area of the right valve. Natural size.

Anterior parts of both valves more or less nearly vertical to the plane of the valves. Around the byssal opening the marginal parts of the valves are sometimes concave. Umbones near the anterior extremity. Hinge-area large with large ligament pits —usually five or six. Numerous narrow transverse teeth.

Left valve larger and more inflated than the right, with its umbo strongly incurved. A very prominent, convex portion extends from the umbo to the rounded postero-ventral extremity; dorsally it bends anteriorly; ventrally it has a slight posterior curvature. This convex part is separated by a shallow depres-

sion from a small anterior portion, and by a linear depression from a very large triangular posterior portion, which is flattened in small specimens but moderately convex in older examples. This posterior portion has a wing-like projection in young specimens, but in older forms its posterior border is nearly straight and forms an obtuse angle with the hinge-line.

Right valve similar to the left, but smaller, less convex, with the posterior portion more flattened, and with the umbo not incurved.

Ornamentation in the adult shell consists of numerous growth-lamellæ. On the earlier part of the shell, and in young examples, there are a few rather strong, broad, rounded radial ribs with a few smaller ribs between.

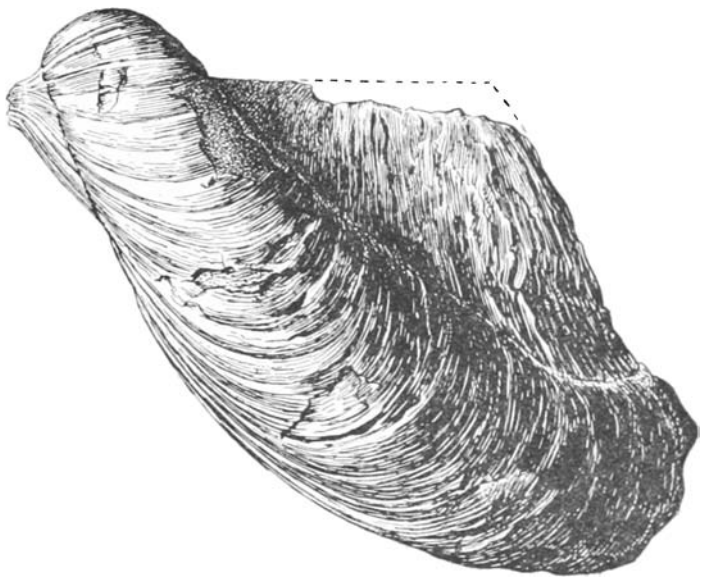


Fig. 10.—*Gervillia alæformis* (Sowerby). Left valve of specimen shown in Fig. 9. × ¾.

Measurements:

	(1)	(2)	(3)
Length of hinge	97	90	85 mm.
Height (oblique)	122	130	116 ,,

(1—3) Crackers, Atherfield.

Affinities.—This species presents some resemblance to *G. allaudiensis* (Matheron[1]) but is more inflated, less inequivalve, and less oblique.

Pictet and Campiche regarded the form figured as *G. alæformis* by d'Orbigny as distinct from Sowerby's *G. alæformis*, and they believed that the former was limited to the Neocomian whereas the latter occurs in the Aptian. Some specimens from the *Perna*-bed of Atherfield agree almost exactly with d'Orbigny's figure, and I

[1] 'Catal. Foss. des Bouches-du-Rhone' (1842), p. 175, pl. xxvi, fig. 1; Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1869), p. 81, pl. clv, fig. 1.

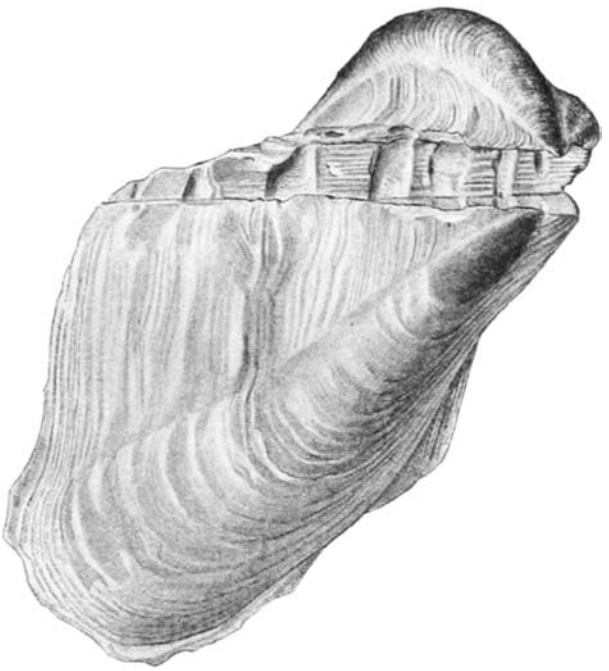
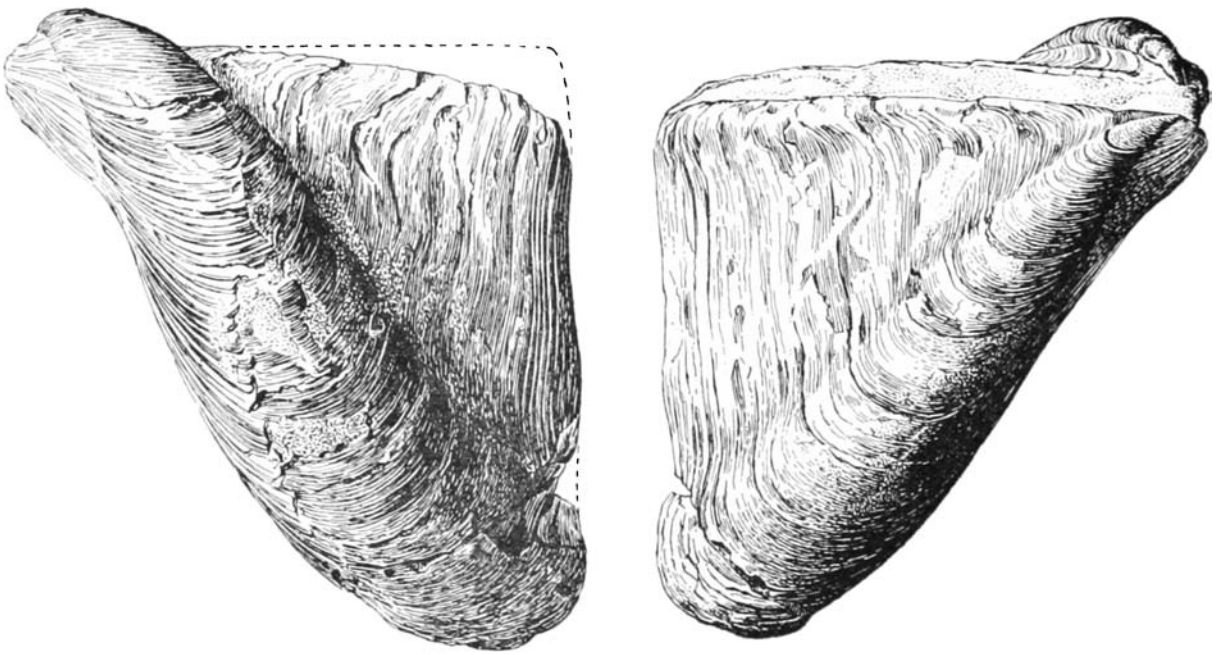


FIG. 11.—*Gervillia alæformis* (Sowerby). Right valve, and umbo and ligament area of the left valve of the specimen shown in figs. 9, 10. × $\frac{3}{4}$.



FIGS. 12, 13.—*Gervillia alæformis* (Sowerby). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. 12. Left valve. 13. Right valve. × $\frac{3}{4}$.

cannot regard them as more than a variety in which the central convex part is rather narrower and more elevated than usual (fig. 14).

Remarks.—*G. alæformis* belongs to Frech's[1] 'Group of *Gervillia Hartmanni*,' in which the shell is obliquely rhombic and has numerous small teeth.

Young specimens of *G. alæformis* differ from older examples in having well-marked radial ribs, in the valves being less inflated, and in the occurrence of a wing-like projection on the posterior ear. They resemble the form described by d'Orbigny as *Avicula Cottaldina*, but in the latter the radial ornamentation and well-marked posterior wing are retained in the adult state, whereas they soon become obsolete in *G. alæformis*. I am not acquainted with the character of the hinge of *Avicula Cottaldina*.

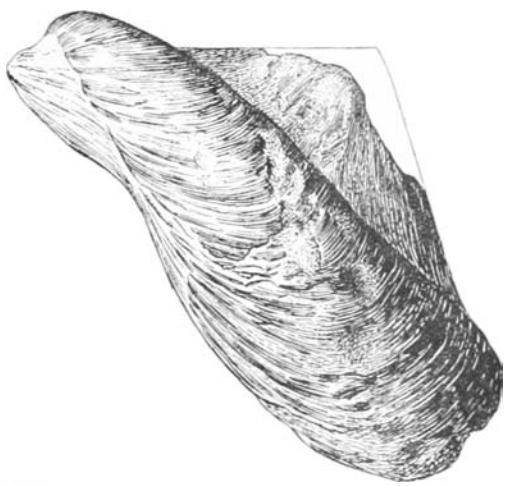


Fig. 14.—*Gervillia alæformis* (Sowerby). Lower Greensand (*Perna*-bed), Atherfield. Sedgwick Museum. Left valve of a narrow variety. × ⅔.

Type.—The type cannot be found; it came from the Lower Greensand (probably the *Perna*-bed) of Sandown, Isle of Wight.

Distribution.—*Perna*-bed of Atherfield and Sandown. Crackers and Bed 11 (of Fitton) of Atherfield. Atherfield Clay of Haslemere. Hythe Beds of Hythe and Lympne.

GERVILLIA ROSTRATA (*Sowerby*), 1836. Plate XI, figs. 12 *a*, *b*, 13–23.

1836. PERNA ROSTRATA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv., pp. 241, 342, pl. xvii, fig. 17.

1846. AVICULA CENOMANENSIS, *A. d'Orbigny*. Pal. Franç. Terr. Cret., vol. iii, p. 476, pl. cccxci, figs. 11—13.

1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 167.

[1] 'Centralb. für Min.,' etc. (1902), p. 613.

1850. Perna rostrata, *d'Orbigny*. Ibid., p. 168.
1854. Gervillia — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 168.
1871. Melina — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 400.
? 1895. Avicula *cf.* cenomanensis, *E. Tiessen*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 479.

Description.—Shell rather small, of moderate convexity, often very oblique, triangular. Ventral and posterior margins rounded. Hinge-line long.

Left valve more convex than the right, with the umbo moderately incurved. The large, central, very convex portion is indistinctly separated from the large, anterior, triangular, wing-like ear and from a narrow, flattened, obtusely triangular posterior part.

Right valve similar to the left but less convex and with the umbo only slightly incurved, and with the anterior ear more distinctly limited.

Surface of valves with narrow, regular growth-layers.

Measurements:

	(1)	(2)	(3)	(4)	(5)
Length of hinge	21	20	20	18	15 mm.
Height (oblique) .	25	28	24	20	17 „

(1—5) Greensand, Blackdown.

Affinities.—*Avicula cenomanensis*, d'Orbigny, from the Cenomanian of Le Mans, appears to be identical with *G. rostrata*. In all the specimens of the latter which I have seen, the terminal portion of the posterior wing is more or less imperfect, but the growth-lines show that the posterior margin must have had the same form as in d'Orbigny's fig. 11.

Gervillia rostrata presents some resemblance to the young forms of *G. alæformis* (p. 79) but is more oblique and without radial ribs, also the central convex portion is less sharply marked off from the lateral parts, and the anterior ear is larger.

G. rostrata is allied to *G. tenuicostata*, Pictet and Campiche (see below), but the right valve is less flattened, and the concentric ornamentation appears to be less developed—this, however, may be due to difference of preservation, since some of the Blackdown specimens are nearly smooth whereas others show distinct concentric ridges.

Remarks.—This species is moderately common at Blackdown but is usually imperfectly preserved. An example from the Gault of Folkestone, recorded by Price as *Avicula cenomanensis*, is probably referable to this species, but the greater part of the shell has disappeared, leaving a mould of the right valve; the specimen is now in the Museum of Practical Geology (No. 1624).

The examples of *G. rostrata* show a considerable amount of variation in obliquity,

and some of the less oblique specimens (Plate XI, figs. 17, 18) appear at first sight to be distinct from the more abundant oblique forms, but there is a complete transition between the extremes.

Distribution.—Upper Greensand (zone of *Schlenbachia rostrata*) of Blackdown, Haldon, and ? Devizes. ? Upper Gault (zone xi) of Folkestone.

GERVILLIA, sp. Plate XI, figs. 24, 25.

Specimens from the Ferruginous Sands of Shanklin, which were collected by the late C. J. A. Meÿer and are now in the Sedgwick Museum, resemble closely *G. rostrata* and *G. tenuicostata* (Pictet and Campiche),[1] but the material at present available is hardly sufficient to justify a definite conclusion as to their relationship. The specimen from the Lower Greensand of Upware figured by Keeping[2] as *Perna sp. nov.* resembles still more closely some examples of *G. rostrata*; the original is in the collection of Mr. J. F. Walker.

GERVILLIA FORBESIANA, *d'Orbigny*, 1846. Plate XI, figs. 26, 27. Plate XII, figs. 1–5.

1826.	GERVILLIA SOLENOIDES, *J. de C. Sowerby.*	Min. Conch., vol. vi, p. 14, pl. dx, figs. 1—3 (not 4).
1845.	— — *E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 246.
1846.	— FORBESIANA, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p 486, pl. cccxcvi, figs. 5, 6.
1850.	— — *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 119.
1854.	— SOLENOIDES, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 168 (*partim*).
1897.	— FORBESIANA, *R. B. Newton.*	Proc. Dorset. Nat. Hist. and Antiq. Field Club, vol. xviii, p. 87.

Description.—Shell compressed, slender, greatly elongated, sabre-shaped, tapering posteriorly to a rounded or subtruncate extremity. Dorsal margin slightly concave; ventral margin convex, with a rather greater curvature than the dorsal margin. Near the dorsal margin the valves are compressed rather abruptly, but ventrally to this they are compressed gradually, giving rise to a knife-like edge. Umbones terminal, acute. Posterior ear large, triangular, with its dorsal margin straight or very slightly concave and its posterior margin curving backwards so as to form an acute angle with the dorsal margin of the valve. The ear is marked by fine growth-lines parallel with its posterior border.

[1] 'Terr. Crét. Ste. Croix' (1869), p. 88, pl. clvi, figs. 4, 5.

[2] 'Foss. Neoc. Upware and Brickhill' (1883), p. 109, pl. v, fig. 3.

Surface of valves smooth except for growth-ridges, of which the curved portions near the dorsal margin are more distinct than the other portions.

Hinge with small transverse teeth at the anterior end and six or seven long narrow oblique teeth near the posterior end—the latter decreasing in length posteriorly.

Measurements :

	(1)	(2)	(3)	(4)
Height [1]	31	24	15	8 mm.
Length [2]	182	125	74	35 ,,

(1—4) Gault, Folkestone.

Affinities.—This species belongs to Frech's [3] 'Group of *Gervillia solenoides*.'

The only localities given for *G. Forbesiana* by d'Orbigny are Shanklin and Atherfield, and apparently his figured specimen came from the latter place. All the examples from Shanklin are in the form of casts of which the posterior part is usually missing; it is consequently difficult to make out their real characters, but they probably belong to this species.

The examples found in the Gault and Upper Greensand differ somewhat from the specimen figured by d'Orbigny. In the former the shell is less slender and tapers more quickly posteriorly; the posterior ear, however, agrees with d'Orbigny's figure.

A considerable number of examples of *Gervillia* from different localities and horizons have been referred by various writers [4] to *G. solenoides*, Defrance,[5] but without seeing a large collection of those forms it is impossible to determine their relationship to one another and to the examples here described. The figures given by Defrance do not enable us to form a satisfactory idea of the characters of the species; in his original account (1820) he gave "Ile d'Aix" as the locality, but in his later remarks (1824) he states that the specimens came from the department of Le Manche.

The Senonian specimens figured by d'Orbigny [6] as *G. aviculoides* (non *G.*

[1] From posterior end of hinge-line to opposite margin of valve.

[2] From umbo to posterior extremity.

[3] 'Centralb. für Min.,' etc. (1902), p. 615.

[4] Sowerby (1826), Goldfuss (1836), Reuss (1846), Müller (1847), d'Orbigny (1847), Alth (1850), Zittel (1866), Favre (1869), Stoliczka (1871), Geinitz (1873), Brauns (1876), Fritsch (1877–93), Nötling (1885), Griepenkerl (1889), Holzapfel (1889), Lündgren (1894), Vogel (1895), Müller (1898), *G. oblonga*, Böhm (1885).

[5] 'Dict. Sci. nat.,' vol. xviii (1820), p. 503; vol. xxxii (1824), p. 316, pl. lxxxvi, fig. 6.

[6] 'Pal. Franç. Terr. Crét.,' vol. iii (1846), p. 489, pl. cccxcvii, fig. 2 (and perhaps fig. 1). Prof. M. Boule informs me that the original of fig. 1 cannot be found in the d'Orbigny collection, and that the original of fig. 2 comes from Valognes (Manche).

aviculoides, Sowerby) were afterwards[1] referred by that writer to *G. solenoides*, Defrance, whilst the Cenomanian forms from Le Mans, also figured as *G. solenoides*, were named[2] *G. subaviculoides*.

The examples of *G. solenoides* from the Senonian of Aachen figured by Holzapfel[3] differ from our specimens of *G. Forbesiana* in the greater height of the posterior ear and in its indistinct separation from the rest of the valve, also in having a larger apical angle.

Types.—Two of the specimens figured as *G. solenoides* by Sowerby (figs. 2, 3) are in the British Museum and came from Shanklin. Another specimen figured by Sowerby (fig. 1), from the Upper Greensand of Lyme Regis, is in the Museum of the Geological Society of London (No. 1555), but is not recorded in Mr. Blake's "List of Types." D'Orbigny's type of *G. Forbesiana* apparently came from the Crackers of Atherfield, but Professor Boule informs me that the specimen cannot now be found in the d'Orbigny Collection.

Distribution.—*Perna*-bed, Atherfield Clay, and Crackers of Atherfield. Fitton's Bed 36 of Blackgang. Ferruginous Sands of Shanklin. Atherfield Beds of Peasmarsh. Hythe Beds of Pulborough. Sandgate Beds of Parham Park.

Gault (zones iii to vii, and viii) of Folkestone. Zone of *Hoplites interruptus* of Okeford Fitzpaine (Dorset). Cambridge Greensand (derived). Upper Greensand of Blackdown.

Genus—PERNA, *J. G. Bruguière*, 1789.

('Encyc. Méthod., Vers,' vol. i, p. xiii.)

PERNA MULLETI, *Deshayes*, 1842. Text-figure 15.

1842. PERNA MULLETI, *Deshayes* in *A. Leymerie*. Mém. Soc. géol. de France, ser. 2, vol. v, p. 8, pl. xi, figs. 1—3.

1845. — — *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 246, pl. i, figs. 1—4.

1846. — MULLETII, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 496, pls. cccc, ccccl, figs. 1—3.

1848. — MULLETI, *C. L. Koch*. Palæontographica, vol. i, p. 171, pl. xxiv, figs. 14—17.

[1] 'Prodr. de Pal.,' vol. ii, 1850, p. 250.

[2] Ibid, vol. iii (1852), p. 72 (index); d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1846), p. 489, pl. cccxcvii, figs. 3, 4, 5. Prof. Boule informs me that these are from Le Mans, and are now in the d'Orbigny collection.

[3] 'Mollusk. Aachen. Kreide' (1889), p. 223, pl. xxiv, figs. 11, 12.

1850. Perna Muletii, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 82.
1854. — Mulleti, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 179.
1855. — Muletii, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 106.
1869. — Mulleti, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 97, pl. clviii.
— — Forbesi, *Pictet and Campiche*. Ibid., p. 99, pl. clix.
1871. Melina Mulleti, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 400.
1883. Perna Mulleti, *W. Keeping*. Foss. etc., Neoc. Upware and Brickhill, p. 150.
1884. — — *O. Weerth*. Die Fauna des Neocom. im Teutoburg. Wald. (Palæont. Abhandl., vol. ii), p. 49.
1886. — (Mulletia) Mulleti, *P. Fischer*. Manuel de Conch., p. 956, fig. 725.
1895. — Mulleti, *F. Vogel*. Holländisch. Kreide, p. 55.
— — — *G. Maas*. Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 267.
1896. — *A. Wollemann*. Ibid., vol. xlviii, p. 843.
1900. — — — Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussich. geol. Land., N. F., pt. 31), p. 60.

Description.—Shell large, thick, compressed, more or less quadrilateral, with unequal angles. Hinge-line long. Umbones almost terminal. Anterior part of the shell sharply bent, and more or less nearly perpendicular to the plane of the two valves; anterior marginal part more or less deeply concave. From the umbo start two strong, broad, rounded folds; the anterior of these is near the anterior margin and curves anteriorly, its extremity forming the antero-ventral angle; the posterior fold at first curves ventrally and afterwards posteriorly, and its termination forms the postero-ventral angle. The part of the shell behind the posterior fold is compressed and flattened and produced into a wing of varying length. The junction of the two valves is sinuous, the anterior, the ventral, and the posterior margins (between the angles) being concave on the right valve and convex on the left.

The shell is ornamented with distinct growth ridges which bend ventrally in passing over the folds and form a semicircular or semi-oval curve near the hinge-line.

Measurements:

	(1)	(2)	(3)
Length of hinge-line . .	128	120	95 mm.
Height (from umbo to postero-ventral angle). . .	114	135	130 „

(1—3) *Perna*-bed, Atherfield.

Affinities.—The forms found in the Lower Greensand of England which had been referred to *Perna Mulleti* by earlier writers were regarded as distinct by Pictet and Campiche, and were named by them *Perna Forbesi*. They considered that the latter were distinguished by the more prominent folds, the shorter and more deeply concave anterior margin, and the longer posterior wing. An examination of a number of specimens shows that these characters are variable, and I am led to agree with Wollemann in thinking that the forms described by Pictet and Campiche cannot be regarded as more than varieties of a variable species.

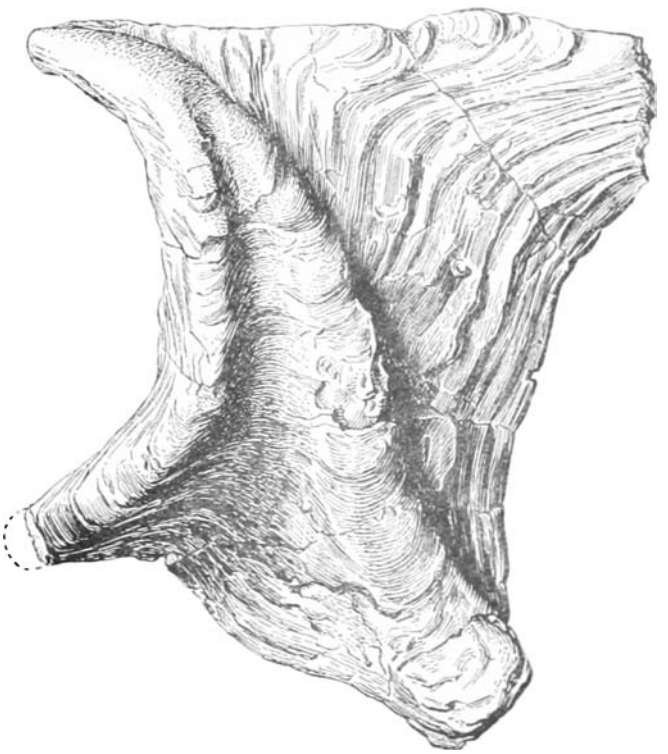


Fig. 15.—*Perna Mulleti*, Deshayes. Lower Greensand (*Perna*-bed), Sandown. Sedgwick Museum. Left valve × ⅔. (The posterior wing is broken. Forbes gives a figure of a specimen in which the wing is perfectly preserved.)

Perna Mulleti is the type of Fischer's section *Mulletia*.

Type.—From the Neocomian of Vendeuvre. I have not seen the specimens figured by Forbes.

Distribution.—*Perna*-bed of Atherfield and Sandown. Atherfield Beds of Haslemere, Peasmarsh, Shalford, Redhill, Sevenoaks, and Hythe. Hythe Beds of Hythe (*fide* Topley). Lower Greensand of Potton and Upware. Tealby Limestone (zone of *B. brunsvicensis*) of North Willingham. Speeton Clay of Speeton.

PERNA RICORDEANA, *d'Orbigny*, 1846. Text-figures 16–18.

1846. PERNA RICORDEANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 494, pl. cccxcix, figs. 1—3.
1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 82.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 179.
1855. *G. Cotteau*. Moll. Foss. de l'Yonne, p. 107.
1858. — — *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 125.
1869. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 93, pl. clvii, fig. 1.
1869. — FITTONI, *Pictet and Campiche*. Ibid., p. 95, pl. clvii, fig. 2.
1883. — RICORDIANA, *W. Keeping*. Foss., etc., Neoc. Upware and Brickhill, p. 150.
1900. — RICORDEANA, *A. Wollemann*. Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 61.

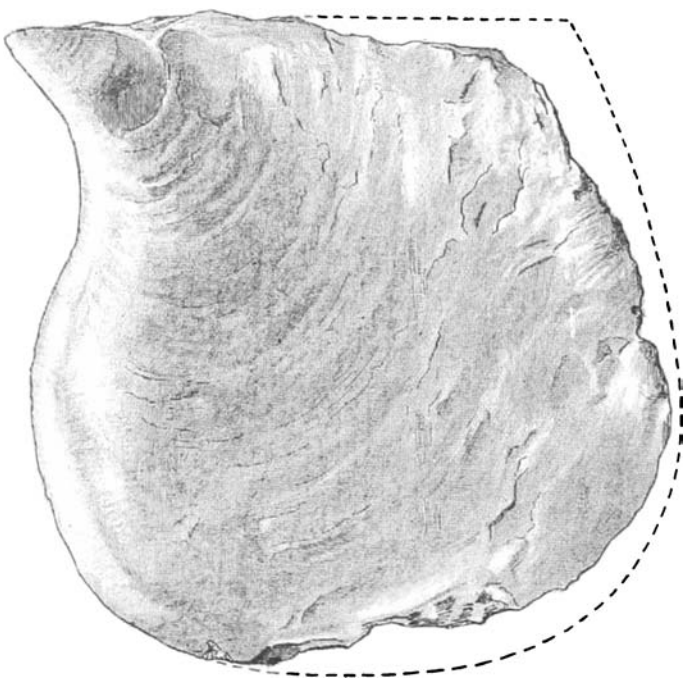


FIG. 16.— *Perna Ricordeana*, d'Orbigny. Lower Greensand (*Perna*-bed), Atherfield. Museum of Practical Geology, No. 12351. Left valve. × ¾.

Description.—Shell large, thick, sub-quadrate, compressed; left valve more convex than the right. Posterior margin slightly convex or nearly straight and forming with the hinge-line an angle which is rather greater than a right-angle.

Ventral margin curved regularly. Dorsal part of anterior margin concave. Valves moderately convex near the anterior margin, but flattened elsewhere. Dorsal half or more of the anterior marginal parts concave and depressed. Umbones sharp, close together, projecting beyond the rest of the anterior margin of the valves.

Surface with growth-lamellæ at more or less regular intervals.

Measurements :

	(1)	(2)	(3)	
Length of hinge	105	91	75	mm.
Height of valve . .	140 .	106	101	,,

(1—3) *Perna*-bed, Atherfield.

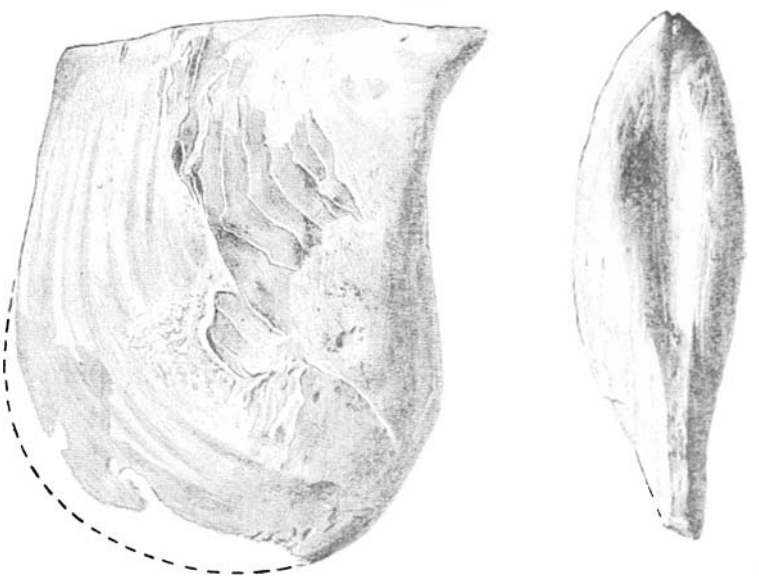


Fig. 17.—*Perna Ricordeana*, d'Orbigny. Lower Greensand (*Perna*-bed), Atherfield. Sedgwick Museum. Right valve and anterior view of both valves. × ¾.

Affinities.—Examples of this species from the Lower Greensand of the Isle of Wight were regarded by Pictet and Campiche as distinct from *P. Ricordeana* and were described as *Perna Fittoni*. According to those writers the former is distinguished from the latter chiefly by the wide separation of the umbones; this separation, however, seems to me to be due to the thickening of the valves in old age, such as may be seen not infrequently in *Gervillia* and other allied forms. The postero-dorsal angle of the valve, according to d'Orbigny's figure, appears to be rather smaller in *P. Ricordeana* than in *P. Fittoni*, but the difference is not great, and moreover, the outline of the shell and the size of this angle vary in different specimens of *P. Fittoni*. *P. Germani*, Pictet and Campiche, is very closely allied to *P. Ricordeana*.

Types.—From the Neocomian of Seignelay, near Auxerre. The type of *P. Fittoni* is from the *Perna*-bed of the Isle of Wight.

Distribution.—Lower Greensand (*Perna*-bed) of Atherfield. Tealby Limestone (zone of *Belemnites brunsvicensis*) of North Willingham.

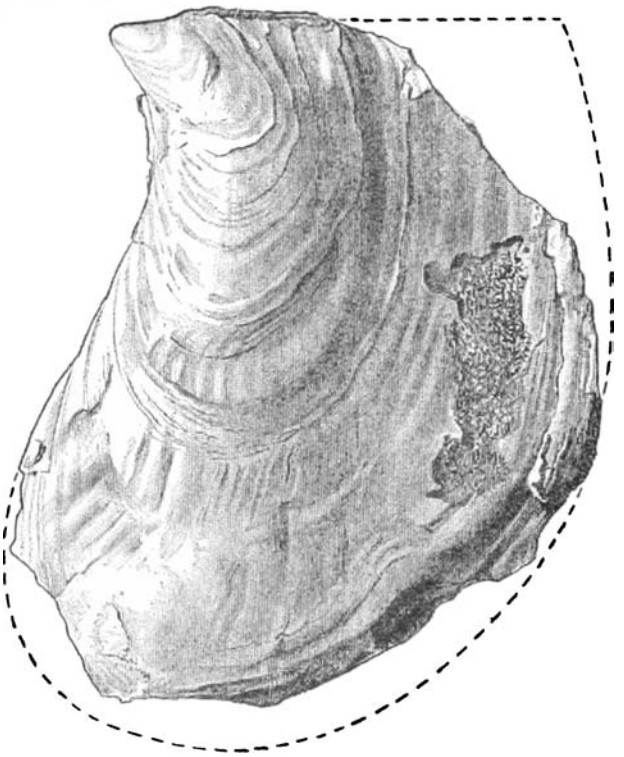


Fig. 18.—*Perna Ricordeana*, d'Orbigny. Tealby Limestone, North Willingham. Sedgwick Museum. Left valve. × ½.

Perna Rauliniana, *d'Orbigny*, 1846. Plate XII, figs. 6, 7*a*, *b*, 8, 9.

1846.	Perna Rauliniana,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 497, pl. cccci, figs. 4, 5.
1850.	—	—	*d'Orbigny.* Prodr. de Pal., vol. ii, p. 138.
1852.	—	—	*F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, p. 497, pl. xli, fig. 4.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 179.
1855.	—	—	*G. Cotteau.* Moll. Foss. de l'Yonne, p. 107.
1869.	—	—	*F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 100, pl. clx, figs. 1, 2.

Description.—Shell of moderate convexity, valves nearly equal, compressed posteriorly, sub-rhomboidal, oblique, much higher than long; postero-ventral margin rounded, anterior margin slightly concave, posterior margin slightly convex,

forming an obtuse angle with the hinge-line. Umbonal portion angular. Apical angle small. Surface with growth-lines.

Measurements :[1]

	(1)	(2)	(3)	(4)	(5)
Length	35	34	24	23	11 mm.
Height	73	69	49	40	22 ,,

(1—3, 5) Cambridge Greensand.
(4) Lower Gault, Folkestone.

Affinities.—This species is closely allied to *P. Ricordeana* (see above), but appears to differ (1) in being relatively shorter and higher; (2) in its more obtuse postero-dorsal angle; (3) in the less prominent umbones; (4) in the anterior marginal parts (near the byssal opening) being less depressed; (5) in the smaller size of the shell.

Remarks.—This species occurs commonly in the Cambridge Greensand in the form of internal casts; these differ in outline from specimens with the shell preserved on account of the fact that the postero-dorsal part is missing—probably owing to the two valves being in contact or almost in contact at this part. Even when the shell is preserved, as in specimens from the Gault, some portion of the postero-dorsal margin is frequently missing.

Types.—From the Albian of Avocourt (Meuse) and Escragnolles.

Distribution.—Cambridge Greensand (derived, internal casts). Lower Gault of Folkestone.

PERNA OBLONGA, *Seeley*, 1861. Text-figure 19 A.

1861. PERNA OBLONGA, *H. G. Seeley*. Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 121, pl. vi, fig. 6.

Remarks.—This species is known only from internal casts, and apparently differs from *P. Rauliniana* in having a larger apical angle and in the smaller angle formed by the hinge-line and the posterior margin. Some of the specimens, however, agree very closely with the figure of a cast of *P. Rauliniana* given by Pictet and Campiche (pl. clx, fig. 2).

Seeley compared *P. oblonga* with *P. subspathulata*, Reuss,[2] and *P. lanceolata*, Geinitz (see below). It is distinguished from the former by its relatively greater height, and from the latter by its larger apical angle.

[1] The height in this case is measured from the umbo to the postero-ventral margin, and the length is taken at right angles to the height.

[2] 'Die Verstein. der böhm. Kreideformat.,' pt. ii (1846), p. 24, pl. xxxii, figs. 16, 17.

Rounded depressions which are found commonly on the casts of this and some other species of *Perna* from the Cambridge Greensand are regarded by Seeley as evidence of the occurrence of pearls.

A specimen from the Gault (Plate XII, fig. 10) resembles *P. oblonga*, but is more convex between the umbo and the postero-ventral extremity.

Type.—In the Sedgwick Museum.

Distribution.—Cambridge Greensand (derived).

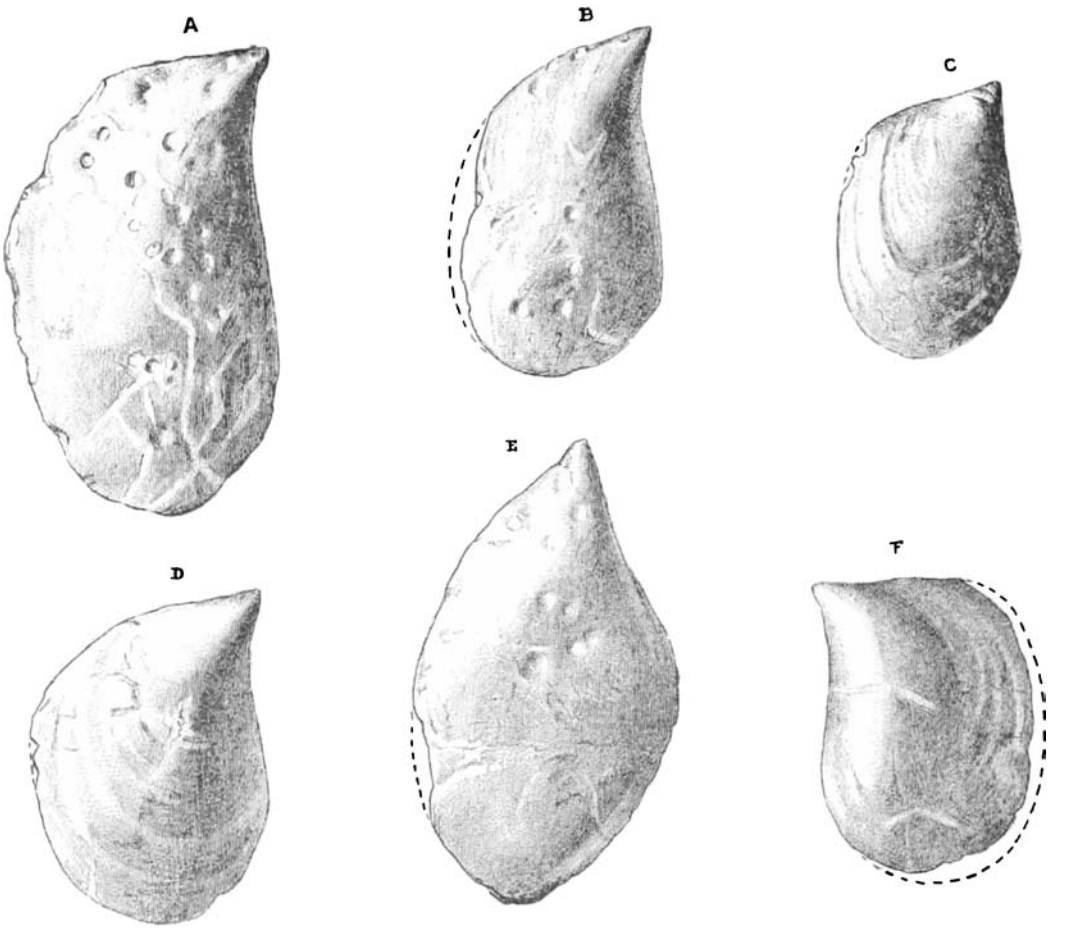


Fig. 19.—*Perna*. Cambridge Greensand (derived). Internal casts. Sedgwick Museum. Natural size, except fig. E.—A. *Perna oblonga*, Seeley. The Type.—B, C, *Perna*, sp. (referred to *P. lanceolata*, Geinitz, by Seeley).—D. *Perna semielliptica*, Seeley. The Type.—E, *Perna*, sp. (regarded by Seeley as a variety of *P. lanceolata*, Geinitz) × ¾.—F, *Perna*, sp. (referred to *P. subspathulata*, Reuss, by Seeley).

Perna semielliptica, *Seeley*, 1861. Text-figure 19 D.

1861. Perna semielliptica, *H. G. Seeley*. Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 121, pl. vi, fig. 7.

Remarks.—This is distinguished from *P. Rauliniana* (p. 92) by its relatively greater length, larger apical angle, and more rounded outline.

Measurements:

	(1)	(2)	(3)
Length	58	46	32 mm.
Height	87	70	47 ,,

(1—3) Cambridge Greensand.

Type.—From the Cambridge Greensand. In the Sedgwick Museum, Cambridge.
Distribution—Cambridge Greensand (derived, internal casts).

PERNA, sp. Text-figures 19, B C.

1861. PERNA LANCEOLATA, *H. G. Seeley.* Ann. Mag. Nat. Hist., ser. 3, vol. vii. p. 122.

Remarks.—This species (figs. 19 B, C) was referred by Professor Seeley to *Perna lanceolata*, Geinitz,[1] and it presents a general resemblance to the examples figured by Reuss and by d'Orbigny, but is less oblique. No satisfactory comparison, however, can be made, since the specimens from the Cambridge Greensand are in the form of internal casts.

Some examples (fig. 19 E) were named *Perna lanceolata*, var., by Seeley; they differ from Geinitz's species in the postero-ventral part being more produced and less rounded, so that the outline of the valve becomes more distinctly quadrate. By this quadrilateral outline they are distinguished from *P. Rauliniana*.

Distribution.—Cambridge Greensand (derived, internal casts).

PERNA, sp. Text-figure 19 F.

1861. PERNA SUBSPATHULATA, *H. G. Seeley.* Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 124.

Remarks.—Internal casts were regarded by Professor Seeley as examples of *P. subspathulata*, Reuss,[2] but they appear to differ from the latter in their greater convexity. The height is less and the length greater than in *P. oblonga*.

Distribution.—Cambridge Greensand (derived).[3]

[1] 'Das Elbthalgeb. in Sachsen,' pt. i (1873), p. 210, pl. xlvi, fig. 8. References to other figures are given by Geinitz.

[2] 'Die Verstein. der böhm. Kreideformat.,' pt. ii (1846), p. 24, pl. xxxii, figs. 16, 17.

[3] *Avicula cuneata*, Seeley, may be a *Perna*. *Perna lissa*, *P. plana*, and *P. transversa*, Seeley, appear to be *Inocerami*. All four come from the Red Limestone of Hunstanton. Seeley, 'Ann. Mag. Nat. Hist.,' ser. 3, vol. xiv (1864), p. 277, and vol. xvii (1866), pp. 178, 179.

Family—PINNIDÆ, *Gray*.

Genus—PINNA, *Linnæus*, 1758.

('Syst. Nat.,' ed. 10. p. 707.)

PINNA ROBINALDINA, *d'Orbigny*, 1844, Plate XII, figs. 11–15; Plate XIII, fig. 1.

1839.	PINNA RUGOSA, *F. A. Römer*.		Die Verstein. d. nord-deutsch. Oolith.-geb. Nachtrag., p. 32, pl. xviii, fig. 37 (non *rugosa*, Schlotheim).
1841.	—	— *F. A. Römer*.	Die Verstein. d. nord-deutsch. Kreidegeb., p. 65.
1844.	—	ROBINALDINA, *A. d'Orbigny*.	Pal. Franç. Terr. Crét., vol. iii, p. 251, pl. cccxxx, figs. 1–3.
1845.	—	RESTITUTA, *E. Forbes*.	Quart. Journ. Geol. Soc., vol. i, p. 248.
1850.	—	ROBINALDINA, *A. d'Orbigny*.	Prodr. de Pal., vol. ii, p. 80.
—	—	SUBRUGOSA, *d'Orbigny*.	Ibid., p. 80.
1854.	—	SULCIFERA, *J. Morris*.	Cat. Brit. Foss., ed. 2, p. 180.
1855.	—	ROBINALDINA, *G. Cotteau*.	Moll. Foss. de l'Yonne, p. 89.
1858.	—	— *F. J. Pictet and E. Renevier*.	Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 117, pl. xvi, fig. 5.
—	—	— *J. Villanova-y-Piera*.	Mem. geog.-agric. de Castellon, pl. iii, fig. 17.
1865.	—	— *H. Coquand*.	Mon. Aptien de l'Espagne, p. 143.
1867.	—	— *F. J. Pictet and G. Campiche*.	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 532, pl. cxxxix, figs. 3–6.
? 1882.	—	— *P. de Loriol*.	Gault de Cosne, p. 82, pl. x, figs. 3–5.
1883.	—	— *W. Keeping*.	Foss., etc., Neoc. Upware and Brickhill, p. 110.
1884.	—	— *O. Weerth*.	Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 48.
? 1892.	—	— *O. Behrendsen*.	Zeitschr. der deutsch. geol. Gesellsch., vol. xliv, p. 25.
? 1895.	—	— *F. Vogel*.	Holländisch. Kreide, p. 55.
1896.	—	— *A. Wollemann*.	Zeitschr. der deutsch. geol. Gesellsch., vol. xlviii, p. 845.
1899.	—	— *G. Maas*.	Zeitschr. der deutsch. geol. Gesellsch., vol. li, p. 248.
1900.	—	— *A. Wollemann*.	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 70.

Palæontographical Society, 1906.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. II. PART III.

PINNIDÆ ASTARTIDÆ, CARDITIDÆ, CRASSATELLITIDÆ, AND CYPRINIDÆ.

PAGES 97—132; PLATES XII—XIX.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY

1906.

? 1888. PINNA ROBINALDINA, *P. Choffat.* Stratigr. et Paléont. d'Angola (Mém. Soc. phys. et d'hist. nat. de Genève, vol. xxx, No. 2), p. 86, pl. v, figs. 4, 5.

? 1903. — — *C. Burckhardt.* Jura u. Kreidef. d. Cordillere (Palæontographica, vol. l), p. 79, pl. xv, figs. 6, 7.

? 1905. — *cf.* ROBINALDINA, *E. Harbort.* Fauna d. Schaumburg-Lippe'schen Kreidemulde (Abhandl. d. k. preussisch. geol. Landesanst., N.F., Heft 45), p. 47, pl. v, fig. 5; pl. vii, figs. 2, 3.

Description.—Shell straight, much elongated; pyramidal, slightly compressed; margins nearly straight; section sub-quadrangular.

Each valve is divided into two parts, which meet at an angle. The dorsal part is smaller and more flattened than the ventral part, and is ornamented with from 6 to 8 or more ribs, which are narrow, strong, and nearly equi-distant. The ribs are separated by broad, shallow, rounded depressions; both depressions and ribs are crossed by very fine, somewhat irregular, concentric ridges, which sometimes give a slightly serrated appearance to the ribs. The ventral part of each valve is moderately convex, and its dorsal portion is ornamented with from 5 to 7 radial ribs similar to those on the dorsal part of the valve, but decreasing in size ventrally; the last one or two of these ribs sometimes become irregular and discontinuous. These radial ribs and their interspaces are crossed by fine concentric ridges. The ventral portion of the ventral part of the valve is ornamented with strong growth-ridges or folds, which curve rapidly in the direction of the umbo, and form an acute angle where they meet the ribs.

Measurements:

	(1)	(2)
Length	135	94 mm.
Height	49	41 ,,

(1) *Perna*-bed, Atherfield.

(2) *Crioceras*-bed, Whale Chine.

Affinities.—The figure of *P. gracilis*, Phillips,[1] is not sufficiently good to enable one to form a satisfactory idea of the character of the species, and the type cannot now be found. But other specimens from Speeton, although very imperfectly preserved, are sufficient to suggest that *P. gracilis* is probably identical with *P. Robinaldina*.

It is suggested by Pictet and Campiche that *P. tetragona*, Sowerby,[2] from the

[1] 'Geol. Yorks.' (1829), p. 122, pl. ii, fig. 22.

[2] 'Min. Conch.,' vol. iv (1821), p. 9, pl. cccxiii, fig. 1; Morris, 'Cat. Brit. Foss.,' ed. 2 (1854), p. 180; *P. subtetragona*, d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 165; Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1867), p. 537; non *P. tetragona*, Brocchi, 1814.

Upper Greensand of Devizes, is probably identical with *P. Robinaldina*. The specimens from Devizes agree with those found at Blackdown in having the folds on the ventral part of the valve rather more strongly marked than in *P. Robinaldina* from the Lower Greensand. In other respects the Upper Greensand form does not appear to differ from *P. Robinaldina*, and may be regarded as a variety of it, *P. Robinaldina* var. *tetragona*, Sowerby.

P. Reynesi, Hébert and Munier-Chalmas,[1] is similar to *P. Robinaldina*, but apparently differs in that the ribs on the ventral part of the shell are all smaller than those on the dorsal part, and do not diminish gradually in size.

P. cretacea (Schlotheim)[2] is closely related to *P. Robinaldina*, but appears to be distinguished (1) by the ribs covering a larger proportion of the ventral part of the shell and being of nearly uniform size, (2) by the growth-lines on the ventral part being more nearly straight, (3) by the shell being usually more elongate.

Remarks.—The specimens of *Pinna* found in the Gault of Folkestone and Black Ven have usually been named *P. tetragona*. Their mode of preservation is more or less unsatisfactory, owing to crushing and to the absence of some of the outer layers of the shell, but after a close comparison with examples of *P. Robinaldina* from the Lower Greensand I am unable to see any reason for regarding the former as specifically distinct from the latter.

Pictet and Campiche thought that the examples from Blackdown were referable to *P. Robinaldina*, differing only in having the folds on the ventral part of the shell rather more strongly marked.

The specimens from the Lower Greensand of the Isle of Wight agree well with the figures given by Pictet and Renevier and by Pictet and Campiche. The number of ribs varies considerably, and in young specimens the apical angle is smaller than in older examples.

A specimen from the Upper Greensand of Ventnor, which has been referred[3] to *P. Reynesi*, Hébert and Munier-Chalmas, is probably a crushed example of *P. Robinaldina*.

Type.—The type of *P. rugosa* came from the Hils-conglomerate of Osterwald. The type of *P. tetragona*, Sowerby, came from the Upper Greensand of Devizes and is now in the British Museum.

Distribution.—*Perna*-bed, Crackers, and Fitton's Beds 16 and 38, of Atherfield. Ferruginous Sands of Shanklin. Atherfield Beds of Redhill, Reigate. Sandgate Beds of Parham Park. Lower Greensand of Brickhill. ?Speeton Clay (zone of *Belemnites brunsvicensis*) of Speeton. Gault of Folkestone and Black Ven.

[1] 'Ann. Sciences géol.,' vol. vi (1875), p. 118, pl. v, fig. 10.

[2] Geinitz, 'Das Elbthalgeb.' (Palæontographica, vol. xx, pt. 2, 1873), p. 54, pl. xiv, figs. 2, 3.

[3] Jukes-Browne, 'Cret. Rocks of Britain,' vol. i (1900), p. 470.

Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown, Devizes, and Ventnor.[1]

PINNA, sp. Plate XIII, figs. 2, 3.

Some specimens of *Pinna* found in the Gault of Folkestone differ from *P. Robinaldina* in having smaller and more numerous ribs, which are crossed at regular intervals by narrow concentric ridges.

PINNA TEGULATA, *Etheridge*, 1881.

1881. PINNA TEGULATA, *R. Etheridge*, in *Penning and Jukes-Browne's* Geol. Cambridge (Mem. Geol. Survey), p. 142, pl. i, fig. 2.

Remarks.—This species is known only by the type and a few fragmentary specimens. The type shows the interior of a right valve. The ornamentation appears to be similar to the form from the Gault described above. On the dorsal half of the valve there are about 18 narrow ribs, which are crossed at regular intervals by concentric ridges, giving rise to a fimbriated appearance. About 8 similar ribs are found on the dorsal part of the ventral half of the valve, below which are strongly curved growth-ridges.

Type.—In the Sedgwick Museum, Cambridge.

Distribution.—Totternhoe Stone (zone of *Holaster subglobosus*) of Burwell.

PINNA DECUSSATA, *Goldfuss*, 1837. Plate XIII, figs. 4 *a–c*, 5, 6. Plate XIV, fig. 1.

1833. PINNA SULCATA, *S. Woodward*. Geol. Norfolk, p. 47, pl. v, fig. 23.
1837. — DECUSSATA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 166, pl. cxxviii, figs. 1, 2.
— — COMPRESSA, *Goldfuss*. Ibid., p. 167, pl. cxxviii, fig. 4.
? 1840. — PYRAMIDALIS, *H. B. Geinitz*. Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 2, p. 55, pl. x, fig. 1.
— — COMPRESSA, *Geinitz*. Ibid, p. 55.
1841. — FENESTRATA, *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 65, pl. viii, fig. 22.
— — DECUSSATA, *Römer*. Ibid., p. 65.
1846. — PYRAMIDALIS, *H. B. Geinitz*. Grundr. d. Verstein., p. 451.

[1] I have not seen any specimen of *Pinna? crassa*, Fitton, 'Trans. Geol. Soc.,' ser. 2, vol. iv (1836), p. 130; Morris, 'Cat. Brit. Foss.,' p. 180.

1846. PINNA DECUSSATA, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 14, pl. xxxvii, figs. 1, 2.
1850. — — *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 165.
— — FENESTRATA, *d'Orbigny.* Ibid., p. 246.
— — DECUSSATA, *J. de C. Sowerby*, in *F. Dixon.* Geol. Sussex, p. 355 (p. 386, ed. 2), pl. xxviii, fig. 20.
— — DILUVIANA, *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 166.
— — FENESTRATA, *Geinitz.* Ibid., p. 166.
1854. — DECUSSATA, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 180.
— — SULCATA, *Morris.* Ibid., p. 180.
1873. — DECUSSATA, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. i, p. 211, pl. xlvii, figs. 4, 5; pt. ii, p. 53, pl. xv, figs. 2, 3; pl. xvi, fig. 1.
1877. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., ii. Weissenberg. u. Malnitz. Schicht., p. 120, fig. 86.
1883. — — *Fritsch.* Ibid., iii. Iserschicht., p. 104.
1888. — — *G. Müller.* Mollusk. d. untersen. v. Braunschweig (Jahrb. d. k. preussisch. geol. Landesanst. für 1887), p. 420.
1889. — — *Fritsch.* Stud. im Gebiete der böhm. Kreideformat., iv. Teplitz. Schicht., p. 79.
? 1890. — — *M. Blanckenhorn.* Beitr. z. Geol. Syriens: Kreidesyst. in Mittel u. Nord-Syrien, p. 80.
1893. — — *Fritsch.* Stud. im Gebiete der böhm. Kreideformat., v. Priesen. Schicht., p. 94.
1897. — — — Ibid., vi. Chlomek. Schicht., p. 57.
? 1894. — *cf.* DECUSSATA, *A. Hennig.* Om Åhussandst. (Geol. Fören. i Stockholm Förhandl., vol. xvi), p. 522.
1902. — DECUSSATA, *J. P. J. Ravn.* Mollusk. i Danmarks Kridtaflej., i. Lamellibr., p. 104.

Non 1846. — — *E. Forbes.* Trans. Geol. Soc., ser. 2, vol. vii, p. 153 (= *P. arata*, Forbes).

Description.—Shell moderately elongate, triangular, laterally compressed, section rhombic, but becoming lenticular in the later portion. Dorsal margin straight, ventral margin slightly curved.

Each valve is divided into two nearly equal parts. The dorsal part is flattened and bears from 7 to 9 strong rounded ribs, separated by broad, shallow, rounded depressions. The distance between the ribs increases in passing from the apex to the posterior extremity. In well-preserved specimens linear ridges are seen crossing the ribs and interspaces at regular intervals. The dorsal portion of

the ventral part of the valve bears from 5 to 7 ribs similar to those on the dorsal part and of nearly uniform size, with transverse linear ridges. On the ventral portion of the ventral part of the valve there are strong ridges or folds which form an acute angle with the last rib, and curve slightly towards the umbo.

Measurements (*approximate*) :

	(1)	(2)	(3)
Length	125	117	120 mm.
Height	66	69	66 ,,

(1) Chalk Marl, Folkestone.
(2) Chalk, Newtimber (Sussex).
(3) Chalk, Trimingham.

Remarks.—Most of the specimens of *Pinna* from the Chalk are very imperfectly preserved, and it is not unlikely that better material would show that more than one species could be distinguished.

In the examples from Trimingham the ribs are rather broader and more rounded than in most of the specimens found at lower horizons.

Affinities.—This species is less elongate than *P. cretacea* (Schlotheim),[1] and has the ridges on the ventral part of the valves more distinctly curved than in that form. It has a larger apical angle than *P. Robinaldina* (see p. 96) ; also the shell is rather more compressed, and the ribs on the ventral part do not decrease regularly in size as they do in *P. Robinaldina*.

P. sulcata, Woodward (Plate XIV, fig. 1), from the Norwich Chalk, as was suggested by J. de C. Sowerby, does not differ from *P. decussata*. Woodward's name is prior to that of Goldfuss, but since the original figure was scarcely sufficient for the recognition of the species and was not accompanied by any description, I do not think it is desirable that the well-known name *P. decussata* should be displaced by *P. sulcata*.

Most of the English specimens of *P. decussata* agree better with the figures given by Geinitz (1873) than with those of Goldfuss and Reuss. But the example figured by Dixon seems to be very similar to the types of Goldfuss.

Types.—From the Quadersandstone of Haltern (Westphalia) and Schandau (Saxony). The specimen figured by Dixon cannot be found. The type of *P. sulcata* is in the Norwich Museum.

Distribution.—Chalk Marl of Ventnor and Folkestone. *Terebratulina* zone of Arn Hill near Warminster. Zone of *Holaster planus* of Balsham. Chalk of Newtimber. Zone of *Micraster cor-anguinum* of Charlton and Gravesend. Upper Chalk (zone of *M. cor-testudinarium* or *M. cor-anguinum*) of Swaffham, Norfolk. (?) Zone of *Actinocamax quadratus* of East Harnham near Salisbury. Zone of *Belemnitella mucronata* of Norwich. Chalk of Trimingham.

[1] Geinitz, 'Das Elbthalgeb.,' pt. ii (1873), p. 54, pl. xiv, figs. 2, 3.

Family—ASTARTIDÆ, *Gray*.

Genus—ASTARTE, *J. Sowerby*, 1816.

('Min. Conch.,' vol. ii, p. 85.)

ASTARTE ELONGATA, *d'Orbigny*, 1844. Plate XIV, figs. 2 *a*, *b*, 3.

1842.	ASTARTE OBLONGATA, *Deshayes* in *A. Leymerie*.		Mém. Soc. géol. de France, ser. 2, vol. v, pp. 5, 24, pl. vi, fig. 1 (non *oblonga*, Sowerby, 1826).
1844.	—	ELONGATA, *A. d'Orbigny*.	Pal. Franç. Terr. Crét., vol. iii, p. 68, pl. cclxiii, figs. 8—11.
1850.	—	— *d'Orbigny*.	Prodr. de Pal., vol. ii, p. 77.
1855.	—	— *G. Cotteau*.	Moll. Foss. de l'Yonne, p. 69.
1866.	—	— *F. J. Pictet and G. Campiche*.	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 310, pl. cxxiv, figs. 8, 9.
1868.	—	— *P. de Loriol*.	Valangien d'Arzier, p. 28, pl. ii, fig. 7.
1871.	—	— *F. Stoliczka*.	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 285.
1900.	—	— *A. Wollemann*.	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 102.

Description.—Shell thick, elongate, rounded-oblong or oval, convex, compressed, very inequilateral. Postero-dorsal margin curving ventrally to join the obtuse and slightly curving posterior margin. Postero-ventral extremity rounded. Ventral margin nearly straight. Anterior margin rounded. Umbones small, with an indistinct keel passing from them towards the postero-ventral extremity. Lunule narrow.

Ornamentation consists of strong concentric ribs, somewhat unequal in size, and separated by narrow grooves. Margins of valves crenulated.

Length 21 mm.; height 22 mm.

Affinities.—*Astarte cingulata*, Geinitz,[1] from the Cenomanian of Plauen, is probably identical with this species.

A. elongata is easily distinguished from other Cretaceous species by its elongate form.

Remarks.—The only specimens seen are in the Museum of Practical Geology.

[1] 'Das Elbthalgeb. in Sachsen' (Palæontographica, vol. xx, pt. i, 1873), p. 226, pl. l, fig. 8. Non *A. cingulata*, Contejean, 'Kimmérid. de Montbéliard' (1859), p. 267, pl. xi, figs. 5—7.

One has the shell preserved, the others are internal casts showing deep muscular impressions.

Types.—Leymerie's specimens came from the Lower Neocomian of Avalleur, Chenay, and Marolles (Aube). D'Orbigny records specimens from the Lower Neocomian of St. Sauveur (Yonne). Pictet and Campiche figure specimens from the Valanginian of Ste. Croix.

Distribution.—Lower Greensand of Seend.

ASTARTE SUBACUTA, *d'Orbigny*, 1850. Plate XIV, figs. 4—6.

1844.	ASTARTE CARINATA, *A. d'Orbigny.*		Pal. Franç. Terr. Crét., vol. iii, p. 63, pl. cclxii, figs. 1–3. (non *A. carinata*, Phillips, 1829.)
1847.	—	ACUTA, *d'Orbigny.*	Ibid., p. 759. (non *A. acuta*, Reuss, 1846.)
1850.	—	SUBACUTA, *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 77.
1866.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 318.
1900	—	— *A. Wollemann.*	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 99.

Description.—Shell triangular, much compressed, length greater than height, slightly inequilateral. Antero-dorsal margin long and concave. Postero-dorsal margin longer than the antero-dorsal, and either concave or nearly straight. Both of these margins form obtuse angles with the well-rounded margin of the ventral half of the shell. Umbones very acute, projecting, often nearly median and not curved. Lunule narrow, with a sharp edge. Escutcheon very narrow.

Ornamentation consists of prominent concentric ribs separated by broad interspaces. The distance between the ribs increases in passing from the umbo ventrally. Margins of valves crenulated.

Measurements:

	(1)	(2)	
Length .	14	10	mm.
Height .	11	8	,,

(1, 2) *Perna*-bed, East Shalford.

Affinities.—*A. subacuta* is distinguished from the other Cretaceous species by its acute umbones and flattened valves.

Remarks.—The only specimens which I have seen are in the Meÿer Collection, Sedgwick Museum.

Type.—From the Neocomian of Brienne (Aube).

Distribution.—*Perna*-bed of East Shalford. Atherfield Beds of Sevenoaks.

ASTARTE SINUATA, *d'Orbigny*, 1844. Plate XIV, figs. 7—9.

1844.	ASTARTE SINUATA,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 69, pl. cclxiv, figs. 1—3.
1850.	—	— *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 118.
1856.		— *F. J. Pictet and E. Renevier.*	Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 89, pl. x, fig. 3.
1866.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 311.
1871.	—	— *F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, pp. 251, 285.
1895.	—	— *G. Maas.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 261.
1900.	—	— *A. Wollemann.*	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 100.

Description.—Shell sub-quadrate, rounded ventrally, truncated posteriorly, longer than high, slightly or moderately inequilateral, much compressed. A furrow extends from just behind the umbo to the sinuosity on the posterior margin, and cuts off a triangular, flattened, postero-dorsal part of the valve. Antero-dorsal margin nearly straight. Anterior margin rounded, passing gradually into the curved ventral margin. Posterior margin with a sinuosity above the postero-ventral angle. Postero-dorsal margin straight or slightly concave, longer than the antero-dorsal margin, and forming an angle with the posterior margin. Umbones pointed, inconspicuous. Lunule and escutcheon long, narrow, with sharp edges which have tooth-like projections where the ribs end.

Ornamentation consists of rounded, concentric ribs separated by shallow furrows. The ribs are rather stronger on the posterior than on the anterior part of the shell, and are sinuous where they cross the posterior furrow. Smaller ribs are present on the main ribs and furrows.

Measurements:

	(1)	(2)
Length . .	16 . .	15 mm.
Height . . .	14·5 . .	14 „
Thickness . .	4· . .	

(1, 2) Crackers, Atherfield.

Affinities.—*A. sinuata* is distinguished from other Cretaceous species of *Astarte* by the furrow passing from the umbo to the posterior margin. Conrad[1] thought that this species might belong to his genus *Lirodiscus*. I am unable to express an opinion on this matter, since I have seen only three examples, none of which shows the hinge, nor is it seen in the figures given by previous writers.

Type.—From the Aptian of Marolles (Aube).

Distribution.—Lower Greensand (Crackers) of Atherfield. Recorded by Pictet and Renevier from the Lower Greensand of Peasmarsh.

ASTARTE UPWARENSIS, sp. nov. Plate XIV, figs. 10 *a–c*, 11 *a*, *b*, 12.

1883. ASTARTE, sp. nov., *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 122, pl. vi, fig. 9.

Description.—Shell ovate, a little higher than long, moderately and evenly inflated, moderately (or sometimes only slightly) inequilateral. Dorsal half narrowing gradually to the umbo; ventral half larger and with evenly-rounded margin. Antero-dorsal border slightly concave; postero-dorsal border long and convex. Umbones curving forward. Lunule large, ovate, depressed, with a sharp border. Escutcheon lanceolate, with a sharp edge.

Ornamentation consists of many flattened, inconspicuous, concentric ribs separated by linear grooves.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	24	21	19	14	13	mm.
Height	25	21·5	21	15	14	,,

(1–5) Lower Greensand, Upware.

Affinities.—This species presents some resemblance to *A. calaugiensis*, Pictet and Campiche,[2] but its dorsal half is not so narrow and pointed, and the antero-dorsal margin is less concave. It is also similar to *A. Rhodani*, Pictet and Campiche,[3] from the Gault of Cosne, but the umbones are less prominent.

Astarte upwarensis is distinguished from *A. circularis*, Guéranger,[4] by its ovate outline and greater height.

Type.—Of the specimens of this species which were figured by W. Keeping as

[1] 'Amer. Journ. Conch.,' vol. v (1869), p. 46.

[2] 'Terr. Crét. Ste. Croix' (Matér. Pal. Suisse, ser. 4, 1866), p. 303, pl. cxxiii, figs. 3, 4.

[3] De Loriol, 'Gault de Cosne' (1882), p. 94, pl. xii, figs. 1–7.

[4] 'Album Paléont. de la Sarthe' (1867), p. 12, pl. xv, fig. 12, pl. xvi, figs. 7, 8.

Astarte, sp. nov., one is in the Sedgwick Museum (fig. 9 *a*), the other in Mr. J. F. Walker's collection (fig. 9 *b*).

Distribution.—Lower Greensand of Upware.

ASTARTE SENECTA, sp. nov. [ex *Bean* MS.] Plate XIV, figs. 13–20.

1889. ASTARTE SENECTA [Bean MS.] *G. W. Lamplugh*. Quart. Journ. Geol. Soc., vol. xlv, p. 616.

Description.—Shell subtriangular, or approaching subquadrangular, sometimes rounded, rather compressed, usually very inequilateral; height usually a little greater than length. Anterior margin rounded, ventral margin curving slightly and often forming a rounded angle with the posterior margin, which is slightly curved and usually makes an obtuse angle with the postero-dorsal margin. Umbones small, curving forwards. Lunule ovate, deep, with a sharp border. Escutcheon narrow, deep, with a sharp border.

Ornamentation consists of strong concentric ribs, with sharp summits, separated by broad furrows, on both of which are numerous small ribs. The ribs bend sharply in passing on to the postero-dorsal part of the valve, and cut the postero-dorsal margin obliquely. Margins of valves strongly crenulated.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Length	23	22	21	19	13	26	25	25	23	23	21	mm.
Height	21·5	20	19	17	11	24	22·5	22	23	22	21	,,

(1–5) Speeton Clay, Speeton.
(6–11) Claxby Ironstone, Benniworth Haven.

Affinities.—*Astarte veneris*, Eichwald,[1] is similar to this species, but has a deeper and larger lunule, more prominent umbones, less compressed valves, and more slender ribs. Specimens of *A. veneris* from the 'Volgian' of Moscow are in Mr. Lamplugh's collection.

Remarks.—This species has been known to collectors for a long time, and has appeared in lists of fossils under the name *Astarte senecta*, Bean MS., but has not hitherto been described and figured.

The specimens from the Claxby Ironstone are, as a rule, more rounded in outline than those from Speeton, and their ornamentation is not so well preserved on account of the difficulty of separating the shells from the hard matrix in which they are found.

[1] D'Orbigny, in Murchison, de Verneuil, and de Keyserling, 'Géol. Russ. d'Europe,' vol. ii (1845), p. 456, pl. xxxviii, figs. 21, 22.

Distribution.—Zone of *Belemnites lateralis:* in the Speeton Clay of Speeton and the Claxby Ironstone of Benniworth Haven.

ASTARTE, sp. Plate XIV, fig. 21.

Description.—Shell oval, moderately convex, slightly inequilateral, length greater than height. Antero-dorsal margin concave. Anterior margin rounded, passing gradually into the curved ventral margin. Postero-dorsal margin convex, forming a rounded angle with the posterior margin. Umbo pointed.

Ornamentation consists of about 15 strong, rounded, concentric ribs separated by rounded furrows of greater breadth. Fine concentric ridges occur on both ribs and furrows. The ribs cut the postero-dorsal margin at a large angle; they are more widely separated on the dorsal than on the ventral half of the valve.

Length 12·5 mm.; height, 11·2 mm.

Remarks.—This species is known by a single right valve only. The ornamentation is somewhat similar to that of *A. senecta*, but the shell is more oval and less inequilateral, also the ribs are more numerous and form a larger angle with the postero-dorsal margin.

Distribution.—Speeton Clay of Speeton.

ASTARTE CANTABRIGIENSIS, sp. nov. Plate XIV, figs. 22*a*, *b*, 23*a*, *b*, 24.

1883. ASTARTE SUBDENTATA, *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 122, pl. vi, fig. 11 (*non* Römer).

Description.—Shell subquadrate, longer than high, very inequilateral, moderately inflated, with the greatest convexity between the umbo and the postero-ventral angle. Postero-dorsal margin long, slightly convex, forming an obtuse angle with the truncated posterior margin, and a blunt angle where it joins the slightly convex ventral margin. Anterior margin rounded. Lunule deep, ovate, distinctly limited. Escutcheon deep, with a sharp edge.

Ornamentation consists of strong concentric ribs bearing finer ribs.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length .	17·5	15	15	14	14	13·5	13	12	mm.
Height	16	13·5	13	12·5	12	12·5	11·5	10·5	,,

(1–8) Lower Greensand, Upware.

Affinities.—This species was identified by W. Keeping with *A. subdentata*, Römer,[1] from the Neocomian of Brunswick. I have submitted photographs of the British fossil to Dr. A. Wollemann and he agrees with me in thinking that it is quite distinct from *A. subdentata*. In the latter the shell is smaller, the valves are much flatter and more elongate, and the umbones are more pointed and less anterior in position.

The ornamentation, when well preserved, is somewhat similar to that of *A. senecta* (see above), but the shell is more inequilateral, more nearly quadrate in outline, and the postero-dorsal part is more compressed.

Remarks.—The ornamentation is often imperfectly preserved, and in some cases it has almost entirely disappeared. The hinge has not been seen.

Type.—The specimen figured by Keeping is in the Sedgwick Museum, Cambridge.

Distribution.—Lower Greensand of Upware.

ASTARTE CLAXBIENSIS, sp. nov. Plate XIV, figs. 25–28.

Description.—Shell small, thick, oval, longer than high, inflated, slightly inequilateral. Antero-dorsal margin concave, postero-dorsal slightly convex. Anterior margin well rounded. Ventral and posterior margins forming a regular curve. Umbones prominent, close together, nearly median, curved greatly inwards and slightly forwards. Lunule large, ovate, with sharp edges. Escutcheon lanceolate, smooth, distinctly limited.

Ornamentation consists of strong, narrow, concentric ribs, separated by broad, deep furrows. Left valve with two stout cardinal teeth and a tooth at the margin of the lunule. Margins of valves coarsely crenulate.

Measurements:

	(1)	(2)	(3)	(4)	(5)
Length	12	11	10	9	8 mm.
Height	10·5	10	9	8·25	7 ,,

(1–3, 5) Claxby Ironstone, Benniworth Haven.
(4) Spilsby Sandstone, Spilsby.

Affinities.—*Astarte claxbiensis* shows considerable resemblance to certain species found in the Jurassic rocks; thus *Astarte robusta*, Lycett,[2] from the Cornbrash, seems to differ only in having the valves more elongate and the umbonal parts narrower.

[1] 'Verstein. norddeutsch. Kreidegeb.' (1841), p. 71, pl. ix, fig. 9. Wollemann, 'Die Bivalven u. Gasterop. d. deutsch. u. holländ. Neocoms' (1900), p. 98, pl. v, fig. 2.

[2] 'Suppl. Mon. Mollusca Great Ool.,' etc. (1863), p. 74, pl. xxxv, fig. 6.

A. cordata, Trautschold,[1] is another example of the same type. *A. Sauvagei*, de Loriol,[2] from the Sequanian, is also similar to *A. claæbiensis*, but appears to be less elongate.

Distribution.—Spilsby Sandstone (zone of *Belemnites lateralis*) of Spilsby. Claxby Ironstone (zone of *B. lateralis*) of Benniworth Haven.

ASTARTE SUBCOSTATA, *d'Orbigny*, 1850. Plate XIV, figs. 29–36.

1842.	ASTARTE LATICOSTA, *Deshayes.*	In *A. Leymerie*, Mém. Soc. géol. de France, ser. 2, vol. v, p. 4, pl. iv, figs. 4, 5 (non *A. laticosta*, Deshayes, 1839).
1844.	— STRIATO-COSTATA, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 64, pl. cclxii, figs. 7–9 (non *A. striato-costata*, Römer, 1836).
1845.	VENUS (?) [STRIATO-COSTATA], *E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 241.
1850.	ASTARTE SUBCOSTATA, *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 77.
1854.	— STRIATO-COSTATA, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 187.
1855.	— SUBCOSTATA, *G. Cotteau.*	Moll. Foss. de l'Yonne, p. 70.
1856.	— LATICOSTA, *F. J. Pictet and E. Renevier.*	Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 88, pl. x, fig. 2.
1865.	— LEYMERII, *K. A. Zittel.*	Die Bivalv. d. Gosaugeb. (Denkschr. d. k. Akad. Wien, Math.-nat. Classe, vol. xxiv), p. 156.
1865.	— LATICOSTA, *H. Coquand.*	Mon. Aptien de l'Espagne, p. 126.
1866.	— SUBCOSTATA, *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 307.
? 1868.	— STRIATO-COSTATA, *E. Eichwald.*	Lethæa Rossica, vol. ii, p. 624.
? 1868.	— LATICOSTA, *Eichwald.*	Ibid., p. 628.
? 1900.	— LEYMERII, *G. Müller.*	Deutsch-Ost-Afrika, vol. vii, p. 552, pl. xxii, figs. 4, 5.
1905.	— SUBCOSTATA, *E. Harbort.*	Die Fauna der Schaumberg-Lippe'schen Kreidemulde, p. 60, pl. iv, fig. 6.

Description.—Shell small, usually rather convex, subquadrate or subtriangular, moderately or very inequilateral. Antero-dorsal margin concave. Anterior and ventral margins rounded. Postero-dorsal margin long, nearly straight, forming an

[1] C. Rouillier, 'Bull. Soc. Nat. Moscou,' vol. xix, pt. 2 (1846), pl. d, fig. 15; pl. e, fig. 1; vol. xxi, pt. 1 (1848), pp. 274, 275. Trautschold, *Ibid.*, vol. xxxiii (1860), p. 347.

[2] De Loriol and Pellat, 'Mon. Paléont. et Géol. étages sup. Jurass. de Boulogne-sur-Mer' (1874), p. 96, pl. xv, figs. 33, 34.

angle with the posterior margin, which is more or less truncated. Umbones inconspicuous. Lunule smooth, ovate, rather broad, with a sharp edge. Escutcheon smooth, deep, long.

Ornamentation consists of 7 to 9 sharp, prominent, concentric ribs, with steep dorsal and gentle ventral slopes. Interspaces broad. Between the ribs there are three or four very small concentric ribs and numerous fine radial striæ.

Measurements :

	(1)	(2)	(3)	(4)
Length	7	6	5·5	5 mm.
Height	5	5	4·5	4·5 ,,

(1) Atherfield Beds, Sevenoaks.
(2) Atherfield Beds, Peasmarsh.
(3, 4) *Perna*-bed, East Shalford.

Affinities.—This species resembles *Astarte formosa* (see p. 112) but is larger, less triangular in outline, with a larger apical angle and fewer ribs. *A. similis*, Goldfuss,[1] belongs to the same group, but is more rounded in outline, and has more numerous ribs than *A. subcostata*.

Forbes states that English examples of this species were identified by d'Orbigny as *A. numismalis*, d'Orbigny,[2] but adds that they resemble much more nearly d'Orbigny's *A. striato-costata*. They differ from the figures of *A. numismalis* given by d'Orbigny in being less triangular, and in having the posterior end more truncated; also the ribs are less numerous but more prominent, and form a larger angle with the postero-dorsal margin. English examples were also seen by Pictet and Renevier, and were identified by them with *Astarte laticosta*, Deshayes (= *striato-costata* and *subcostata*, d'Orbigny). The specimen figured by d'Orbigny is more elongate than most of the English examples, but agrees in this respect with some found in the Atherfield Clay of Sevenoaks. The specimens figured by Leymerie are much larger than the English examples, and the ribs are more numerous and less prominent. Some of the differences seen in the figures of the authors quoted in the synonymy are probably due to the differences in the age of the specimens. In the young specimens the posterior end is more rounded, in old specimens it is more truncated.

Remarks.—Specimens which occur in the Crackers of Atherfield (Plate XV, figs. 1, 2) differ slightly from those described above, but probably constitute only a local variety; the valves are not quite so convex, the ribs are rather more numerous and

[1] For figures and references see Holzapfel, 'Die Mollusk. Aachen. Kreide' (Palæontographica, vol. xxxv, 1889), p. 194, pl. xix, figs. 11—15. *A. similis* was referred to the genus *Gouldia* by Stoliczka: Holzapfel discusses this subject, and I am in agreement with his conclusions.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 63, pl. cclxii, figs. 4—6; Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1866), p. 309.

less prominent, and the posterior end of the shell is rather more pointed. This form resembles *A. angulata*, Guéranger.[1]

Types.—The types of *A. laticosta* came from the Neocomian of Chaource and Jully (Aube). D'Orbigny's specimens of *A. striato-costata* were obtained from the Neocomian of Marolles (Aube), Attancourt (Haute-Marne), and Saint-Sauveur (Yonne). The specimens described by Forbes are in the Museum of the Geological Society (No. 2181).

Distribution.—Atherfield Beds of Peasmarsh and Sevenoaks. *Perna*-bed of East Shalford, and probably Atherfield. Recorded by Topley from the Atherfield Beds of Haslemere, and the Hythe Beds of Lympne.

ASTARTE, sp. Plate XV, figs. 3, 4.

Some specimens from the Folkestone Beds of Folkestone are very similar to *A. subcostata*, d'Orbigny, but are larger, less elongate, and have a smaller apical angle.

ASTARTE OMALIOIDES, sp. nov. [ex *Gardner* MS.]. Plate XV, figs. 5–7.

Description.—Shell small, triangular or sub-quadrate, compressed, slightly inequilateral, height and length nearly equal. Dorsal half of valves pointed. Antero-dorsal margin slightly concave; postero-dorsal margin rather longer and nearly straight, the remaining margin forming a regular curve. Umbones pointed. Margins of valves finely crenulate.

Ornamentation consists of a few (usually 6 or 7) prominent, sharp, concentric ribs, with steep dorsal slopes and more gentle ventral slopes. Interspaces very broad. The ribs become more distant from one another in passing from the umbo to the ventral margin. A few very faint concentric ribs are sometimes present also.

Measurements:

	(1)	(2)	(3)
Length	5·0	4·25	4·0 mm.
Height	4·75	4·25	4·0 ,,

(1—3) Gault, Folkestone.

Affinities.—This species is closely allied to *A. subcostata* (see p. 109), but is relatively shorter and less convex, and has a smaller apical angle and rather fewer ribs.

[1] 'Album Paléont. de la Sarthe' (1867), p. 13, pl. xvi, fig. 5.

Remarks.—Since the name *Omalioides* has been used in stratigraphical lists,[1] it seems desirable to retain it, although its construction is not in accordance with the recommendations of the International Congress of Zoology.

Distribution.—Gault (zones vii, x, and xi) of Folkestone.

ASTARTE FORMOSA, *Sowerby*, 1836. Plate XV, figs. 8–13.

1836.	ASTARTE FORMOSA,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv., pp. 239, 341, pl. xvi, fig. 16.
1842.	—	—	*F. Römer.* De Astartarum Genere, p. 21.
1850.	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 160.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 186.
1871.	—	—	*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 285 (? *Gouldia*).
Non 1842.	—	—	*H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs.-böhm. Kreidegeb., pt. 3, p. 76, pl. xxi, fig. 19 (see *Geinitz*, Elbthalgeb. i, p. 227).
— 1844.	—	—	*A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 65, pl. cclxii, figs. 10—12 (*A. subformosa*, d'Orb., 1850).

Description.—Shell small, rather convex, sub-triangular, moderately inequilateral. Antero-dorsal margin slightly concave. Anterior and ventral margins forming a regular curve. Posterior margin less curved, often truncated, and forming an obtuse angle with the long and slightly convex postero-dorsal margin. Umbones pointed. Lunule large, ovate, depressed, smooth, with a sharp border. Escutcheon long, lanceolate, depressed, smooth, with a sharp border. Margins of valves smooth.

Ornamentation consists of strong concentric ribs with sharp summits, separated by broad concave interspaces. The ribs end abruptly at the margins of the lunule and escutcheon. On the ribs and interspaces fine concentric ridges may be seen.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)
Length	5·0	4·75	4·5	4·0	3·25	3·0 mm.
Height	4·5	4·5	4·0	3·75	3·0	2·5 ,,

(1—6) Blackdown.

Affinities.—*A. formosa* is smaller and has more numerous ribs than *A. subformosa*,

[1] Price, 'The Gault' (1879), p. 58; Jukes-Browne, 'Cret. Rocks of Britain,' vol. i (1900), p. 465.

d'Orbigny.[1] *A. acuta*, Reuss,[2] is another allied form, but possesses fewer ribs than *A. formosa*. See also *A. subcostata* (p. 109).

Type.—From Blackdown, in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown and Haldon.

ASTARTE IMPOLITA, *Sowerby*, 1836. Plate XV, fig. 14.

1836. ASTARTE IMPOLITA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 239, 341, pl. xvi, fig. 18.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 187.

The only example of this which I have seen is the type specimen from the Greensand of Blackdown.[3] Both valves are present, but the parts near the umbo and lunule are missing. The specimen is in the Bristol Museum.

Sub-genus—ERIPHYLA, *W. M. Gabb*, 1864.

('Geol. Surv. California, Palæont.,' vol. i, p. 180. Stoliczka, 'Palæont. Indica, Cret. Fauna, S. India,' vol. iii, 1870, p. 156.)

ASTARTE (ERIPHYLA) OBOVATA, *Sowerby*, 1822. Plate XV, figs. 15–18. Plate XVI, figs. 1–3.

1822. ASTARTE OBOVATA, *J. de C. Sowerby*. Min. Conch., vol. iv, p. 73, pl. cccliii.
1842. — — *F. Römer*. De Astartarum Genere, p. 22.
1845. — — *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 241.
1850. CORBIS OBOVATA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 78.
1852. ASTARTE BRUNNERI, *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 435, pl. xxxii, fig. 3.
— — GURGITIS, *Pictet and Roux*. Ibid., p. 436, pl. xxxiii, fig. 1.
1854. — OBOVATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 187.
1857. — — *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 86, pl. xi, fig. 1.

[1] 'Prodr. de Pal.,' vol. ii (1850), p. 77.

[2] 'Die Verstein. der böhm. Kreideformat.,' pt. 2 (1846), p. 3, pl. xxxiii, fig. 17; pl. xxxvii, fig. 14; Nötling, 'Die Fauna d. baltisch. Cenoman.' (Palæont. Abhandl., vol. ii, 1885), p. 28, pl. v, fig. 1. According to Nötling, *A. plauensis*, Geinitz, is a synonym of *A. acuta*.

[3] *Astarte multistriata* was also described by J. de C. Sowerby from Blackdown, but I have not seen any example of it. See 'Trans. Geol. Soc.,' ser. 2, vol. iv, pp. 240, 341, pl. xvi, fig. 17; Morris, 'Cat. Brit. Foss.,' ed. 2 (1854), p. 187.

? 1865. ASTARTE OBOVATA, *H. Coquand.* Mon. Aptien de l'Espagne, p. 122, pl. xiii, figs. 3, 4.

1866. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 312.

1871. — — (ERYPHYLA), *F. Stoliczka.* Palæont. Indica, Cret. Fauna, S. India, vol. iii, p. 285.

1892. — — *O. Behrendsen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xliv, p. 22.

Description.—Shell large, oval, transverse, moderately inflated, very inequilateral. Anterior margin rounded, concave in front of the umbo. Behind the umbo the dorsal margin has a gentle and regular curve. Posterior margin rounded or sub-truncate. Umbones prominent, curving forward. Lunule deep. Escutcheon narrow, deep.

Ornamentation consists of numerous, strong, close, somewhat irregular concentric ribs, on which fine, concentric, linear ribs occur.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	75	74	73	70	72	71	mm.
Height	62	58	60	59	63	59	„

(1–4) *Perna*-bed, Atherfield.
(5, 6) *Perna*-bed, Sandown.

Affinities.—*Astarte Beaumonti*, Leymerie,[1] and *A. transversa*, Leymerie,[2] are closely allied to *A. obovata*, and were regarded by Forbes as merely varieties of the latter. Pictet and Renevier (1857) were inclined to regard the differences as not of specific importance. Pictet and Campiche (1866), however, kept the three forms distinct, but were uncertain whether they should be regarded as species or varieties. They state that in *A. Beaumonti* the margin is smooth, whilst in *A. obovata* and *A. transversa* it is crenulated. In the first two forms the posterior margin is more rounded, but in the last it is more truncate. It is very doubtful whether the crenulation of the margin is a feature of specific importance in *Astarte*; indeed, one writer[3] thinks that it is a characteristic of sex. Whether the other differences are of specific value can be determined only by the comparison of a number of examples of *A. Beaumonti* and *A. transversa* with specimens of *A. obovata*.

[1] 'Mem. Soc. géol. de France,' vol. v (1842), pp. 4, 24, pl. iv. fig. 1. D'Orbigny, 'Terr. Crét.,' vol. iii (1844), p. 60, pl. cclx. Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1866), p. 300, pl. cxxiv, fig. 1. Wollemann, 'Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms' (1900), p. 95.

[2] *Op. cit.* (1842), pp. 4, 24, pl. v, fig. 5. D'Orbigny, *op. cit.*, p. 61, pl. cclxi. Pictet and Campiche, *op. cit.*, p. 301, pl. cxxiv, fig. 2. De Loriol, 'Anim. Invert. Foss. Mt. Salève' (1861), p. 68, pl. viii, fig. 9.

[3] A. Ostroumoff, 'Zool. Anzeiger,' vol. xxiii (1900), p. 499.

The shallow pallial sinus shown in internal casts, and the characters of the hinge seem to warrant the reference of this species to the sub-genus *Eriphyla*.

Remarks.—Some of the specimens found in the Isle of Wight have the posterior end rounded, but in the larger number it is more or less distinctly truncated. The former approach *A. Beaumonti*; the latter resemble *A. transversa*. I have not seen any examples from the Isle of Wight which show the internal margin of the valve sufficiently clearly to determine whether it is crenulate or not, but in an internal cast from the Hythe Beds of Hythe (Museum of the Geological Society, No. 2187) the crenulation is distinct.

The specimens of *A. oborata* show a fairly large amount of variation. In some the anterior part of the valve is quite short, as in Leymerie's figure of *A. transversa*; in others it is much longer. The relative height and length, the amount of rounding or truncation of the posterior margin, and the coarseness of the ornamentation also vary.

The specimens from the Hythe Beds of Hythe are very poorly preserved. Those from the Greensand of Blackdown and Haldon appear, so far as one can tell from the few perfect specimens available, to be rather shorter than most of the Lower Greensand examples.

Types.—The type cannot be found; it came from the *Perna*-bed of Sandown.

Distribution.—Lower Greensand (*Perna*-bed) of Atherfield and Sandown. Recorded by Topley from the Atherfield Beds of Peasemarsh and Shalford, and from the Hythe Beds of Hythe and Lympne.

Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown and Haldon.

ASTARTE (ERIPHYLA) LÆVIS (*Phillips*), 1829. Plate XVI, figs. 5–7. Plate XVII, fig. 1.

1829. CRASSINA LÆVIS, *J. Phillips*. Geol. Yorks., p. 122, pl. ii, fig. 19 (? fig. 18).
1835. ASTARTE LÆVIS, *Phillips*. Ibid., ed. 2, pt. 1, p. 158 (ed. 3, 1879, p. 252).
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 187.

Description.—Shell large, thick, convex, ovate, usually considerably inequilateral; height and length nearly equal, or the height may be rather greater than the length or *vice versâ*. Antero-dorsal margin rather long and slightly concave; postero-dorsal margin very long and moderately convex. Anterior and ventral margins well rounded. Posterior extremity rounded or sometimes subangular. Umbones large. Lunule large, ovate, deep, nearly smooth, with a sharp border. Escutcheon narrow, deep.

Ornamentation consists of numerous, rather strong, narrow, concentric ribs which are somewhat irregular.

Hinge-plate broad, triangular. In the left valve two strong cardinal teeth and one lateral at the margin of the lunule. Teeth of right valve not seen. Margins of valves strongly crenulate.

Measurements:

	(1)	(2)	(3)	(4)
Length	57	51	51	44 mm.
Height	59	56	47	39 „

(1–4) Claxby Ironstone, Benniworth Haven.

Affinities.—This species is allied to *Astarte Sæmanni*, de Loriol,[1] of which good specimens are found in the Portland Sands of Swindon. In some cases the resemblance is very close, but generally the umbones are more prominent, the antero-dorsal margin relatively longer, and the valves more convex in *A. lævis* than in *A. Sæmanni*.

A. Buchi, Römer,[2] is apparently allied to *A. lævis*, but is distinguished by the greater anterior curvature of its umbones. *A. gigantea*, Leymerie,[3] is less inequilateral and more elongate than *A. lævis*.

Remarks.—Most of the examples of this species have been obtained from the Claxby Ironstone. Only two have been seen from the Speeton Clay, one being in the Leckenby Collection (Sedgwick Museum), the other in Mr. Lamplugh's Collection; these appear to agree with the larger example of *Astarte lævis* figured by Phillips (fig. 19).

Types.—The type, from the Speeton Clay, appears to be missing.

Distribution.—Claxby Ironstone (zone of *Belemnites lateralis*) of Benniworth Haven. Speeton Clay of Speeton.

ASTARTE (ERIPHYLA) STRIATA, Sowerby, 1826. Plate XVII, figs. 2–7.

1826.	ASTARTE STRIATA, *J. de C. Sowerby.*	Min. Conch., vol. vi., p. 35, pl. dxx, fig. 1.
1836.	— CONCINNA, *J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 239, 341, pl. xvi, fig. 15.
1842.	— — *F. Römer.*	De Astartarum Genere, p. 21.

[1] De Loriol and Pellat, 'Portlandien de Boulogne-sur-mer' (1866), p. 68, pl. vi, fig. 9. E. G. Skeat and V. Madsen, 'Jur. Neoc. and Gault Boulders in Denmark' (1898), p. 123, pl. iii, fig. 2.

[2] 'De Astartarum Genere' (1842), p. 20, fig. 4. Pictet and Renevier, 'Foss. Terr. Aptien' (1856), p. 85, pl. x, fig. 1.

[3] For references see Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1866), p. 298.

1850. ASTARTE STRIATA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 160 (*partim*).
— — CONCINNA, *d'Orbigny*. Ibid., p. 160.
1854. — STRIATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 187.
— — CONCINNA, *Morris*. Ibid., p. 186.
1866. — STRIATA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 230.
1871. — — (ERYPHILA), *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 285.
— — CONCINNA (ERIPHYLA), *Stoliczka*. Ibid., p. 285.
? 1873. ERIPHYLA STRIATA, *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 228, pl. li, figs. 1-3.

Description.—Shell with rounded outline, sometimes nearly orbicular, usually only moderately inequilateral, moderately convex. Length usually a little greater than height, but occasionally less. The margin in front of the umbo is concave for a short distance; behind the umbo it is convex; the anterior, the ventral, and posterior margins form a more or less regular curve. Umbones rather small, placed a little in front of the median line. Lunule small, deep, with a sharp edge. Escutcheon narrow.

Ornamentation consists of numerous small concentric ribs, which are slightly irregular and are separated by linear grooves; at intervals somewhat deeper grooves may occur.

Hinge-plate wide. Two cardinal teeth in each valve, and one lateral tooth next the lunule in the left valve. Adductor impressions deep, the anterior somewhat elongated. Pallial sinus shallow, rounded. Margins of valves smooth.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length	46	45	44	42	39	37	35	28	mm.
Height	45	42	41	43	37	34	34·5	27·5	,,

(1–8) Blackdown.

Affinities.—This species is closely allied to *A.* (*Eriphyla*) *lenticularis* (Goldfuss),[1] but the outline of the valve is less regularly orbicular.

Astarte Koninckı, d'Archiac,[2] from the Tourtia of Tournay, was regarded by d'Orbigny, Pictet and Campiche, Stoliczka, and Geinitz as a synonym of *A. striata*. I have not seen any example of the former, but it appears to differ from *A. striata* in having less prominent umbones, more inflated valves, a more regularly orbicular

[1] 'Petref. Germ.,' vol. ii (1840), p. 228, pl. cxlvi, fig. 16. Holzapfel, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xxxvi (1884), p. 458, pl. vi, figs. 1, 2, and 'Palæontographica,' vol. xxxv (1889), p. 195, pl. xiv, figs. 5–7.

[2] 'Mém. Soc. géol. de France,' ser 2, vol. ii (1847), p. 302, pl. xiv, fig. 4.

outline, and apparently also fewer ribs. Two imperfect specimens from the Cenomanian (Bed 11) of Dunscombe were referred to *A. Koninckı* by the late C. J. A. Meÿer, but they are less convex than that species and seem to agree more nearly with *A. striata*.

Astarte concinna, Sowerby, was regarded by Stoliczka as probably identical with *A. striata*. It is known by the type specimen only, and agrees with *A. striata*, except that it is rather higher and more inequilateral. I believe that it is merely an individual variation of *A. striata*.

Types.—From Blackdown, in the British Museum. The type of *A. concinna* is from Blackdown and is now in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown.

Genus—Opis, *M. J. L. Defrance*, 1825.

('Dict. Sci. nat.' vol. xxxvi, p. 219.)

Opis neocomiensis, *d'Orbigny*, 1844. Plate XVII, figs. 8–12.

1842.	Opis	*A. Leymerie.*	Mém. Soc. géol. de France, ser. 2, vol. v, p. 25, pl. vii, fig. 4.
1844.	—	neocomiensis, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 51, pl. cclii, figs. 1—5.
1850.	—	— *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 76.
1855.	—	— *G. Cotteau.*	Moll. Foss. de l'Yonne, p. 67.
1857.	—	— *F. J. Pictet and E. Renevier.*	Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 83, pl. ix, fig. 7.
1861.	—	Desori, *P. de Loriol.*	Anim. Invert. Foss. Mt. Salève, p. 66, pl. viii, figs. 4—7.
1866.	—	neocomiensis, *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 324, pl. cxxv, figs 3, 4.
1868.	—	— *P. de Loriol.*	Valangien d'Arzier, p. 31.
? 1871.	—	— *W. A. Ooster.*	Protozoe Helvet., vol. ii, p. 101, pl. xv, fig. 17.
1883.	—	— *W. Keeping.*	Foss. etc., Neoc. Upware and Brickhill, p. 121, pl. vi, fig. 8.
1900.	—	— *A. Wollemann.*	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 102.

Description.—Shell trigonal or sub-quadrilateral, much higher than long, inequilateral, greatly inflated, but with flattened sides. Anterior margin rounded.

Posterior margin truncated, slightly concave, forming an angle with the gently curved ventral margin and also with the postero-dorsal margin. Umbones prominent, slender, greatly incurved, almost touching in the young, but separated in older specimens. A prominent carina extends from the umbo to the postero-ventral angle, cutting off an area which is divided into two parts by a prominent but rounded carina which ends at the postero-dorsal angle; the outer part only of the area is seen in a side view, and is concave; the inner part is depressed, and its dorsal portion is flattened and resembles a lunule. Lunule very large, cordate, flattened.

Ornamentation consists of many small concentric ribs separated by narrow grooves. Behind and in front of the flattened part of the valve this ornamentation becomes less distinct or may disappear altogether. Margin of valve entire.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	23	22	20	14	14	mm.
Height[1]	35	33	29	20·5	19	„
Thickness	26	26	24	16	15	„

(1—5) Lower Greensand, Upware.

Affinities.—This species shows some resemblance to *O. Hugardiana*, d'Orbigny,[2] from the Gault.

Remarks.—The shell is relatively higher in large than in small specimens. In all the examples obtained from Upware the shell is preserved. Specimens from Seend are in the Museum of Practical Geology.

Types.—Leymerie's specimen came from the Lower Neocomian of Bernon (Aube). D'Orbigny's specimens were obtained from Saint Sauveur (Yonne), Bernon, and Marolles. The specimen figured by Keeping is in the Sedgwick Museum.

Distribution.—Lower Greensand of Upware and Seend. Internal casts, probably belonging to this species, are found in the Lower Greensand of Coleshill near Faringdon.

OPIS HALDONENSIS, sp. nov. Plate XVIII, fig. 1 *a–d*.

Description.—Shell trigonal, higher than long, moderately inequilateral, convex, with flattened sides. Anterior margin slightly convex, passing gradually into the

[1] Measured from the umbo to the postero-ventral angle.

[2] Syn. *O. Sabaudiana*, d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 53, pl. cclvii, figs. 4–6; Pictet and Roux, 'Moll. Foss. Grès verts de Genève' (1852), pp. 432—434, pl. xxxii, fig. 1.

slightly curved ventral margin. Posterior margin somewhat oblique, slightly concave. Postero-ventral angle rounded. Umbones high, prominent, not much incurved. A prominent, rounded carina extends from the umbo to the postero-ventral angle, and cuts off a posterior area which is divided into two parts by a strong, rounded carina ending at the postero-dorsal angle. The part of the area between the carinæ is concave; the part behind the median carina is deeply depressed. Lunule large, very deep, flattened. Surface of shell apparently smooth. Length, 43 mm. Height, 58 mm.

Affinities.—It is possible that this species may be related to *O. Gallienneï*, d'Orbigny,[1] which seems to be known by casts only, but the height of the shell appears to be relatively less. *O. Gallienneï* has been identified by some authors with *O. bicornis* (Geinitz)[2] from the Cenomanian of Plauen. The latter differs from the species described above in possessing strong concentric ribs and in the absence of a carina between the umbo and the postero-ventral angle.

Remarks.—The only undoubted example of this species which I have seen is a right valve collected by the late W. Vicary, and now in the British Museum. The surface of the shell is not well preserved, but appears to have been nearly smooth.

An imperfect specimen of a large *Opis* (length about 63 mm.) from the Chloritic Marl of Eggerdon Hill (Dorset) is in the Sedgwick Museum, Cambridge, and may belong to this species.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Haldon.

Opis, sp. Pl. XVII, figs. 13 *a–c*, 14 *a–c*.

Description.—Shell small, sub-triangular, rather oblique; greatest convexity along the carina. Anterior margin rounded; posterior margin slightly convex. Umbones prominent, sharp, considerably curved anteriorly. Carina sharp, prominent, cutting off a steeply sloping posterior area, which is not divided by a median carina. Sides of shell flattened, sloping slightly in front of the carina, and passing gradually into the anterior part of the shell. Lunule very deep, with a sharp border.

Ornamentation consists of regular, concentric ribs. Posterior area nearly smooth.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), pl. cclvii*bis*, fig. 5 (not described in the text); Guéranger, 'Album Paléont. de la Sarthe' (1867), p. 17, pl. xxii, fig. 13.

[2] "Das Elbthalgeb. in Sachsen" ('Palæontographica,' vol. xx, pt. 1, 1873), p. 227, pl. l, figs. 1–3. Internal casts of *Opis* from the base of the Chalk at Maiden Newton and Chard have been recorded as *O. bicornis?* (Gein.) by Jukes-Browne, 'Cret. Rocks of Britain,' vol. ii (1903), pp. 113, 122. Two of the specimens on which the determination was based are in the Oxford Museum.

Measurements:

	(1)	(2)	
Length . .	8	7·5	mm.
Umbo to postero-ventral angle .	12	11·0	,,

(1, 2) Haldon.

Affinities.—This species may perhaps be related to *O. cenomanensis*, Guéranger,[1] but the figure of the latter is too indistinct for recognition.

Remarks.—There are four examples of this species in the Vicary Collection, British Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Haldon.

Family—CARDITIDÆ, *Gill.*

Genus—CARDITA, *J. G. Bruguière*, 1792.[2]

('Encyc. méth., Vers,' vol. i, p. 401.)

CARDITA? FENESTRATA (*Forbes*), 1845. Plate XVIII, figs. 2–4.

1845.	VENUS? FENESTRATA,	*E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 240, pl. ii, fig. 6.
1850.	CARDITA	— *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 77.
1854.	VENUS	— *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 230.
1856.	CARDITA	— *F. J. Pictet and E. Renevier.*	Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 82, pl. ix, fig. 4.
1866.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 333.
1871.	—	— *F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 287.

Description.—Shell oval or somewhat rhomboidal, much longer than high, very inequilateral, moderately inflated, but with flattened sides. Anterior margin rounded; ventral margin slightly curved or almost straight, and nearly parallel with the dorsal margin; posterior margin obliquely truncated, forming an acute angle

[1] 'Album Paléont. de la Sarthe' (1867), p. 13, pl. xvi, fig. 3.

[2] Owing to the difficulty of distinguishing the fossil forms of *Cardita* from *Venericardia* when, as in the case of nearly all the examples found in the Cretaceous rocks of England, the hinge is unknown, all the species are, for the present, referred to *Cardita*.

with the ventral margin, and an obtuse angle with the dorsal margin. Umbones moderately prominent, curving forwards, bearing a carina which extends to the postero-ventral angle and cuts off a flattened or concave area. Lunule ovate, rather large, nearly smooth. Escutcheon with a sharp edge.

Ornamentation consists of narrow, rounded, radial ribs, separated by broad, flat interspaces, and crossed at rather distant intervals by strong, narrow, concentric, lamellar ribs, which give rise to a scale-like projection where they join the radial ribs. The postero-dorsal area has similar concentric ribs, and a strong radial rib near the dorsal margin, and another near the middle of the area with smaller ribs between.

Measurements :

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	20	19	19	19	18	16	mm.
Height	14	13	12	11·5	12	11	,,

(1—6) *Perna*-bed, Atherfield.

Affinities.—*C. fenestrata* appears to be quite distinct from other Cretaceous species of *Cardita*, but shows some resemblance in form to *C. tricarinata*, d'Orbigny,[1] from the Cenomanian of Le Mans. The hinge and interior are unknown, and the generic position of the species is not free from doubt. Stoliczka remarks that '*C. fenestrata* is not unlike a *Venerupis*.'

Type.—From Peasmarsh, in the Museum of the Geological Society, Nos. 2182, 2183.

Distribution.—*Perna*-bed and Atherfield Clay of Atherfield. Atherfield Beds of Peasmarsh and East Shalford.

CARDITA UPWARENSIS, sp. nov. Plate XVIII, fig. 5.

1883. CARDITA ROTUNDATA? *W. Keeping.* Foss., etc. Neoc. Upware and Brickhill, p. 121, pl. vi, fig. 7.

Description.—Shell subtriangular, inflated, height and length nearly equal, inequilateral. Anterior margin rounded, passing gradually into the convex ventral margin. Posterior margin truncated, oblique, not sharply limited from the postero-dorsal margin. Umbones prominent, strongly curved anteriorly, with a rounded

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 95, pl. cclxxxiii *bis*., figs. 5—7; Guéranger, 'Album Paléont. de la Sarthe' (1867), p. 13, pl. xvi, figs. 19, 20.

carina extending to the postero-ventral angle, and cutting off a steeply-sloping postero-dorsal part of the valve. Lunule rather small, cordate, broader than long.

Ornamentation consists of about twenty-five radial ribs on the part of the valve in front of the carina; the ribs are strong and rounded, but are narrower than the interspaces. Both are crossed by regular concentric lamellæ, which become prominent on the ribs. On the postero-dorsal area the ribs are smaller, more numerous, and closer together; two of these ribs are rather stronger than the others, and divide the area into three parts. Length 21 mm.; height 20·5 mm.; thickness 17 mm.

Affinities.—This species was doubtfully referred by W. Keeping to *C. rotundata*, Pictet and Roux, but it differs from that form by its fewer and stronger ribs and more triangular outline (see p. 125).

In form it resembles *C. Dupiniana*, d'Orbigny,[1] but the ribs on the postero-dorsal area are smaller and more numerous. In this respect, and in its shorter and less quadrate outline, it differs from *C. neocomiensis*, d'Orbigny.[2]

Remarks.—I have seen only three examples of this species, two of which are in the Sedgwick Museum, and one is in the collection of Mr. J. F. Walker.

Distribution.—Lower Greensand of Upware and Potton.

CARDITA, sp. Plate XVIII, fig. 6.

A specimen consisting of the united valves from which the ventral parts are missing was obtained by Leckenby from the *Perna*-bed of Atherfield, and is now in the Sedgwick Museum. It shows some resemblance to *C. uparensis* (see above), but is more elongate and more distinctly carinate.

CARDITA, sp.

Two specimens of *Cardita* from the Hythe Beds of Maidstone are in the Museum of the Geological Society. They were examined by Edward Forbes,[3] who identified one with *C. neocomiensis*, d'Orbigny, and the other with *C. quadrata*, d'Orbigny. The specimens are similar in form to those species, but their state of preservation is too imperfect for satisfactory determination.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 88, pl. cclxviii, figs. 6—10; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1866), p. 334, pl. cxxvi, figs. 4, 5.

[2] D'Orbigny, *op. cit.*, p. 85, pl. cclxvii, figs. 1—6.

[3] 'Quart. Journ. Geol. Soc.,' vol. i (1845), p. 242.

CARDITA TENUICOSTA (*Sowerby*), 1836. Plate XVIII, figs. 7–14.

1836. VENERICARDIA TENUICOSTA. *J. de C. Sowerby.* Trans. Geol. Soc., ser. 2, vol. iv, pp. 114, 259, 356, pl. xi, fig. 7*.

1838. CARDIUM TETRAGONUM, *H. Michelin.* Mém. Soc. géol. de France, vol. iii, p. 102, pl. xii, fig. 3.

1842. VENERICARDIA TENUICOSTA, *A. Leymerie.* Mém. Soc. géol. de France, ser. 2, vol. v, p. 25, pl. iii, fig. 9.

1844. CARDITA TENUICOSTA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 87, pl. cclxviii, figs. 1—5.

1846. VENERICARDIA TENUICOSTA, *A. Leymerie.* Statist. géol. et min. de l'Aube, pl. v, fig. 7.

1850. CARDITA — *d'Orbigny.* Prodr. de Pal., vol. ii, p. 137.

1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 191.

1855. — — *G. Cotteau.* Moll. Foss. de l'Yonne, p. 72.

1866. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 335, pl. cxxvi, figs. 6—9.

1871. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 287.

Non 1842. VENERICARDIA — *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs.-böhm. Kreidegeb., pt. 3, p. 76, pl. xx, fig. 9 (*C. Geinitzi*, d'Orbigny).

— 1846. CARDITA (VENERICARDIA) TENUICOSTA, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 4, pl. xxxiii, fig. 16 (*C. corrugata*, Reuss).

— 1873. CARDITA TENUICOSTA, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 60, pl. xvii, figs. 11—13.

— 1885. — (VENERICARDIA) TENUICOSTA, *F. Nötling.* Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 29, pl. v, fig. 4.

— 1889. — TENUICOSTA, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., iv. Teplitz. Schicht., p. 78, fig. 62.

— 1893. — — *Fritsch. Ibid* v. Priesener Schicht., p. 91.

? — 1900. — — *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 94, pl. iv, fig. 9.

Description.—Shell more or less sub-quadrate, rounded, moderately convex, with the postero-dorsal portion compressed; length greater than height; moderately inequilateral. Postero-dorsal margin only slightly curved; posterior margin more or less truncated, passing by a regular curve into the ventral margin, which is only slightly convex and nearly parallel with the postero-dorsal margin. Anterior margin rounded. Antero-dorsal margin concave. Umbones curved anteriorly. Lunule ovate, nearly smooth. Escutcheon lanceolate, with a sharp edge.

Ornamentation consists of 47 to 57 rounded radial ribs, which are separated by furrows of greater breadth than themselves; near the postero-dorsal margin these ribs are rather closer together than elsewhere. In some cases the postero-dorsal part of the valve is divided into two parts by two ribs, which are more prominent than the others. At regular intervals concentric lamellæ occur and form marked projections where they cross the ribs. Near the umbo these lamellæ are more widely separated, and near the margin, especially in large specimens, they are closer together than elsewhere. Sometimes faintly marked concentric ridges may be seen on the ribs between the lamellæ. Margins of valves crenulate.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
Length .	30	27	25	24	24	23·5	23	23	22	22	20	16	15	15	mm.
Height .	26·5	23	22	22	20	21	21	19·5	20	19	17	14·5	14	13	,,

(1—14) Gault, Folkestone.

Affinities.—This species has more numerous ribs and is less inflated than *C. neocomiensis*, d'Orbigny and *C. Dupiniana*, d'Orbigny.[1] It possesses about the same number of ribs as *C. Constanti*, d'Orbigny,[2] but is less elongate and less inflated. *C. rotundata*, Pictet and Roux,[3] differs from *C. tenuicosta* in being more inflated, and can be regarded as only an individual variation. Some examples found at Folkestone, which in other respects agree with *C. tenuicosta*, are as much inflated as the type of *C. rotundata*. *C. clathrata*, Buvignier,[4] is a small form, but has the concentric laminæ more widely separated than in even the young of *C. tenuicosta*. *C. argonnensis*, Buvignier,[5] is more compressed and has more slender ribs than *C. tenuicosta*. *C. cenomanensis*, d'Orbigny,[6] is distinguished from *C. tenuicosta* by its broader ribs and more closely placed concentric lamellæ.

C. tenuicosta has narrower ribs and broader furrows than the forms from the Chalk

[1] For references to figures of these species see p. 123, footnotes 1, 2.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 89, pl. cclxix, figs. 1—5; Pictet and Campiche, 'Foss Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1866), p. 337, pl. cxxvi, fig. 10.

[3] 'Moll. Foss. Grès verts de Genève' (1852), p. 443, pl. xxxiii, fig. 6.

[4] 'Statist. géol., etc., de la Meuse,' Atlas (1852), p. 19, pl. xv, figs. 16, 17.

[5] Ibid., p. 19, pl. xxxii, figs. 1—3.

[6] D'Orbigny, *op. cit.*, p. 94, pl. cclxxxiii *bis.*, figs. 1—4.

of Saxony and Bohemia which have been referred to that species by Geinitz and by Reuss. *C. tenuicosta* of Reuss is the type of *C.* (*Venericardia*) *bohemica*, Griepenkerl.[1]

Remarks.—Numerous specimens of *C. tenuicosta* from Folkestone have been examined, and they are found to show a considerable amount of variation in convexity and in relative height and length.

Type.—The type came from the Gault of Folkestone, but cannot now be found.

Distribution.—Gault (zones i, v, vii, viii, ix, xi) of Folkestone. Recorded by Jukes-Browne from the Cambridge Greensand, and by Barrois from the Upper Greensand (zone of *Schlænbachia rostrata*) of the Isle of Wight.

CARDITA COTTALDINA, *d'Orbigny*, 1844. Plate XVIII, figs. 15, 16.

1844.	CARDITA COTTALDINA,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 91, pl. cclxix, figs. 6—8.
1871.	—	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 287.
? 1895.	—	*cf.* COTTALDINA,	*E. Tiessen.*	Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 485.

Remarks.—Examples of a species of *Cardita*, which is not uncommon in the Chloritic Marl of Dorset, appear to belong to *C. Cottaldina*, but their state of preservation is very unsatisfactory. Most of the specimens are internal casts, and in cases where parts of the shell are present the surface is very imperfect, so that the characters of the ornamentation cannot be clearly distinguished. M. Raoul Fortin informs me that the preservation is equally unsatisfactory in the Cenomanian of Rouen, from whence d'Orbigny's specimens were obtained.

The shell is quadrate in outline, very convex, carinate, and somewhat longer than high. The ornamentation appears to consist of about 40 ribs, separated by interspaces of great width.

C. Cottaldina may be distinguished from *C. tenuicosta* (p. 124) by its fewer ribs, by the length and height being more nearly equal, and by the greater convexity of the valves.

Measurements:

	(1)	(2)	(3)
Length	21	20	16·5 mm.
Height .	19	18	14 „
Thickness .	16 .	15·5 .	12 „

(1—3) Chloritic Marl. (1) Chaldon, (2) Chard, (3) Balcombe.

[1] 'Palæont. Abhandl.,' vol. iv (1889), p. 58.

Distribution.—Chloritic Marl of Balcombe, Cerne, Chaldon, Chalmington, Chard, Maiden Bradley, and Maiden Newton. Recorded by Jukes-Browne from the Chloritic Marl and the zone of *Schlœnbachia varians* of the Isle of Wight.

Cardita, sp.

Specimens of *Cardita* from which the shell has disappeared, but showing traces of the ribs, are found in the Chalk Marl of Ventnor, Folkestone, etc. These are too imperfect for specific determination. A specimen from Ringmer was figured by Sowerby,[1] and was subsequently regarded by d'Orbigny[2] as an example of his *C. dubia.*

Somewhat similar specimens also occur in the Upper Greensand of Devizes.

Cardita cancellata, *Woods*, 1897. Plate XVIII, figs. 17, 18.

1897. Cardita cancellata, *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 390 pl. xxviii, figs. 2—5.

Description.—Shell oval, slightly inequilateral, inflated, postero-dorsal part compressed, faintly carinate; length rather greater than height; margins rounded. Umbones moderately prominent, curved anteriorly.

Ornamentation consists of a large number of radial ribs separated by narrow furrows, and crossed by numerous concentric ribs, giving a nodular appearance at the points of intersection. The concentric ribs are more distinct on the anterior part and the radial ribs more distinct on the median and posterior parts of the shell. Margin of valves finely crenulate.

Measurements:

	(1)	(2)	(3)
Length	18	16	13 mm.
Height	16	14·5	12 ,,

(1—3) Chalk Rock, Cuckhamsley.

Affinities.—This species is more inflated and more rounded than *C. costata* (p. 124), and possesses more numerous radial ribs with narrow furrows and strong concentric ribs instead of laminæ.

The concentric ribs distinguish *C. cancellata* from the forms described by

[1] 'Min. Conch.,' vol. iii (1820), p. 106, pl. cclix, fig. 3 (the original is now in the British Museum). *Venericardia?* Mantell, 'Foss. S. Downs' (1822), p. 126.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 92, pl. cclxx, figs. 1—5. Guéranger, 'Album Paléont. de la Sarthe' (1867), p. 13, pl. xvi, figs. 14—18.

Geinitz[1] and by Reuss[2] as *C. tenuicosta*. The concentric ribs and the nodular character which they give to the radial ribs separate *C. cancellata* from *Venericardia santonensis*, Müller.[3]

Remarks.—The specimens of *C. cancellata* are chiefly in the form of internal and external moulds; wax casts of the latter show the character of the ornamentation. In a few cases small portions of the shell are still preserved.

Type.—From the Chalk Rock of Cuckhamsley, in the Sedgwick Museum.

Distribution.—Chalk Rock of Cuckhamsley, Aston Hill, Chinnor Hill, Thickthorn Hill (Bledlow), Boxmoor, Luton, and Wood Ditton.

Family—CRASSATELLITIDÆ, *Dall.*

Genus—CRASSATELLITES, *J. F. Krüger*, 1823.

('Geschichte d. Urwelt.,' ii, p. 466.)

CRASSATELLITES DIVISIENSIS, sp. nov. Plate XIX, fig. 1.

Description.—Shell subquadrate, very inequilateral, moderately long, convex, but with flattened sides, carinate. Anterior margin regularly rounded; ventral margin nearly straight, oblique to the postero-dorsal margin; posterior margin convex, oblique, forming an obtuse angle with the postero-dorsal margin, which is nearly straight. Umbones rather prominent, curved anteriorly. Carina rounded, forming a gentle curve between the umbo and the postero-ventral angle. Posterior area moderately large, apparently not divided by a median rib. Lunule deep.

Ornamentation consists of numerous, strong, regular, concentric ribs, separated by shallow furrows. On the posterior area the ribs appear to be narrower. Length 45 mm.; height 37 mm.

Affinities.—This species shows some resemblance to *C. Guerangeri*, d'Orbigny,[4]

[1] *C. Geinitzii*, d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 239. For references to Geinitz's figures see above (p. 124).

[2] 'Die Verstein. der böhm. Kreideformat.,' pt. 2 (1846), p. 4, pl. xxxiii, fig. 16. *C. corrugata*, Reuss, 'Geogn. Skizzen aus Böhmen,' vol. ii (1844), p. 190; Gümbel, 'Abhandl. d. k. bayerisch. Akad.' (München), vol. x (1868), p. 568. *Cardita* (*Venericardia*) *bohemica*, Griepenkerl, 'Senon. Königslutter' ('Palæont. Abhandl.,' vol. iv, 1889), p. 58. See also *C. Cottaldina*, d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 161.

[3] 'Mollusk. Untersen. v. Braunschweig u. Ilsede' (1898), p. 55, pl. vii, figs. 10—12.

[4] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 76, pl. cclxv, figs. 1, 2; Guéranger, 'Album Paléont. de la Sarthe' (1867), p. 13, pl. xvi, fig. 11.

but is more inequilateral, the ventral margin is nearly straight, the posterior margin is more oblique, and the posterior area is relatively smaller. It is much more inequilateral than *C. regularis*, d'Orbigny.[1] *C. divisiensis* also resembles some of the varieties of *C. macrodonta* (Sowerby)[2] from Gosau.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Devizes. An imperfect specimen from Warminster (zone of *Pecten asper*) probably belongs to this species.

CRASSATELLITES VINDINNENSIS (*d'Orbigny*), 1844. Plate XIX, figs. 2, 3.

1844.	CRASSATELLA VINDINNENSIS, *A. d'Orbigny*.	Pal. Franç. Terr. Crét., vol. iii, p. 79, pl. cclxvi, figs. 1–3.
1850.	— VENDINNENSIS, *d'Orbigny*.	Prodr. de Pal., vol. ii, p. 160.
1867.	— VINDINNENSIS, *E. Guéranger*.	Album Paléont. de la Sarthe, p. 13, pl. xvi, figs. 9, 10.
? 1868.	— *C. W. Gümbel*.	Geogn. Beschreib. Königreichs Bayern, vol. ii, p. 766.
1871.	— — *F. Stoliczka*.	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 294.

Description.—Shell subquadrate, but trigonal without the posterior area, very inequilateral, convex, with rounded carina. Anterior margin rounded, passing gradually into the slightly curved ventral margin; posterior margin oblique, somewhat sinuous; postero-dorsal margin nearly straight, forming an obtuse angle with the posterior margin. Lunule elongate, deep. Umbones prominent, incurved. Posterior area of moderate size, divided by a median rib into two parts, of which the anterior is concave.

Ornamentation consists of strong, regular, concentric ribs, separated by narrow furrows. On the posterior area the ribs become very narrow and more or less lamellar, and the interspaces are broad and flat.

Measurements:

	(1)	(2)
Length .	31	30 mm.
Height .	26	26 ,,

(1, 2) Dunscombe.

Affinities.—This species is related to *C. ligeriensis*, d'Orbigny,[3] and *C. Guerau-*

[1] *Op. cit.*, p. 80, pl. cclxvi, figs. 4–7.

[2] Zittel, "Bivalv. d. Gosaugeb." ('Denkschr. d. k. Akad. Wien. Math.-Nat. Cl.,' vol. xxv, pt. 2, 1866), p. 150, pl. viii, figs. 2, 3.

[3] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 77, pl. cclxv, figs. 3–5; Guéranger, 'Album Paléont. de la Sarthe' (1867), p. 13, pl. xvi, fig. 12.

geri, d'Orbigny,[1] but the posterior margin is more oblique and the posterior area relatively smaller.

Remarks.—The lamellar ribs on the posterior area are not mentioned by d'Orbigny, but attention is called to them by Guéranger.

I have seen only five specimens, which were collected by the late C. J. A. Meÿer, and are now in the Sedgwick Museum, Cambridge.

C. rindinnensis is the type of Conrad's[2] genus *Pachytharus*.

Types.—From the Cenomanian of Rouen and Le Mans.

Distribution.—Cenomanian (Meÿer's Beds 10 and 12) of Dunscombe, Devon.

Genus—ANTHONYA, *W. M. Gabb*, 1864.

('Geol. Surv. California, Palæont.,' vol. i, p. 181, pl. xxx, fig. 236.)

ANTHONYA CANTIANA, sp. nov. Plate XIX, figs. 4, 5.

Description.—Shell elongate, tapering posteriorly, very inequilateral, much compressed. Anterior margin slightly convex. Ventral margin long, moderately convex. Posterior margin short, truncate, forming angles with the ventral and dorsal margins. Postero-dorsal margin concave. Umbones acute, near the anterior end. A faint carina passes from the umbo to the postero-ventral angle and cuts off a flattened or slightly concave postero-dorsal area.

Ornamentation consists of numerous narrow, regular, concentric ribs over the whole surface of the shell. The ribs are separated by furrows of greater width than themselves.

Measurements:

	(1)	(2)
Length .	34	27 mm.
Height . . .	27 . .	14 „

(1, 2) Folkestone Beds, near Copt Point.

Affinities.—This species is distinguished from *A. Cornueliana* (d'Orbigny)[3] by the shorter anterior part of the shell, the smaller apical angle, and by the ribs, which are of equal or nearly equal strength over the whole surface. It is less elongate and has a smaller apical angle than the type species *A. cultriformis*, Gabb.

[1] *Op. cit.*, p. 76, pl. cclxv, figs. 1, 2; Guéranger, *op. cit.*, p. 13, pl. xvi, fig. 11.

[2] 'Amer. Journ. Conch.,' vol. v (1869), p. 47.

[3] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 74, pl. cclxiv, figs. 7—9; referred to *Ptychomya* by Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1866), p. 357; E. G. Skeat and V. Madsen, "Jur. Neoc. and Gault Boulders in Denmark" ('Danmarks geol. Undersög.,' vol. ii, No. 8, 1898), p. 178, pl. vi, fig. 13.

Remarks.—Only two specimens have been seen, both of which were collected by Mr. H. Keeping, and are now in the Sedgwick Museum, Cambridge.

Distribution.—Folkestone Beds, near Copt Point, Folkestone.

ANTHONYA, sp. Plate XIX, fig. 6.

Description.—Shell elongate, tapering posteriorly, very inequilateral, greatly compressed. Anterior margin convex, rounded, passing gradually into the slightly curved ventral margin. Posterior margin short, truncate, forming angles with the ventral and dorsal margins. Postero-dorsal margin long, slightly concave. Umbones sharp, anterior. Carina indistinct. Postero-dorsal area narrow. Surface of shell smooth, except for growth-lines, which are rather more distinct near the anterior margin than elsewhere.

Length, 38 mm. Height, 15 mm.

Affinities.—This species appears to be closely allied to *A. Cornueliana* (d'Orbigny),[1] but does not possess the concentric ribs near the anterior margin. It differs from *A. cantiana*, sp. nov., in the greater length of the anterior part of the shell, the greater curvature of the anterior margin, the larger apical angle, and the absence of concentric ribs.

Remarks.—A left valve is the only specimen seen.

Distribution.—Lower Greensand (Crackers) of Atherfield.

Family—CYPRINIDÆ, *Lamarck.*

Genus—CYPRINA, *Lamarck*, 1818.

('Anim. sans Vert.,' vol. v, p. 556)

CYPRINA SAUSSURI (*Brongniart*), 1821. Plate XIX, figs. 7—13.

1821. DONACITES SAUSSURI, *A. Brongniart.* Ann. des Mines, vol. vi, p. 555, pl. vii, fig. 5 (non *Venus Saussurii*, Goldfuss, 1840).

1854. MACTRA SAUSSURI, *E. Renevier.* Mém. géol. sur la Perte-du-Rhône, p. 24.

1856. CYPRINA SAUSSURI, *F. J. Pictet and E. Renevier.* Foss. Terr. Aptien (Matér Pal. Suisse, ser. 1), p. 73, pl. viii, figs. 1—2.

1865. Cyprina Saussuri, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 220.

H. Coquand. Mon. Aptien de l'Espagne, p. 113.

Description.—Shell usually of small or moderate size, sub-triangular, rounded, often cyreniform, convex, more or less considerably inequilateral. Lunular margin of moderate length, concave. Anterior margin regularly rounded, passing gradually into the convex ventral margin. Posterior margin short, often more or less rounded, sometimes truncate, forming an angle with the ventral margin, and not sharply limited from the long postero-dorsal margin. Umbones prominent, broad. Carina rounded, sometimes rather indistinct. Postero-dorsal area narrow. Lunular region deep, indistinctly limited. Escutcheon elongate, bounded by an inconspicuous carina. Hinge not seen. Ornamentation consists of growth-lines and numerous minute radial ribs.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Length	52	49	40	38·5	38	33	26	25·5	24	mm.
Height .	40	40	31	33	31	27	21	21·5	19	,,
Thickness	34	31	27	26		20	16		14	,,

(1, 2) *Perna*-bed, Atherfield.
(3—9) Crackers, Atherfield.

Affinities.—This species is related to *C. cuneata* (see p. 134), but the outline of the shell is less distinctly triangular, the sides are less flattened, the ventral margin is more convex, the umbones are broader and not so high, the lunular margin is not so long, and the carina is less distinct.

Remarks.—The relative height and length of the shell, and consequently the outline, vary considerably.

Much larger and more globose specimens (Plate XIX, fig. 13) in which the carina is indistinct, are associated with the normal forms of *C. Saussuri*, but are less abundant. At first sight, especially when the shell is not quite perfect, these appear to be distinct from *C. Saussuri*, but after comparing a number of specimens I am led to the conclusion that they are only old individuals which have attained a large size.

Examples of *C. Saussuri* from Atherfield were identified by Pictet and Campiche, but, hitherto, no record of the species appears to have been made by any English writer.

Type.—From the Aptian of the Perte-du-Rhône.

Distribution.—Lower Greensand (*Perna*-bed and Crackers) of Atherfield. Atherfield Beds of Haslemere and Redhill.

Palæontographical Society, 1907.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. II. PART IV.

CYPRINIDÆ, ISOCARDIIDÆ, LUCINIDÆ, CORBIDÆ, UNICARDIIDÆ, TELLINIDÆ, MACTRIDÆ, AND VENERIDÆ.

PAGES 133—180; PLATES XX—XXVII.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY

1907.

CYPRINA SEDGWICKI (*Walker*), 1866. Plate XIX, fig. 14. Plate XX, figs. 1–5.

1866. SPHÆRA SEDGWICKII, *J. F. Walker*. Ann. Mag. Nat. Hist., ser. 3, vol. xviii, p. 386, pl. xiii, figs. 1, 2.
1867. CYPRINA ANGULATA, var., *H. G. Seeley*. Ibid., ser. 3, vol. xx, p. 27.
1875. — SEDGWICKII, *W. Keeping* in *T. G. Bonney*. 'Cambridgeshire Geology,' p. 68.
1883. — — *W. Keeping*. Foss., etc., Neoc. Upware and Brickhill, p. 123, pl. vi, fig. 12.

Description.— Shell more or less oval, sometimes sub-triangular, rounded, inflated, slightly or moderately inequilateral; length as a rule not greatly exceeding the height. Lunular margin of moderate length, concave. Anterior margin rounded, passing gradually into the convex ventral margin. Postero-dorsal margin moderately convex. Umbones prominent, broad, curved inward and forward. Carina absent or indistinct. Postero-dorsal region convex, rounded. Lunule large, ovate, bounded by a faint groove. Escutcheon long, bounded by a more or less distinct carina. Ornamentation consists of growth-lines.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Length	39	38	37	37	34	32	31	27	23	mm.
Height .	34	31	31	32	31	26·5	27	24	20	,,
Thickness	29	25	26·5			23	24			,,

(1—9) Lower Greensand, Upware.

Affinities.—This species is closely related to, and may perhaps be only a local variety of *C. Saussuri* (see above). The chief points in which it differs from the latter are (1) the carina is absent or indistinct, (2) the posterior margin is relatively higher, (3) the valves are usually more inflated, (4) the shell is usually less triangular in outline and less inequilateral.

Remarks.—The examples of *C. Sedgwicki* vary in relative height and length, and consequently in outline. The longer forms approach *C. Saussuri* more nearly than the shorter forms.

This species was placed in the genus *Sphæra* by Mr. J. F. Walker, but was subsequently referred to *Cyprina* by Seeley and by W. Keeping.

Type.—From Potton, in Mr. J. F. Walker's collection.

Distribution.—Lower Greensand of Upware and Potton.

CYPRINA OBTUSA, *Keeping*, 1883. Plate XX, fig. 6.

1883. CYPRINA OBTUSA, *W. Keeping*. Foss., etc., Neoc. Upware and Brickhill, p. 124, pl. vi, fig. 13.

Remarks.—*C. obtusa*, of which I have seen two specimens only, closely resembles some forms of *C. Saussuri*, but differs in having narrower and less curved umbones. It also resembles the more elongate forms of *C. Sedgwicki*.

Type.—In the Sedgwick Museum.

Distribution.—Lower Greensand of Upware.

CYPRINA CUNEATA, *Sowerby*, 1836. Plate XX, figs. 7–12.

1836.	CYPRINA CUNEATA,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 240, 341, pl. xvi, fig. 19.
1849.	— TRIANGULARIS,	*T. Brown.*	Foss. Conch., p. 207, pl. lxxxv, fig. 2.
1850.	— CUNEATA,	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 161.
1851.	— —	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 199.
1865.	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4) p. 230.
1870.	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 193 [*Anisocardia* (*Veniella*)].

Description.—Shell of small or moderate size, triangular, convex with flattened sides, carinate, considerably inequilateral. Lunular margin long, concave. Anterior margin regularly rounded. Ventral margin only slightly curved, sometimes with the posterior part concave. Posterior margin short, truncated, almost straight, nearly parallel to the height of the shell, forming a right angle with the ventral margin and an obtuse angle with the long postero-dorsal margin. Umbones prominent, high, curved considerably inward and forward. A distinct, but rounded, carina extends in a gentle curve from the umbo to the postero-ventral angle. In front of the carina the shell is sometimes slightly concave. Postero-dorsal area narrow, sloping steeply except near the posterior margin. Lunular region deep, indistinctly limited. Escutcheon elongate, bounded by a small carina. Ornamentation consists of very fine growth-lines at regular intervals.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Length	48	36	35	31	29	26·5	26	26	23	20	mm.
Height	40	29	29	26	24	20·5	21	19·5	20	16	,,

(1—10) Blackdown.

Affinities.—The differences between *C. Saussuri* and this species are given above (p. 132).

The form from the Meule de Bracquegnies which was referred to *C. angulata*,

Sowerby, by Briart and Cornet,[1] appears to be more nearly related to *C. cuneata* than to *C. angulata*.

C. securiformis, Sharpe,[2] is similar to *C. cuneata*, but its ventral margin has a much greater curvature.

C. cuneata is mentioned by Stoliczka as a typical example of the sub-genus *Veniella*, Stoliczka.[3] The anterior right cardinal tooth, however, does not appear to be so strongly developed as in the type of *Veniella*.

Types.—The types came from Blackdown, but cannot now be found.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown and Haldon. Upper Greensand (Meÿer's Bed 2) of Weston Mouth (Devon).

CYPRINA CLAXBIENSIS, sp. nov. Plate XXI, fig. 2; Plate XXIV, fig. 1.

Description.—Shell large, stout, oval, rather elongate, considerably inequilateral, moderately convex. Antero-dorsal margin short, straight or slightly concave. Anterior margin well rounded, passing gradually into the convex ventral margin. Posterior margin oblique, sub-truncate, more or less rounded. Postero-dorsal margin rather long, slightly convex. Umbones broad, curved anteriorly, with a rounded carina extending to the postero-ventral extremity, and limiting a flattened or somewhat convex postero-dorsal area which slopes rapidly to the postero-dorsal margin, but more gradually to the posterior margin. Lunular region excavated, not limited. Ornamentation consists of small concentric ribs.

Hinge: in the right valve the anterior cardinal is conical, larger than the median cardinal, and placed below and separated from the latter; the posterior cardinal is oblique, laminar, and divided by a furrow. In the left valve the anterior and median cardinals are stout, the posterior cardinal is oblique and laminar.

Measurements (approximate):

	(1)	(2)	(3)
Length	99	80	74 mm.
Height	75	64	56 ,,

Affinities.—This species resembles *C. Constanti*, Dollfus,[4] from the Kimeridgian,

[1] Meule de Bracquegnies ('Mém. cour. et Mém. des. Sav. étrangers,' vol. xxxiv, 1867), p. 68, pl. viii, figs. 26—28.

[2] 'Quart. Journ. Geol. Soc.,' vol. vi (1850), p. 182, pl. xxii, figs. 1—3. *C. globosa*, Sharpe (Ibid., p. 182, pl. xv, fig. 1) is recorded by Morris from Blackdown, but I have seen no example of it.

[3] 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1870), p. 189. See also Meek, 'Invert. Cret. and Tert. Foss. U. Missouri' (1876), pp. 147—152.

[4] 'Faune Kimmérid. du Cap de la Hève' (1863), p. 65, pl. x, figs. 6—8. De Loriol and Pellat, 'Mon. Étages supér. Jurass. de Boulogne-sur-Mer' (1874), p. 42, pl. xii, fig. 14.

but is much larger and stouter, and the lunular region is more deeply excavated; also the umbones appear to have a greater anterior curvature.

Type.—From Benniworth Haven, in the Sedgwick Museum.

Distribution.—Claxby Ironstone (zone of *Belemnites lateralis*) of Benniworth Haven and Donnington.

CYPRINA TEALBIENSIS, sp. nov. Plate XX, fig. 13*a*, *b*.

Description.—Shell very thick, large, elongate, oval, regularly convex, very inequilateral. Antero-dorsal margin concave. Anterior margin rounded, curving rapidly, passing gradually into the ventral margin. Posterior margin rounded, forming an obtuse angle with the long, slightly convex postero-dorsal margin. Umbones broad, anterior, curved inward. A faint carina extends from the umbo to the posterior end. Lunular region deep. Escutcheon large, deep, limited by a strong carina. Ornamentation consists of growth-ridges.

Measurements:

	(1)	(2)
Length .	105	62 mm.
Height .	82	49 ,,

(1, 2) Tealby Limestone.

Affinities.—In its elongate form, and deep, carinate escutcheon this species resembles *C. bolonicusis*, de Loriol,[1] from the Portlandian.

Remarks.—There are two specimens in the Sedgwick Museum and one in the British Museum. The hinge has not been seen.

Distribution.—Tealby Limestone of Walesby and Claxby, Lincolnshire.

CYPRINA, sp. Plate XXI, fig. 3.

A large *Cyprina* from the Tealby Limestone of Claxby is known by a right and a left valve, now in the Sedgwick Museum, and appears to belong to a distinct species. It shows some resemblance to *C. angulata*, Sowerby (see page 141), but differs from that species in the greater ventral slope of the postero-dorsal margin; the greater obliquity of the posterior margin; the smaller curvature of the umbones; the longer and less concave antero-dorsal margin; and in the absence of a carina cutting off a postero-dorsal area. The surface of the shell is imperfectly preserved, but in places there is evidence of well-marked growth-ridges. Length, 92 mm. Height, 80 mm.

[1] De Loriol and Pellat, 'Portlandien de Boulogne-sur-Mer' (1866), p. 54, pl. v, fig. 9.

CYPRINA, sp. Plate XX, fig. 14.

A few specimens of a small *Cyprina*, with the shell imperfectly preserved, have been found in the Speeton Clay (D, 1).

CYPRINA ANGLICA, sp. nov. Plate XX, figs. 15, 16. Plate XXI, fig. 1*a*, *b*.

Description.—Shell of moderate size, oval, inflated, very inequilateral. Anterior margin rounded, forming a continuous curve with the convex ventral margin. Posterior margin less convex than the anterior, sometimes slightly truncated, more or less oblique, usually curving gradually to join the ventral margin. Postero-dorsal margin long, slightly convex. Antero-dorsal margin short, nearly straight. Umbones broad, anterior, curving inward and forward. Postero-dorsal part of shell slightly compressed; carina absent or indistinct. Lunule ovate, depressed, more or less distinctly limited. Ornamentation consists of growth-lines.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)
Length	42	41	38	32	27	21 mm.
Height	35	33	31	24	20	14·5 ,,
Thickness	28	26·5	24	16·5	14·5	9·5 ,,

(1–6) Crackers, Atherfield.

Affinities.—*C. anglica* does not appear to be closely related to any other English species. Externally it shows some resemblance to *C. angulata*, Sowerby (see below), but is of much smaller size, more elongate, with a more or less distinctly limited lunule, and either without a carina or with an indistinct carina near the umbones.

Remarks.—Nearly all the specimens show the two valves united, so that the hinge and pallial line do not appear to have been seen by previous workers; this probably accounts for the fact that in several collections the species has been referred to the genus *Venus*. A left valve, from which I have removed the matrix, shows that the hinge agrees with *Cyprina*, and that there is no pallial sinus.

Type.—In the Sedgwick Museum, Cambridge.

Distribution.—Lower Greensand (Crackers) of Atherfield. Atherfield Beds of Peasemarsh.

CYPRINA (VENILICARDIA) PROTENSA, sp. nov. Plate XXI, figs. 4–7. Text-figs. 20, 21.

1845. CYPRINA ANGULATA, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 240 (*partim*).

Description.—Shell large, oval, convex, moderately inequilateral, anterior part produced. Antero-dorsal margin concave. Anterior margin rounded, passing gradually into the convex ventral margin which curves upward to join the posterior margin. Posterior margin rounded, sometimes forming a large and rounded angle with the ventral margin, but sometimes passing into it gradually. Postero-dorsal margin convex. Postero-dorsal part of valves compressed, sometimes limited by an indistinct carina. Umbones prominent, curving forward and inward. Lunule indistinctly limited. Escutcheon narrow, deep, with a sharp edge. Ornamentation consists of growth-lines.

Fig. 20.—*Cyprina* (*Venilicardia*) *protensa*, sp. nov. Lower Greensand (*Perna*-bed), Atherfield. Sedgwick Museum. Right valve. × ⅔.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)
Length	106	105	103	99	75	49 mm.
Height	84	89	91	88	60	40 „

(1—5) *Perna*-bed, Atherfield.
(6) Crackers, Atherfield.

Affinities.—The characters which distinguish this species from *C. angulata*, Sowerby, are: the umbones are less anterior and the shell is less inequilateral; the umbonal part of the shell is relatively smaller; the carina is less distinct; the anterior part of the shell is more produced; the posterior part is more rounded; the ventral margin has a greater curvature; the shell is less inflated, so that the marginal parts of the valves meet at a smaller angle. The anterior part of the shell resembles that of *C. truncata*, but the posterior part is more rounded, and

the postero-dorsal margin has a greater ventral slope. *C. protensa* belongs to the sub-genus *Venilicardia*, Stoliczka.[1]

Type.—In the Sedgwick Museum; from the *Perna*-bed of Atherfield.

Distribution.—Lower Greensand: *Perna*-bed of Atherfield and Sandown.

Fig. 21.—*Cyprina* (*Venilicardia*) *protensa*, sp. nov. Lower Greensand (*Perna*-bed), Atherfield. Sedgwick Museum. Right valve. × ½.

Crackers of Atherfield. Ferruginous Sands of Shanklin (Meÿer Collection). Atherfield Beds of Peasemarsh.

CYPRINA SOWERBYI, *d'Orbigny*, 1850. Plate XXI, figs. 8, 9. Text-fig. 22.

1836. CYPRINA ANGULATA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, p. 128.
1845. — *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 240 (*partim*).
1850. SOWERBYI, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 78.
1854. — ANGULATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 199 (*partim*).

Measurements:

	(1)	(2)	(3)	(4)
Length	71	64	59	55 mm.
Height	60	51	52	48 ,,

(1, 2, 4) Hythe Beds, Hythe.
(3) Lower Greensand, near Atherfield.

[1] 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1870), p. 190.

Remarks.—Internal casts of *Cyprina* are found commonly in the Hythe Beds of Hythe, etc. Those from the "rag" have their original form well preserved, but the specimens found in the softer greensand beds are more or less crushed. One example of the same species with the shell preserved has been obtained from the Lower Greensand between Atherfield and Blackgang. The form of the shell

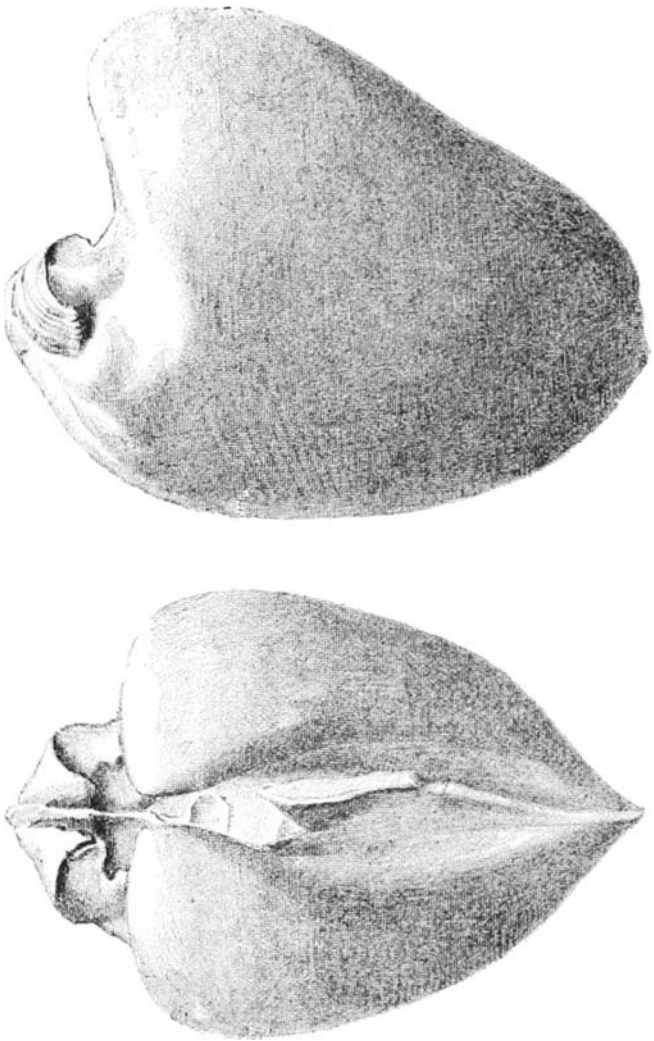


Fig. 22.—*Cyprina Sowerbyi*, d'Orb. Lower Greensand, Parham Park. British Museum, No. 5933. Internal cast. Left valve, and dorsal view of both valves. × ½.

resembles that of *C. lineolata* (see below), but the anterior curvature of the umbones is considerably less, and the postero-dorsal margin of the shell is less convex. It is difficult to determine satisfactorily the affinities of this species until more specimens with the shell have been obtained. It may be identical with the form from the Upper Aptian of Ste. Croix and the Perte-du-Rhône referred by

Pictet and Roux[1] to *C. crycusis*, Leymerie, and by Pictet and Campiche[2] to *C. angulata*, Sowerby. English examples were identified with *C. angulata* by J. de C. Sowerby, Forbes, and Morris, but were regarded by d'Orbigny as belonging to a distinct species which he named *C. Sowerbyi*, and mentioned as types the specimens collected by Fitton from the Hythe Beds near Folkestone. *C. Sowerbyi* also resembles *C. neocomiensis*, d'Orbigny.[3]

Distribution.—Hythe Beds of Hythe. Sandgate Beds of Parham Park. Lower Greensand between Atherfield and Blackgang.

CYPRINA (VENILICARDIA) ANGULATA (*Sowerby*), 1814. Plate XXII, figs. 1—4. Text-figs. 23, 24.

1814.	VENUS ANGULATA, *J. Sowerby.*		Min. Conch., vol. i, p. 145, pl. lxv.
1828.	CYPRINA ANGULATA, *J. Fleming.*		Hist. Brit. Animals, p. 444.
1836.	—	—	*J. de C. Sowerby.* Trans. Geol. Soc., ser. 2, vol. iv, p. 240.
1850.	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 161.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 199 (*partim*).
1870.	—	—	*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 193.
Non 1868.	—	-	*A. Briart and F. L. Cornet.* Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 68, pl. viii, figs. 26—28.

Description.—Shell large, sub-quadrate, rounded, very inequilateral, moderately inflated. Anterior margin rounded, passing quickly into the ventral margin, with which it forms a regular and continuous curve. Posterior margin more or less truncated, slightly or moderately convex, usually oblique, and forming an obtuse angle with the postero-dorsal margin. Umbones large, broad, anterior. A more or less distinct carina passes from the umbo to the postero-ventral angle, cutting off a postero-dorsal area, which slopes rather rapidly to the posterior margin. Lunular region more or less depressed, not limited. Escutcheon narrow, deep, limited by a sharp carina.

Ornamentation consists of growth-lines.

In the right valve the posterior cardinal tooth is large and divided; the median cardinal is smaller than the anterior cardinal, and in most forms adjoins

[1] Pictet and Roux, 'Moll. Foss. Grès verts de Genève' (1852), p. 444, pl. xxxiv, fig. 1.

[2] 'Terr. Crét. de Ste. Croix' (1865), p. 221.

[3] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), pp. 98, 759, pl. cclxxi. Afterwards referred to *C. bernensis*, Leymerie, see d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 77.

the postero-dorsal side of the latter, but in examples in which the umbones are more anterior in position the median cardinal is dorsal to the anterior cardinal, and is almost continuous dorsally with the posterior cardinal tooth.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length	103	104	99	98	96	89	87	82	mm.
Height	92	90	86	86	86	79	79	70	,,

(1—8) Blackdown.

Affinities.—Specimens of *Cyprina* from the Aptian and Gault of the Perte du Rhône and Ste. Croix were referred by Pictet, Roux, and Renevier, to *C. ervyensis*, Leymerie, but were subsequently identified with *C. angulata* by Pictet, Renevier,

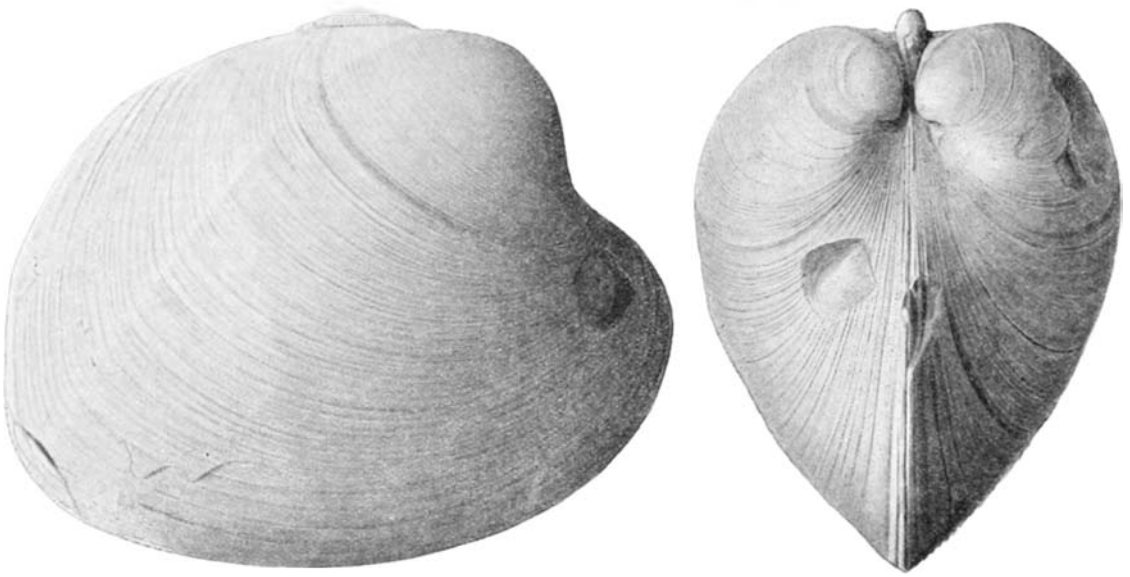


Fig. 23.—*Cyprina* (*Venilicardia*) *angulata* (Sow.). Upper Greensand, Blackdown. Museum of Practical Geology, No. 18698. Right valve, and anterior view of both valves. × ½.

and Campiche.[1] Pictet and Campiche, after an examination of specimens from the Gault of Nièvre and Yonne, came to the conclusion that *C. ervyensis*, as described and figured by Leymerie[2] and d'Orbigny,[3] must be regarded as a synonym of *C. angulata*. I have had no opportunity of comparing French specimens with examples from Blackdown, but so far as I can judge from the figures of *C. ervyensis* there appear to be some differences, consequently I do not at present feel justified in including *C. ervyensis* as a synonym of *C. angulata*.

[1] Pictet and Roux, 'Moll. Foss. Grès verts de Genève' (1852), p. 444, pl. xxxiv, fig. 1. Pictet and Renevier, 'Foss. Terr. Aptien' ('Matér. Pal. Suisse,' ser. 1, 1856–58), pp. 75, 177. Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 221.

[2] 'Mém. Soc. géol. de France,' vol. v (1842), pp. 5, 25, pl. iv, figs. 6, 7.

[3] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 102, pl. cclxxiv.

C. angulata of Briart and Cornet appears to be closely related to *C. cuneata*, Sowerby (see p. 134).

C. (*Venilicardia*) *Jukesi*, de Loriol,[1] from the Gault of Cosne, resembles some forms of *C. angulata*.[2]

Remarks.—*C. angulata* varies in its relative height and length, and in the position of the umbones. The shell is usually stout, but occasionally rather thin. Sowerby gives a good figure of *C. angulata*, except that the teeth, as pointed out by Stoliczka, are not correctly drawn.[3]

Fig. 24.—*Cyprina* (*Venilicardia*) *angulata* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum. Right valve × $\frac{4}{5}$. The hinge of this specimen is shown on Plate XXII, fig. 2.

Types.—From the Upper Greensand of Blackdown, in the British Museum.

Distribution.—Upper Greensand (zone of *Schlenbachia rostrata*) of Blackdown and Haldon. Recorded by Jukes-Browne from the Lower Gault of Wiltshire, and from the Upper Greensand of the Isle of Wight.

CYPRINA (VENILICARDIA) LINEOLATA (*Sowerby*), 1813. Plate XXII, figs. 5—8. Plate XXIII, figs. 1, 2.

1811. VENUS CASTRENSIS, *J. Parkinson*. Organic Remains, vol. iii, p. 187 (non *V. castrensis*, L.).

[1] 'Gault de Cosne' (1882), p. 68, pl. ix, fig. 1.

[2] Morris records *Cyprina globosa*, Sharpe, from the Greensand of Blackdown, but I have not seen any specimen from that locality. Morris, 'Cat. Brit. Foss.,' ed. 2 (1854), p. 199. Sharpe, 'Quart. Journ. Geol. Soc.,' vol. vi (1850), p. 182, pl. xv, fig. 1.

[3] From the remark on Sowerby's figure made by Briart and Cornet (p. 69) I can only conclude that they had not seen specimens of *C. angulata*.

1813. VENUS LINEOLATA, *J. Sowerby*. Min. Conch., vol. i, p. 57, pl. xx (upper figure).
1828. — — *J. Fleming*. Hist. Brit. Animals, p. 449.
1836. CYPRINA ROSTRATA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 240, 341, pl. xvii, fig. 1.
1836. CYTHEREA LINEOLATA, *Sowerby*. Ibid., p. 240.
1850. CYPRINA ROSTRATA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 161.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 199.
1854. CYTHEREA LINEOLATA, *Morris*. Ibid., p. 200.
1865. CYPRINA ROSTRATA, *F. J. Pictet* and *G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pp. 222, 229.
1870. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 193 (*Venilicardia*).
1907. — LINEOLATA, *R. B. Newton*. Proc. Malacol. Soc., vol. vii, p. 284, pl. xxiv, fig. 14.

Non 1844. — — *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 98, pl. cclxxi (*Cyprina neocomiensis*, d'Orbigny, Ibid., p. 759).

Measurements:

	(1)	(2)	(3)	(4)
Length	71	67	66	52 mm.
Height	61	60	58	43 ,,

(1—4) Blackdown.

Affinities.—This species differs from *C. angulata* in its more prominent and more strongly curved umbones, in the shorter posterior margin and the greater slope of the postero-dorsal margin, and in the more deeply depressed lunular region. The hinge also differs: in the right valve the median cardinal tooth is distinctly separated from the anterior cardinal and is dorsal to the latter and continuous with the posterior cardinal tooth; the latter is either undivided or the division is indistinctly shown.

Remarks.—*C. lineolata* varies considerably in the prominence and curvature of the umbones, and, as a result, in the outline of the shell. An extreme form was figured by J. de C. Sowerby as the type of *C. rostrata*; in specimens in which the umbones are less prominent and their anterior curvature less pronounced the outline of the shell becomes less triangular, and in some cases approaches that of *C. angulata*, but the differences in the hinge of the right valve and the greater depth of the lunular region appear to be present in all specimens. The average size of this species is considerably less than that of *C. angulata*.

The type of *Venus lineolata*, Sowerby (*V. castrensis*, Parkinson), from Blackdown, agrees with the normal forms of *C. rostrata*, except for the presence of

numerous W-shaped markings on the surface. These appear to be due to the structure of the shell (possibly connected with colour markings), since they are seen only in specimens which are somewhat decorticated, and are in some cases present on one valve but not on the other, or are seen on the dorsal but not on the ventral part of a valve.

Stoliczka[1] thought that *Venus lineolata* was probably identical with *Cytherea plana*, Sowerby, but the hinge and pallial line of the former prove conclusively that it belongs to the genus *Cyprina*.

Types.—From Blackdown; *Venus lineolata* in the British Museum; *C. rostrata* in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown.

CYPRINA (VENILICARDIA) TRUNCATA (*Sowerby*), 1836. Plate XXIII, fig. 3.

1836. VENUS? TRUNCATA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 242, 341, pl. xvii, fig. 3.
1850. — SUBTRUNCATA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 159.
1854. CYTHEREA TRUNCATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 201.
1865. VENUS SUBTRUNCATA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 190.
1870 — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 161 (*Caryatis*).

Affinities.—*C. truncata* is closely allied to, and probably only a variety of *C. angulata*. The shell is thinner, the posterior margin higher, and the anterior part more produced than in *C. angulata*.

This species, or variety, has hitherto been referred to *Venus* or *Cytherea*, but a specimen showing the hinge and pallial line proves that it is a *Cyprina*. The hinge agrees with that of *C. angulata*.

An example collected by the late Rev. W. Downes (Plate XXIII, fig. 4) is more elongated and more inflated than the type of *C. truncata*, but agrees in other respects, and is probably only an individual variation.

Type.—From Blackdown; in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown.

CYPRINA LIGERIENSIS, *d'Orbigny*, 1844.

Internal casts of a large *Cyprina* have been found in the Cenomanian Sandstone of Wilmington,[2] Devon, and in the cherty blocks in the Eocene Gravel

[1] 'Cret. Fauna S. India,' vol. iii (1870), pp. 160, 169.

[2] Jukes-Browne, 'Cret. Rocks of Britain,' vol. ii (1903), p. 129

(derived from the Upper Greensand) of Aller Vale near Torquay. They have been identified with *C. ligeriensis*, d'Orbigny,[1] by Mr. Jukes-Browne, who has compared them with examples of that species from the Cenomanian of Vimoutiers and Orbiquet, and states that the agreement is very close. The English specimens also resemble *C. Nouletiana*, d'Orbigny,[2] of which a cast only is figured by d'Orbigny, and was at first regarded as *C. ligeriensis*. An example from Wilmington is in the Sedgwick Museum. Others from Aller Vale are in the Torquay Museum and in the Sedgwick Museum.

CYPRINA (VENILICARDIA ?) QUADRATA, *d'Orbigny*, 1844. Plate XXIII, figs. 6—9.

1840.	ISOCARDIA CRETACEA,		*H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 2, p. 53, pl. xi, figs. 6, 7 (*non* Goldfuss).
1844.	CYPRINA QUADRATA,		*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 104, pl. cclxxvi.
1850.	—	—	—	Prodr. de Pal., vol. ii, p. 161.
—	—	—	*H. B. Geinitz.*	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 156.
1865.	—	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 225, pl. cxv, figs. 3—5.
1870.	—	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 193.
1873.	—	—	*H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 62, pl. xvii, figs. 14—16.
? 1877.	—	—	*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. II Weissenberg. u. Malnitz. Schicht., p. 116, fig. 76.
? 1883.	—	—	—	Ibid., III Iserschicht., p. 100, fig. 65.
1895.	—	—	*E. Tiessen.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 486.
1897.	ARCTICA	—	*H. Woods.*	Quart. Journ. Geol. Soc., vol. liii, p. 390, pl. xxvii, fig. 25, pl. xxviii, fig. 1.

Description.—Shell sub-rhomboidal, much inflated, rather strongly carinate, very inequilateral; length somewhat greater than height. Anterior margin rounded, passing gradually into the slightly curved ventral margin. Posterior

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 103, pl. cclxxv, figs. 1, 2; 'Prodr. de Pal.,' vol. ii (1850), p. 161; Guéranger, 'Album Paléont. de la Sarthe,' 1867, p. 13, pl. xvii, figs. 1, 5.

[2] *Op. cit.* (1844), pl. cclxxv, figs. 3, 4; *op. cit.* (1850), p. 195.

margin truncated, high. Postero-dorsal region flattened. Umbones prominent, anterior, curved inwards. Lunular region excavated. Ornamentation consists of concentric striæ.

Measurements :

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Length .	54	46	37	35	26	23	46	40	20	45	58	mm.
Height .	46	41	34	31	24	19	39	33	15	38	52	„

(1—6) Gault, Folkestone.
(7—9) Rye Hill Sand, Warminster.
(10) Chloritic Marl, Maiden Bradley.
(11) Base of Chalk, Chard.

Affinities.—In *C. ligeriensis*, d'Orbigny,[1] the umbones are less anterior in position, and the angle between the posterior and the dorsal margins is larger than in *C. quadrata*.

C. regularis, d'Orbigny,[2] is distinguished from *C. quadrata* by its less inequilateral and more regularly globose shell, by its less incurved umbones, and the smaller truncation of the posterior end.

C. crassicornis (Agassiz)[3] possesses a relatively higher and less inequilateral shell, with more prominent umbones, which are not so much curved anteriorly as in *C. quadrata*.

Remarks.—The specimens from the Gault have the shell more or less perfectly preserved, but most of the examples from higher beds are, like the type, in the form of internal casts. The specimens found in the Chalk Rock are rather imperfect, but do not appear to differ specifically from those found at lower horizons.

Type.—The locality of the type is not given by d'Orbigny, but he records specimens from the Cenomanian of Villers (Calvados), Rouen, St. Calais (Sarthe), etc.

Distribution.—Upper Gault of Folkestone. Upper Greensand (zone of *Schlænbachia rostrata*) of Devizes (*fide* Jukes-Browne). Rye Hill Sand of Warminster. Base of the Chalk of Chard. Chloritic Marl of Maiden Bradley and the Isle of Wight. Chalk Rock of Morgan's Hill near Devizes, Cuckhamsley, and Luton.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 103, pl. cclxxv, figs. 1, 2 (not 3, 4).

[2] Ibid., p. 100, pl. cclxxii, figs. 3—6; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' (1865), p. 224, pl. cxv, figs. 1, 2.

[3] 'Études crit. Moll. Foss., Myes' (1842), p. 36, pl. viii *f*, figs. 5—10; Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 226, pl. cxv, figs. 6—8.

Genus—TRAPEZIUM, *Megerle v. Mühlfeldt*, 1811.
(' Naturf. Freunde zu Berlin Mag.,' vol. v, p. 68.)

TRAPEZIUM ? ARCADIFORME (*Keeping*), 1883. Plate XXIII, figs. 10, 11.

1883. CYPRICARDIA ARCADIFORMIS, *W. Keeping*. Foss. etc., Neoc. Upware and Brickhill, p. 120, pl. vi, fig. 6.

Description.—Shell trapezoidal, inflated; length much greater than height. Dorsal and ventral margins nearly straight and nearly parallel. Posterior margin oblique, straight or slightly curved, forming an obtuse angle with the dorsal margin and an acute but rounded angle with the ventral margin. Anterior margin rounded. Umbones near the anterior end, much curved, with a strong, rounded keel extending to the postero-ventral angle. The part in front of the keel is slightly concave, giving a faint sinuosity to the ventral margin of the valve. The triangular part dorsal to the keel is compressed and flattened, and slopes steeply to the margin. Lunule cordate. Hinge not seen.

Ornamentation consists of small, rounded radial ribs, and, at intervals, strong concentric laminar ridges; both ribs and ridges are indistinct on the part dorsal to the keel. Length 21 mm.; height 12·5 mm.; thickness, 13 mm.

Affinities.—This species is more elongate, and the carina is more angular than in *T. squamosum* (see below).

Remarks.—The only examples seen are the type and a specimen in Mr. J. F. Walker's collection.

Type.—The type is in the Sedgwick Museum.

Distribution.—Lower Greensand, Upware.

TRAPEZIUM ? SQUAMOSUM (*Keeping*), 1883. Plate XXIII, figs. 12—15.

1883. CYPRICARDIA SQUAMOSA, *W. Keeping*. Foss., etc., Neoc. Upware and Brickhill, p. 120, pl. vi, fig. 5.

Description.—Shell rounded-oblong, much inflated, highest near the posterior end. Dorsal margin nearly straight; the posterior forms a regular curve, which passes into the slightly concave ventral margin. Dorsal part of anterior margin concave, ventral part rounded. Umbones prominent, anterior, much curved. A broad, rounded ridge extends from the umbo to the postero-ventral extremity and divides the shell into two parts. The part in front of the ridge is slightly concave, the part above is larger and convex. Lunule cordate.

Ornamentation consists of small radial ribs, and, at rather distant intervals,

strong concentric lamellæ. The ornamentation is indistinct on the part above the rounded ridge. Margin of valve crenulate.

Measurements :

	(1)	(2)	(3)	(4)
Length	15·5	14	13·5	12·5 mm.
Height	12	11	11	10
Thickness	10	10	10·5	9

(1—4) Lower Greensand, Upware.

Affinities.—Keeping compared this species with *Cardita neocomiensis*, d'Orbigny, to which it shows some resemblance in general form. But the faint radial ribs and strong concentric lamellæ, as well as the character of the hinge, so far as it can be made out, seem to connect this species with *Trapezium* rather than with *Cardita*.

Type.—In the Sedgwick Museum.

Distribution.—Lower Greensand, Upware.

TRAPEZIUM ? sp. Plate XXIII, fig. 16.

1883. CYPRICARDIA STRIATA, *W. Keeping*. Foss., etc., Neoc. Upware and Brickhill, p. 119.

An imperfect left valve from the Lower Greensand of Upware, in the Sedgwick Museum, was identified by W. Keeping with *Cypricardia striata* (Geinitz) [1] from the Cenomanian of Saxony. The ribs are fewer in number than in the examples of *C. striata* figured by Geinitz.

TRAPEZIUM TRAPEZOIDALE (*Römer*), 1841. Plate XXIII, figs. 17—19.

1841.	CRASSATELLA TRAPEZOIDALIS,	*F. A. Römer*.	Die Verstein. d. nord-deutsch. Kreidegeb., p. 74, pl. ix, fig. 22.
? 1847.	—	— *A. d'Archiac*.	Mém. Soc. géol. de France, ser. 2, vol. ii, p. 302.
1850.	CYPRINA	*H. B. Geinitz*.	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 158 (*partim*).
1854.	CYPRICARDIA	— *A. d'Orbigny*.	Prodr. de Pal., vol. ii, p. 240.

[1] 'Char. d. Schicht. u. Petref. des sächs. Kreidegeb.,' pt. 2 (1840), p. 52, pl. x, fig. 3. *Modiola cardiloides*, Geinitz, 'Das Elbthalgeb. in Sachsen' ('Palæontographica,' vol. xx, pt. 1, 1873), p. 218, pl. xlviii, figs. 11—13; pl. xlix, figs. 19, 20.

1873. Cyprina trapezoidalis, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 229, pl. l, fig. 6 (? 5).

1889. Cypricardia — *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 179.

1897. Trapezium trapezoidale, *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 391, pl. xxviii, figs. 9, 10.

1901. Cypricardia trapezoidalis, *F. Sturm.* Jahrb. d. k. preussisch. geol. Landesanst. für 1900, vol. xxi, p. 80, pl. vii, fig. 5.

1902. — — *A. Wollemann.* Lüneburg. Kreide (Abhandl. d. k. preussisch. geol. Landesanst. N. F., Heft. 37), p. 78, pl. ii, fig. 3; pl. iii, fig. 1.

Description.—Shell trapezoidal, rounded, inflated. Ventral margin slightly curved, roughly parallel to the dorsal margin, and passing gradually into the rounded anterior margin. Posterior margin oblique, forming an obtuse angle with the dorsal margin and an acute angle with the ventral margin. Umbones near the anterior end, much curved. A sharp, gently curving carina extends from the umbo to the posterior angle and cuts off a triangular and slightly concave area.

Ornamentation consists of fine concentric lines.

Measurements:

	(1)	(2)	(3)
Length	25	23	21 mm.
Height	17	14	14 ,,
Thickness . .	16 .	15 .	15 ,,

(1—3) Chalk Rock, Cuckhamsley.

Affinities.—Wollemann considers that *Trapezium galicianum* (Favre)[1] is not distinct from this species, but is founded on an older example than the type of *T. trapezoidale*. According to Wollemann, various changes in the form of the shell take place during growth. Thus, in the older specimens the valves become more convex, the length relatively less, the posterior margin less oblique, the ventral margin more curved, the outline less trapezoidal, and the umbones less curved. This view is probably correct, but none of the English examples which I have seen pass beyond the stage represented by Römer's type.

In *Trapezium tricarinatum* (Römer)[2] the umbones are less anterior in position than in *T. trapezoidale*.

[1] 'Moll. Foss. de la Craie de Lemberg' (1869), p. 109, pl. xii, fig. 3.

[2] 'Die Verstein. d. nord-deutsch. Kreidegeb.' (1841), p. 74, pl. ix, fig. 23.

Remarks.—This species occurs in the Chalk Rock, but is not common. All the specimens seen are casts, but one shows a fragment of shell.

Type.—The type is stated by Römer to have come from the Pläner-kalk of Strehlen (Dresden), but Geinitz says that he has never found the species at that locality.

Distribution.—Chalk Rock of Dover, Cuckhamsley, Aston Rowant, Princes Risborough, Thickthorn Hill (Bledlow), and Luton railway cutting.

Family—ISOCARDIIDÆ, *Gray.*

Genus—Isocardia, *Lamarck*, 1799.

('Mém. Soc. Hist. Nat. Paris,' p. 86.)

Isocardia similis, *Sowerby*, 1826. Text-fig. 25.

1826. Isocardia similis, *J. de C. Sowerby.* Min. Conch., vol. vi, p. 27, pl. dxvi, fig. 1.
1850. — — *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 163.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 204.
1865. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 240.
1870. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, pp. 188, 194.

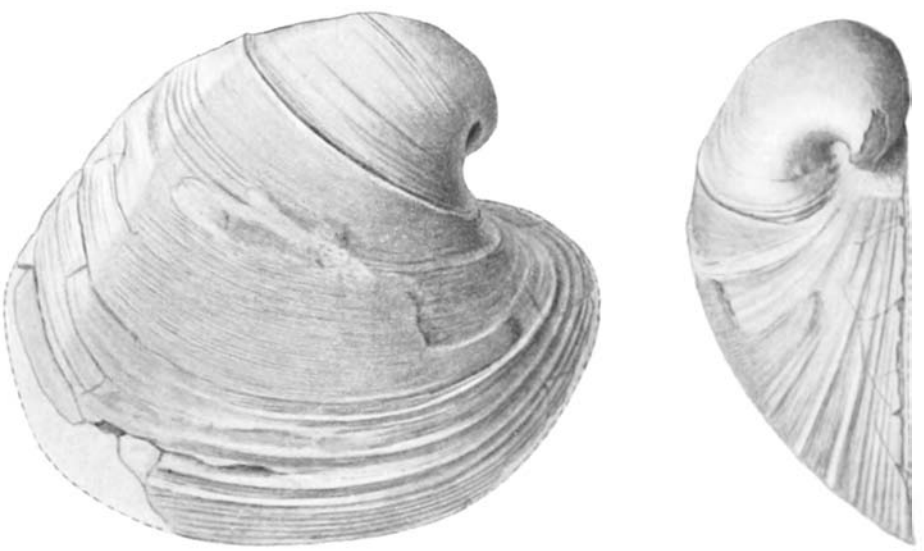


Fig. 25.—*Isocardia similis*, Sowerby. Lower Greensand, near Sandgate. Right valve, and anterior view. British Museum (Nat. Hist.). The Type. Natural size.

Description.—Shell convex, oval, longer than high. Antero-dorsal margin short. Anterior margin produced, somewhat pointed, rounded, curving rapidly to join the slightly convex ventral margin. Posterior margin short, somewhat truncated. Postero-dorsal margin long, convex, with a considerable ventral slope. Umbo prominent, recurved. Lunular region deep. A faint carina extends from the umbo to the postero-ventral extremity. Ornamentation consists of growth-lines. Length 78 mm. Height 70 mm.

Remarks.—The type, a right valve, now in the British Museum, is the only undoubted example of this species which I have seen. From the nature of the matrix there seems no doubt that this specimen comes from the *mammilatum* zone. The hinge cannot be made out satisfactorily, but the form of the shell agrees closely with that typical of *Isocardia*.

Distribution.—Lower Greensand (zone of *Douvilleiceras mammilatum*) near Sandgate.[1]

Family—LUCINIDÆ, *Fleming*.

Genus—Lucina, *J. G. Bruguière*, 1797.

('Encyc. Méth., Vers,' pl. cclxxxiv. Lamarck, 'Mém. Soc. Hist. Nat. Paris,' 1799, p. 84.)

Lucina, sp. Plate XXIV, figs. 2, 3.

Internal casts of a *Lucina* have been obtained from the Spilsby Sandstone (zone of *Belemnites lateralis*) of Donnington and Claxby. A right valve with the shell preserved was found by Mr. Lamplugh in the Spilsby Sandstone at Holton and probably belongs to the same species as the casts. The shell bears numerous small concentric ridges.

Lucina, sp. Plate XXIV, figs. 4, 5.

Some internal casts and a portion of an external cast of *Lucina* have been

[1] *Isocardia? ornata*, Forbes, 'Quart. Journ. Geol. Soc.,' vol. i (1845), p. 242, pl. ii, fig. 10, is known only by the imperfect type specimen which is now in the Museum of the Geological Society (No. 2150), and was obtained from the Lower Greensand of Atherfield. It was referred to *Opis* by d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 118.

Isocardia cryptoceras, d'Orbigny, has been recorded by Barrois from the Upper Greensand near Devizes. See 'Terrain Crét. supér. de l'Angleterre et de l'Irlande' (1876), p. 61.

found in the Lower Greensand[1] of Blackgang, Shanklin, and Parham Park. The outline is nearly circular and the convexity small or moderate. The ornamentation consists of concentric ribs and flat interspaces.

LUCINA, sp. Plate XXIV, fig. 6.

A specimen with the two valves united was obtained by the late C. J. A. Meÿer from the Lower Greensand (Ferruginous Sands) of Shanklin, and appears to belong to a distinct species. The shell is regularly convex, slightly higher than long, and the lunule is deeply depressed. The ornamentation consists of numerous, small, regular, concentric ribs.

LUCINA ? SCULPTA, *Phillips*, 1829. Plate XXIV, figs. 7—9.

1829.	LUCINA SCULPTA,		*J. Phillips.* Geol. Yorks., pp. 122, 170, pl. ii, fig. 15 (p. 252, ed. 3).
1844.	—	—	*A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 118, pl. cclxxxiii, figs. 1—4.
1850.	—	—	*E. Eichwald.* Zeitschr. d. deutsch. geol. Gesellsch., vol. ii, p. 471.
—	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 118.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 208.
1862.	—	—	*J. G. Chenu.* Man. de Conchyl., vol. ii, p. 119, fig. 571.
1866.	—	—	*F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 291.
1871.	—	—	*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 252.
1906.	—	—	*A. Wollemann.* Die Biv. u. Gastrop. norddeutsch. Gaults, p. 277.

Description.—Shell very convex, higher than long, with angular outline. Antero-dorsal margin long, concave. Postero-dorsal margin long, convex. Angles occur at the ventral limit of the lunule, at the junction of the anterior and ventral margins, near the posterior part of the ventral margin, and at the ventral limit and the middle of the escutcheon. Umbones high, prominent, sharp, curved

[1] *Lucina arduennensis*, d'Orbigny, and *L. Dupiniana*, d'Orbigny, have been recorded by Topley from the Lower Greensand of the Weald. I have not seen any specimens which could be identified with those species. Two imperfect left valves from the Lower Greensand of Atherfield, now in the Museum of the Geological Society, were referred by Forbes to *L. globiformis*, Leymerie. Without better specimens it is difficult to determine the genus to which Forbes' specimens belong. See Forbes, 'Quart. Journ. Geol. Soc.,' vol. i. (1845), p. 240; Leymerie, 'Mem. Soc. géol. de France,' vol. v (1842), p. 4, pl. iii, fig. 8.

anteriorly. Ridges extend from the umbo to the angles at the margin of the valve; the parts between the ridges are flattened. Lunule large, ovate, divided into an inner and an outer part by a ridge. Escutcheon very large, consisting of a median lanceolate part which is much depressed and separated by a sharp edge from a large concave outer portion.

Ornamentation consists of broad concentric ridges which run parallel to the margin of the valve and end abruptly at the lunule and escutcheon. Very fine, sometimes indistinct, ribs occur on the ridges and interspaces.

Affinities.—*Lucina sculpta* is quite unlike any other Cretaceous species. Its angular outline and large concave escutcheon give it an unusual appearance. Externally it shows some resemblance to some species of *Thyasira*,[1] but the hinge and adductor impressions are at present unknown. Stoliczka regarded it as probably a true *Lucina*.

Remarks.—I have seen only four specimens, of which three are in the British Museum and one is in the Museum of Practical Geology.

Type.—The type cannot be found. It is stated to have come from the Speeton Clay (? zone of *Belemnites minimus*).

Distribution.—Lower Gault (Bed vi) of Folkestone.

LUCINA TENERA (*Sowerby*), 1836. Plate XXIV, figs. 10—14.

1836.	VENUS ? TENERA,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 114, 335, pl. xi, fig. 7.
1854.	—	— *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 231.
1865.	—	— (? LUCINA), *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 189.
1870.	-	(? CARYATIS), *F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 160.
1875.	LUCINA	-- *A. J. Jukes-Browne.*	Quart. Journ. Geol. Soc., vol. xxxi, p. 300, pl. xv, figs. 10—12.

Description.—Shell oval, moderately convex, longer than high, inequilateral, the anterior part longer and higher than the posterior part. Anterior margin regularly rounded, passing gradually into the curved ventral margin. Posterior margin somewhat truncated, forming an obtuse angle with the postero-dorsal margin. Umbones of moderate size with a slight forward curvature. Lunule elongate, depressed, limited by a carina. Escutcheon large, not distinctly limited.

[1] *Axinus*, Sowerby; *Cryptodon*, Turton.

Ornamentation consists of numerous, regular, strong, concentric ribs which become smaller near the antero-dorsal and postero-dorsal margins.

Measurements :

	(1)	(2)	(3)	(4)	(5)	
Length	15	14	13	12·5	9	mm.
Height .	14	12	11	11	7·5	,,
Thickness	8	7	6·5	—	4·5	,,

(1—5) Gault, Folkestone.

Affinities.—In form and ornamentation this species resembles *L. Sanctæ-Crucis*, Pictet and Campiche,[1] but is much smaller and relatively longer.

Type.—The type came from the Gault of Folkestone, but cannot now be found. The specimens figured by Jukes-Browne are in the Sedgwick Museum, Cambridge.

Distribution.—Gault of Folkestone and Black Ven. Cambridge Greensand. Upper Greensand (zone of *Schlœnbachia rostrata*) of Devizes.

LUCINA DOWNESI, sp. nov. Plate XXIV, figs. 15 *a—c*.

Description.—Shell oval or nearly orbicular, moderately convex, slightly inequilateral, longer than high, postero-dorsal part compressed. Anterior and ventral margins rounded. Posterior margin less convex than the anterior, forming an obtuse angle with the convex postero-dorsal margin. Umbones of moderate size. Lunule elongate. Ornamentation consists of numerous regular, concentric, lamellar ribs separated by broad, flat interspaces with fine concentric ribs.

Measurements :

	(1)	(2)	
Length	32	26	mm.
Height	28·5	24	,,
Thickness .	14 .	—	,,

(1, 2) Blackdown.

Affinities.—This species resembles *L. Carteliana*, d'Orbigny,[2] from the Neocomian, but the umbones are less prominent and the shell is less inequilateral. It is also similar to *L. subnummismalis*, d'Orbigny,[3] from the Aachen Greensand, but the ribs are more numerous and the antero-dorsal margin has a greater

[1] "Terr. Crét. Ste. Croix" ('Matér. Pal. Suisse,' ser. 4, 1866), p. 289, pl. cxxii, fig. 8.

[2] 'Pal. Franç. Terr. Cret.,' vol. iii (1844), p. 116, pl. cclxxxi, figs. 3–5.

[3] Holzapfel, "Die Mollusk. Aachen. Kreide" ('Palæontographica,' vol. xxxv, 1889), p. 187, pl. xix. figs. 1—3. Ravn, 'Mollusk. i Danmarks Kridtaft. I. Lamellibr.' (1902), p. 129, pl. iv. fig. 21.

ventral slope. The ribs are more numerous than in *Lucina Nereis*, d'Orbigny,[1] from the Cenomanian.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown. Upper Greensand near Lyme Regis.

LUCINA PISUM, *Sowerby*, 1836. Plate XXIV, figs. 16—19.

1836.	LUCINA PISUM.	*J. de C. Sowerby.* Trans. Geol. Soc., ser. 2, vol. iv, pp. 241, 341, pl. xvi, fig. 14.
1850.		*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 162.
1854.	"	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 208.
1871.	—	*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 252.
Non 1844.		*A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, pl. cclxxxi, figs. 3—5 (*L. Cornueliana*, p. 116).
? —1868.	"	*A. Briart and F. L. Cornet.* Meule de Braequegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 69, pl. viii, figs. 18—21.

Description.—Shell small, very convex, with nearly circular outline, slightly inequilateral; length and height nearly equal. Anterior and ventral margins forming a regular curve; posterior margin slightly truncated, forming an obtuse angle with the postero-dorsal margin. Umbones rather large. Lunule ovate, broad, depressed. Escutcheon indistinctly limited. Ornamentation consists of concentric ribs, with growth-rings at intervals.

Measurements:

	(1)	(2)	(3)	
Length	5	4·5	4	mm.
Height	4·9	4·3	4	,,
Thickness	3·5	3	2·9	,,

(1—3) Blackdown.

Remarks.—The form referred to *L. pisum* by Briart and Cornet is much larger than the English examples of that species, and also differs in its relatively longer and more compressed shell.

Type.—From Blackdown; in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown.

[1] 'Prodr. de Pal.,' vol. ii (1850), p. 162. Guéranger, 'Album Paléont. de la Sarthe' (1867), p. 12, pl. xv, fig. 15. The hinge figured by Guéranger does not agree with *Lucina*. Stoliczka suggests that this species belongs to *Cyprimeria*, see 'Palæont. Indica, Cret. Fauna S. India' (1871), pp. 164, 253.

Family—CORBIDÆ, *Dall.*

Genus—CORBICELLA, *J. Morris and J. Lycett*, 1853.

('Moll. Great Ool.,' pt. ii, p. 94.)

CORBICELLA CLAXBIENSIS, sp. nov. Plate XXIV, figs. 20—23.

Description.—Shell oval, regularly convex, slightly inequilateral, anterior part rather larger than the posterior part, length equal to nearly 1½ times the height. Anterior margin rounded. Ventral margin convex, curving rapidly to join the posterior margin which forms an angle with the nearly straight postero-dorsal margin. Umbones broad, inconspicuous, scarcely curved, close together. Surface of shell smooth except for growth-lines.

Measurements:

	(1)	(2)	(3)	(4)	
Length	38	37	30	27	mm.
Height	26	25	21	19	,,

(1—4) Claxby Ironstone, Benniworth Haven.

Remarks.—The genus *Corbicella* does not appear to have been recognised in deposits of Cretaceous age, but since it is present in the Portlandian its occurrence in the lower part of the Speeton Series of Lincolnshire causes no surprise.

C. claxbiensis is similar in outline to some forms of *C. Pellati*, de Loriol,[1] from the Portlandian.

Type.—In the Sedgwick Museum, Cambridge.

Distribution.—Spilsby Sandstone (zone of *Belemnites lateralis*) of Claxby and Donnington. Claxby Ironstone (zone of *B. lateralis*) of Benniworth Haven.

Genus—SPHÆRA, *J. Sowerby*, 1822.

('Min. Conch.,' vol. iv, p. 41.)

SPHÆRA CORRUGATA, *Sowerby*, 1822. Plate XXIV, fig. 24; Plate XXV, figs. 1, 2; text-fig. 26.

1822. SPHÆRA CORRUGATA, *J. Sowerby*. Min. Conch., vol. iv, p. 42, pl. ccexxxv.
1842. VENUS CORDIFORMIS, *A. Leymerie*. Mém. Soc. géol. de France, ser. 2, vol. v, p. 5, pl. v, fig. 8.

[1] De Loriol and Pellat, 'Jurass. de Boulogne-sur-mer' (1875), p. 67, pl. xiv, fig. 12.

1842. Cardium galloprovinciale, *P. Matheron*. Catal. Foss. du Départ. des Bouches-du-Rhone, p. 155, pl. xvii, figs. 1, 2.
1844. Corbis cordiformis, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 111, pl. cclxxix.
1845. — corrugata, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 239.
1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 78.
1854. Sphæra — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 224.
1855. Corbis — *G. Cotteau*. Moll. Foss. de l'Yonne, p. 80.
1856. — — *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 76, pl. viii, fig. 3.
1859. — cordiformis, *J. Vilanova-y-Piera*. Mem. geog.-agric. de Castellon, pl. iii, fig. 13.
1865. — corrugata, *H. Coquand*. Mon. Aptien de l'Espagne, p. 116.
1866. Fimbria — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 279.
1869. Palæocorbis cordiformis, *T. A. Conrad*. Amer. Journ. Conch., vol. v, p. 101.
1871. Sphæra corrugata, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, pp. 247, 252.
? 1877. Corbis cf. corrugata, *G. Böhm*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix, p. 240.
1897. — corrugata, *K. Gerhardt*. Neues Jahrb. für Min., etc., Beil.-Bd. xi, p. 186.
1899. Fimbria — *A. Wollemann*. Zeitschr. der deutsch. geol. Gesellsch., vol. li, p. 592.

Description.—Shell large, stout, inflated, subglobular, slightly inequilateral, height and length nearly equal. Anterior margin rounded, forming an angle with the hinge-margin, and passing gradually into the ventral margin with which it forms a regular curve. The ventral margin curves rapidly towards the posterior margin, which makes an obtuse angle with the hinge-margin. Lunule flattened or depressed, with a swollen lower margin which is separated from the rest of the valve by a furrow. Escutcheon triangular, limited by a furrow which passes from the umbo to the posterior margin. Umbones large, prominent, curved anteriorly. Ornamentation consists of broad, strong, unequal, concentric ridges which are more numerous on the middle than on the anterior and posterior parts of the shell. The concentric ridges are crossed by numerous, small, radial ribs.

Measurements:

	(1)	(2)	(3)	(4)
Length	95	84	80	70 mm.
Height	93	83	77	68 ,,

(1—4) Lower Greensand, Atherfield.

Remarks.—This species is the type of the genus *Sphæra*. It is fairly common in the *Perna*-bed of the Isle of Wight. A young example is figured by d'Orbigny.

Type.—The type was obtained by Professor Sedgwick from the *Perna*-bed of Sandown, but cannot now be found.

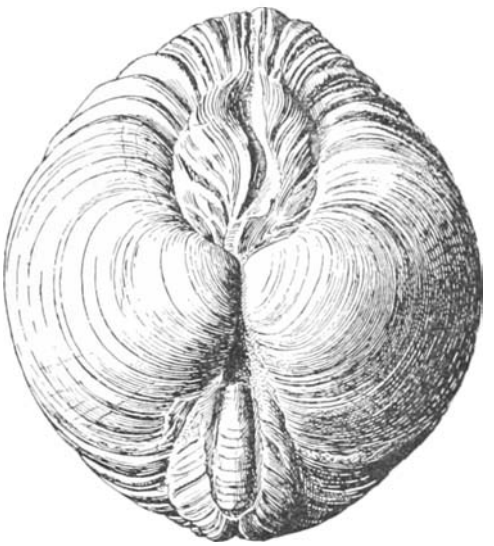


Fig. 26.—*Sphæra corrugata*, Sow. Lower Greensand, near Hythe. Museum of Practical Geology, No. 19716. Dorsal view. × ½.

Distribution.—Lower Greensand (*Perna*-bed and Crackers) of Atherfield; also recorded by Fitton from Beds viii and xiv. Hythe Beds of Hythe and Maidstone. Recorded by Topley from the Atherfield Beds of Peasmarsh and Shalford; the Hythe Beds of Lympe; and the Sandgate Beds of Sandgate.[1]

SPHÆRA, sp. Plate XXV, fig. 3.

A small specimen from the Chalk Marl of Chard appears to belong to a distinct species. It is much smaller than *S. corrugata*, also relatively longer, more oval in outline, and less inflated. The escutcheon is not defined, the lunule is small or absent, and the antero-dorsal margins are thick and prominent. The concentric ridges resemble those of *S. corrugata*, but the radial ribs are more distinct. Length 16·5 mm.; height 14 mm.; thickness 12·5 mm.

[1] The type of *Corbis? fibrosa*, Forbes, from Peasmarsh, is in the Museum of the Geological Society (R 2154), but is too imperfect for determination. Forbes, 'Quart. Journ. Geol. Soc.,' vol. i (1845), p. 239.

Genus—MUTIELLA, *Stoliczka*, 1871.

('Palæont. Indica, Cret. Fauna S. India,' p. 247.)

MUTIELLA ? CANALICULATA (*Sowerby*), 1836. Plate XXV, figs. 4—6.

1836. PETRICOLA CANALICULATA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 241, 341, pl. xvi, fig. 11.
— — NUCIFORMIS, *Sowerby*. Ibid., pp. 241, 341, pl. xvi, fig. 10.
1850. CARDIUM CANALICULATUM, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 163.
— — NUCIFORME, *d'Orbigny*. Ibid., p. 163.
1854. PETRICOLA ? CANALICULATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 220.
— NUCIFORMIS, *Morris*. Ibid., p. 220.
1866. CARDIUM CANALICULATUM, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 270.
1865–66. PETRICOLA NUCIFORMIS, *Pictet and Campiche*. Ibid., pp. 163, 276.
1870. — CANALICULATA (CARDIUM), *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 141.
— — NUCIFORMIS (? CORBIS), *Stoliczka*. Ibid., p. 141.

Description.—Shell inflated, outline more or less orbicular, inequilateral, length and height equal. Margins rounded. Anterior margin less convex than the posterior margin. The latter makes an obtuse angle with postero-dorsal margin and curves rapidly to join the ventral margin. The margin in front of the umbo expands. Umbones large, contiguous, curving inward and forward. No lunule.

Ornamentation consists of numerous, regular, radial ribs, separated by narrow furrows, and crossed by narrow concentric ridges which are more prominent on the posterior part of the shell than elsewhere. Inner margins of the valves crenulate.

There are two cardinal teeth in the left valve and one in the right. Behind the umbo a long, nearly straight, sharp ridge forms the inner margin of the ligament groove.

Measurements :

	(1)	(2)	(3)	(4)	
Length	20·5	19	17	14·5	10 mm.
Height	20·5	19	17	14·5	10 „

(1—4) Blackdown.

Affinities.—The generic position of this species has been for a long time a matter of doubt, but no one appears to have accepted Sowerby's view. The

species is rare, and the opinions expressed by various authors appear to have been based entirely on the figures given by Sowerby.

The hinge is similar to that of *Mutiella coarctata* (Zittel),[1] but shows some points of difference: thus the transverse corrugations or teeth on the expanded anterior margin appear to be absent, and the terminal posterior lateral tooth cannot be recognised with certainty. The points of resemblance, however, and the similarity in the form of the shell and the character of the ornamentation seem sufficient to justify the assignment of this species either to *Mutiella* or to a closely allied genus.

From the figures given by Sowerby, *Petricola nuciformis* appears to differ considerably from *P. canaliculata*, but after an examination of the type of the former I am led to the conclusion that it is not specifically distinct from the latter; it differs only in being more inequilateral, and the apparent difference in the ornamentation is due to the imperfect preservation of the surface of the shell in *P. nuciformis*.

Types.—From Blackdown. The type of *Petricola canaliculata* cannot be found. The type of *P. nuciformis* is in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown, and Peak Hill, near Sidmouth.

MUTIELLA ROTUNDATA (*d'Orbigny*), 1844.

1844.	CORBIS ROTUNDATA,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 113, pl. cclxxx, figs. 1–4.
1850.	—	—	Prodr. de Pal., vol. ii, p. 162.
1867.	—	*E. Guéranger.*	Album Paléont. de la Sarthe, p. 15, pl. xix, figs. 10, 11.
1870.	—	*F. Römer.*	Geol. v. Oberschles., p. 340.
1871.	MUTIELLA ROTUNDATA,	*F. Stoliczka.*	Palæont. Indica, Cret Fauna S. India, vol. iii, pp. 247, 252.
1896.	CORBIS ROTUNDATA,	*A. J. Jukes-Browne and W. Hill.*	Quart. Journ. Geol. Soc., vol. lii, p. 153.

A portion of a right valve of *Mutiella rotundata* from the Cenomanian (Bed 11) of Dunscombe, South Devon, was found and determined by the late C. J. A. Meÿer. An internal cast was collected from Bed 10 of Beer Head by Mr. Jukes-Browne, who also records the species from the Chloritic Marl of Maiden Bradley,

[1] *Fimbria coarctata*, Zittel, 'Die Biv. d. Gosaugeb.,' pt. i (1864), p. 44, pl. vii, fig. 5. Referred by Stoliczka, and subsequently by Zittel and by G. Müller, to the genus *Mutiella*. Compare also the hinge of *Mutiella rotundata* figured by Guéranger, 'Album Paléont. de la Sarthe' (1867), pl. xix, fig. 11.

and the Chalk Marl of Chard. The specimens seen are not sufficiently perfect for figuring.

M. rotundata is the type of the genus *Mutiella*. In France this species is found in the Cenomanian of Le Mans, Sarthe, Rouen, etc.[1]

Family—UNICARDIIDÆ, *Fischer*.

Genus—UNICARDIUM, *A. d'Orbigny*, 1849.

('Prodr. de Pal.,' vol. i, p. 218.)

UNICARDIUM CLAXBIENSE, sp. nov. Plate XXV, figs. 7 *a*, *b*.

Description.—Shell large, oval, inflated, with somewhat flattened sides, very inequilateral; anterior part much longer than posterior part. Anterior margin well rounded, passing gradually into the antero-dorsal margin, and into the ventral margin, which is only slightly curved. Posterior margin truncated. Umbones broad, curved inward and slightly forward. In front of the umbones the shell is depressed.

Ornamentation consists of narrow, sharp, prominent, somewhat irregular concentric ribs separated by relatively broad, concave interspaces.

Measurements:

	(1)	(2)
Length	52	40 mm.
Height	45	34 „

(1, 2) Benniworth Haven.

Affinities.—In this species the umbones are not so high and the posterior part of the shell is longer than in *U. heteroclitum* (d'Orbigny)[2]; also the ribs appear to be narrow and sharper.

Type.—In the Sedgwick Museum, Cambridge.

Distribution.—Claxby Ironstone (zone of *Belemnites lateralis*) of Benniworth Haven, Lincolnshire.

[1] *Corbis? Morisoni*, Woods, from the Chalk Rock of Cuckhamsley, is at present known by two imperfect valves only. The hinge cannot be seen, and the generic position of the species is still uncertain. See Woods, 'Quart. Journ. Geol. Soc.,' vol. liii, p. 392, pl. xxviii, figs. 13, 14.

[2] In Murchison, de Verneuil and de Keyserling, 'Géol. Russie de l'Europe,' vol. ii (1845), p. 460, pl. xxxix, figs. 9, 10. D'Orbigny, 'Prodr. de Pal.,' vol. i (1849), p. 367. Eichwald, 'Lethæa Rossica,' vol. ii (1868), p. 647. Two examples of *U. heteroclitum* from the Lower Volgian, near Moscow, are in Mr. Lamplugh's collection.

UNICARDIUM VECTENSE, sp. nov. Plate. XXV, figs. 8—11.

Description.—Shell thin, much inflated, oval or slightly subquadrate, inequilateral, the anterior part rather larger than the posterior part; length a little greater than height. Antero-dorsal margin short, nearly straight. Anterior margin rounded, making an obtuse angle with the antero-dorsal margin, and curving rapidly to join the moderately convex ventral margin. Posterior margin rounded, slightly truncated. Postero-dorsal margin slightly convex. Umbones prominent, contiguous, curving inward and forward. Ornamentation consists of numerous, strong, somewhat irregular, concentric ribs. Ligament in a long, narrow groove. Teeth absent or poorly developed.

Measurements:

	(1)	(2)	(3)	(4)	
Length	20	18	16	12	mm.
Height	19	17	15	11·2	,,

(1—4) Crackers, Atherfield.

Affinities.—The shell is relatively higher, the umbones more prominent, and the ribs rather stronger than in *U. Ebrayi*, de Loriol.[1]

Distribution.—Lower Greensand: Crackers of Atherfield, *Perna*-bed of Sandown, and Ferruginous Sands of Shanklin.

UNICARDIUM, sp. Plate XXV, fig. 12.

A specimen of *Unicardium* from the Upper Greensand of South Devon[2] was collected by Sir H. T. De la Beche and is now in the Museum of the Geological Society, No. 1580. It resembles *U. rectense*, but the umbones are not so prominent and the ribs are smaller, more numerous, and more regular.

UNICARDIUM ? GAULTINUM (*Pictet and Roux*), 1852.

1852. CORBIS GAULTINA, *F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, p. 448, pl. xxxiv, fig. 4.

1866. FIMBRIA — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 282, pl. cxxii, figs. 3, 4.

1871. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 252.

1875. CORBIS — *A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. xxxi, p. 300, pl. xv, fig. 9.

[1] 'Gault de Cosne' (1882), p. 70, pl. viii, figs. 13–16.

[2] Probably from near Sidmouth or Blackdown.

Two internal casts from the Cambridge Greensand (derived from the Gault) were identified by Mr. Jukes-Browne as *Corbis gaultina*, Pictet and Roux. The specimens are in the Sedgwick Museum, and no other examples appear to have been found. The type of *C. gaultina* came from the Gault of Saxonet. In external form this species agrees closely with *Unicardium*, but the hinge is unknown, so that the generic position cannot be determined with certainty.

UNICARDIUM RINGMERIENSE (*Mantell*), 1822. Plate XXV, figs. 13, 14.

1822.	VENUS? RINGMERIENSIS,		*G. Mantell.*	Foss. S. Downs, p. 126, pl. xxv, fig. 5.
1850.	PANOPÆA	—	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 157.
1854.	UNICARDIUM RINGMERIENSE,		*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 229.
1865.	CARDIUM	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 195.
Non 1850.	ARCA RINGMERENSIS,		*H. B. Geinitz.*	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 162.
— 1872.	MUTIELLA RINGMERENSIS,		*H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 61, pl. xvi, figs. 11–13.
1877.	—	—	*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. II Weissenberg. u. Malnitz. Schicht., p. 115, fig. 75.
— 1883.	—	—	*Fritsch.*	Ibid. III Iserschicht., p. 100, fig. 64.
— 1889.	—	—	*Fritsch.*	Ibid. IV Teplitz. Schicht., p. 78.
— 1897.	—	—	*Fritsch.*	Ibid. VI Chlomek. Schicht., p. 54, fig. 59.

Description.—Shell subquadrate, rounded, inflated, antero-dorsal part compressed, length rather greater than height, inequilateral, anterior part larger than the posterior part. Antero-dorsal margin nearly straight. Anterior margin moderately convex, making an obtuse angle with the antero-dorsal margin and curving rapidly near the ventral margin. The latter is moderately convex and curves upward to join the posterior margin, which is slightly curved, and forms an obtuse angle with the postero-dorsal margin. Umbones large, prominent, contiguous, curving forward. Ornamentation consists of strong, narrow, concentric ridges.

Measurements :

	(1)	(2)
Length	42	36 mm.
Height	38	34 ,,

(1) Chalk Marl, Titherleigh.
(2) Chalk Marl, Chardstock.

Remarks.—The specimens from the Pläner-kalk of Strehlen which were referred to this species by Geinitz appear to be related to *Mutiella coarctata* (Zittel).[1]

Type.—The type came from the Chalk Marl of Middleham, but cannot now be found.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Devizes. Base of Chalk Marl of Titherleigh and Chardstock. Chalk Marl of Middleham and Ringmer.

[Systematic position not determined.]

Genus—THETIRONIA, *F. Stoliczka*, 1870.

('Palæont. Indica, Cret. Fauna S. India,' vol. iii, p. 158. *Thetis*, J. de C. Sowerby, 'Min. Conch.,' vol. vi, 1826, p. 19. Non *Thetis*, Oken, 1815. Syn. *Fimbriella*, Stoliczka, op. cit., p. 246.)

The genus *Thetironia* [*Thetis*] has been placed in the family Veneridæ by Deshayes, d'Orbigny, Chenu, Stoliczka, Zittel, Fischer, Dall, and other authors, on account of the presence of the acutely angular line which has often been regarded as a pallial sinus. This angular line appears as a deep groove on internal casts, and must consequently have been a prominent rib on the interior of the shell. In its position and rib-like form it is quite unlike the pallial sinus of any lamellibranch,[2] and it seems to be a structure of an entirely different nature, probably serving, as was suggested by S. P. Woodward[3] merely to strengthen the thin shell. *Thetironia* is further distinguished from the Veneridæ by its hinge, which is of quite a different type (see Plate XXVI, figs. 10*b*, 14). Stoliczka, in referring this genus to the Veneridæ and sub-family Dosiniinæ, says: "There can be little doubt that all the external characters indicate a close appproach to the recent *Clementia*"; the hinge, however, which seems to have been unknown to Stoliczka, shows that this view of the relationship of *Thetironia* cannot be maintained.

A concentric ridge seen near the ventral margin on some internal casts of *Thetironia* has been regarded by some authors as evidence of a simple pallial line; but the presence in some specimens of several similar ridges at different distances from the margin suggests that they are really of the nature of growth-rings (see Plate XXVI, fig. 6).

Thetironia was identified with *Poromya* by S. P. Woodward (1854) and by H.

[1] G. Müller, 'Mollusk. Untersen. v. Braunschweig u. Ilsede' (1898), p. 60.

[2] De Loriol compared it with *Lucinopsis*, but the differences between the pallial sinus of that genus and the angular rib of *Thetironia* are considerable.

[3] 'Manual of the Mollusca,' ed. 1 (1854), p. 319; ed. 3 (1875), p. 491. Woodward says, "umbones strengthened inside by a posterior lamina."

and A. Adams (1858). Deshayes (1858), and Pictet and Campiche (1865), though considering them allied forms, did not regard them as generically identical. The latter authors had little confidence in the suggested relationship of *Thetironia* to *Venus*, but in the absence of specimens furnishing decisive evidence they left the former genus in the family Veneridæ. In its external form and thin shell *Thetironia* shows some resemblance to *Poromya*, but the conspicuous internal ligament found in the latter is absent in the former.

In a systematic list of Mollusca, J. E. Gray [1] placed *Thetironia* in the Lucinidæ, but gave no reasons for assigning it to that family. Although elongate markings do occur in the interior of some species of *Lucina*, they show but little resemblance to the angular rib of *Thetironia*. Further, the hinge is unlike that typical of *Lucina*; for although in some few species (*e. g. L. gibba*, *L. pennsylvanica*) in which the umbones have a considerable anterior curvature, the positions of the cardinal teeth become somewhat similar to those in *Thetironia*, yet this is clearly a secondary character due to torsion and cannot be taken as evidence of any affinity between *Lucina* and *Thetironia*.

The hinge in some of the Corbidæ, such as *Sphæriola*, *Gonodon*, and *Mutiella* resembles that of *Thetironia*, but is far stouter, and the shell is much thicker. The hinge in *Unicardium* also is somewhat similar to that of *Thetironia*, since lateral teeth are absent, but the cardinals are less developed. *Unicardium*, however, differs from *Thetironia* in the character of its ornamentation and in the form of the shell.

In both form and position the teeth of *Thetironia* show a striking resemblance to the cardinal teeth of the Cardiidæ (especially to *Protocardia*), and the hinge-margin in front of the umbo expands in a similar way; some further resemblance is seen in the position and prominence of the external ligament, and in the general form of the shell, which is similar to that of the nearly smooth *Cardium* (*Serripes*) *grænlandicum*, Chemnitz.[2] The greater development of ornamentation on the posterior part than on the remainder of the shell in *Thetironia* is also suggestive of some forms of *Protocardia*. The position of the cardinal teeth in the Cardiidæ is practically constant and is a character of systematic importance; so that the close resemblance between these teeth in *Thetironia* and in the Cardiidæ seems to indicate a real relationship. Opposed to this, however, is the absence of lateral teeth [3] in *Thetironia*; but although these teeth are usually found in the Cardiidæ,

[1] 'Synopsis Brit. Mus.,' ed. 44 (1842), p. 91.

[2] Although d'Orbigny placed *Thetironia* in the Veneridæ, he recognised that in some respects it clearly resembles *Cardium*. See 'Pal. Franç. Terr. Crét.,' vol. iii (1846), p. 451.

[3] In the 'Additions and Corrections' to his Monograph Stoliczka states that in *Thetironia ignobilis* there are two cardinals and a minute posterior lateral in the right valve, and three cardinals in the left valve. 'Palæont. Indica, Cret. Fauna S. Indica' (1871), p. 485.

yet they are occasionally absent. Other differences are seen in the very thin and punctate shell, and in the internal rib.

Nothing closely resembling the internal rib of *Thetironia* seems to be known in any other lamellibranch. But in some Jurassic and Cretaceous[1] species of *Protocardia* a rib, either single or Λ-shaped, is found at the inner boundary of the posterior area; this, however, differs from the rib of *Thetironia*, in that it reaches the margin of the valve and is not continued anteriorly to the neighbourhood of the anterior adductor.

It seems, therefore, that although *Thetironia* resembles the Cardiidæ in several respects, yet the points of difference are too great to allow of its being included in that family.

THETIRONIA MINOR (*Sowerby*), 1826. Plate XXV, figs. 15*a*—*c*; Plate XXVI, figs. 1—8.

1822. VENUS, *G. Mantell*. Foss. S. Downs, p. 73.
1826. THETIS MINOR, *J. de C. Sowerby*. Min. Conch., vol. vi, p. 21, pl. dxiii, figs. 6 (? 5).
1829. — — *M. J. L. Defrance*. Dict. Sci. Nat., vol. liv, p. 275.
1841. — SOWERBII, *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb. p. 72 (*partim*).
1845. — — var. *α minor*, var. *β. major*. *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 242.
1846. — LÆVIGATA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 452, pl. cccIxxxvii, figs. 1—3.
1832-53. — MINOR, *G. P. Deshayes*. Traité Élément. Conchyl., vol. i, p. 575, pl. xxii, figs. 3, 4.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 227.
— — — *S. P. Woodward*. Manual of the Mollusca, fig. 221 (on p. 318).
1865. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 202, pl. cxii, fig. 4.
1870. LÆVIGATA, *Pictet and Campiche*. Ibid., p. 203, pl. cxii, figs. 2, 3.
— THETIRONIA MINOR, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 158.
1884. THETIS MINOR, *O. Weerth*. Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 41, pl. ix, figs. 5, 6.
1898. — LÆVIGATA, *E. G. Skeat and V. Madsen*. Jur. Neoc. and Gault Boulders in Denmark, p. 176, pl. vi, figs. 7—9.

[1] Part of this rib is seen in a figure given by Pictet and Campiche, 'Terr. Crét. Ste. Croix' ("Matér. Pal. Suisse," ser. 4, 1866), pl. cxxi, fig. 7*a*.

1895. THETIS MINOR, *F. Vogel.* Holländisch. Kreide, p. 58.
1900 — — *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms, p. 118.

Non 1846. — — *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 453, pl. cccIxxxvii, figs. 4—7.
— 1850. — — *d'Orbigny.* Prodr. de Pal., vol. ii, p. 136.
— 1868. — — *E. v. Eichwald.* Lethæa Rossica, vol. ii, p. 707, pl. xxvi, fig. 6.

Description.—Shell oval, rounded, convex, slightly (sometimes moderately) inequilateral; length rather greater than height. Margins forming nearly regular curves; anterior margin less convex than the posterior, making a rounded angle where it meets the nearly straight antero-dorsal margin. Umbones prominent, rather broad, close together, more or less curved forward. Lunular region depressed, not limited. Postero-dorsal region sometimes slightly compressed.

Ornamentation consists of slightly-raised concentric lines at regular intervals with less distinct lines between; and of regular rows of radial pits, which on the posterior part of the shell are replaced by rows of short spiny projections or minute tubercles.

A long, acutely angular rib extends from the level of the posterior adductor to near the umbo. The front part of this rib is continued to near the anterior adductor, but is less prominent than the angular part; at first it curves ventrally, and afterwards dorsally, the last part being somewhat angular.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Length	31	30	27	26·5	25	23	30	26	20	17·5	17	mm.
Height	28·5	29	25	25	24	21·5	27	23·5	18	16·5	16	„

(1—6) Crackers, Atherfield.
(7—11) Internal casts, Lower Greensand, Shanklin.

Affinities.—Pictet and Campiche separated, but with considerable hesitation, the examples of *Thetironia* found in the Crackers of Atherfield from those found in the Ferruginous Rock of Shanklin. The former they referred to *T. lævigata*, d'Orbigny (*non* Sowerby); whilst the latter are typical of *T. minor*. There is, as stated by those authors, considerable difficulty in comparing specimens from the two localities owing to their different states of preservation. Those from Atherfield have the shell well preserved in nearly all cases, although not uncommonly the original form has been somewhat modified by crushing. The specimens from Shanklin, on the other hand, are nearly always casts, but owing to the hardness of the rock they retain their original form more perfectly.

Pictet and Campiche thought that the Atherfield form was less convex and

more inequilateral than the Shanklin form. After comparing a considerable number of specimens I find that those from Atherfield are, as a rule, slightly less convex; but the more inequilateral character is not constant; specimens of the *same size* are commonly quite as nearly equilateral, but the inequilateral character becomes more marked with age. Since larger forms are more common at Atherfield than at Shanklin, one may at first sight get the impression that there is a real difference in the inequilateral character. I have not seen any specimen from Atherfield so inequilateral as the form figured by Pictet and Campiche appears to be, and I think it is probable that their specimen was somewhat distorted by crushing.

T. genevensis, Pictet and Roux,[1] is distinguished from *T. minor* by the height and length being equal, by its more nearly equilateral form, and by a difference in the curvature of the rib in front of the angular part.

Remarks.—*Thetironia* has been recorded by Phillips and Judd from the Speeton Clay, but I have not seen any examples from that deposit. In some collections from Speeton specimens of *Cyprina* have been identified as *Thetironia*.

Type.—Fig. 6, Lower Greensand of Shanklin; in the British Museum. The original of fig. 5 from near Lyme Regis has not been seen.

Distribution.—Lower Greensand: Crackers of Atherfield; also recorded by Fitton from the *Perna*-bed and Beds vi, viii, ix, x, xiii, and xiv between Atherfield and Blackgang Chine. Ferruginous Sands of Shanklin. Atherfield Beds of East Shalford. Hythe Beds of Hythe. Sandgate Beds of Sandgate, etc. Folkestone Beds of Folkestone.

THETIRONIA LÆVIGATA (*Sowerby*), 1818. Plate XXVI, figs. 9—14.

1818. CORBULA LÆVIGATA, *J. Sowerby*. Min. Conch., vol. iii, p. 14, pl. ccix, figs. 1, 2.
1826. THETIS MAJOR, *J. de C. Sowerby*. Ibid., vol. vi, p. 20, pl. dxiii, figs. 1–4.
1829. — — *M. J. L. Defrance*. Dict. Sci. Nat., vol. liv, p. 276.
1850. UNICARDIUM LÆVIGATUM, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 163.
1854. THETIS LÆVIGATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 227.
— — MAJOR, *Morris*. Ibid., ed. 2, p. 227.
1862. — — *J. G. Chenu*. Manuel de Conchyl., vol. ii, p. 90, fig. 405.
1865. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pp. 209, 210, pl. cxii, fig. 5.

[1] Pictet and Roux, 'Moll. Foss. Grès verts de Genève' (1852), p. 420, pl. xxx, fig. 2. Pictet and Campiche, 'Terr. Crét. de Ste. Croix' (1865), p. 206, pl. cxii, fig. 7. Barrois records *T. genevensis* from the Upper Greensand of Lulworth, but I have not seen any specimens; see Barrois, 'Terr. Crét. Supér. de l'Angleterre,' etc. (1876), p. 90.

? 1868. Thetis major, *A. Briart and F. L. Cornet.* Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 83, pl. vii, figs. 14, 15.

1871. Fimbriella lævigata, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 246.

1882. Thetis major, *P. de Loriol.* Gault de Cosne, p. 61, pl. viii, figs. 6—8.

? 1874. — — *W. Dames.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxvi, p. 766, pl. xxi, fig. 4.

1885. — — *F. Nötling.* Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 29, pl. v, fig. 6.

Non 1845. Sowerbii var. β major, *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 242.

— 1846. — major, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 454, vol. cccIxxxvii, figs. 8—10.

— — — lævigata, *d'Orbigny.* Ibid., vol. iii, p. 452, pl. cccIxxxvii, figs. 1—3.

1850. — — *d'Orbigny.* Prodr. de Pal., vol. ii, p. 118.

— — — major, *d'Orbigny.* Ibid., vol. ii, p. 160.

? — 1852. — Sowerbyi, *R. Kner.* Denkschr. d. k. Akad. Wissensch. Wien, Math.-nat. Cl., vol. iii, p. 311, pl. xvi, fig. 21.

? 1868. — major, *E. v. Eichwald.* Lethæa Rossica, vol. ii, p. 708.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Length	47	42	41	39	30·5	29·5	22·5	22	13	mm.
Height .	43	40	39	37	27	28	21	22	13	„

(1—9) Blackdown.

Affinities.—This species is closely allied to *T. minor*, with which it was united by Römer under the name *T. Sowerbii*, but it possesses relatively higher and narrower umbones than *T. minor*. *T. lævigata* is commonly of larger size than *T. minor*, and as in the case of the latter, the large forms are more inequilateral than the small forms. A rather small example was figured by Sowerby as *Corbula lævigata*, and was taken by Stoliczka as the type of a new genus *Fimbriella*, but it proves to be, as was suggested by Pictet and Campiche, an example of *T. major*.

The hinge can be seen in some specimens from Blackdown (Plate XXVI, figs. 10*b*, 14). It consists of two small conical or tubercular teeth just below the umbo of each valve. In the right valve the teeth are placed one above the other, but the dorsal tooth is slightly in front of the ventral and rather smaller than the latter. In the left valve the teeth are side by side, nearly on the same level, and the anterior tooth is rather larger than the posterior. Lateral teeth are absent. The external ligament is short and prominent.

Types.—The type of *Corbula lævigata*, from Blackdown, and the types of *Thetis major*, from Blackdown and Devizes, are in the British Museum. *T. major* is the type of the genus *Thetis*, Sowerby.

Distribution.—Gault of Black Ven. Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown, Potterne, Devizes, and near Lyme Regis. Recorded by Price from the Gault of Folkestone.

Family—TELLINIDÆ, *Deshayes.*

Genus—TELLINA, *Linnæus.*

('Syst. Nat.,' ed. 10, 1758, p. 674; ed. 12, 1767, p. 1116.)

TELLINA CARTERONI, *d'Orbigny*, 1845. Plate XXVI, figs. 15, 16.

1842.	TELLINA ? vel PSAMMOBIA ? ANGULATA,	*Deshayes* in *A. Leymerie.*	Mem. Soc. géol. de France, vol. v, pp. 3, 24, pl. iii, fig. 6 (non *T. angulata*, L.).
1845.	— ANGULATA ?,	*E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 239.
—	TELLINA CARTERONI,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 420, pl. ccclxxx, figs. 1, 2.
1850.	— —	*d'Orbigny.*	Prodr. de Pal., vol. ii, p. 75.
1861.	— —	*P. de Loriol.*	Anim. Invert. Foss. Mt. Salève, p. 59, pl. vii, fig. 2.
1865.	— —	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 134.
1870.	— —	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 123.
1884.	— —	*O. Weerth.*	Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 41.
1895.	— —	*G. Maas.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 257.
1900.	— —	*A. Wollemann.*	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms, p. 121.

Description.—Shell elongate, much compressed, inequilateral, length equal to more than twice the height. Anterior margin rounded, curving rapidly to join the slightly curved ventral margin. Posterior margin oblique, forming an angle with the ventral margin. A shallow furrow passes from the umbo to the middle of the ventral margin. Umbones small, curved forward. A sharp carina extends in a curve from the umbo to the postero-ventral angle, and cuts off a narrow, flattened, postero-dorsal area. Ornamentation consists of fine radial ribs on the anterior and posterior parts of the valves, especially just in front of the carina; growth-lines distinct.

Measurements :

	(1)	(2)	(3)	(4)	
Length	39·2	39	38	36	mm.
Height	17	16	16·5	15·2	,,

(1—4) Crackers, Atherfield.

Affinities.—The English specimens differ from the figure of *T. Carteroni* given by d'Orbigny in the greater curvature of the carina, the narrower postero-dorsal area, and the greater upward bend of the anterior end of the shell. Professor Boule has kindly examined the specimen figured by d'Orbigny, and states that the carina is more curved and the postero-dorsal area narrower than represented in the figure; also the anterior part has been restored. Professor Boule has also compared a photograph of a specimen from Atherfield with d'Orbigny's specimen and considers that they do not differ specifically. Pictet and Campiche were able to compare English with French specimens, and the principal difference which they noted was the occurrence of fine radial ribs on the posterior part of the shell in English specimens; but I find that those ribs are indistinct or absent in specimens which are not quite perfectly preserved.

The figure of *T. angulata* given by Deshayes appears to differ from *T. Carteroni* in its more elongate form and the greater length of the anterior region, but these differences are probably due to the imperfection of the specimen. Previous writers have not regarded it as distinct from d'Orbigny's *T. Carteroni*.

Stoliczka regarded *T. Carteroni* as a typical *Tellina*. It resembles closely the sub-genus *Phyllodu*, Schumacher.

One specimen from Atherfield (Plate XXVI, fig. 17) differs from the other examples of this species in the occurrence of strong radial ribs on the posterior part of the shell. It may be only a variety of *T. Carteroni*.

Type.—From the Neocomian of Vendeuvre; the original cannot be found. The specimen figured by d'Orbigny came from Marolles.

Distribution.—Lower Greensand (Crackers) of Atherfield. Atherfield Beds of East Shalford.

TELLINA STRIATULOIDES, *Stoliczka*, 1870. Plate XXVI, figs. 18, 19; Plate XXVII, fig. 1.

1824. TELLINA STRIATULA, *J. de C. Sowerby.* Min. Conch., vol. v, p. 79, pl. ccccl vi, fig. 1 (non *T. striatula*, Olivi, Bolten, Lamarck).
1850. — — *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 159.
1854. — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 226.

1865. TELLINA STRIATULA, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 139.

1870. — (TELLINELLA) STRIATULOIDES, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 123.

Description.—Shell elongate-oval, compressed, inequilateral; length equal to about twice the height; the anterior part longer than the posterior part. Anterior margin rounded. Ventral margin slightly curved, making an angle with the posterior margin. Posterior margin oblique, curved near the postero-ventral angle, and forming an obtuse angle with the postero-dorsal margin. Umbones inconspicuous, only slightly curved. A rounded carina extends in a nearly straight line from the umbo to the postero-ventral angle, and cuts off a flattened postero-dorsal area. Ornamentation consists of small radial ribs on the postero-dorsal area and on the part just in front of the carina; also on a small part of the shell near the anterior margin. Fine concentric lines are also present, and are more distinct on the anterior and posterior parts of the shell than elsewhere. Pallial sinus relatively small, somewhat angular.

Measurements :

	(1)	(2)
Length	30	27 mm.
Height	14·5	13·2 ,,

(1—2) Blackdown.

Affinities.—Stoliczka placed this species in the sub-genus *Tellinella*, with which it agrees closely in external form, but the oblique cardinal teeth resemble more closely those of the sub-genus *Palæomæra*.

Type.—From Blackdown; in the British Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown and Haldon. Recorded by Jukes-Browne from the higher part of the zone of *Pecten asper* in North Dorset.

Section—PALÆOMÆRA, *F. Stoliczka*, 1870.

('Palæont. Indica, Cret. Fauna S. India,' vol. iii, p. 116.)

TELLINA (PALÆOMÆRA) INÆQUALIS, *Sowerby*, 1824. Plate XXVII, figs. 2—8.

1824. TELLINA INÆQUALIS, *J. de C. Sowerby.* Min. Conch., vol. v, p. 80, pl. ccccl vi, fig. 2.

1850. ARCOPAGIA — *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 158 (*partim*).

1854. TELLINA — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 226.

? 1868. Tellina inæqualis, *A. Briart and F. L. Cornet.* Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 77, pl. viii, figs. 24, 25.

1870. Arcopagia — (Linearia), *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 124.

Non 1845. Tellina — ?, *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 239.

Description.—Shell oval, moderately inequilateral; length rather more than 1½ times the height; left valve less convex than the right. Anterior part of valves rounded. Posterior margin convex, subtruncate, more or less oblique, forming a blunt angle with the ventral margin. A slight carina extends from the umbo to the postero-ventral angle and cuts off a flattened postero-dorsal area. Umbones moderately prominent. Pallial sinus large, rounded. Postero-dorsal area ornamented with small radial ribs; the remainder of the shell smooth except for growth-lines.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	29	28	27	26	23·5	18	mm.
Height	18·5	18	17	16·5	14·5	11	,,
Thickness	9	7·5	8	7·25	6·5	—	,,

(1—6) Blackdown.

Affinities.—*T. striata* Goldfuss,[1] from the Aachen Greensand, is similar in form to *T. inæqualis*, but possesses fine radial ornamentation over the entire surface of the shell. *T. Royana*, d'Orbigny,[2] is also similar in form, but appears to be more nearly equilateral and without radial ribs.

A species of *Tellina* found in the Meule de Bracquegnies was referred to *T. inæqualis* by Briart and Cornet, but it appears to differ in some respects from the latter. The specimens which I have seen from Bracquegnies are not sufficiently well preserved to enable me to express a definite opinion as to their relationship to *T. inæqualis*.

Type.—From the Upper Greensand of Blackdown; in the British Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown and Haldon. Recorded by Jukes-Browne from the Upper Greensand of Devizes and the Isle of Wight.

[1] 'Petref. Germ.,' vol. ii (1840), p. 234, pl. cxlvii, fig. 18. Holzapfel, 'Die Mollusk. Aachen. Kreide' (Palæontographica, vol. xxxv, 1889), p. 159, pl. xi, figs. 6–10. This species is the type of the sub-genus or section *Palæmæra*, Stoliczka, 1870.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 422, pl. cccIxxx, figs. 9–11.

Sub-genus—LINEARIA, *T. A. Conrad*, 1860.

('Journ. Acad. Nat. Sci. Philad.,' ser. 2, vol. iv, p. 279, and 'Amer. Journ. Conch.,' vol. vi [1870], p. 73.)

TELLINA (LINEARIA), sp. Plate XXVII, fig. 9.

Description.—Shell oval, moderately convex with flattened sides, nearly equilateral. Anterior margin rounded. Ventral margin slightly convex. Posterior margin slightly truncated, rounded. Umbones inconspicuous. Postero-dorsal region slightly compressed, but not limited by a carina.

Ornamentation consists of numerous, strong, regular, concentric ribs separated by narrow grooves; and a few small radial ribs on the anterior and posterior parts, those on the latter sometimes not reaching the margin. Length 16·5 mm.; height 10·5 mm.

Affinities.—This species, of which only a few examples have been seen, is closely allied to, if not identical with, *T. Raulliniana* (d'Orbigny),[1] but the posterior ribs are less prominent. The shell is less elongate than is d'Orbigny's type, but scarcely differs in this respect from the example figured by Pictet and Campiche. It is more elongate and has the postero-dorsal region less flattened than in *T. subconcentrica* (d'Orbigny).[2] *T. subhercynica*, Maas, is another similar form.

Distribution.—Lower Greensand (Crackers) of Atherfield. Atherfield Beds of East Shalford.[3]

TELLINA (LINEARIA) SUBTENUISTRIATA, *d'Orbigny*, 1850. Plate XXVII, figs. 10—13.

1836. AMPHIDESMA? TENUISTRIATUM, *J. de C. Sowerby.* Trans. Geol. Soc., ser. 2, vol. iv, pp. 239, 341, pl. xvi, fig. 7.

1850. TELLINA SUBTENUISTRIATA, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 159 (non *T. tenuistriata*, Deshayes, 1824).

1854. AMPHIDESMA? TENUISTRIATUM, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 183.

[1] For references see p. 176, footnotes 1 and 2.

[2] Some specimens from the Folkestone Beds of Folkestone agree in form with *T. subconcentrica*, but owing to the imperfect preservation of the surface the character of the ornamentation cannot be made out satisfactorily.

[3] It is possible that *Tellina æqualis*, Mantell (*nom. nud.*), from the Lower Greensand of Parham, may be the form described above. Mantell, 'Trans. Geol. Soc.,' ser. 2, vol. iii (1829), p. 211.

1865. TELLINA SUBTENUISTRIATA, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pp. 132, 138.

1870. AMPHIDESMA TENUISTRIATUM, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 111 (? *Thracia* or *Tellina*).

Description.—Shell oval, of moderate convexity, nearly equilateral. Anterior margin rounded; ventral margin moderately convex; posterior margin truncated, more or less oblique, forming a blunt angle with the ventral margin, and an obtuse angle with the postero-dorsal margin. Umbones rather broad, scarcely curved. Postero-dorsal part of shell compressed and flattened.

Ornamentation consists of numerous strong, regular, concentric ribs, and of a few small radial ribs on the anterior part, and of a larger number on the postero-dorsal region and the part just in front of it.

Measurements:

	(1)	(2)	(3)	(4)	
Length	19	18	17	13	mm.
Height	13·5	13	11·5	9	,,

(1—4) Blackdown.

Affinities.—This species resembles *Tellina Raulliniana* (d'Orbigny),[1] but possesses a relatively shorter and higher shell, with a more convex ventral margin and more numerous radial ribs. In form it approaches more nearly the examples from the Gault of the Perte du Rhône figured by Pictet and Campiche,[2] but in the latter the posterior extremity is more angular and the posterior ribs more prominent and limited to the postero-dorsal region.

T. subtenuistriata also resembles *T. subconcentrica* (d'Orbigny),[3] but is more nearly equilateral and the ventral border is more convex.

It differs from the species from the Lower Greensand described above in the flattened postero-dorsal region, the more angular posterior extremity, the smaller apical angle, the larger curvature of the ventral margin, and greater relative height. *T. subhercynica*, Maas,[4] is another similar form.

Remarks.—The type is somewhat imperfectly preserved, but the radial ribs on the anterior and posterior parts, which are not shown in Sowerby's figure, can be made out satisfactorily. The size of the apical angle and the outline of the shell vary in different examples.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 411, pl. cccIxxviii, figs. 7–10.

[2] Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1865), p. 141, pl. cix, figs. 1–3.

[3] Op. cit., p. 410, pl. cccIxxviii, figs. 1–6, and 'Prodr. de Pal.,' vol. iii (1850), p. 75. Pictet and Renevier, 'Foss. Terr. Aptien' (Matér. Pal. Suisse, ser. 1, 1856), p. 69, pl. vii, fig. 7.

[4] 'Zeitschr. der deutsch. geol. Gesellsch.,' vol. xlvii (1895), p. 258, pl. vi, figs. 3, 4.

Type.—From Blackdown; in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown.

TELLINA (LINEARIA) sp. Plate XXVII, figs. 14—16.

Description.—Shell oval, moderately convex, with flattened sides, nearly equilateral. Anterior and posterior margins rounded. Ventral margin only slightly curved, and nearly parallel with the dorsal margin. Umbones broad, nearly median. Postero-dorsal part of valve flattened, rather large, limited by a faint carina.

Ornamentation consists of numerous small, regular, concentric ribs, and numerous small radial ribs on the postero-dorsal area and near the anterior end.

Measurements:

	(1)	(2)	(3)	
Length	17	15	14	mm.
Height	12	10	9·5	,,

(1—3) Blackdown.

Affinities.—This species resembles *T. Rauliniana* (d'Orbigny), but the radial ribs are much more numerous. It is also similar to the form from the Lower Greensand described above, and to *T. subhercynica*, Maas.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown.

Family—MACTRIDÆ, *Gray.*

Genus—MACTRA, *Linnæus*, 1767.

('Syst. Nat.,' ed. 12, vol. i, p. 1125.)

MACTRA, sp. Plate XXVII, figs. 17, 18.

A few specimens which resemble *Mactra* externally, but of which the hinge has not been seen, were found in the Lower Greensand (Ferruginous Sands) of Shanklin by the late C. J. A. Meÿer. They are rather larger and relatively higher than *M. angulata*, and the carina is less distinct. The surface of the shell is ornamented with small concentric ribs.

MACTRA ANGULATA, *Sowerby*, 1836. Plate XXVII, figs. 19—23.

1836. MACTRA ? ANGULATA, *J. de C. Sowerby.* Trans. Geol. Soc., ser. 2, vol. iv. pp. 241, 341, pl. xvi. fig. 9.

1850. MACTRA ANGULATA, *A. d'Orbigny.* Prodr. de Pal., vol. ii. p. 158.

1854.	Mactra angulata,	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 209.
1865.	—	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Mater. Pal. Suisse, ser. 4), p. 129.
1870.	—	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, pp. 55, 56.
Non 1851.	—	—	*J. Müller.*	Petref. der Aachen. Kreidef., pt. 2, p. 66 (= *M. Bosquetiana*, Stoliczka).
— 1901.	—	—	*F. Sturm.*	Jahrb. d. k. preuss. geol. Landesanst. für. 1900, vol. xxi, p. 84, pl. viii, fig. 1.

Description.—Shell small, convex, subtriangular, slightly inequilateral, with the antero- and postero-dorsal parts bending rapidly to the margins. Antero-dorsal margin long. Anterior margin rounded. Ventral margin convex, forming an angle with the posterior margin, which is truncated, oblique, and slightly convex. Umbones prominent, pointed, curved inwards, with a carina which extends in a gentle curve to the postero-ventral angle. Ornamentation consists of fine concentric ribs, which become fewer and stronger near the antero-dorsal and postero-dorsal margin.

Measurements:

	(1)	(2)	(3)	(4)
Length	14	13	10	8 mm.
Height	12	10·5	8	7 „

(1—4) Blackdown.

Affinities.—In form and ornamentation *M. angulata* resembles *M. Warrenana*, Meek and Hayden,[1] but the latter is of larger size and the umbones show a distinct anterior curvature.

A species found in the Aachen Greensand, now known as *M. Bosquetiana*, Stoliczka, was identified with *M. angulata* by Müller, but is distinguished from the latter, as Stoliczka pointed out, by its greater length, smaller convexity, rounded posterior margin, and other characters.

Type.—From Blackdown; in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown and Haldon. Recorded by Barrois from the Upper Greensand of Lulworth and by Jukes-Browne from the equivalent of the Blackdown Beds at Sidmouth.

[1] Meek, 'Invert. Cret. and Tert. Foss. U. Missouri' (1876), p. 208, pl. xxx, fig. 7. Whiteaves, 'Mesozoic Foss.' (Geol. Surv. Canada), vol. i (1879), p. 142, pl. xvii, fig. 9, pl. xix, fig. 3.

Family—VENERIDÆ, *Leach*.

Genus—Ptychomya, *L. Agassiz*, 1842.

('Études crit. Moll. Foss.'; Myes, p. xviii, pl. xi, figs. 3, 4.)

Ptychomya Robinaldina (*d'Orbigny*), 1844. Plate XXVII, figs. 24—26.

1842–45.	Ptychomya plana,	*L. Agassiz.*	Etudes crit. Moll. Foss.; Myes, p. xviii (1845), pl. xi, figs. 3, 4 (1842).
1844.	Crassatella robinaldina,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 75, pl. cclxiv, figs. 10—13.
1845.	—	*E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 241.
1850.	—	*d'Orbigny.*	Prodr. de Pal., vol. ii, p. 77.
1854.	—	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 196.
1855.	—	*G. Cotteau.*	Moll. Foss. de l'Yonne, p. 71.
1866.	Ptychomya	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 352, pl. cxxvii, figs. 2—6.
1869.	Radioconcha	*T. A. Conrad.*	Amer. Journ. Conch., vol. v, p. 47.

Description.—Shell oval-oblong, elongate, convex, but with flattened sides, very inequilateral, anterior part rather higher than the posterior part. Anterior margin regularly rounded. Ventral margin only slightly curved, nearly parallel to the dorsal margin. Posterior margin oblique, forming an acute angle with the ventral margin and an obtuse angle with the slightly curved postero-dorsal margin. Umbones inconspicuous. On the postero-dorsal side of a line from the umbone to the posterior extremity the shell is flattened. Lunule narrow, elongate.

Ornamentation consists of strong radial ribs, which are sometimes more or less nodose. Those on the posterior part of the shell are stronger and separated by broader furrows than those on the anterior part. The ribs which reach the posterior margin start from the umbo; the others start from a line between the umbo and a point on the opposite margin which is about a quarter of the distance from the anterior to the posterior end. In front of this line the ribs form a considerable curve; behind it they are only slightly curved; the ribs meet at an acute angle at the line mentioned forming either a Λ throughout or a chevron Μ, on the ventral part. The postero-dorsal margin is ornamented with strong nodose ridges.

Measurements:

	(1)	(2)	(3)
Length	80	70	69 mm.
Height	44	39	36 ,,

(1—3), *Perna*-bed, Atherfield.

Affinities.—Forbes states that English examples of this species were identified by comparison with French specimens. I have not seen any foreign examples of *P. Robinaldina*, but the English specimens appear to differ from those figured by d'Orbigny and by Pictet and Campiche in their greater convexity and larger size, in the more acute angle which the ribs make at the dorso-ventral line, and in the somewhat less anterior position of that line. In all these respects the English examples approach more nearly to *P. neocomiensis* (de Loriol),[1] but differ from that species in their more elongate form. It seems, however, not unlikely that a large number of specimens might show that *P. Robinaldina* and *P. neocomiensis* are not specifically distinct. In connection with this, attention may be called to *Nucula* (*Acila*) *bivirgata*, Sowerby, in which the ornamentation is somewhat similar and shows considerable variation.

The genus *Ptychomya* was placed in the Crassatellitidæ by Pictet and Campiche and by Stoliczka. Its resemblance to *Circe* (*Crista*) was pointed out and fully discussed by Dames,[2] whose view of its systematic position is accepted by Fischer.

Remarks.—The date of the plate on which Agassiz figured *Ptychomya plana* is earlier, but the text relating to it is later than d'Orbigny's figure and description of *Crassatella Robinaldina*. Since the specimen figured by Agassiz is rather unsatisfactory and d'Orbigny's name has been used by nearly all writers it seems desirable to retain the latter.

Distribution.—Lower Greensand (*Perna*-bed) of Atherfield. Ferruginous Sands of Shanklin. Hythe Beds of Hythe, Lympne, and Maidstone.

[1] Pictet and Campiche, "Terr. Crét. Ste. Croix" ('Matér. Pal. Suisse,' ser. 4, 1866), p. 355, pl. cxxvii, figs. 9—12.

[2] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xxv (1873), p. 374, pl. xii, figs. 1—4.

Palæontographical Society, 1908.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. II. PART V.

VENERIDÆ, CARDIIDÆ, DICERATIDÆ, MONOPLEURIDÆ, AND CORBULIDÆ.

PAGES 181—216; PLATES XXVIII—XXXIV.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY

1908.

Genus—Dosiniopsis, *T. A. Conrad*, 1864.

('Proc. Acad. Nat. Sci. Philadelphia,' p. 213.)

Dosiniopsis subrotunda (*Sowerby*), 1836. Plate XXVIII, figs. 1–6.

1836.	Cytherea subrotunda,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 240, 341, pl. xvii, fig. 2.
1850.	Venus	— *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 159.
1854.	Cytherea	— *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 201.
1870.	Venus	— *F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 161 (*Cargatis*).

Description.—Shell rather thick, rounded, oval or somewhat orbicular, of small or moderate convexity; length rather greater than height; moderately, sometimes considerably, inequilateral. Antero-dorsal margin long, concave. Anterior margin rounded, passing gradually into the considerably curved ventral margin. Postero-dorsal margin very long, convex, with a considerable ventral slope. Posterior margin rounded. Umbones small, pointed, close together, slightly curved anteriorly. Lunule elongate, depressed, distinctly limited. Escutcheon narrow, depressed, with a sharp border. Pallial sinus rather large, sub-angular. Ornamentation consists of fine concentric striæ, and growth-lines.

Hinge: In the right valve three strong, nearly straight, diverging cardinal teeth, of which the anterior and median are closer together and diverge at a smaller angle than the median and posterior, the last being divided by a shallow longitudinal groove; there is a small posterior lateral tooth and an elongate anterior pit. In the left valve the anterior of the three diverging cardinal teeth is nearly vertical, the median is the stoutest, and the posterior is oblique and slender; the anterior lateral tooth is elongate and parallel to the lunular margin; the posterior lateral is very small.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	34	31	29	28	26	mm.
Height	32	28	26·5	26	23·5	,,

(1–5) Blackdown.

Type.—From Blackdown; in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schloenbachia rostrata*) of Blackdown.

DOSINIOPSIS CAPERATA (*Sowerby*), 1826. Plate XXVIII, figs. 7–10.

1826.	VENUS CAPERATA,	*J. de C. Sowerby.*	Min. Conch., vol. vi, p. 31, pl. dxviii, figs. 1–3.
1850.	—	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 159.
1854.	CYTHEREA —	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 200.
1865.	VENUS CAPERATA,	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 189.
1868.	—	*A. Briart and F. L. Cornet.*	Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 74, pl. vii, figs. 6–8.
1870.	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 160 (*Caryatis*).
? Non 1845.	—	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 445, pl. cccIxxxv, figs. 9, 10 (*V. uniformis*, Prodr. de Pal., vol. ii, p. 236).

Description.—Shell oval, convex, moderately or considerably inequilateral; length rather greater than height. Antero-dorsal margin concave. Anterior margin rounded, passing gradually into the convex ventral margin. Posterior less convex than the anterior margin, sometimes subtruncate. Postero-dorsal margin long, slightly convex. Umbones prominent, curved anteriorly. Lunule ovate. Pallial sinus rather large, sub-angular. Ornamentation consists of strong, regular, concentric ribs.

Hinge: In the right valve three stout cardinals separated dorsally, the anterior and median being close together and nearly vertical, the posterior oblique and divided by a longitudinal groove; there is an anterior elongate pit and a strong posterior lateral tooth. In the left valve the median is the stoutest of the three cardinals and is sometimes joined dorsally to the nearly vertical anterior cardinal; the posterior cardinal is slender and very oblique; the anterior lateral is strong, elongate and parallel to the lunular margin.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length	34	31	30	28	26	25	21	15	mm.
Height	30·5	29	26	24·5	22	23	18·5	14	,,

(1–8) Blackdown.

Remarks.—Internal casts from the Folkestone Beds of Pulborough were referred to this species by Forbes. I have not seen any specimens which would enable me to record the occurrence of *D. caperata* in the Lower Greensand.

Type.—From Blackdown; in the British Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown and Haldon. Recorded by Barrois from the Upper Greensand of Lulworth, and by Jukes-Browne from the Upper Greensand of the Isle of Wight.

Genus—Cyprimeria, *T. A. Conrad*, 1864.

('Proc. Acad. Nat. Sci. Philad.,' 1864, p. 212, and 'Amer. Journ. Conch.,' vol. ii, 1866, p. 102. Stoliczka, 'Palæont. Indica, Cret. Fauna S. India,' 1870, p. 157.)[1]

Sub-genus—Cyclorisma, *W. H. Dall*, 1903.

('Proc. U.S. Nat. Mus.,' vol. xxvi, 1903, p. 357. Syn. *Cyclothyris*, T. A. Conrad in W. C. Kerr's 'Geol. Rep. N. Carolina,' vol. i, Appendix 1 (1875), p. 8. Non *Cyclothyris*, M'Coy, 1844.)

Cyprimeria (Cyclorisma) vectensis (*Forbes*), 1845. Plate XXVIII, figs. 11—18.

1845.	Venus vectensis,	*E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 240, pl. ii, fig. 4.
1850.	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 118.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 231.
1865.	—	—	*F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 188.
1870.		—	*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 160.
? 1883.	—	-	*W. Keeping.* Foss., etc. Neoc. Upware and Brickhill, p. 125.

Description.—Shell oval, or nearly orbicular, a little longer than high, regularly convex, slightly or moderately inequilateral. Margin rounded. Umbones small, pointed, somewhat curved forwards. Lunule indistinct, not impressed, limited by a faint line. Pallial sinus angular, directed upwards. Margins of valves smooth. Surface of shell smooth except for small, inconspicuous, concentric ridges, and occasional growth-rings.

Hinge: In the right valve an anterior and a median cardinal and two posterior laminar teeth (which together represent the posterior cardinal) diverge from under the umbo; the anterior is directed forwards, the median is nearly vertical,

[1] The following European species are referred by Conrad and by Stoliczka to the genus *Cyprimeria*: *Cyclina primæva*, Zitt., *Dosinia cretacea*, Zitt., *Circe discus* (Math.), *Circe concentrica*, Zitt., and *Arcopagia rotundata*, d'Orb. Holzapfel figures *Cyprimeria Geinitzi* (Müll.) and *C. menda*, Holz., from the Aachen Greensand.

and the two posterior slope obliquely backwards. In the left valve a long, oblique laminar, posterior cardinal; a median cardinal (which is divided); and an anterior cardinal, diverge under the umbo, from which they are separated by a narrow space or channel. In front of the anterior cardinal the anterior part of the hinge-plate is concave.

Measurements :

	(1)	(2)	(3)	(4)	(5)	
Length	38	32	31	28	24	mm.
Height	34	29·5	29	26	22·5	,,

(1—5) Crackers, Atherfield.

Affinities.—This species shows some resemblance to *Venus rendoperana* (Leymerie), especially to the example figured by Pictet and Renevier,[1] but the umbones are less prominent and the lunule is less distinct.

Type.—The type came from the Crackers of Atherfield, but cannot now be found.

Distribution.—Lower Greensand (Crackers) of Atherfield. Recorded from the Atherfield Clay and Bed vii of Atherfield by Fitton. Recorded by Topley from the Atherfield Beds of Peasmarsh and Shalford.[2]

CYPRIMERIA (CYCLORISMA) PARVA (*Sowerby*), 1826. Plate XXVIII, figs. 19—23; Plate XXIX, figs. 1—3.

1826. VENUS PARVA, *J. de C. Sowerby.* Min. Conch., vol. vi, p. 32, pl. dxviii, figs. 4—6.

1845. LUCINA ? SOLIDULA, *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 239, pl. ii, fig. 7.

1850. VENUS PARVA, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 159 (not Blackdown).

— LUCINA SOLIDULA, *d'Orbigny.* Ibid., vol. ii, p. 118.

1854. CYTHEREA PARVA, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 201 (*partim*).

— LUCINA SOLIDULA, *Morris* Ibid., ed. 2, p. 208.

1865. VENUS PARVA, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 188.

1870. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 160 (*Caryatis*).

— LUCINA ? SOLIDULA (? MYSIA), *Stoliczka.* Ibid., vol. iii, pp. 252, 262.

? 1895. VENUS *cf.* PARVA, *E. Tiessen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 484.

[1] Pictet and Renevier, 'Foss. Terr. Aptien' ('Matér. Pal. Suisse,' ser. 1, 1855–56), p. 71, pl. vii, fig. 9. Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 181, pl. cxi, fig. 12.

[2] I have not seen the specimen recorded by Keeping from Upware.

Non 1840. VENUS PARVA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 246, pl. cli, fig. 4 (*V. Goldfussi*, Geinitz, 1850; *V. subparva*, d'Orbigny, 1850).

— 1841. — — *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 72 (*Venus subinflexa*, Römer, 1836).

— 1846. — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 20, pl. xli, figs. 16, 17.

— 1863. — — *A. v. Strombeck*. Zeitschr. der deutsch. geol. Gesellsch., vol. xv, p. 146.

— 1868. — — *A. Briart and F. L. Cornet*. Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 75, pl. viii, figs. 1, 2.

— 1877. CYTHEREA PARVA, *G. Böhm*. Zeitschr. der deutsch. geol. Gesellsch., vol. xxix, p. 241.

— 1883. VENUS *cf.* PARVA, *A. Fritsch*. Stud. im Gebiete der böhm. Kreideformat., iii, Iserschicht., p. 109, fig. 77.

— 1885. VENUS PARVA, *F. Nötling*. Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 32, pl. v, fig. 11.

— 1893. — — *Fritsch*. Op. cit., v, Priesen. Schicht., p. 98, fig. 118.

Description.—Shell small, oval, convex, moderately inequilateral. Antero-dorsal margin slightly concave, or nearly straight, forming a rounded angle with the anterior margin which curves rapidly to join the convex ventral margin. Posterior margin rounded or subtruncate. Postero-dorsal margin slightly convex. Umbones rather prominent, curved inwards and forwards. Lunule broad, ovate, more or less projecting, limited by a groove. Pallial sinus large, angular. Ornamentation consists of small, somewhat irregular, concentric ribs, and occasional growth-rings.

Hinge: In the right valve the anterior and median cardinals are stout and nearly parallel, and the two posterior teeth (which represent the posterior cardinal) are oblique and diverging; in front of the anterior cardinal is a groove, bounded by a ridge above and below, parallel to the inner margin of the hinge-plate. In the left valve the anterior and median cardinal teeth diverge widely under the umbo and the posterior cardinal is oblique; the anterior cardinal is continued forward into a ridge along the inner margin of the hinge-plate.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length .	20·5	21	20	20	19	16	14	10	mm.
Height .	17	17·5	17·5	17	16	14	12	8·5	,,

(1) *Perna*-bed, East Shalford.
(2—8) Crackers, Atherfield.

Affinities.—The differences between this species and *C.* (*Cyclorisma*) *rotomagensis* are given below.

The form from Bracquegnies, which was referred to *Venus parva* by Briart and Cornet, is less elongate.

The hinge differs from that of other species of *Cyclorisma* in that the anterior tooth in the left valve is continued forwards into a ridge at the inner margin of the hinge-plate.

Lucina? solidula, Forbes, appears to be identical with *Venus parva*, Sowerby; the type is missing, but other specimens which are in the Museum of the Geological Society and were probably identified by Forbes, are undoubtedly examples of *V. parva*. The type of *Lucina? solidula*, so far as one can judge from the figure, seems to have been rather shorter than most examples of *Venus parva*.

Venus Orbignyana, Forbes,[1] from the Crackers of Atherfield, is stated to be allied to *V. parva*. The type is missing, but a specimen named *V. Orbignyana* in the Museum of the Geological Society appears to be a small example of *Cyprina Saussuri* (p. 131).

Remarks.—Examples of this species vary somewhat in convexity, in relative height and length, in the prominence and position of the umbones, and in the projection of the lunule at the margin where the valves meet. The types are internal casts from Parham, and they agree, except in being slightly more convex, with casts from East Shalford, where specimens with the shell preserved are also found. The latter do not differ from the perfectly preserved specimens found in the Crackers of Atherfield.

Type.—From the Sandgate Beds of Parham Park, in the British Museum.

Distribution.—Lower Greensand: *Perna*-bed, Crackers, and Bed 45 of Atherfield. *Perna*-bed of Sandown. Atherfield Beds of Peasmarsh and Shalford. Sandgate Beds of Parham Park.

Cyprimeria (Cyclorisma) rotomagensis (*d'Orbigny*), 1845. Plate XXIX, figs. 4—6.

1845.	Venus rhotomagensis, *A. d'Orbigny*.	Pal. Franç. Terr. Crét., vol. iii, p. 443, pl. ccclxxxv, figs. 1–5.
1850.	rothomagensis, *d'Orbigny*.	Prodr. de Pal., vol. ii, p. 194.
1865.	rotomagensis, *F. J. Pictet and G. Campiche*.	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 190.
1870.	*F. Stoliczka*.	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 161 (*? Caryatis*).

Remarks.—The English examples of this species are internal casts occasionally with small portions of the shell preserved. D'Orbigny's specimens were obtained

[1] 'Quart. Journ. Geol. Soc.,' vol. i (1845), p. 240, pl. ii, fig. 5; d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 118; Morris, 'Cat. Brit. Foss.,' ed. 2 (1854), p. 231; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865) pp. 184, 188; Stoliczka, 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1870), p. 160.

from the Cenomanian of Rouen. English specimens agree with those found at Rouen, except that in many cases the shell is somewhat shorter relatively. The surface is ornamented with concentric ribs. In *C.* (*Cyclorisma*) *rotomagensis* the shell is more convex, more inequilateral, and the postero-dorsal margin has a greater slope than in *C.* (*Cyclorisma*) *parva*. The hinge appears to be unknown.

Distribution.—Base of the Chalk Marl of Maiden Newton and Chard. Chloritic Marl of Melbury, Woolcombe, Maiden Bradley and the Isle of Wight.[1]

CYPRIMERIA (CYCLORISMA) FABA (*Sowerby*), 1827. Plate XXIX, figs. 7—13.

1827. VENUS FABA, *J. de C. Sowerby*. Min. Conch., vol. vi, p. 129, pl. dlxvii, fig. 3.
1850. — — *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 159 (*partim*).
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 230 (*partim*).
1868. — — *A. Briart and F. L. Cornet*. Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 73, pl. viii, figs. 9, 10.
1870. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 160.
1873. — — *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 65, pl. xviii, figs. 9, 10.
? 1882. — — *J. Kiesow*. Schrift. d. nat. Gesellsch. in Danzig, N.F., vol. v, p. 239.
? 1885. — — *F. Nölling*. Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 32, pl. vi, fig. 1.

Non 1840. — — *A. Goldfuss*. Petref. Germ., vol. ii, p. 247, pl. cli, fig. 6 (*V. subfaba*, d'Orbigny).
— 1843. — — *H. B. Geinitz*. Die Verstein. von Kieslingswalda, p. 13, pl. ii, figs. 7—9.
? — 1845. — — *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 444, pl. cccl xxxv, figs. 6—8.
1846 — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 21, pl. xli, fig. 12.
— 1847. — — *J. Müller*. Petref. der Aachen. Kreidef., pt. 1, p. 24.
— 1859. — IMMERSA, *Müller*. Ibid., Supplement, p. 13.
— 1863. — FABA, *A. v. Strombeck*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 147.

[1] An imperfect left valve from the Cenomanian (Bed 12) of Whitecliff, South Devon, was identified by C. J. A. Meÿer with *Venus Goldfussi*, Geinitz, 'Das Quadersandst. oder Kreidegeb. in Deutschland' (1850), p. 154, pl. x, figs. 7, 8; 'Das Elbthalgeb. in Sachsen' ('Palæontographica,' vol. xx, pt. 2, 1873), p. 67, pl. xviii, figs. 16, 17. There is not sufficient evidence to confirm this identification; the anterior part of the specimen is more produced than in the case of the examples figured by Geinitz.

Non 1863. Venus faba, *R. Drescher*. Ibid., vol. xv, p. 343.
1884. Cyprimeria faba, *E. Holzapfel*. Ibid., vol. xxxvi, p. 467, pl. vii, fig. 1.
1889. Tapes faba, *E. Holzapfel*. Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 165, pl. xiii, figs. 7–10.
— 1897. Venus (Tapes) faba, *A. Fritsch*. Stud. im Gebiete der böhm. Kreideformat., vi, Chlomek. Schicht, p. 63, fig. 80.
1901. — — — *F. Sturm*. Jahrb. d. k. preussisch. geol. Landesanst. für 1900, vol. xxi, p. 82.

Description.—Shell oval, of moderate convexity, with flattened sides, considerably inequilateral. Antero-dorsal margin short, slightly concave. Anterior margin rounded, passing gradually into the slightly convex ventral margin. Postero-dorsal margin long, slightly convex, with a moderate or considerable ventral slope. Porterior margin short, rounded or subtruncate. Umbones small. Lunule elongate, not impressed, faintly limited. Ornamentation consists of small, regular, concentric ribs.

Hinge: In the right valve the anterior and median cardinals are stout, diverge slightly, and are directed forwards, and reach the lower margin of the hinge-plate; the two posterior teeth (which represent the posterior cardinal) are laminar, oblique and diverging. In the left valve the anterior and median cardinals are rather stout and diverge; the posterior cardinal is slender and oblique. In front of the anterior cardinal there is a concave space on the hinge-plate in both valves.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	30	29	29	28	27	mm.
Height	25	24	22	21	22	„

(1—5) Blackdown.

Affinities.—*Venus Archiaciana*, d'Orbigny,[1] from the Senonian of Charente-Inférieure, is somewhat similar in form to *C.* (*Cyclorisma*) *faba*, but the surface of the shell is smooth.

A species found in the Aachen Greensand has been identified by Goldfuss, Holzapfel, and others with Sowerby's *Venus faba*, but was regarded as distinct by d'Orbigny and G. Müller. It differs from Sowerby's species in the greater curvature of the ventral margin and the more pointed posterior extremity; also the posterior teeth in the right valve are less widely separated and are more oblique.

In d'Orbigny's figure of *Venus faba* the ornamentation is coarser than in English examples, but a specimen from the Cenomanian of Rouen (one of the localities cited by d'Orbigny) differs but little in this respect from Blackdown specimens.

Remarks.—The principal variation consists in the amount of the ventral slope

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 449, pl. cccl xxxvi, figs. 6, 7.

of the postero-dorsal margin. In the type specimen that slope is small, so that the outline of the shell is distinctly oval. The position of the umbones also varies, so that some specimens are more inequilateral than others.

Specimens found in the Gault of Black Ven are usually somewhat crushed and often larger than Blackdown examples; some are more elongate and agree closely with *Venus sublævis*, Sowerby (see below).

Type.—From Blackdown; in the British Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown and (?) Devizes. Gault of Black Ven.

CYPRIMERIA (CYCLORISMA) SUBLÆVIS (*Sowerby*), 1836. Plate XXIX, fig. 14.

1836. VENUS? SUBLÆVIS, *J. de C. Sowerby.* Trans. Geol. Soc., ser. 2, vol. iv, pp. 242, 342, pl. xvii, fig. 5.
1850. VENUS SUBLÆVIS, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 159.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 231.
1870. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 161.

Remarks.—The only specimen which I have seen is the type. It differs from *C.* (*Cyclorisma*) *faba* only in being more elongate, and seems to be merely an individual variation. *Venus immersa*, Sowerby,[1] also known by the type only (Plate XXIX, fig. 15), does not appear to differ from *V. sublævis*. The types of both are in the Bristol Museum and come from the Upper Greensand of Blackdown.

Genus—CLEMENTIA, *J. E. Gray*, 1840.
('Synopsis Brit. Mus.,' p. 149.)

Sub-genus—FLAVENTIA, *A. J. Jukes-Browne*, 1908.
('Proc. Malacol. Soc.,' vol. viii, p. 167.)

CLEMENTIA (FLAVENTIA) RICORDEANA (*d'Orbigny*), 1845. Plate XXIX, figs. 16—18.

1845. VENUS RICORDEANA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 431, pl. cccIxxxii, figs. 1, 2.

[1] Sowerby, 'Trans. Geol. Soc.,' ser. 2, vol. iv (1836), pp. 242, 342, pl. xvii, fig. 6; d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 159; Morris, 'Cat. Brit. Foss.,' ed. 2 (1854), p. 231; Stoliczka, 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1870), p. 161. Non *Venus immersa*, Müller, 'Petref. der Aachen. Kreidef.,' Supplement (1859), p. 13; Reuss, 'Die Verstein. der böhm. Kreideformat.,' pt. 2 (1846), p. 20, pl. xli, fig. 11; Kner, 'Denkschr. d. k. Akad. Wissensch. Wien, Math.-Nat. Cl.,' vol. iii (1852), p. 311, pl. xvi, fig. 20.

1850. Venus Ricordeana, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 76.
1855. — — *G. Cotteau*. Moll. Foss. de l'Yonne, p. 64.
1865. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 169.
1870. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 159.

Description.—Shell oval, convex with flattened sides, considerably inequilateral, anterior part higher than the posterior part. Anterior margin regularly rounded, passing gradually into the slightly curved ventral margin. Postero-dorsal margin long, convex, with a considerable ventral slope. Posterior margin short, oblique, forming a rounded angle with the ventral margin. Umbones broad, curved forwards. The part of the shell behind a line between the umbones and the postero-ventral angle slopes rapidly from the flattened sides. Lunule elongate, limited by a groove. Escutcheon elongate, deep, limited by a sharp edge.

Ornamentation consists of sharp concentric ridges. Pallial sinus angular, somewhat ascending.

Measurements :

	(1)	(2)	(3)	(4)	(5)	
Length	56	52	52	50	43	mm.
Height	47	40	39	35	34	,,

(1) Atherfield Beds, Peasmarsh.
(2, 5) *Perna*-bed, Atherfield.
(3) Hythe Beds, Lympne.
(4) Hythe Beds, Pulborough.

Affinities.—English specimens differ from d'Orbigny's figure in the more rapid ventral slope of the postero-dorsal margin. I am indebted to Professor Boule for comparing photographs of specimens from the Lower Greensand with the examples in the d'Orbigny collection which appear to be the types, and he states that in the latter the shell is less elongate and the postero-dorsal border has a greater slope than in d'Orbigny's figure, consequently the photographs agree much more closely with the types than with the figure. M. A. de Grossouvre has been good enough to lend me a specimen of *C.* (*Flaventia*) *Ricordeana* from the Lower Aptian of Seignelay, Yonne, one of the localities mentioned by d'Orbigny, and a comparison of that with English examples leaves no doubt as to their specific identity.

The generic position of *Clementia* (*Flaventia*) *Ricordeana* is at present somewhat uncertain since none of the specimens shows the hinge; but on account of the resemblance in the form of the shell to that of *C.* (*Flaventia*) *ovalis* it is probable that this species belongs to the sub-genus *Flaventia*. *C.* (*Flaventia*)

Ricordeana is less elongate and its postero-dorsal margin is more convex and slopes more rapidly than in *Venus sub-Brongniartiana* d'Orbigny.[1]

Remarks.—This is probably the species which has been recorded by some authors from the Lower Greensand as *Venus ovalis* and *Astarte substriata*, Leymerie. The proportions of length and height vary considerably in different specimens.

Distribution.—Lower Greensand (*Perna*-bed) of Atherfield. Atherfield Beds of East Shalford, Redhill, and Peasmarsh. Hythe Beds of Hythe, Lympne, and Pulborough.

CLEMENTIA (FLAVENTIA) OVALIS (*Sowerby*), 1827. Plate XXIX, figs. 19—26.

1827.	VENUS OVALIS,	*J. de C. Sowerby.*	Min. Conch., vol. vi. p. 129, pl. dlxvii, fig. 1 (not fig. 2).
1850.	—	— *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 159.
1854.	—	— *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 231 (not from the localities given).
1870.	—	— *F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 160.
Non 1840.		— *A. Goldfuss.*	Petref. Germ., vol. ii, p. 247, pl. cli, fig. 5 (*Venus suboralis*, d'Orbigny, 1850).
— 1846.	—	— *A. E. Reuss.*	Die Verstein. der böhm. Kreideformat., pt. 2, p. 21, pl. xxxiv, fig. 22.
— 1847.	—	— *J. Müller.*	Petref. der Aachen. Kreidef., pt. 1, p. 24.
— 1870.	—	— *H. Credner.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xx, p. 191.
— 1884.	CYTHEREA OVALIS,	*E. Holzapfel.*	Ibid., vol. xxxvi, p. 464, pl. vii, figs. 2—4.
— 1888.	—	— *G. Müller.*	Jahrb. d. k. preussisch. geol. Landesanst. für 1887, p. 427.
— 1889.	—	— *E. Holzapfel.*	Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 169, pl. xiii, figs. 11—15.
— —	VENUS	— *A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat., iv, Teplitz. Schicht., p. 80, fig. 69.
— 1898.	CYTHEREA	— *G. Müller.*	Mollusk. d. Untersen. v. Braunschweig u. Ilsede, p. 66, pl. ix, fig. 15.
— 1901.	—	— *F. Sturm.*	Jahrb. d. k. preussisch. geol. Landesanst. für 1900, vol. xxi, p. 83.

Description.—Shell elongate-oval, of moderate convexity, considerably inequilateral. Antero-dorsal margin rather long, concave. Anterior margin rounded,

[1] Leymerie, 'Mém. Soc. géol. de France,' ser. 2, vol. v (1842), pp. 5, 25, pl. v, fig. 7; d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 432, pl. cccl xxxii, figs. 3—6; Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1865), p. 168, pl. cxi, fig. 1.

passing gradually into the considerably curved ventral margin. Postero-dorsal margin long, convex. Posterior margin short, rounded. Umbones prominent, pointed, with a considerable anterior curvature. Lunule ovate, faintly limited.

Ornamentation consists of growth-rings and (in well-preserved specimens) of numerous small, regular, concentric ribs. Pallial sinus deep, ascending, with rounded end.

Hinge: In the right valve the anterior and median cardinals are strong, and diverge below the umbo; the posterior cardinal is long, oblique, curved, and divided into two parts of which the anterior is shorter than the posterior. In the left valve the anterior and median cardinals are strong and diverge below the umbo; the posterior cardinal is laminar and very oblique.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	44	40	37	34	32	30	mm.
Height	33	31	32	26	27	23	,,

(1—6) Blackdown.

Affinities.—The form from the Aachen Greensand which was referred to this species by Goldfuss and others possesses an anterior lateral tooth.

Remarks.—In Sowerby's figure the lunule projects more than in any specimen which I have seen, but in other respects the examples from Blackdown agree with that figure.

Type.—The type came from Blackdown, but cannot now be found.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown.[1] Recorded by Jukes-Browne from the Upper Greensand of Devizes.

Genus—CALLISTA, *O. A. L. Mörch*, 1853.
('Catalog. Conchyl. de Yoldi,' ii, p. 27.)

CALLISTA PLANA (*Sowerby*), 1813. Plate XXX, figs. 1—6.

1813. VENUS PLANUS, *J. Sowerby*. Min. Conch., vol. i, p. 58, pl. xx, lower figures.
1854. CYTHEREA PLANA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 201.
?1845. VENUS PLANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 447, pl. cccIxxxvi, figs. 1—3 (*? partim*).

[1] The type of *Venus submersa*, Sowerby, from the Upper Greensand of Pinhay, cannot be found. I have seen no specimen which could be referred to that species. Barrois, however, records it from the Upper Greensand of Lulworth. J. de C. Sowerby, 'Trans. Geol. Soc.,' ser. 2, vol. iv (1836), pp. 242, 342, pl. xvii, fig. 4; d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 159; Morris, 'Cat. Brit. Foss.,' ed. 2 (1854), p. 231; Stoliczka, 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1870), p. 161 (*Caryatis*) Barrois, 'Terr. Crét. Supér. de l'Anglet. et de l'Irelande' (1876), p. 90.

1850. VENUS PLANA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 159.
1865. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 190.
1867. — — *E. Guéranger*. Album Paléont. de la Sarthe, p. 13, pl. xvii, fig. 11.
1868. — — *A. Briart and F. L. Cornet*. Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 72, pl. viii, figs. 3—5.

? Non 1846. VENUS PLANA, *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 21, pl. xli, fig. 14.
? — 1879. CYTHEREA (CARYATIS) PLANA, *J. F. Whiteaves*. Mesoz. Foss., vol. i (Geol. Surv. Canada), p. 149, pl. xvii, fig. 14.

Description.—Shell oval, sometimes more or less triangular, rounded, moderately convex, considerably inequilateral; length greater than height. Antero-dorsal margin long, concave. Anterior part of valve more or less produced, with rounded margin. Ventral margin forming a considerable curve. Posterior margin short, rounded or slightly truncate. Postero-dorsal margin convex, much longer than the antero-dorsal margin. Umbones rather prominent, pointed, close together, curved anteriorly. Lunule long, cordiform, distinctly limited. Escutcheon not defined. Ornamentation consists of small concentric ridges, with stronger growth-ridges at intervals. Fine radial ribbing is occasionally seen in the posterior part of well-preserved specimens. Pallial sinus fairly large, angular or sub-angular, slightly ascending.

Hinge: In the right valve the anterior and median cardinals are nearly vertical, slightly diverging, and separated dorsally, the posterior cardinal is oblique, long and divided, its posterior part is much longer than the anterior part, and the latter nearly meets the anterior cardinal under the umbo; in front of the cardinal teeth there is a shallow, elongate pit with slightly raised upper and lower margins. In the left valve the stout anterior and median cardinals diverge from under the umbo, the anterior tooth being nearly vertical; there is a long slender, oblique posterior cardinal, and an elongate, ridge-like anterior lateral tooth, which is grooved or corrugated.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Length	72	69	63	62	54	52	48	44	35	mm.
Height	63	57	53	51	46	43	41	37	29	,,

(1—9) Blackdown.

Affinities.—Specimens from Senonian deposits of Europe have been referred to

Venus planus, Sowerby, by several authors;[1] and so far as I can judge from the few figures which have been published, they seem to differ but little from Sowerby's species. The example from Aachen figured by Goldfuss agrees closely with specimens from Blackdown except that the lunule projects more at the margin. Holzapfel has compared Aachen with Blackdown specimens, and confirms Goldfuss's identification. The example figured by d'Orbigny[2] differs in having a large and deep escutcheon.

Specimens from the Trichinopoli Group (near the base of the Ariyalúr Group) were identified by Stoliczka[3] with *Venus planus*.

The absence of a channel under the anterior right cardinal, and the occurrence of fine radial ornamentation connect this species with *Callista*. The pallial sinus, however, resembles that of *Pitaria*. The anterior lateral tooth in the left valve is much less prominent, and the corresponding pit in the right valve much smaller and shallower than in either *Callista* or *Pitaria*. This species is the type of the section or sub-genus *Callistina*, Jukes-Browne.[4]

Remarks.—This is a common fossil at Blackdown. The variations seen consist in the proportion of height to length, the more or less triangular or oval outline, and the more or less produced anterior part of the shell.

Type.—From Blackdown; in the British Museum.

Distribution.—Upper Greensand (zone of *Schloenbachia rostrata*) of Blackdown and Haldon. Recorded by Jukes-Browne from the Upper Greensand of Devizes, the Isle of Wight, etc.

Family—CARDIIDÆ, *Lamarck*.

Genus—PROTOCARDIA, *E. Beyrich*, 1845.
('Menke's Zeitschr. f. Malakozool.,' p. 17.)

PROTOCARDIA ANGLICA, sp. nov. Plate XXX, figs. 7 *a*, *b*; Plate XXXI, fig. 1.

Description.—Shell large, convex, with flattened sides, subquadrate, moderately

[1] Goldfuss, 'Petref. Germ.,' vol. ii (1840), p. 238, pl. cxlviii, fig. 4; Müller, 'Petref. der Aachen. Kreidef.,' (1847), pt. 1, p. 25; Drescher, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xv (1863), p. 344; Brauns, 'Zeitschr. f. d. gesammt. Naturwiss.,' vol. xlvi (1876), p. 368; H. Schröder, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xxiv (1882), p. 275; Holzapfel, 'Die Mollusk. Aachen. Kreide' ('Palæontographica,' vol. xxxv, 1889), p. 171, pl. xiii, figs. 16—18; Vogel, 'Holländisch. Kreide' (1895), p. 42.

[2] D'Orbigny subsequently separated the Senonian form under the name *Venus subplana*, 'Prodr. de Pal.,' vol. ii (1850), p. 237. See also *V. Renauxiana*, d'Orbigny, ibid., p. 194.

[3] Stoliczka, 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1870), pp. 151, 160, 169, pl. vii, figs. 1—4.

[4] Proc. Malacol. Soc., vol. viii (1908), p. 156.

inequilateral, length and height nearly equal. Antero-dorsal margin nearly straight. Anterior margin convex, curving rapidly to join the ventral margin, which is moderately or slightly convex. Posterior margin truncated, forming angles with the ventral and postero-dorsal margins. Umbones large, curved forwards, with a sharp carina extending in a curve to the postero-ventral angle and limiting the flattened, steeply-sloping posterior area, the dorsal portion of which is concave. Shell depressed in front of the umbones.

Ornamentation: Sides of shell nearly smooth except for numerous, very small, concentric ribs which are separated by flat interspaces. The posterior area is covered, except near the postero-dorsal margin, by 12 strong radial ribs.

Measurements:

	(1)	(2)	(3)	
Length	80	76	46	mm.
Height	78	79	46	,,

(1–3) Crackers, Atherfield.

Affinities.—This species resembles *P. Forbesi* (Pictet and Renevier),[1] from the Lower Aptian of Ste. Croix, but the umbones are less prominent, and the ribs on the posterior area are less numerous.

It is also similar to *P. impressa* (Deshayes),[2] but is distinguished by the smaller curvature of the ventral margin, the greater flattening of the sides of the shell, and the more considerable curvature of the umbones.

Distribution.—Lower Greensand (Crackers) of Atherfield.[3]

PROTOCARDIA SPHÆROIDEA (*Forbes*), 1845. Plate XXXI, figs. 2, 3.

1845.	CARDIUM SPHÆROIDIUM,	*E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 243. pl. ii, fig. 8.
1850.	— —	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 79.
1852.	— NECKERIANUM,	*F. J. Pictet and W. Roux.*	Moll. Foss. Grès verts de Genève, pp. 424, 425, pl. xxx, fig. 3.
—	— SPHÆROIDEUM,	*Pictet and Roux.*	Ibid., p. 546.
1854.	— —	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 193.

[1] 'Foss. Terr. Aptien' ('Matér. Pal. Suisse,' ser 1, 1856), p. 79, pl. viii, fig. 4; Pictet and Campiche, 'Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4, 1866), p. 261.

[2] D'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 20, pl. ccxl; Pictet and Campiche, *op. cit.*, p. 249.

[3] Some specimens of *Protocardia* from the Lower Greensand of Atherfield were referred by Forbes to *Cardium peregrinorsum*, d'Orbigny, but that identification was doubted by Pictet and Campiche. The specimens at present available are insufficient for exact determination. See Forbes, 'Quart. Journ. Geol. Soc.,' vol. i (1845), p. 243.

1856. Cardium sphæroideum, *F. J. Pictet and E. Renevier.* Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 77, pl. ix, fig. 3.

1866. — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 260.

1871. — (? Lævicardium), *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 213.

Description.—Shell stout, large, much inflated, higher than long, slightly inequilateral. Anterior and ventral margins rounded. Posterior margins truncated, forming angles with the postero-dorsal and ventral margins. Umbones prominent, with a small forward curvature, and an inconspicuous carina extending to the postero-ventral angle and limiting the flattened postero-dorsal area.

Ornamentation consists of regular, broad, flat, concentric ribs separated by narrow grooves. On the posterior area strong growth-ridges are present.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	79	76	73	69	47	mm.
Height	84	91	87	87	48	,,

(1—5) *Perna*-bed, Isle of Wight.

Affinities.—Pictet and Campiche state that this species is very near to *C. imbricatarium* (Deshayes),[1] but that the posterior area is more flattened and forms an angle with the sides of the shell; also the truncated posterior margin is relatively longer.

Remarks.—In this species the radial ornamentation of the posterior area is either very indistinct or quite obsolete. There is considerable variation in relative height and length of the shell.

Type.—From the Lower Greensand (*Perna*-bed) of Sandown; in the Museum of the Geological Society.

Distribution.—Lower Greensand (*Perna*-bed) of Atherfield and Sandown. Recorded by Topley from the Hythe Beds of Hythe.

Protocardia, sp. Plate XXXI, fig. 4.

The collection of Upper Greensand fossils made by the late W. Vicary, which is now in the British Museum, contains two imperfect right valves (No. L 17041)

[1] D'Orbigny, 'Pal. Franç. Terr. Crét.' (1844), vol. iii, p. 18, pl. ccxxxix, figs. 4—6; Leymerie, 'Mém. Soc. géol. de France,' ser. 2, vol. v (1842), p. 4, pl. v, fig. 2; Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1866), p. 258, pl. cxxi, figs. 6, 7. The specimens referred to *C. imbricatarium* by Forbes are examples of *Unicardium vectense* (p. 163); see Forbes, 'Quart. Journ. Geol. Soc.,' vol. i (1845), p. 243.

from Haldon, which resemble in shape the higher forms of *P. sphæroidea*, but the umbones are narrower and more curved, and the carina is more distinct. Better specimens are needed before a satisfactory comparison can be made. The occurrence of *P. sphæroidea* in the Upper Greensand (zone of *Pecten asper*) of Wiltshire has been recorded by Mr. Jukes-Browne.

PROTOCARDIA, sp. Plate XXXI, fig. 5 *a*, *b*.

Description.—Shell globose, with rounded outline, slightly inequilateral, height and length nearly equal. Umbones low, curved anteriorly. The posterior part of the shell (except near the postero-dorsal margin) is ornamented with from ten to twelve strong radial ribs; the remainder of the shell bears numerous, small concentric ribs.

Affinities.—This species resembles *P. peregrinorsa* (d'Orbigny),[1] but the area with radial ribs is relatively larger, and the concentric ribs are finer.

Remarks.—The only specimens seen are two in the Museum of Practical Geology and two in Mr. Lamplugh's collection.

Distribution.—Speeton Clay (zone of *Belemnites lateralis*, D, 4) of Speeton.[2]

PROTOCARDIA HILLANA (*Sowerby*), 1813. Plate XXXI, figs. 6 *a*—*c*; Plate XXXII, fig. 1—6.

1813.	CARDIUM HILLANUM,	*J. Sowerby.*	Min. Conch., vol. i, p. 41, pl. xiv (upper figure).
1819.	—	— *Lamarck.*	Hist. nat. Anim. sans Vert., vol. vi. p. 20.
1837.	—	— *A. Goldfuss.*	Petref. Germ., vol. ii, p. 220, pl. cxliv, fig. 4.
—	—	— *F. Dujardin.*	Mém. Soc. géol. de France, vol ii p. 224.
1840.	—	— *H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 2, p. 53.
1841.	—	*F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 71.
1842.	—	REQUENIANUM, *P. Matheron.*	Catal. Foss. du Départ. des Bouches-du-Rhône, p. 157, pl. xviii, fig. 6.

[1] 'Pal. Franç. Terr. Cret.,' vol. iii (1844), p. 16, pl. cexxxix, figs. 1—3; Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1866), p. 254, pl. cxxi, figs. 1, 2.

[2] Internal casts of a globose and nearly equilateral "*Cardium*" (perhaps *Protocardia*), from the Spilsby Sandstone of Donnington, are in the Sedgwick Museum.

1843. Cardium Hillanum, *H. B. Geinitz.* Die Verstein. von Kieslingswalda, p. 13, pl. ii, figs. 10, 11.

1844. — — *A. d'Orbigny.* Pal. Franç. Terr. Crét, vol. iii, p. 27, pl. cexliii.

1845. Protocardia Hillana, *E. Beyrich.* Menke's Zeitschr. f. Malakozool., p. 18.

1846. — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 22, pl. xlv, fig. 2.

– — — *H. B. Geinitz.* Grundr. d. Verstein., p. 421, pl. xix, fig. 4.

? — Cardium Hillanum, *E. Forbes.* Trans. Geol. Soc., ser. 2, vol. vii, p. 146.

1850. — — *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 162.

– Protocardia Hillana, *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 154.

? 1852. Cardium Hillanum, *F. Römer.* Kreidebild. v. Texas, p. 49, pl. vi, fig. 12.

– Protocardia Hillana, *H. G. Bronn.* Lethæa Geogn., vol. ii, p. 302, pl. xxx, fig. 12.

1854. Cardium bifrons, *A. E. Reuss.* Kreideschicht. i. d. Ostalpen, p. 145, pl. xxviii, fig. 19.

— Hillanum, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 192.

1863. Protocardia Hillana, *R. Drescher.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 346,

1864. Cardium (Protocardia) Hillana, *K. A. Zittel.* Die Bivalv. d. Gosaugeb., I, p. 42 [146], pl. vii, figs. 1, 2.

1866. — Hillanum, *F. J. Pictet and G. Campiche.* Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pp. 268, 273.

? 1867. — *O. Fraas.* Aus dem Orient, I, p. 91.

— — — *E. Guéranger.* Album Paléont. de la Sarthe, p. 15, pl. xx, figs. 3, 11.

1868. — — *A. Briart and F. L. Cornet.* Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 66, pl. vii, figs. 4, 5.

1870. Protocardia Hillana, *F. Römer.* Geol. v. Oberschles., p. 334, pl. xxvi, fig. 2.

? 1871. Protocardium Hillanum, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, pp. 209, 219, pl. xii, figs. 8—10, pl. xiii, figs. 1—3.

1873. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. i), p. 230, pl. l, figs. 11, 12.

— Cardium — var. moabiticum, *L. Lartet.* Ann. Sci. géol., vol. iii, p. 53, pl. xii, fig. 9.

1876. Protocardia Hillana, *D. Brauns.* Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 266.

1877. Protocardium Hillanum, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., ii, Weissenberg. u. Malnitz. Schicht., p. 112, fig. 64.

? 1878. PROTOCARDIUM HILLANUM, *O. Fraas.* Aus dem Orient. II Geol. Beobacht. am Libanon, p. 70.

1882. CARDIUM (PROTOCARDIUM) HILLANUM, *P. de Loriol.* Gault de Cosne, p. 69, pl. viii, fig. 17.

1884. PROTOCARDIUM HILLANUM, *J. F. Whiteaves.* Mesoz. Foss. (Geol. Surv. Canada), vol. i, p. 228, pl. xxx, fig. 5.

? — CARDIUM (PROTOCARDIA) HILLANUM, *C. E. Hamlin.* Mem. Mus. Comp. Zool., vol. x, No. 3, p. 50.

1893. PROTOCARDIUM HILLANUM, *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 232.

1897. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., vi, Chlomek. Schicht., p. 52.

— — — *R. Leonhard.* Kreidef. in Oberschles. (Palæontographica, vol. xliv), p. 28.

1898. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., iii, Iserschicht., p. 98.

1901. PROTOCARDIA HILLANA, *F. Sturm.* Jahrb. d. k. preussisch. geol. Landesanst. für 1900, vol. xxi, p. 79.

1902. — — *A. Quaas.* Kreidebild. in der libysch. Wüste (Palæontographica, vol. xxx, 2), p. 218, pl. xxiv, fig. 18.

1904. — — *R. Fortau.* Bull. Instit. Egyptien, ser. 4, no. 4, p. 331.

— — — var. UMKWELANENSIS, *R. Etheridge, jun.* Second Rep. Geol. Surv. Natal and Zululand, p. 79, pl. i, fig. 16.

1906. — — var., *H. Woods.* Cret. Fauna of Pondoland (Ann. S. African Mus., vol. iv), p. 307, pl. xxxvii, fig. 6.

Description.—Shell convex, with flattened posterior slope, nearly equilateral; outline more or less sub-quadrate, rounded, sometimes nearly oval; usually a little higher than long, but rarely with the height and length equal Anterior margin either fairly convex and forming a rounded angle with the antero-dorsal margin, or very convex and passing almost gradually into the antero-dorsal margin. Anterior margin passes gradually into the ventral margin, which may be considerably convex, but is usually only slightly convex, with its posterior part nearly straight and forming a more or less well-marked angle with the posterior margin. The latter is truncated, slightly convex, and forms an obtuse angle with the postero-dorsal margin. Umbones of moderate size.

Ornamentation consists (except on the posterior part of the shell) of numerous, very regular, rounded, concentric ribs separated by narrow furrows; these ribs become smaller or nearly obsolete near the antero-dorsal margin. On the posterior

slope of the shell, and sometimes for a short distance in front of it, are from 10 to 15 (usually 12 or 13) strong, more or less angular ribs, separated by broad furrows, both being crossed by well-marked growth-ridges. Sometimes some of these ribs are divided at their summits by a narrow, longitudinal groove. The ribs become rather smaller dorsally and are absent near the postero-dorsal margin. Internal margins of valves smooth, except the posterior part with radial ribs, which is serrate.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
Length	51	48	44	44	43	41	38	36	36	32	27	19	mm.
Height	47	47	44	42	41	39	36	36	34	29·5	26	18	,,

(1—12) Blackdown.

Affinities.—Although this species has a very wide geographical distribution and a long range in time, yet the principal variations seen in specimens found at different horizons and in different kinds of sediment consist in the number and coarseness of the concentric ribs. The modifications do not appear to be more than varietal, and such as would be found at the present day in examples of a widely distributed species.

In the example from the Cenomanian figured by d'Orbigny the shell is rather higher and the ornamentation coarser than in specimens from Blackdown, but in the latter respect it agrees with examples found by the late C. J. A. Meÿer in the Cenomanian of South Devon. One specimen from the Cenomanian of Sarthe, shown in Guéranger's photographic illustrations, agrees in its ornamentation with Blackdown examples.

The Cenomanian form figured by Römer (1870), and the examples from higher horizons figured by Geinitz (1843) and by Goldfuss agree closely with Blackdown specimens. Coarser ribbing is found in specimens from the Gault of Cosne, showing that that character is not limited to examples from horizons above the Blackdown Greensand.

Protocardia bifrons (Reuss) is more rounded than *P. Hillana*, but does not seem to be specifically distinct.

Cardium marticense, Matheron, and *C. Requienianum*, Matheron, were regarded by d'Orbigny and by Zittel as synonyms of *P. Hillana*.

Specimens from the Trichinopoli Group of Southern India were identified with *P. Hillana* by Forbes and by Stoliczka, who stated that they were unable to draw any line of separation between the Indian and European examples. The concentric ribbing is coarser in most of the Indian forms, and in some the smooth inner portion of the posterior area is relatively larger than in specimens from Blackdown.[1]

[1] See Stoliczka's fig. 10*a*.

P. delicatula, Stoliczka,[1] and *P. pondicherieuse* (d'Orbigny),[2] are allied to *P. Hillana*.

P. biseriata (Conrad),[3] from Syria, possesses coarse concentric ribs, and is regarded by Blanckenhorn as a variety of *P. Hillana*.

Remarks.—Examples of this species are common at Blackdown, but probably on account of the uniformity of the conditions under which they lived, do not show any very striking variations.

There are some differences in the proportion of length and height; usually the former exceeds the latter slightly, but occasionally the two are equal. The outline of the shell is sometimes oval, but more usually subquadrate. The radial ribs vary in number from 10 to 15, and sometimes the area with these ribs is continued for a short distance in front of the posterior slope.

The number of concentric ribs in 10 mm. (measured between 34 mm. and 44 mm. from the umbo) varies from 15 to 19.

Type.—From Blackdown, in the British Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown, Haldon, Whitecliff (South Devon), Peak Hill near Sidmouth, Devizes, and Ventnor. Cenomanian of Dunscombe. Recorded by Jukes-Browne from the Chloritic Marl of the Isle of Wight.

Genus—CARDIUM, *Linnæus*.

('Syst. Nat.,' ed. 10, 1758, p. 678; ed. 12, 1766, p. 1121.)

CARDIUM IBBETSONI, *Forbes*, 1845. Plate XXXII, figs. 7—10.

1845.	CARDIUM IBBETSONI,		*E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 243, pl. ii, fig. 9.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 192.
1856.		—	*F. J. Pictet and E. Renevier.* Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 78, pl. ix, figs. 1, 2.
1866.	—	—	*F. J. Pictet and G. Campiche.* Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 262.
1871.	—	—	(LÆVICARDIUM), *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 213.

[1] 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1871), p. 220, pl. xiii, fig. 8.

[2] Stoliczka, ibid., p. 220, pl. xii, figs. 4—7.

[3] 'Official Report U. S. Exped. Dead Sea, etc.,' by W. F. Lynch (1852), p. 216, pl. vi, figs. 38, 39 (non 40); R. B. Newton, 'Geol. Mag.,' (1898), p. 400, pl. xv, fig. 11. *P. Hillana* var. *typica*, M. Blanckenhorn, 'Beitr. zur Geol. Syriens: Kreidesyst. in Mittel u. Nord-Syriens' (1890), p. 89.

Description.—Shell small, inflated, oval, a little higher than long, slightly inequilateral. Anterior margin rounded, passing gradually into the convex ventral margin. Posterior margin subtruncate, higher than the anterior margin. Umbones prominent, with a faint carina extending to the postero-ventral extremity and forming the limit of the flattened postero-dorsal area. Margins of valves serrate.

Ornamentation consists of numerous small, slightly-raised radial ribs separated by narrow grooves; anteriorly the ribs become gradually smaller and are absent or indistinct near the antero-dorsal margin; on the postero-dorsal area the ribs are stronger and the grooves broader than elsewhere, and the anterior margins of these ribs are sometimes serrate. In well-preserved specimens faint concentric linear ridges are seen.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	17	15·5	14·2	14	10·5	mm.
Height	18	16·5	15	14·5	11	,,

(1—5) Crackers, Atherfield.

Affinities.—See *C. Cottaldinum* (p. 203).

In form *C. Ibbetsoni* resembles *C. Raulinianum*, d'Orbigny,[1] but the latter is distinguished by its broader grooves which bear pointed projections.[2]

In the specimens figured by Pictet and Renevier from the Aptian of the Perte du Rhône the umbones are more prominent than in English examples of *C. Ibbetsoni*, but Pictet and Campiche, who were able to compare examples from Atherfield with those obtained from the Perte du Rhône, felt no doubt as to their specific identity.

Type.—From Atherfield, in the Museum of the Geological Society.

Distribution.—Lower Greensand (Crackers) of Atherfield.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 25, pl. cexlii, figs. 7–11.

[2] *C. Raulinianum* is recorded by Morris from the Lower Greensand of the Isle of Wight, and by Topley from the Atherfield Beds of Peasmarsh and Shalford. Specimens from the Atherfield Clay were referred to *C. subhillanum*, Leymerie, by Forbes, but that identification was regarded as doubtful by Pictet and Campiche; the form of the shell cannot be made out satisfactorily, but the ornamentation resembles that of *C. Ibbetsoni*. An internal cast from the Lower Greensand of Upware was referred with doubt to *C. subhillanum* by W. Keeping ('Foss. Neoc. Upware and Brickhill,' 1883, p. 119); the specimen is now in the Sedgwick Museum, Cambridge, and seems to me insufficient for determination. A specimen with radial ribs, from the Lower Greensand of Maidstone, was named *Cardium Benstedi* by Forbes, but was too imperfect for figuring; the type is in the Museum of the Geological Society (No. 2124); no other specimen has been seen. Forbes, 'Quart. Journ. Geol. Soc.,' vol. i (1845), p. 244; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser 4, 1866), p. 267.

CARDIUM COTTALDINUM, *d'Orbigny*, 1844. Plate XXXII, fig. 11 *a*—*c*.

1844.	CARDIUM COTTALDINUM,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 22, pl. ccxlii, figs. 1—4.
1850.	—	*d'Orbigny.*	Prodr. de Pal., vol. ii, p. 79.
1866.	—	*F. J. Pictet and G. Campiche.*	Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 246, pl. cxviii, figs. 1, 2.
1871.	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 212.
1883.	—	*W. Keeping.*	Foss., etc., Neoc. Upware and Brickhill, p. 118, pl. vi, fig. 4.
1884.	—	*O. Weerth.*	Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 44, pl. ix, fig. 3.
—	—	OERLINGHUSANUM, *Weerth.*	Ibid., p. 44, pl. ix, fig. 4.
1895.	—	COTTALDINUM, *G. Maas.*	Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 263, pl. vii, figs. 2, 3.
1900.	—	*A. Wollemann.*	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 107.

Description.—Shell oval, inflated, slightly inequilateral, rather higher than long. Anterior and ventral margins rounded. Posterior margin more or less truncated. Umbones rather high, sharp, curved inward and forward, with an indistinct carina.

Ornamentation consists of numerous, small, regular, radial ribs, which are rather more prominent on the posterior area than on the sides of the shell.

Measurements:

Length		24 mm.
Height	.	25·5 „

Upware.

Affinities.—This species closely resembles *C. Ibbetsoni*, but differs in having the posterior area less flattened and the outline of the shell more rounded. The English specimens of *C. Cottaldinum* are larger than those of *C. Ibbetsoni*, but are not sufficiently numerous or well-preserved for exact comparison.

In *C. Cottaldinum* the shell is relatively higher than in *C. Voltzi*, Leymerie.[1]

C. landeronense, de Loriol,[2] appears to be closely related to *C. Cottaldinum*.

Type.—D'Orbigny's specimens came from the Neocomian of Wassy (Haute-

[1] For references see Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1866), p. 247.

[2] P. de Loriol and V. Gilliéron, 'Urgonien Infér. de Landeron' (1869), p. 14, pl. i, fig. 12.

Marne), Brillon (Meuse), St. Sauveur and Auxerre (Yonne). The specimens figured by Keeping are in the Sedgwick Museum.

Distribution.—Lower Greensand of Upware.[1]

CARDIUM, sp. Plate XXXII, fig. 12 *a*, *b*.

Internal casts of a globose form of *Cardium* occur in the Lower Greensand of Seend and Faringdon. On one specimen (No. 21272, Museum of Practical Geology) a portion of the shell is preserved, and its ornamentation resembles that of *C. Ibbetsoni* and *C. Cottaldinum*. The form of the shell seems to be rather more like that of *C. Ibbetsoni* than of *C. Cottaldinum*.

CARDIUM, spp.

Specimens of *Cardium* from the Cenomanian of Dunscombe, South Devon, were referred by C. J. A. Meÿer to *C. alternans*, Reuss, and *C. alutaceum*, Goldfuss. Better preserved specimens are needed before these determinations can be confirmed.

CARDIUM TURONIENSE, *Woods*, 1897. Plate XXXII, figs. 13—15.

1897. CARDIUM TURONIENSE, *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 389, pl. xxvii, figs. 20–22.

Description.—Shell small, oval, higher than long, inequilateral, much inflated, postero-dorsal part compressed. Umbones prominent, with a considerable anterior curvature. Ornamentation consists of many strong radial ribs. Length, 6 mm.; height, 7 mm.

Affinities.—This species shows some resemblance to *C. cenomanense*, d'Orbigny,[2] but is more inequilateral owing to the much greater curvature of the umbones; also the ribs are less numerous, and tubercles appear to be absent from the grooves.

Type.—In the Sedgwick Museum, Cambridge.

Distribution.—Chalk Rock of Cuckhamsley.

[1] Some small specimens found in the Ferruginous Sands of Shanklin may perhaps be referred to *C. Cottaldinum*, but they are too imperfectly preserved for exact determination.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 37, pl. cexlix, figs. 5—9.

CARDIUM, sp. Plate XXXII, fig. 16 *a*, *b*.

1897. CARDIUM, sp. cf. CENOMANENSE, *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 389, pl. xxvii, figs. 23, 24.

Internal casts, similar in form to *C. cenomanense*, d'Orbigny, are found in the Chalk Rock of Cuckhamsley. A part of the shell is imperfectly preserved on one specimen and is ornamented with fine radial ribs. A cast measures: height, 8 mm.; length, 8 mm.; thickness, 7·5 mm.

CARDIUM, sp. Plate XXXII, fig. 17 *a*—*c*.

Two internal casts from the Chalk of Norwich (one of which was found by the late T. G. Bayfield) are in the British Museum (Nos. L 19443, L20103). The shell is much inflated, so that the height and thickness are approximately equal; the height is considerably greater than the length. The umbones are prominent. The postero-dorsal part of the shell is flattened and shows indications of fine radial ribs.

This species shows some resemblance to *C. ventricosum*, d'Orbigny,[1] but is relatively higher.

Sub-genus—GRANOCARDIUM, *W. M. Gabb*, 1869.
("Geol. Survey California," 'Palæont.,' vol. ii, p. 266.)

CARDIUM (GRANOCARDIUM) PROBOSCIDEUM, *Sowerby*, 1817. Plate XXXII, figs. 18, 19; Plate XXXIII, figs. 1—3.

1816. CARDITA TUBERCULATA, *J. Sowerby*. Min. Conch., vol. ii, p. 97, pl. cxliii. (Non *Cardium tuberculatum*, Linnæus).
1817. CARDIUM PROBOSCIDEUM, *J. Sowerby*. Min. Conch., vol. ii, p. 127, pl. clvi, fig. 1.
1835. — GENTIANUM, *J. de C. Sowerby*. Ibid. (Systematical Index), vol. vi, p. 242.
1854. — PROBOSCIDEUM, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 193.
— — GENTIANUM, *Morris*. Ibid., p. 192.
1866. — PROBOSCIDEUM, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 269.

[1] *C. ventricosum* is recorded from the Upper Greensand (zone of *Pecten asper*) of Lulworth by Barrois ('Terr. Crét. Supér. de l'Angleterre et de l'Irelande,' 1876, p. 92). I have not seen any English example of that species.

1866. Cardium Gentianum, *Pictet and Campiche*. Ibid., p. 269.
1871. — proboscideum, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 213 (*Acanthocardium*).
— — Gentianum, *Stoliczka*. Ibid., p. 213 (*Acanthocardium*).
1882. — proboscideum, *P. de Loriol*, Gault de Cosne, p. 91, pl. xi, fig. 4.
1900. — Gentianum, *E. T. Newton and A. J. Jukes-Browne*. In Jukes-Browne, Cret. Rocks of Britain, vol. i, p. 448.

Description.—Shell stout, very convex, oval, higher than long, slightly inequilateral. Anterior margin rounded; posterior margin truncated, forming an angle with the postero-dorsal margin. Umbones prominent.

Ornamentation consists of radial ribs separated by narrow grooves; the stronger ribs bear prominent, angular, laterally compressed tooth-like projections, which may be rather larger near the posterior margin than elsewhere; in the spaces between the stronger ribs are two (sometimes one or three) smaller ribs with similar but smaller tooth-like projections. Margins of valves toothed.

Measurements:

	(1)	(2)	(3)	(4)	(5)
Length	63	59	58	57	47 mm.
Height	74	70	68	65	54 ,,

(1—5) Blackdown.

Affinities.—A form from the Cenomanian was referred by d'Orbigny to *C. productum*, Sowerby,[1] the type of which comes from the Senonian of Gosau. This identification has been accepted by Zittel, Holzapfel and others, but not by Pictet and Campiche, and de Loriol. The specimen figured by d'Orbigny[2] is probably an example of *C. proboscideum*, Sowerby, and differs from *C. productum* in the distinct differentiation of the ribs into a larger series separated by smaller series.

The differences between *C. Gentianum* and *C. proboscideum* seem to be due entirely to their different modes of preservation. The former is found in the Upper Greensand of Devizes and Ventnor; the shell is absent, but the sand which filled the interior of the shell now forms a natural cast of the exterior, showing more or less imperfectly the character of the ornamentation; usually the spines are represented by stumps only or are almost completely obliterated. In these specimens the original form of the shell has been more or less considerably

[1] 'Trans. Geol. Soc.,' ser. 2, vol. iii (1832), p. 417, pl. xxxix, fig. 15; Goldfuss, 'Petref. Germ.,' vol. ii (1837), p. 221, pl. cxliv, fig. 7; Zittel, 'Bivalv. d. Gosaugeb.,' pt. i (1864), p. 37, pl. vi, fig. 1; Holzapfel, "Die Mollusk. Aachen. Kreide" ('Palæontographica,' vol. xxxv), p. 179, pl. xvii, figs. 1—5; G. Müller, 'Mollusk. d. Untersen. v. Braunschweig u. Ilsede' (1898), p. 63, pl. ix, figs. 13, 14.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 31, pl. ccxlvii; Guéranger, 'Album Paléont. de la Sarthe' (1867), p. 15, pl. xx, figs. 8—10.

modified by pressure. On the other hand the shell in *C. proboscideum*, from Blackdown, is replaced by silica, so that both its ornamentation and original shape are perfectly preserved.

French examples were identified by d'Orbigny[1] with this species, for which he proposed the name *Cardium Moutonianum* since the specific name (*tuberculata*) under which Sowerby originally described the species had already been used. Sowerby, however, in the index at the end of vol. vi of the 'Mineral Conchology,' had already substituted *Gentianum* for the name which he originally used. I have not seen any specimen of *C. Moutonianum*, and am unable to say whether or not it is really identical with *C. Gentianum*, but in d'Orbigny's figures the difference in the sizes of the ribs and tubercles is seen on the anterior and posterior parts of the shell only.

C. Carolinum, d'Orbigny,[2] and *C. inæquicostatum*, Matheron,[3] are closely related to, and perhaps identical with, *C. proboscideum*.

Types.—*C. proboscideum*, from the Upper Greensand of Blackdown, and *Cardita tuberculata* (*Cardium Gentianum*), from the Upper Greensand of Devizes, are in the British Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown, Haldon, Devizes, and Ventnor.

Family—DICERATIDÆ, *Dall.*

Genus—Toucasia, *E. Munier-Chalmas*, 1873.

('Journ. de Conchyl.,' ser. 3, vol. xxi, p. 74. Douvillé, 'Bull. Soc. géol. de France,' ser. 3, vol. xv, 1887, p. 762.)

Toucasia Lonsdalei (*Sowerby*), 1836. Plate XXXIII, figs. 4—6.

1836. Diceras Lonsdalii, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 268, 338, pl. xiii, fig. 4.
1850. Caprotina Lonsdalii, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 109 (*partim*).
1854. Diceras Lonsdalii, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 201.
1855. Requienia Lonsdalei, *S. P. Woodward*. Quart. Journ. Geol. Soc., vol. xi, p. 53, fig. 29.
1871. — Lonsdalii, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 233.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 34, pl. ccxlviii; and 'Prodr. de Pal.,' vol. ii (1850), p. 162.

[2] Op. cit. (1844), p. 29, pl. ccxlv.

[3] 'Catal. Foss. des Bouches-du-Rhône' (1842), p. 157, pl. xviii, figs. 3, 4.

Remarks.—The examples of *Toucasia Lonsdalei* are in the condition of internal casts in a ferruginous sandstone, so that it is difficult to compare this with other species. The casts show a considerable amount of variation in form. D'Orbigny, de Loriol, and Pictet and Campiche included *Requienia carinata*, Matheron,[1] from the Urgonian of Orgon, as a synonym of Sowerby's *Diceras Lonsdalei*; but Prof. Douvillé[2] and M. Paquier[3] think that the identity of the two forms is doubtful and can only be determined by a careful comparison of English specimens with internal casts of *T. carinata*. Prof. Douvillé[4] suggests that there is a resemblance between *T. Seunesi* and *T. Lonsdalei*.

Type.—The type, which is stated to have come from near Calne, cannot now be found. The specimen from which Woodward's outline figure was drawn is in the British Museum, No. 88825.

Distribution.—Lower Greensand of Stock Orchard, south of Calne. Recorded by Morris from Lockswell Heath, south-west of Calne.

Family—MONOPLEURIDÆ, *Fischer*.

Genus—Gyropleura, *H. Douvillé*, 1887.

('Bull. Soc. géol. de France,' ser. 3, vol. xv, p. 768.)

Gyropleura cornucopiæ (*d'Orbigny*), 1847. Plate XXXIII, fig. 7 *a*, *b*.

1847.	Chama	cornucopiæ,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 689, pl. cccclxiv, figs. 3—7.
1850.	—	—	*d'Orbigny.*	Prodr. de Pal., vol. ii, p. 170.
1868.	—	—	*F. J. Pictet and G. Campiche.*	Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 7.
1871.		—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 234.
1887.	Gyropleura	—	*H. Douvillé.*	Bull. Soc. géol. de France, ser. 3, vol. xv, p. 771, fig. 3.

Remarks.—Two specimens from the Chloritic Marl of Dorset agree in form with examples of *G. cornucopiæ* from the Cenomanian of Rouen (the locality

[1] 'Catal. Foss. des Bouches-du-Rhône' (1842), p. 104, pl. ii, figs. 1, 2; *Caprotina Lonsdalii*, d'Orbigny, 'Ann. Sci. Nat. Zool.,' ser. 2, vol. xvii (1842), p. 180; *Requienia Lonsdalii*, d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iv (1850), p. 248, pls. dlxxvi, dlxxvii; *Caprotina Lonsdalii*, de Loriol, in Favre, 'Rech. géol. dans Savoie,' vol. i (1867), p. 386, pl. C, fig. 22; *Requienia Lonsdalii*, Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Mater. Pal. Suisse,' ser. 5, 1868), p. 14, pl. clxi.

[2] 'Bull. Soc. géol. de France,' ser. 3, vol. xvii (1889), p. 630.

[3] 'Les Rudistes Urgoniens,' I ('Mém. Soc. géol. de France,' Paléont. XI, 1903), p. 41.

[4] *Op. cit.*, p. 632.

of the type) and with d'Orbigny's figs. 4 and 5. The ornamentation in this species is imperfectly known; most of the examples from Rouen are either internal casts or have only portions of the shell present, on which the ornamentation is rather indistinct. In one specimen from Dorset part of the shell of the fixed valve is preserved; the radial ribs are not so prominent as in *G. inequirostrata*, but concentric lamellæ are distinct.

Distribution.—Chloritic Marl of Melbury Park and Chaldon, Dorset. Recorded by Jukes-Browne from the base of the Lower Chalk of Chard and Maiden Newton.

GYROPLEURA INEQUIROSTRATA (*Woodward*), 1833. Plate XXXIII, figs. 8—13.

1833. DICERAS INEQUIROSTRATUS, *S. Woodward*. Geol. Norfolk, p. 47, pl. v, fig. 22.
1854. CHAMA INÆQUIROSTRATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 194.

Description.—Shell much inflated. Right valve large, oval, attached by a considerable portion of the anterior side; umbo prominent, pointed, incurved anteriorly. Left valve capuliform, with the umbo near the hinge-margin.

Ornamentation consists of strong, lamellar radial ribs, which are undulose where they cross growth-rings. The ribs have strongly serrate summits and are separated by rather broad, flat, smooth interspaces; sometimes the serrations are replaced by numerous transverse, scale-like structures. Near the fixed part of the right valve the ribs are more numerous than on the flank.

Measurements of fixed valve:

	(1)	(2)	(3)	(4)
Length	22	19	16	14 mm.
Height	28	26	20	18 „

(1—4) Norwich.

Affinities.—*G. ciplyana* (de Ryckholt),[1] from Ciply, differs from this species in having the ribs more widely separated and in the presence of small ribs in the interspaces and on the sides of the main ribs. *G. russiensis* (d'Orbigny)[2] resembles closely *G. inequirostrata* and was regarded by Morris as a synonym of the latter, but it possesses small ribs on the sides of the main ribs.[3]

[1] 'Mélanges Paléont.,' pt. ii (1851), p. 179, pl. xii, figs. 12, 13; Douvillé, 'Bull. Soc. géol. de France,' ser. 3, vol. xv (1887), p. 744, pl. xxviii, fig. 11; Holzapfel, 'Mollusk. Aachen. Kreide' (1889), p. 189, pl. xix, figs. 5, 6; Wollemann, 'Fauna d. Lüneburg. Kreide' (1902), p. 75, pl. ii, figs. 5, 6.

[2] Murchison, de Verneuil, and de Keyserling, 'Géol. de la Russie,' vol. ii (1845), p. 496, pl. xliii, figs. 31—33; Douvillé, 'Bull. Soc. géol. de France,' ser. iii, vol. xv (1887), p. 775, pl. xxviii, fig. 13.

[3] *G. Münsteri* (v. Hagenow) is probably related to *G. inæquirostrata*. See Ravn, 'Mollusk. i Danmarks Kreidtafl. I, Lamellibr.' (1902), p. 126, pl. iv, figs. 10, 11.

Type.—From Norwich; in the British Museum.

Distribution.—Upper Chalk (zone of *Belemnitella mucronata*) of Norwich.

GYROPLEURA, sp. Plate XXXIV, fig. 1 *a*—*d*.

Description.—Right valve inflated, attached by a large portion of the dorsal surface. Left valve convex, subquadrate, with a pointed and incurved umbo. Right valve ornamented with numerous, small radial ribs which bear transverse nodes or scales. Left valve with relatively few, stout ribs bearing strong, somewhat irregular, transverse scales or lappet-like projections.

Affinities.—The ornamentation on the right valve is finer and that on the left valve coarser than in *G. cenomanensis* (d'Orbigny[1]); also the transverse ornamentation of the ribs is much coarser and less regular.[2]

Remarks.—The portion of the right valve which was attached includes the umbo and the neighbouring parts, whereas in most examples of *Gyropleura* only the part in front of the umbo is attached. The size of the area which was attached is larger than usual, but in other species it is seen that that area varies considerably in size in different examples.[3]

The only specimen seen was collected by Mr. Francis R. B. Williams.

Distribution.—Upper Chalk (zone of *Actinocamax quadratus*) near the groyne at Seaford.

Family—CORBULIDÆ, *Fleming*.

Genus—CORBULA, *J. G. Bruguière*, 1797.

('Encyc. Méth.,' Tabl. Vers., pl. 230.)

CORBULA ANGULATA (*Phillips*), 1829. Plate XXXIV, figs. 2—5.

1829.	ISOCARDIA ANGULATA,	*J. Phillips.*	Geol. Yorks., p. 94, pl. ii, figs. 20, 21 (ed. 3, 1875, p. 252).
1841.	—	—	*F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 70.
1854.	—	—	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 204.

[1] 'Pal. Franç. Terr. Crét.,' vol. iv (1850), p. 261, pl. dxcv, figs. 1—4.

[2] Douvillé, 'Bull. Soc. géol. de France,' ser. 3, vol. xv (1887), p. 771, pl. xxviii, fig. 7.

[3] In a specimen figured by Griepenkerl the surface of attachment is unusually large; 'Senon v. Königslutter' ('Palæont. Abhandl.,' v, 1889), pl. vii, fig. 3.

1865. Isocardia? angulata, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 240.

1871. Isocardia angulata, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 194.

1877. Isocardia? angulata, *G. Böhm.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix, p. 241.

1889. Isocardia angulata, *G. W. Lamplugh.* Quart. Journ. Geol. Soc., vol. xlv, p. 616.

1900. — — *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 114.

1905. Corbula (Isocardia) angulata, *E. Harbort.* Fauna d. Schaumberg-Lippeschen Kreidemulde (Ibid., pt. 45), p. 81.

1906. Isocardia angulata, *A. Wollemann.* Die Biv. u. Gastrop. nord-deutsch. Gaults (Jahrb. d. k. preussisch. geol. Land., für 1906, vol. xxvii), p. 277.

Description.—Shell with sub-quadrate outline, rounded, occasionally sub-triangular, very convex, equivalve, more or less considerably inequilateral; length greater than height. Anterior part produced, rounded; ventral margin slightly curved; posterior margin truncate, slightly convex, somewhat oblique, forming angles with the ventral and dorsal margins. Postero-dorsal margin sloping ventrally. Umbones moderately large, curved inward and more or less considerably forward, with a carina extending to the postero-ventral angle, cutting off a large, flattened postero-dorsal area. The part of the valve in front of the carina is regularly convex. Lunular region depressed.

Ornamentation consists of fine concentric striæ.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Length	7·1	6·8	6·2	6	6·0	5·0	4·5	mm.
Height	6·0	5·5	5·0	5	4·5	4·1	4·0	„

(1—7) Speeton.

Affinities.—This species shows some resemblance to *C. gaultina* (see p. 214), but is more nearly quadrate in outline, relatively longer, of larger size, and without distinct ribs.

C. angulata is fairly common in the Speeton Clay, but no specimen showing the hinge appears to have been found, so that the generic position assigned to this species by Phillips was presumably based on the external character of the shell. Pictet and Campiche thought that it probably belonged to *Cyprina*. Wollemann states that it is most likely a *Corbula*, and Harbort, who has seen the hinge,

definitely refers it to that genus; if this view of its position is confirmed it will be necessary to substitute a new name, since *angulata* had been previously used by Lamarck for a species of *Corbula* from the Eocene.

Distribution.—Speeton Clay (zones of *Belemnites jaculum* and *B. brunsvicensis*) of Speeton.[1]

CORBULA STRIATULA, *Sowerby*, 1827. Plate XXXIV, figs. 6—12.

	1827.	CORBULA STRIATULA,	*J. de C. Sowerby.*	Min. Conch., vol. vi, p. 139, pl. dlxxii, figs. 2, 3.
	1846.	—	— *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 459, pl. cccIxxxviii, figs. 9—13.
	1850.	—	— *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 118.
	1854.	—	— *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 196.
	1858.	—	— *F. J. Pictet and E. Renevier.*	Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 176.
	1864.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 36.
	1870.	—	— *F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 40.
	1895.	—	— *G. Maas.*	Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 257.
	—	—	LÆVIS, *Maas.*	Ibid., p. 257.
	1900.	—	STRIATULA, *A. Wollemann.*	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 144.
Non	1840.	—	— *A. Goldfuss.*	Petref. Germ., vol. ii, p. 251, pl. cli, fig. 16 (*C. substriatula*, d'Orbigny, 1850).
—	1847.	—	— *J. Müller.*	Petref. der Aachen. Kreidef., pt. i, p. 25, pl. ii, fig. 8.
—	1854.	—	— *A. d'Archiac.*	Bull. Soc. géol. de France, ser. 2, vol. xi, p. 209, pl. iv, figs. 14, 15.
—	1858.	—	— *J. Vilanova-y-Piera.*	Mem. geog.-agric. de Castellon, pl. iii, fig. 14.
—	1867.	—	— *O. Fraas.*	Aus dem Orient, p. 92.
—	1870.	—	— *H. Credner.*	Zeitschr. der deutsch. geol. Gesellsch., vol. xxii, p. 236.

[1] The type of *Corbula punctum*, Phillips, from Speeton, cannot be found, and I have not seen any specimen which could be satisfactorily identified with that species. Phillips, 'Geol. Yorks.' (1829), p. 122, pl. ii, fig. 6.

Non 1885. CORBULAMELLA STRIATULA, *J. Böhm.* Verhandl. d. nat. Vereines d. preuss. Rheinl., vol. xlii, p. 144.

-- 1887. — — *F. Frech.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxix, p. 173, pl. xii, figs. 5—8.

-- 1888. — — *G. Müller.* Jahrb. d. k. preussisch. geol. Land., für 1887, p. 436.

- 1889. CORBULA STRIATULA, *O. Griepenkerl.* Senon. v. Königslutter (Palæont. Abhandl., vol. iv), p. 69.

- 1897. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., vi, Chlomek. Schicht., p. 64, fig. 83.

— 1901. CORBULAMELLA STRIATULA, *F. Sturm.* Jahrb. d. k. preussisch. geol. Land., für 1900, vol. xxi, p. 88.

Description.—Shell ovate, usually much inflated, produced and pointed posteriorly, inequilateral, slightly inequivalve. Anterior and ventral margins rounded. Posterior margin short, obliquely truncated. Umbones broad, strongly incurved, with a carina extending to the postero-ventral angle and cutting off a flattened postero-dorsal area. Ornamentation consists of numerous concentric ribs which extend on to the postero-dorsal area, where they are narrower and more distinct.

Measurements:

	(1)	(2)	(3)	
Length	6·7	6·0	5·5	mm.
Height	5·0	4·2	4·0	,,

(1) Atherfield Beds, East Shalford; (2, 3) Crackers, Atherfield.

Affinities.—This species is distinguished from *C. neocomiensis*, d'Orbigny,[1] by the smaller and more pointed posterior end. It differs from *C. substriatula* in being less inequivalve and in possessing a distinct carina. Wollemann considers that *C. lævis*, Maas, is identical with *C. striatula*. Another form which appears to be closely allied is *C. neverisensis*, de Loriol,[2] from the Gault of Cosne.

Remarks.—This species varies considerably in convexity and in relative length and height. The shorter, more globose, and more distinctly rostrate forms agree with the type. The more elongate and less convex forms are not so numerous, and although differing considerably in shape from the globose forms, yet they agree with them in other respects and do not appear to be specifically distinct.

Specimens from the Lower Greensand of Punfield resemble *C. striatula*, but possess stronger concentric ribs—in some cases, as in the example figured (Plate XXXIV, fig. 13), the ribs are considerably stronger, but in others the difference is not so great.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1846), p. 457, pl. cccIxxxviii, figs. 3—5, and 'Prodr. de Pal.,' vol. ii (1850), p. 76.

[2] 'Gault de Cosne' (1882), p. 43, pl. v, figs. 23—25.

Type.—Internal casts from the Hythe Beds of Pulborough, in the British Museum.

Distribution.—Lower Greensand: Crackers of Atherfield. Recorded by Fitton from the *Perna*-bed, Atherfield Clay, and Beds VI—IX, XIII, XIV near Atherfield. Ferruginous Sands of Shanklin. Atherfield Beds of Peasmarsh, East Shalford and Sevenoaks. Hythe Beds of Pulborough. Folkestone Beds of Folkestone.

CORBULA GAULTINA, *Pictet and Campiche*, 1864. Plate XXXIV, figs. 14—16.

1864. CORBULA GAULTINA, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 34, pl. c, figs. 3, 4.

1870. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 40.

Description.—Shell subtriangular, rounded, inflated, slightly inequivalve, a little longer than high, moderately inequilateral. Anterior margin rounded. Posterior margin subtruncate, oblique. Umbones prominent, rather high, curved forward, with an inconspicuous carina cutting off a concave postero-dorsal area. Ornamentation consists of small, concentric ribs.

Measurements:

	(1)	(2)	(3)	(4)
Length	5·5	5·0	4·6	4·0 mm.
Height	5·0	4·5	4·0	3·6 ,,

(1—4) Gault, Folkestone.

Affinities.—In this species the shell is relatively shorter and more inflated than in *C. elegantula*, d'Orbigny.[1]

C. gaultina may perhaps be, as was pointed out by Pictet and Campiche, identical with *C. socialis*, d'Orbigny,[2] of which no sufficient diagnosis has been given.

Remarks.—Numerous individuals of this species are found close together in groups. When the surface of the shell is not perfectly preserved the ribs become indistinct.

Type.—From the Gault of Folkestone.

Distribution.—Lower Gault (Bed 2) of Folkestone.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1846), p. 460, pl. cclxxxviii, figs. 14—17.

[2] 'Prodr. de Pal.,' vol. ii (1850), p. 136.

CORBULA TRUNCATA, *Sowerby*, 1836. Plate XXXIV, figs. 17—22.

1836.	CORBULA TRUNCATA,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 240, 341, pl. xvi, fig. 8.
1850.	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 160.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 196.
1868.	—	—	*A. Briart and F. L. Cornet.* Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 81, pl. vi, figs. 13—15.
1870.	—	—	*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 40.
(?) 1895.	—	cf. —	*E. Tiessen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 485.
Non 1846.	—	—	*A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 461, pl. cccIxxxviii, figs. 18—20 (? *C. Goldfussiana*, Matheron).

Description.—Shell subquadrate or subtriangular, elongate, rounded, moderately convex, inequilateral, slightly inequivalve, considerably longer than high. Anterior margin well rounded. Ventral margin slightly convex, its posterior part bending upwards. Posterior margin obliquely truncated, forming an acute angle with the ventral margin and an obtuse angle with the dorsal margin. Umbones broad, with a carina extending to the postero-ventral angle and cutting off a flattened or concave postero-dorsal area. Ornamentation consists of numerous fine, concentric ribs which are continued on to the postero-dorsal area.

Measurements:

	(1)	(2)	(3)	(4)	
Length .	9	8·5	8	7·5	mm.
Height .	6·5	6	5·75	5	„

(1—4) Blackdown.

Affinities.—This species is less elongate than *C. truncata*, d'Orbigny, and is also distinguished by its concentric ornamentation. It differs from *C. lineata*, Müller,[1] in the greater obliquity of the posterior margin and in the more numerous concentric ribs.

Type.—From Blackdown, in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown.

[1] Holzapfel, "Die Mollusk. Aachen. Kreide" ('Palæontographica,' vol. xxxv, 1889), p. 146, pl. x, figs. 16—19.

CORBULA ELEGANS, *Sowerby*, 1827. Plate XXXIV, figs. 23—28.

1827.	CORBULA ELEGANS,	*J. de C. Sowerby.*	Min. Conch., vol. vi, p. 139, pl. dlxxii, fig. 1.
1850.	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 160.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 195.
? 1867.	—	—	?, *E. Guéranger.* Album Paléont. de la Sarthe, p. 12, pl. xvi, fig. 1.
1870.	—	—	*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 40.
Non 1846.	—	—	*A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 460, pl. cccIxxxviii, figs. 14—17 (*C. elegantula*, d'Orbigny, 1850).
? — 1847.		—	?, *A. d'Archiac.* Mém. Soc. géol. de France, ser. 2, vol. ii, p. 302.

Description.—Shell subtrigonal, rounded, very convex, inequivalve, inequilateral, a little longer than high.

Right valve with the anterior part sloping rapidly to the margin; anterior margin rounded; ventral margin convex, its posterior part curving upwards. Posterior part produced, compressed, separated from the sides by a groove passing from the umbo to the postero-ventral angle; on the dorsal side of the groove is a small carina. Posterior margin truncated, forming approximately a right angle with the straight postero-dorsal margin. Umbo prominent, sharp, curved considerably inward and somewhat forward. Ornamentation consists of strong, broad, concentric ribs separated by narrow grooves, except on the postero-dorsal area, which is nearly smooth.

Left valve smaller, less convex, and with smaller ribs than the right valve. Postero-dorsal area separated from the side of the valve by a groove or sharp carina.

Measurements:

	(1)	(2)	(3)	(4)
Length	6	5·5	5	4·5 mm.
Height	4·75	4·5	4	3·6 ,,

(1—4) Blackdown.

Affinities.—This species is distinguished from *C. elegantula*, d'Orbigny, by its broader concentric ribs and rostrate posterior end. It is less globose, less pointed posteriorly, and has stronger ribs than *C. substriatula*, d'Orbigny.

Type.—From Blackdown, in the British Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown and Haldon. Recorded by Price from the Upper and Lower Gault of Folkestone.

Palæontographical Society, 1909.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. II. PART VI.

SOLENIDÆ, SAXICAVIDÆ, PHOLADIDÆ, TEREDINIDÆ, ANATINIDÆ, PHOLADOMYIDÆ, PLEUROMYIDÆ, POROMYACIDÆ, AND CUSPIDARIIDÆ.

PAGES 217—260; PLATES XXXV—XLIV.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY

1909.

Family—SOLENIDÆ, *Lamarck*.

Genus—PHARUS, *Leach* in *J. E. Gray*, 1847.

('Synops. Brit. Mus.,' ed 42, 1840, p. 154; 'Ann. Mag. Nat. Hist.,' vol. xx, 1847, p. 272; and 'Proc. Zool. Soc.,' 1847, p. 189.)

PHARUS WARBURTONI (*Forbes*), 1845. Plate XXXV, figs. 1—3.

1845.	SOLECURTUS WARBURTONI,	*E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 237, pl. ii, fig. 1.
1850.	—	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 117.
1854.	—	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 224.
1864.	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 30.
1870.	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 99.

Description.—Shell elongate-oblong, compressed, slightly inequilateral, gaping at the ends, the posterior higher than the anterior part. Dorsal margin almost straight. Ventral margin slightly flexuous, and slightly oblique to the dorsal margin. Anterior margin rounded. Posterior margin slightly truncate, rounded. Umbones small, inconspicuous, sub-median. Ornamentation consists of growth-rings, and on the anterior part of the shell, of numerous, very small, rather irregular, radial ribs.

Measurements:

	(1)	(2)	(3)	(4)
Length	67	60·5	55	44 mm.
Height	17	16	15	12 ,,

(1—4) Crackers, Atherfield.

Affinities.—This species, as was pointed out by Stoliczka, closely resembles in form living examples of the genus *Pharus;* but the hinge appears to be unknown, for although the species is well represented in collections, and the specimens are in an excellent state of preservation, none of them shows the interior of the shell. A single valve resembling *P. Warburtoni*, but relatively higher, has been described by Dr. Kitchin[1] from the Uitenhage Series. Dr. Harbort[2] states that his *Solecurtus longovatus* is similar to our species, but is relatively higher and shorter.

[1] 'Ann. S. African Mus.,' vol. vii (1908), p. 155, fig. 1.

[2] 'Die Fauna d. Schaumburg-Lippe'schen Kreidemulde' (1905), p. 71, pl. viii, fig. 6. An imperfect internal cast found in the Upper Greensand of Devizes shows some resemblance to this species.

Type.—From Atherfield, in the Museum of the Geological Society.

Distribution.—Lower Greensand (Crackers) of Atherfield. Atherfield Beds of East Shalford and Sevenoaks. Sandgate Beds of Parham Park.

Genus—Solecurtus, *H. M. D. de Blainville*, 1824.

('Dict. Sci. nat.,' vol. xxxii, p. 351.)

Sub-genus—Azor, *W. E. Leach*, 1847.

(In *Gray*, 'Ann. Mag. Nat. Hist.,' vol. xx, p. 272; and 'Proc. Zool. Soc.,' 1847, p. 189.)

Solecurtus (Azor?) Pelagi, *d'Orbigny*, 1850. Plate XXXV, fig. 4.

1850.	Solecurtus Pelagi,	*A. d'Orbigny*.	Prodr. de Pal., vol. ii, p. 158.
1867.	— —	*E. Guéranger*.	Album Paléont. de la Sarthe, p. 12, pl. xv, fig. 6.
1870.	— —	*F. Stoliczka*.	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 99.

Description.—Shell elongate, considerably inequilateral, moderately convex, but slightly concave at the middle of the sides. Postero-dorsal area flattened or slightly concave, limited by an indistinct carina. Antero-dorsal margin curved; anterior margin rounded; postero-dorsal margin straight, nearly parallel to the ventral margin; posterior margin curved, slightly oblique. Ornamentation consists of small concentric ribs near the umbo, and of growth-rings elsewhere. Length 30 mm.; height 12 mm.

Affinities.—The identification of the English specimens with d'Orbigny's species is not quite free from doubt, since only two valves, both somewhat imperfect, have yet been seen. In the specimen figured by Guéranger the postero-dorsal area seems relatively higher than in our specimens; also the postero-dorsal margin is less nearly straight, but this difference may be due to imperfect preservation.

S. Pelagi seems to be closely allied to *S. Guerangeri*, d'Orbigny,[1] but the carina is less distinct, and the postero-ventral angle appears to be more rounded.

Until specimens showing the hinge satisfactorily have been found, the generic position of this species must be regarded as doubtful.

Type.—From the Cenomanian of Le Mans.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 321, pl. cccli, figs. 1, 2. Guéranger, 'Album Paléont. de la Sarthe' (1867), p. 12, pl. xv, fig. 4. An internal cast of a left valve from the Upper Greensand of Warminster resembles *S. Guerangeri*.

SOLECURTUS? (AZOR?) ACTEON, *d'Orbigny*, 1850. Plate XXXV, figs. 5, 6.

1850. SOLECURTUS ACTEON, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 158.
1867. — — *E. Guéranger*. Album Paléont. de la Sarthe, p. 12, pl. xv, figs. 1, 2.
1870. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 99.

Description.—Shell somewhat oblong, moderately inequilateral, moderately convex, with flattened sides and flattened postero-dorsal area. Anterior margin rounded; postero-dorsal margin nearly straight, sloping ventrally from the umbo; posterior margin slightly convex, somewhat oblique; ventral margin nearly parallel to the dorsal margin and forming a rounded angle with the posterior margin. Umbones broad, inconspicuous. Ornamentation consists of strong, regular, concentric ribs, separated by furrows of greater breadth.

Measurements (approximate):

	(1)	(2)
Length	46	20 mm.
Height . .	24	10 ,,

(1) Haldon, (2) Dunscombe.

Affinities.—Only two specimens have been seen; they resemble closely Guéranger's figures of *S. Acteon*. The hinge is unknown, so that the generic position cannot be determined at present.

Type.—From the Cenomanian of Le Mans.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Haldon. Cenomanian (Meÿer's Bed 10) of Dunscombe, South Devon.[1]

Genus—LEPTOSOLEN, *T. A. Conrad*, 1867.

('Amer. Journ. Conch.,' vol. iii, pp. 15, 188; F. B. Meek, 'Invert. Cret. and Tert. Foss. U. Missouri,' 1876, p. 252.)

LEPTOSOLEN DUPINIANUS (*d'Orbigny*), 1845. Plate XXXV, figs. 7, 8.

1845. SOLEN DUPINIANUS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 320, pl. ccel, figs. 3, 4.
1850. — — *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 135.

[1] An internal cast from the Cenomanian (Bed 11) of Dunscombe, South Devon, resembles *Solecurtus æqualis*, d'Orbigny, but is not sufficiently well-preserved for identification. *S. æqualis* has been referred doubtfully to the genus *Pharella* by Stoliczka and by Meek, whilst de Loriol regards it as belonging to *Siliquaria* (= *Tagalus*). See d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 321, pl. ccel, figs. 5—7, and 'Prodr. de Pal.,' vol. ii (1850), p. 158; Guéranger, 'Album Paléont. de la Sarthe' (1867), p. 12, pl. xv, fig. 3.

1864. Solen dupinianus, *F. J. Pictet and G. Campiche.* Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 29.

1897. -- -- *R. B. Newton.* Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 93.

Description.—Shell elongate, more or less oblong, slightly convex, compressed near the antero-dorsal margin, considerably inequilateral. Dorsal margin nearly straight. Anterior end rounded, not so high as the posterior part of the shell. Ventral margin nearly straight and nearly parallel to the dorsal margin, curving upwards anteriorly. Posterior margin convex, forming a rounded angle with the ventral margin. Umbones small, inconspicuous, situated at less than a third of the length of the shell from the anterior margin.

Ornamentation consists of small concentric ridges; in some cases the ridges cut the posterior part of the ventral margin obliquely. A strong internal rib extends from the umbo ventrally, but does not reach the ventral margin.

Measurements:

	(1)	(2)	(3)	
Length	31	29	26	mm.
Height	10	10	9	,,

(1—3) Gault, Black Ven.

Affinities.—The occurrence of this species in the Gault of England has been recorded by De Rance and R. B. Newton—by the former from Black Ven, and by the latter from Okeford Fitzpaine. Although the example figured by d'Orbigny is imperfect, consisting of the posterior part of a left valve only, yet the English specimens agree sufficiently closely with d'Orbigny's figure to make it probable that they have been correctly identified with *L. Dupinianus*. In most of the English examples, however, the posterior margin is more convex and the postero-dorsal angle more rounded than in d'Orbigny's figure; but in a few specimens, which have been slightly crushed, these differences are not noticeable.

The species which resemble *L. Dupinianus* are *L. concentristriatus* (Müller[1]), *L. Petersi* (Reuss[2]), *L. truncatula* (Reuss[3]), *L. Moreana* (d'Orbigny[4]) and *L. limata* (Stoliczka[5]).

Type.—From the Albian of Ervy (Aube).

Distribution.—Lower Gault of Black Ven and Okeford Fitzpaine. Upper Greensand of Devizes. Recorded by Jukes-Browne from the Gault of the Isle of Wight.

[1] 'Jahrb. d. k. preussisch. geol. Landesanst. für 1887' (1888), p. 431, pl. xviii, fig. 5.

[2] 'Kreideschicht. i. d. Ostalpen' (1854), p. 145, pl. xxviii, fig. 10. Zittel, 'Die Bivalv. d. Gosaugeb.,' I (1865), p. 5 [109], pl. i, fig. 3.

[3] 'Die Verstein. der böhm. Kreideformat.,' pt. 2 (1846), p. 17, pl. xxxvi, figs. 13, 16, 17.

[4] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 324, pl. ccel, figs. 8—10. This species has been recorded by Barrois from the Upper Greensand of Lulworth and Devizes; I have not seen any examples from those localities.

[5] 'Palæont. Indica, Cret. Fauna S. India' (1870), p. 101, pl. i, figs. 12, 13.

Family—SAXICAVIDÆ, *Gray*.

Genus—PANOPEA, *Ménard de la Groye*, 1807.

('Ann. Mus. Hist. nat., Paris,' vol. ix, p. 131, pl. xii.)

PANOPEA, sp. Text-fig. 27.

Internal casts of a large, convex *Panopea* occur in the Tealby Limestone of

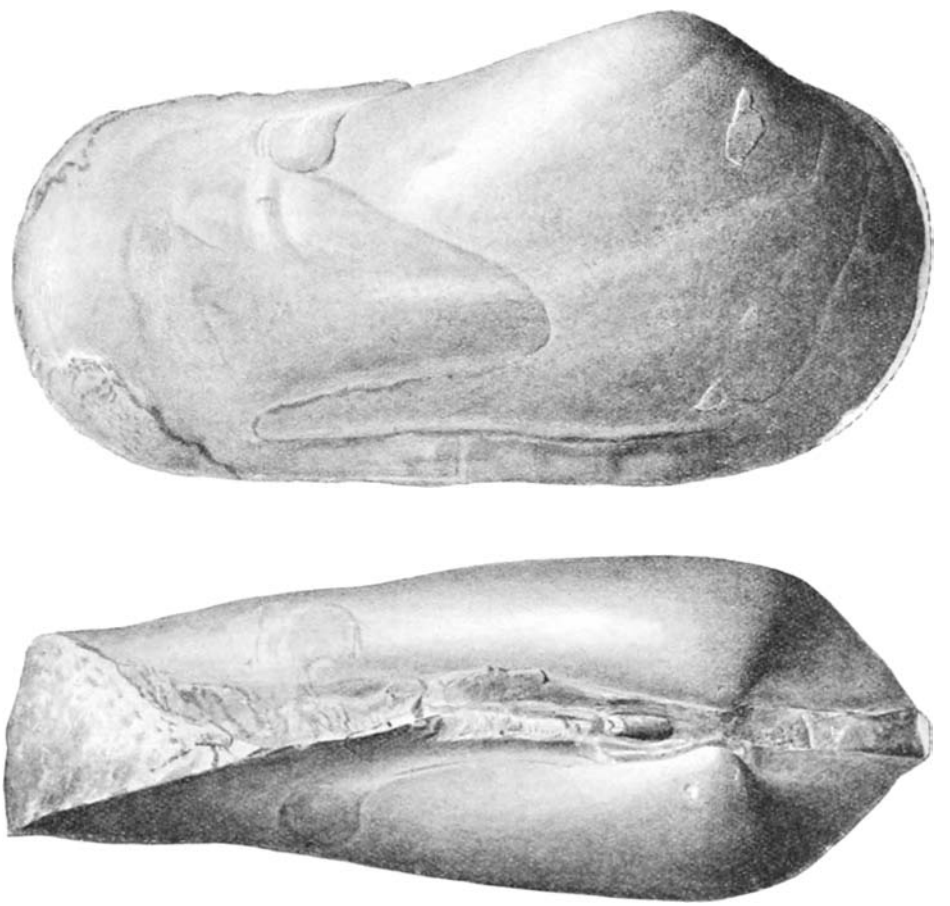


FIG. 27.—*Panopea*, sp. Tealby Limestone, North Willingham, Lincolnshire. Sedgwick Museum, Cambridge. × ⅓.

Hainton, Claxby, and North Willingham, Lincolnshire. In form they resemble some varieties of *P. gurgitis*, but the posterior part of the shell is more elongated. One specimen shows a large external ligament, and on a small portion of shell indications of radial rows of fine granules are seen. The pallial sinus is large and rounded.

PANOPEA SPILSBIENSIS, sp. nov. Plate XXXVIII, fig. 2 *a*, *b*.

Description.—Shell elongate-oval, convex, not very inequilateral. Posterior part more compressed and not so high as the median and anterior parts. Anterior margin rounded; ventral margin slightly curved, not quite parallel to the long dorsal margin. Umbones broad, incurved, at about six-fifteenths of the entire length from the anterior end. Pallial sinus large, deep, and rounded. Surface of shell nearly smooth.

Remarks.—Only a few internal casts with small portions of the shell preserved have been obtained, but they seem to differ considerably from other species and are provisionally referred to the genus *Panopea*.

Distribution.—Spilsby Sandstone (zone of *Belemnites lateralis*) of Donnington.

PANOPEA GURGITIS (*Brongniart*), 1822. Plate XXXV, figs. 9—14; Plate XXXVI, figs. 1—8.

1822. LUTRARIA GURGITIS, *A. Brongniart*, in *Cuvier*. Ossemens Foss., vol. ii, pt. 2, pp. 333, 615, pl. ix, fig. 15.
1823. MYA PLICATA, *J. de C. Sowerby*. Min. Conch., vol. v, p. 20, pl. cccexix, fig. 3.
1835. PANOPÆA PLICATA, *Sowerby*. Ibid., vol. vi, Systemat. Index, p. 241.
1841. — — *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 75, pl. ix, fig. 25.
1842. PHOLADOMYA NEOCOMIENSIS, *A. Leymerie*. Mém. Soc. géol. de France, ser. 2, vol. v, p. 3, pl. iii, fig. 4.
— — PREVOSTI, *Deshayes* in *Leymerie*. Ibid., p. 3, pl. ii, fig. 7.
1845. PANOPÆA NEOCOMIENSIS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 329, pl. cccliii, figs. 3—8.
PREVOSTI, *d'Orbigny*. Ibid., p. 334, pl. cccIvi, figs. 3, 4.
NEOCOMIENSIS, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 238.
— — PLICATA, *Forbes*. Ibid., p. 238.
— MYOPSIS NEOCOMIENSIS, *L. Agassiz*. Études crit. Moll. Foss., Myes, p. 257, pl. xxxi, figs. 5—10.
— — UNIOIDES, *Agassiz*. Ibid., p. 258, pl. xxxi, figs. 11, 12.
1850. PANOPÆA NEOCOMIENSIS, *A. d'Orbigny*. Prodr. de Pal., vol. ii, pp. 73, 117.
— — PREVOSTII, *d'Orbigny*. Ibid., pp. 105, 117.
1852. PLICATA, *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 399, pl. xxviii, fig. 2.
— — RHODANI, *Pictet and Roux*. Ibid., p. 400, pl. xxviii, fig. 3.
1854. MYACITES NEOCOMIENSIS, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 213.
1855. PANOPÆA — — *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), pp. 56, 175, pl. vi, figs. 2, 3.
— — — PLICATA, *Pictet and Renevier*. Ibid., p. 57, pl. vi, figs. 4, 5.

1855. PANOPÆA NEOCOMIENSIS, *G. Cotteau.* Moll. Foss. de l'Yonne, p. 51.
1861. — — *P. de Loriol.* Anim. Invert. Foss. Mt. Salève, p. 55.
1864–5. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 49, pl. c, figs. 10–12.
1865. — PLICATA, *Pictet and Campiche.* Ibid., p. 63.
1869. — NEOCOMIENSIS, *P. de Loriol and V. Gilliéron.* Urgon. inférr. de Landeron, p. 10, pl. i, fig. 10.
1870. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 87.
1877. — PUNCTATO-PLICATA, *G. Böhm.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix, p. 241.
? 1883. — PLICATA, *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 126.
1884. — NEOCOMIENSIS, *O. Weerth.* Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 37, pl. viii, fig. 7.
1886. PLEUROMYA — *H. Trautschold.* Néocom. de Sably (Nouv. Mém. Soc. Impér. Nat. Moscou, vol. xv), p. 135.
1892. PANOPÆA — *O. Behrendsen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xliv, p. 20.
1895. — — *G. Maas.* Ibid., vol. xlvii, p. 256.
— — — *F. Vogel.* Holländisch. Kreide, p. 59.
1896. — — *A. Wollemann.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 849.
1897. PLEUROMYA PLICATA, *R. B. Newton.* Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, pp. 71, 93, pl. ii, figs. 4, 5.
1898. — NEOCOMIENSIS, *E. G. Skeat and V. Madsen.* Jur. Neoc. and Gault Boulders in Denmark (Danmarks geol. Undersög., 2 R., Nr. 8), p. 185, pl. vi, fig. 11.
1900. PANOPÆA — *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 124.
1905. — — *E. Harbort.* Die Fauna d. Schaumburg-Lippe-'schen Kreidemulde (ibid., pt. 45), p. 74.
1906. — — *A. Wollemann.* Jahrb. d. k. preuss. geol. Landesanst. für 1906, vol. xxvii, p. 278.
1908. — — *A. Stojanoff.* Ann. géol. et min. de la Russie, vol. x, p. 115.

Non 1827. LUTRARIA GURGITIS, *S. Nilsson.* Petrif. Suecana, p. 18, pl. v, fig. 9 (*Glycimeris Holzapfeli*, Hennig).
— 1837. — — *W. Hisinger.* Lethæa Suecica, p. 67, pl. xx, fig. 1.

Non 1840. PANOPÆA GURGITES, *A. Goldfuss*. Petref. Germ., vol. ii, p. 274, pl. cliii, fig. 7 (*P. Goldfussi*, d'Orbigny, 1850).

— — PLICATA, *Goldfuss*. Ibid., p. 274, pl. clviii, fig. 5.

— 1845. — GURGITIS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 345, pl. cccl xi, figs. 1, 2.

— 1846. — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 17, pl. xxxvi, fig. 3.

— 1847. — PLICATA, *J. Müller*. Petref. der Aachen. Kreidef., pt. 1, p. 28 (*Glycimeris Geinitzi*, Holzapfel).

— 1873. — GURGITIS, *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 68, pl. xix, figs. 1, 2.

— 1876. — — *D. Brauns*. Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 362.

— 1877. — — *A. Fritsch*. Stud. im Gebiete der böhm. Kreideformat., ii, Weissenberg. u. Malnitz. Schichten, p. 125, fig. 100.

— 1898. GLYCIMERIS — *G. Müller*. Die Mollusk. d. Untersenon v. Braunschweig u. Ilsede, p. 70, pl. x, fig. 4.

— 1901. PANOPÆA — *F. Sturm*. Jahrb. d. k. preuss geol. Landesanst. für 1900, vol. xxi, p. 70, pl. x, fig. 4.

Description.—Shell more or less oblong, rounded, convex; posterior part somewhat compressed, anterior part sloping more or less rapidly to the margin; moderately or considerably inequilateral; posterior gape large. Anterior margin more or less convex, sometimes subtruncate; antero-ventral margin rounded; ventral margin slightly or moderately convex, nearly parallel to the dorsal margin; posterior margin convex, or subtruncate and rounded; postero-dorsal margin nearly straight. Umbones incurved, often broad, sometimes narrow and pointed; the dorsal part of the shell in front of the umbones is moderately or considerably depressed; sometimes a more or less distinct carina extends from the umbo towards the antero-ventral extremity; another carina, usually faint, may extend from the umbo posteriorly. Pallial sinus large, rounded.

Ornamentation consists of concentric folds, which may be conspicuous or only faintly indicated, and of numerous radial rows of minute granules.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Length	93	80	69	65	61	56	50	43	33	mm.
Height	49	46	36	38	35	29	29	24	19	,,

(1, 5) *Perna*-bed, Atherfield.

(3, 4, 6—9) Crackers, Atherfield.

(2) Ferruginous Sands, Shanklin.

Affinities.—This species has been referred by most authors to the genus

Panopea, but by some to *Pleuromya*.[1] There seems now to be sufficient evidence to show that it belongs to the former rather than the latter, since the hinge-margins of the two valves are alike and there is no overlap of left by the right margin; the hinge possesses the prominent, conical tooth characteristic of *Panopea* (Plate XXXVI, fig. 6); and a well-developed, broad, external ligament is present (Plate XXXV, figs. 9 *b*, 11 *b*). The fine radial ornamentation (Plate XXXV, figs. 9 *c*, 13 *b*) agrees perfectly with that found in Tertiary species of *Panopea*.[2] I have not seen the hinge in any specimen from the Lower Greensand, but it is well preserved in a left valve from Blackdown. Pictet and Campiche[3] state that casts from the Aptian show clearly the presence of the teeth of *Panopea*.

Pictet and Renevier thought that *P. plicata* (Sowerby) and *P. neocomiensis* (Leymerie) should be united as one species; Pictet and Campiche, however, in a later work regarded them as distinct, and stated that the former differs from the latter by the possession of strong concentric folds and by the absence of fine radial ornamentation. But when numerous specimens are examined all stages in the strength of the folds can be seen; and those with well-developed folds show, when the surface is well-preserved, the same kind of radial ornamentation that occurs on specimens with indistinct folds. The presence of a carina in front of the umbones and the somewhat smaller height of the posterior part of the shell have also been mentioned as characteristic of *P. neocomiensis*, but these features are now known to be inconstant. It appears, therefore, that there is no character by which *P. plicata* can be separated from *P. neocomiensis*.

It is evident from Brongniart's remarks that his specimens of *Lutraria gurgitis* came from the Perte-du-Rhône. Pictet and Renevier,[4] who had seen the type of that species in the collection of M. Deluc, recognised it as a specimen from the Aptian of the Perte-du-Rhône, and state that it is certainly an example of either *P. neocomiensis* or *P. plicata*. Since these two forms are now united it follows that the earlier name given by Brongniart should be used for this species. Later writers have unfortunately used the name *gurgitis* for a species from the Chalk.

P. acutisulcata (Deshayes[5]) and *P. Schröderi* (Wollemann[6]) appear to be closely allied to *P. gurgitis*.

[1] For an account of the characters of this genus see Terquem, 'Bull. Soc. géol. de France,' ser. 3, vol. x (1853), p. 534, and "Observations sur les Études critiques des Mollusques Fossiles comprenant la monographie des Myaires de M. Agassiz," 'Mém. Acad. Imp. de Metz,' année 1854–55 (1855), p. 253.

[2] See, for instance, *P. intermedia* (Sow.) from the London Clay, etc., and *P. floridana*, Heilprin, from the Caloosahatchie Beds of Florida.

[3] 'Terr. Crét. Ste. Croix' (1865), p. 51.

[4] 'Foss. Terr. Aptien' ('Matér. Pal. Suisse,' ser. 1, 1855), pp. 56 (footnote), 175.

[5] Leymerie, 'Mém. Soc. géol. de France,' ser. 2, vol. v (1842), p. 3, pl. iii, fig. 2; d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 336, pl. cccIvii, figs. 1–3; Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 65.

[6] 'Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms' ('Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31, 1900), p. 126, pl. v, fig. 7.

P. læviuscula (Sowerby[1]), from the Upper Greensand of Blackdown, closely resembles the small forms of the *neocomiensis* variety of *P. gurgitis* and does not appear to be specifically distinct. The type consists of an imperfect right valve; a specimen similar to the type, but with both valves preserved, is in the Museum of Practical Geology (No. 23,823).

Remarks.—Previous writers have remarked on the great amount of variation shown by this species. At first sight some of the varieties appear to be distinct, but, as Wollemann has pointed out, when a large number of specimens are studied, transitions can be traced between the different forms. The varieties do not appear to be confined to definite horizons, and nearly all of them are found together in the *Perna*-bed and Crackers of Atherfield.

Considerable differences are seen in the position of the umbones, so that some specimens are much more inequilateral than others; in those in which the anterior part is relatively short the anterior slope is rapid. The size and depth of the depression in the lunular region show considerable variation; when large and deep the umbones are usually narrower and more pointed than when the depression is small and shallow, and in the former case the carina extending from the umbo to the antero-ventral margin is usually distinct. The relative length and height of the shell, the rounded or truncate character of the anterior margin, the curvature of the ventral margin, the height of the posterior end, and the convexity of the anterior compared with that of the posterior part of the shell also show more or less considerable differences. The concentric folds may be conspicuous, but are sometimes indistinct; sometimes they appear to be better marked on internal casts than on the shell itself; in some cases their prominence is due to the state of preservation of the shell; thus Wollemann mentions a specimen in which one valve is weathered and shows strong folds, whilst the other valve is well preserved and nearly smooth.

Some forms of this species are represented by a larger number of individuals than others. One common form (Plate XXXVI, figs. 3, 4), agrees more or less closely with the type of *P. plicata* (Sowerby), and it may perhaps be convenient to refer to this as *P. gurgitis* var. *plicata*. In this the concentric folds are usually prominent, the ventral margin is only slightly curved, the posterior part of the shell is of nearly the same height as the anterior part, and the lunular depression is distinct and usually large.

Another form (Plate XXXV, figs. 9, 13) resembles *P. neocomiensis* (Leymerie) and may be referred to as *P. gurgitis* var. *neocomiensis*. The concentric folds are

[1] *Mya læviuscula*, J. de C. Sowerby, 'Trans. Geol. Soc.,' ser. 2 (1836), vol. iv, pp. 241, 340, pl. xvi, fig. 6; Morris, 'Cat. Brit. Foss.,' ed. 2 (1854), p. 212. *Panopæa læviuscula*, d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 157; Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 70.

usually less distinct than in the variety *plicata*, the lunular depression is smaller and shallower, the umbones broader, and the ventral margin usually more distinctly curved. The smaller specimens of the var. *neocomiensis* resemble the example figured by d'Orbigny, in which the anterior margin is obliquely truncated, and a carina extends from the umbo antero-ventrally.

In one form (Plate XXXV, fig. 10), which in other respects resembles the variety *neocomiensis*, the anterior half of the shell is relatively more inflated, and the posterior part is not so high as the anterior part; this form may be known as *P. gurgitis* var. *a*. In addition to these forms of *P. gurgitis* numerous other modifications occur.

Specimens from the Speeton Clay have been recorded by previous writers as *P. neocomiensis*; the examples seen are few in number and not well preserved, but resemble closely the smaller form of *P. gurgitis* var. *neocomiensis* (Plate XXXV, fig. 13). In one case the fine, radial ornamentation is shown.

Specimens from Blackdown (Plate XXXVI, figs. 6, 7) resemble the variety *plicata* from the Lower Greensand, but are somewhat less convex; these probably constitute only a local variety, since examples from the Upper Greensand of Dorset agree in convexity and in other characters with typical forms of the var. *plicata* from the Lower Greensand. The examples from Blackdown, although few in number, show considerable variation; one specimen (Plate XXXVI, fig. 8), is much shorter than usual, and resembles d'Orbigny's[1] figure of *P. plicata*, but is less convex.

Crushed internal casts of *Panopea* have been found in the Chalk Marl of Folkestone; they resemble *P. gurgitis* var. *plicata*, but their imperfect preservation renders determination difficult.

Types.—The type of *P. gurgitis* came from the Aptian of the Perte-du-Rhône; that of *P. neocomiensis* from the Neocomian of Aube. The type of *P. plicata* was obtained from the Lower Greensand of Sandgate, but cannot now be found. The type of *P. lævinscula*, from the Upper Greensand of Blackdown, is in the Bristol Museum.

Distribution.—Lower Greensand: *Perna*-bed, Crackers and Beds iv, vi, vii, x, xiii, and xiv of Atherfield. *Perna*-bed of Sandown. Ferruginous Sands of Shanklin. Atherfield Beds of East Shalford and Sevenoaks. Hythe Beds of Hythe and Court-at-Street. Sandgate Beds of Parham Park. *Mammillatus* Bed of Folkestone. Recorded by Topley from the Atherfield Clay of Haslemere, Peasmarsh, Redhill, and Hythe; from the Hythe Beds of Pulborough; from the Sandgate Beds of Folkestone and Sandgate; and from the Folkestone Beds of Folkestone. ? Lower Greensand of Upware. ? Speeton Clay of Speeton. Gault of Black Ven and Folkestone. Upper Greensand of Blackdown and Black Ven.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 337, pl. cccl vii, figs. 4, 5.

PANOPEA MANDIBULA (*Sowerby*), 1813. Plate XXXVII, figs. 1—5.

1813.	MYA MANDIBULA,	*J. Sowerby.*	Min. Conch., vol. i, p. 93, pl. xliii.
? 1840.	PANOPÆA BAUMONTII,	*A. Goldfuss.*	Petref. Germ., vol. ii, p. 274, pl. clviii, fig. 4.
? 1841.	— JUGLERI,	*F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 75, pl. x, fig. 4.
1845.	— MANDIBULA,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 344, pl. cccix, figs. 3, 4.
1850.	— —	*H. B. Geinitz.*	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 146.
1854.	MYACITES MANDIBULA,	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 213.
1865.	PANOPÆA —	*F. J. Pictet and G. Campiche.*	Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 70.
1870.	— —	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 87.
1873.	— —	*H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 70, pl. xviii, figs. 20, 21.
? 1883.	— —	*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat., iii, Iserschicht., p. 108.
? 1897.	— —	*Fritsch.*	Ibid., vi, Chlomek. Schicht., p. 60.
1900.	PLEUROMYA —	*A. J. Jukes-Browne.*	Cret. Rocks of Britain, vol. i, p. 470.

Description. — Shell oblong or rhomboidal in outline, very inequilateral, convex, anterior part sloping rapidly to the anterior margin, with a wide posterior gape. Anterior margin somewhat convex; antero-ventral extremity rounded; ventral margin straight or slightly curved and nearly parallel to the dorsal margin; postero-ventral extremity rounded; posterior margin truncated, nearly straight, either perpendicular or slightly oblique to the nearly straight postero-dorsal margin. Umbones prominent, narrow, pointed, considerably incurved, with a broad, shallow furrow extending from their posterior side to the postero-ventral part of the valves. In front of the umbones the shell is considerably depressed.

Ornamentation consists of strong, rounded, concentric folds, which become less distinct in and posterior to the dorso-ventral furrow; and of radial rows of minute granules.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	72	70	53	53	49	36	mm.
Height	57	46	41	38	35	33	,,
Thickness	41	39	—	28	26	27	,,

(1, 4—6) Upper Greensand, Ventnor.
(2, 3) Upper Greensand, Devizes.

Affinities.—The more elongate forms of this species resemble some specimens of *P. gurgitis* var. *plicata*, but are more inequilateral, more convex, usually relatively longer, with narrower and more pointed umbones, and with a distinct furrow extending from the umbo to the postero-ventral margin.

Remarks.—Many of the specimens are more or less crushed, and nearly all are internal casts, but the shell is preserved in some specimens from the Gault, and shows radial rows of fine granules. The hinge is not seen in any instance. *P. mandibula* is common in the Upper Greensand of Ventnor and Devizes, and is less abundant at other horizons. The principal variation seen is in the relative length and height of the shell.

Type.—From the Upper Greensand of Devizes, in the British Museum.

Distribution.—Lower Greensand of Atherfield. Atherfield Beds of Sevenoaks. Sandgate Beds of Nutfield. Folkestone Beds of Folkestone. Upper Greensand (zone of *Schlœnbachia rostrata*) of Devizes and Ventnor. Gault and Upper Greensand of Black Ven. Chalk Marl of Folkestone.

PANOPEA OVALIS, *Sowerby*, 1836. Plate XXXVII, fig. 6*a*, *b*.

1836. PANOPÆA OVALIS, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 241, 340, pl. xvi, fig. 5.
1850. — — *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 157.
1854. MYACITES — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 214.

Description.—Shell oval, convex, moderately inequilateral. Antero-dorsal margin slightly convex; anterior margin rounded, passing gradually into the slightly convex ventral margin. Umbones broad, incurved. The parts of the shell in the front of and behind the umbones are considerably depressed. The surface is ornamented with growth-rings.

Remarks.—The only specimen seen is the type, in which the posterior part of the shell is not preserved.

Type.—In the British Museum.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown.

PANOPEA MEYERI, sp. nov. Plate XXXVIII, fig. 1*a*, *b*.

Description.—Shell oval, moderately convex, with flattened sides, slightly inequilateral, with a wide posterior gape. Antero-dorsal margin convex. Anterior

margin rounded. Ventral margin straight or slightly convex. Posterior margin truncated, slightly convex. Postero-dorsal margin slightly concave, nearly parallel to the ventral margin. Umbones broad, curved inwards and backwards. The part of the shell in front of the umbones is slightly depressed; the part behind the umbones is more deeply depressed. Surface with well-marked growth-rings. Length 87 mm.; height 59 mm.

Affinities.—In this species the sides of the shell are more flattened, the antero-dorsal margin is more convex, and the part of the shell in front of the umbones is less depressed than in *P. ovalis*. The hinge has not been seen, but the form of the shell agrees closely with that of typical species of *Panopea*.

Fig. 28.—*Panopea*, sp. Lower Greensand ("Scaphites" Beds), Whale Chine, Atherfield. Sedgwick Museum. Internal cast of right valve. Natural size.

Remarks.—In addition to the specimen figured, which was collected by C. J. A. Meÿer, an internal cast and the posterior part of a left valve only have been seen.

Distribution.—Upper Greensand (zone of *Schlænbachia varians*) of Blackdown.

Panopea, sp. Text-fig. 28.

Internal casts resembling *P. Meyeri*, but with the posterior border obliquely truncated, occur in the Lower Greensand ("Scaphites" Beds) of Whale Chine, Atherfield.

Family—PHOLADIDÆ, *Leach.*

Genus—MARTESIA, *Leach* in *H. M. D. de Blainville*, 1825.
('Manuel de Malacol.,' p. 632.)

MARTESIA CONSTRICTA (*Phillips*), 1829. Plate XXXVIII, figs. 3—10.

1829. PHOLAS CONSTRICTA, *J. Phillips.* Geol. Yorks., p. 169 (p. 256, ed. 3), pl. ii, fig. 17.
1850. — — *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 117.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 221.
1864. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 26.
1870. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, p. 23 (? *Martesia*).
1900. PHOLADIDEA CONSTRICTA, *A. J. Jukes-Browne.* Cret. Rocks of Britain, vol. i, p. 470.

Description.—Shell small, more or less elongate; anterior part short, convex, rounded; posterior part wedge-shaped. Umbones prominent, close together, curved inwards and forwards. Ventral margin nearly straight. Posterior margin sub-truncate, more or less rounded, somewhat oblique. Postero-dorsal margin sloping ventrally. Two narrow furrows, with corresponding internal ribs, extend from the umbo to the ventral margin; the anterior furrow is rather broader and less oblique than the posterior, but is sometimes short or absent. An internal ridge, near the postero-dorsal margin, extends from the umbo to near the posterior adductor. Anterior callus shield-shaped. Ventral margin of valves diverging posteriorly, joined by a hypoplax. Metaplax elongated, divided.

Ornamentation: on the larger part of the shell distinct, regular, concentric ribs with minute transverse serrations. In front of the anterior furrow the ribs become smaller and closer together; they bend dorsally and unite at an angle with similar ribs on the dorsal part of the anterior end of the valve. On the postero-dorsal part of the shell the ribs are less regular and less distinct.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Length	18	17	16	18	15	14	10	mm.
Height	9	9	9	10	9	7	6·5	,,
Thickness	9	9	9	10·5	9	7.5	6·5	,,

(1—3) Specton, (4—7) Folkestone.

Affinities.—This species is less elongate than *M. subcylindrica* (d'Orbigny).[1]

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 306, pl. cccxlix, figs. 5—8.

The height of the anterior part of the shell is less and the length of the ventral margin greater relatively than in *M. Sanctæ-Crucis* (Pictet and Campiche).[1]

Remarks.—This species varies somewhat in relative length and breadth, and in the extent of the development of the anterior furrow. Many of the specimens are found in burrows in wood. The protoplax is not preserved in any example seen.

Type.—The type came from Speeton, but cannot now be found.

Distribution.—Speeton Clay of Speeton. Lower and Upper Gault of Folkestone. Probably also in the Upper Greensand of Blackdown. Specimens which belong to either this or a closely allied species occur in the Spilsby Sandstone of Benniworth Haven. Borings in wood found in the Tealby Limestone of Claxby may be due to this species but the valves are concealed.

MARTESIA PRISCA (*Sowerby*), 1828. Plate XXXVIII, fig. 11.

1828. PHOLAS PRISCUS, *J. de C. Sowerby.* Min. Conch., vol. vi, p. 157, pl. dlxxxi.
1845. PHOLAS ? PRISCUS, *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 237.
1850. PHOLAS PRISCA, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 72.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 221.
1864. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 26.
1870. — — (MARTESIA), *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 22.
1875. PHOLADIDEA PRISCA, *R. Etheridge* in *W. Topley.* Geol. Weald, p. 419.

This species appears to be closely related to *M. constricta*, but no satisfactory description can be given until better specimens have been obtained. The type, in which the shell was well preserved, cannot now be traced; in other examples the shell is concealed by a coating of hard matrix, and in the few cases in which it has been possible to remove the matrix only internal casts of the valves have been exposed. The type came from the Lower Greensand (? Sandgate Beds) near Sandgate. Other specimens have been obtained from the Hythe Beds of Hythe and Maidstone.[2]

[1] 'Foss. Terr. Crét. Ste. Croix' (1864), p. 24, pl. c, fig. 1. This species has been recorded by Price from the Gault of Folkestone; I have not seen any examples of it.

[2] *Fistulana pyriformis*, Mantell, is perhaps a *Martesia*, but no specimens showing the valves have been seen. No figure or specific description was given by Mantell. The "type" came from Willingdon near Eastbourne, apparently from the top of the Lower Greensand. Mantell, 'Foss. S. Downs' (1822), p. 76; *Gastrochæna pyriformis*, Morris, 'Cat. Brit. Foss.,' ed. 2 (1854), p. 203; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse,' ser. 4, 1864), p. 18; Stoliczka, 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1870), p. 29.

Gastrochæna dilatata, Deshayes, has been recorded by Forbes and other writers from the Lower Greensand; I have not seen any specimens in which the valves are exposed. Deshayes, in Leymerie, 'Mém. Soc. géol. de France,' vol. v (1842), p. 2, pl. iii, fig. 1; Forbes, 'Quart. Journ. Geol. Soc.,' vol. i (1845), p. 237; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' (1864), p. 11, pl. xcix, figs. 4, 5.

MARTESIA? ROTUNDA (*Sowerby*), 1850. Plate XXXVIII, figs. 12 *a*—*c*, 13.

1850. TEREDO ROTUNDUS, *J. de C. Sowerby* in *F. Dixon*. Geol. Sussex, p. 346 (p. 382, ed. 2), pl. xxviii, figs. 27, 28.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 227.
1897. MARTESIA? ROTUNDA, *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 393, pl. xxviii, figs. 15—18.

Description.—Shell small, ovoid, inflated, with rounded outline. Anterior gape large, apparently closed by callus. Umbones sub-median, curved inwards and forwards. A strong groove and a corresponding internal rib pass from the umbo to the ventral margin. Near the dorsal margin a strong, narrow internal rib passes backward from the umbo but does not reach the posterior margin. Ornamentation posterior to the groove consists of concentric ribs and of two radial ribs immediately behind the groove; anterior to the groove are a few regular radial ribs, and concentric ribs parallel to the margin of the anterior gape. Length, 7 mm.; height, 5·5 mm.; thickness, 5 mm.

Remarks.—I have seen only three casts of the interior and two of part of the exterior of this species, so that at present it is difficult to determine satisfactorily its generic position.

Type.—The type came from the Chalk of Kent, but cannot now be found.

Distribution.—Chalk Rock of Cuckhamsley (Berkshire), and of Whyteleafe (Surrey).

Genus—TURNUS, *W. M. Gabb*, 1864.

('Geol. Surv. California,' Palæontology, vol. i, p. 145.)

TURNUS DALLASI (*Walker*), 1866. Plate XXXVIII, figs. 14 *a*, *b*, 15.

1866. PHOLAS DALLASI, *J. F. Walker*. Ann. Mag. Nat. Hist., ser. 3, vol. xviii, p. 386, pl. xiii, figs. 3, 4.

Description.—Shell ovate, short, inflated in front, wedge-like behind. Margin of the anterior gape oblique, gently curved. Posterior margin rounded. Umbones prominent, curved inwards and forwards. A narrow furrow, and a corresponding internal rib, extend from the umbo to the ventral margin in a somewhat oblique direction, and the furrow is crossed by small ribs. A broad and strong internal rib

passes from the umbo to near the postero-ventral margin. The shell is ornamented with small concentric ribs, which bend dorsally in front of the furrow and become parallel to the anterior margin.

Measurements:

	(1)	(2)	
Length	15	8	mm.
Height	11	6·5	
Thickness . . .	—	6·5	,,

Affinities.—The very slight curvature of the anterior margin and of the anterior ribs distinguishes this species from the one described below.

Remarks.—*T. Dallasi* occurs commonly boring in wood.

Type.—From Potton; in the Sedgwick Museum.

Distribution.—Lower Greensand of Potton.

TURNUS, sp. Plate XXXVIII, figs. 16, 17.

Description.—Shell oval, inflated, posterior end wedge-like. Ventral margin curved; posterior margin rounded. Antero-ventral excavation angular. Umbones prominent, anterior, incurved, close together. An external furrow and a corresponding internal rib extend from the umbo to the ventral margin. A strong internal rib passes from the umbo to near the postero-ventral edge.

Posterior to the dorso-ventral groove the shell is ornamented with narrow, regular concentric ribs; for a short distance in front of the groove the ribs bend sharply upwards, and soon become smaller and close together; on the dorsal part of the anterior end the ribs bend forwards.

Measurements:

	(1)	(2)	
Length	14	13	mm.
Height	11	9·5	,,
Thickness . .	12	10	,,

(1—2) Gault, Folkestone.

Affinities.—This species resembles *T. argonnensis* (Buvignier),[1] but exact comparison is difficult since only a small internal cast is figured by Buvignier. The English form appears to differ from *T. argonnensis* in the larger size and more angular character of the anterior gape, and in the smaller and closer ribs, especially on the anterior part of the shell.

Distribution.—Lower Gault of Folkestone.

[1] 'Statist. géol. min. et palæont. de la Meuse,' Atlas (1852), p. 6, pl. vi, figs. 33—39.

TURNUS, sp. Plate XXXVIII, fig. 18.

A specimen from the Upper Greensand of Blackdown resembles the species from the Gault, described above, but the concentric ribs are finer and more numerous, and the dorso-ventral furrow is narrower. The exterior of a left valve only is preserved and is associated with large and rather irregular tubes.

TURNUS ? AMPHISBÆNA (*Goldfuss*), 1831. Plate XXXVIII, figs. 19, 20.

1822. TEREDO, *G. Mantell.* Foss. S. Downs, p. 207, pl. xviii, fig. 23.

1831. SERPULA AMPHISBÆNA, *A. Goldfuss.* Petref. Germ., vol. i, p. 239, pl. lxx, fig. 16.

? 1839. CERAMBYCITES, sp., *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 13, pls. iii—vi.

1840. TEREDO AMPHISBÆNA, *J. de C. Sowerby.* Min. Conch., vol. vii, p. 17, pl. dcxviii, figs. 1—5 (*Teredo articulata* on the plate).

1841. SERPULA AMPHISBÆNA, *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 100.

1842. — — *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs.-böhmisch. Kreidegeb., pt. 3, p. 65.

1843. FISTULANA AMPHISBÆNA, *H. B. Geinitz.* Die Verstein. von Kieslingswalda, p. 11, pl. iv, figs. 11—14.

1845. SERPULA AMPHISBÆNA, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 1, p. 19, pl. v, figs. 29—32.

1846. GASTROCHÆNA ? (TEREDO ?) AMPHISBÆNA, *H. B. Geinitz.* Grundr. d. Verstein., p. 396.

? 1850. FISTULANA AMPHISBÆNA, *P. de Ryckholt.* Mélanges Paléont. i (Mém. cour. et Mém. des sav. étrang., vol. xxiv), p. 117, pl. v, figs. 19—22.

1850. TEREDO AMPHISBŒNA, *J. de C. Sowerby*, in *F. Dixon.* Geol. Sussex, p. 354 (p. 385, ed. 2), pl. xxviii, fig. 35.

1851. GASTROCHÆNA AMPHISBÆNA, *J. Müller.* Petref. der Aachen. Kreidef., pt. 2, p. 63.

? 1852. — ?, *R. Kner.* Denkschr. d. k. Akad. d. Wissensch. Wien, Math.-nat. Cl., vol. iii, p. 310, pl. xvi, fig. 18.

1854. TEREDO AMPHISBÆNA, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 227.

1863. GASTROCHÆNA AMPHISBÆNA, *R. Drescher.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 341.

1864. *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 19.

1870.	Teredo amphisbæna,		*F. Römer.*	Geol. v. Oberschles., pp. 317, 340, pl. xxxiv, figs. 14, 15.
—	Gastrochæna amphisbæna,		*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, pp. 14, 29.
1873.	—	—	*H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 235, pl. lii, figs. 8–12.
1876.	—	—	*D. Brauns.*	Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 358.
1877.	—	—	*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. ii, Weissenberg. u. Malnitz. Schicht., p. 122, fig. 93.
1888.	—	—	*G. Müller.*	Jahrb. d. k. preussisch. geol. Landesanst. für 1887, p. 436.
1889.	—	—	*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. iv, Teplitz. Schicht., p. 79, fig. 67.
—	—	—	*O. Griepenkerl.*	Senon. v. Königslutter (Palæont. Abhandl., vol. iv), p. 69, (? pl. vii, fig. 1).
? 1889.	?	—	*E. Holzapfel.*	Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 143.
? 1893.		—	*Fritsch.*	Op. cit. v. Priesen. Schicht., p. 96, fig. 113.
? 1895.	?	—	*F. Vogel.*	Holländisch. Kreide, p. 49, pl. iii, fig. 13.
1897.	—	—	*R. Leonhard.*	Kreideformat. in Oberschles. (Palæontographica, xliv), p. 53, fig. 8.
1898.	Turnus amphisbæna,		*G. Müller.*	Mollusk. d. Untersenon v. Braunschweig u. Ilsede (Abhandl. d. k. preuss. geol. Landesanst., N. F., Heft 25), p. 79, pl. x, fig. 12.
1902.	—		*A. Wollemann.*	Fauna der Lüneburg. Kreide (Abhandl. d. k. preuss. geol. Landesanst. N. F., Heft 37), p. 81.

Description.—Tubes long, conical, tapering gradually, sometimes nearly straight, but usually bending or curving irregularly, circular in section, but often compressed, and then showing a median longitudinal furrow on one side. Diameter sometimes reaches 15 mm. and the length 210 mm. Surface with narrow transverse ridges at more or less regular intervals giving a segmented appearance; sometimes also with smaller growth-rings between the ridges.

Remarks.—This species ranges almost throughout the Chalk and is widely distributed. It has been referred by various authors to five different genera, but

its systematic position must still be regarded as uncertain, for although the tubes are common the valves have not been found in association with them. Fritsch (1893) and Müller (1898) have found the valves of *Turnus* in the same deposit as the tubes, and think it probable that the former belong to the same species as the latter. Some authors have referred these tubes to the genus *Gastrochæna*, but Stoliczka points out that they resemble more nearly the tubes of *Teredo*.

Types.—From the Senonian of Maestricht and Bochum. The specimens figured by Sowerby (except fig. 2, which is in the British Museum), by Mantell, and by Dixon cannot be found.

Distribution.—Chloritic Marl of Eastbourne. Cambridge Greensand. Chalk Marl of Chard and Ventnor. Zone of *Holaster subglobosus* of Holborough near Rochester, Totternhoe, Cherry Hinton, and Burwell. Zone of *Rhynchonella Cuvieri* of the Devon coast, Winchester, the Isle of Wight, and Lewes. Zone of *Terebratulina* of Winchester, the Isle of Wight, Croydon, and Devon. Zone of *Holaster planus* of the Dorset coast, the Isle of Wight, Dover, and Luton. Zone of *Micraster cor-testudinarium* of Mitcheldever, Dover, the Sussex coast, and Coulsdon (Surrey). Zone of *M. cor-anguinum* of the Sussex coast, St. Margaret's, Thanet, and Gravesend. Zone of *Marsupites testudinarius* of Highfield, near Salisbury, the Sussex coast, and Thanet. Zone of *Actinocamax quadratus* of the Sussex coast.

Family—TEREDINIDÆ, *Scacchi.*

Genus—Teredo, *Linnæus*, 1758.

('Syst. Nat.,' ed. 10, p. 651; ed. 12, 1767, p. 1267.)

Teredo gaultina, sp. nov. Plate XXXVIII, fig. 21.

Description.—Shell convex, inequilateral. Anterior gape large, angular. Postero-ventral gape small. Postero-dorsal margin produced upwards and outwards. Umbones large, incurved. A shallow furrow extends from the umbo to the ventral margin. Posterior to the furrow the shell is ornamented with ribs and narrow furrows, which soon bend dorsally, and disappear or become indistinct on the postero-dorsal part; in front of the furrow the ribs are much smaller, and are parallel to the margin of the anterior gape; at first they are directed dorsally, but soon bend forwards. Length, 9 mm.; breadth, 8·5 mm.

Affinities.—In *T. carentonensis*, Buvignier,[1] the anterior ribs are coarser and the posterior end of the shell is more produced than in this species.

Distribution.—Gault of Folkestone.

[1] 'Statist. géol. min. et paléont. de la Meuse,' Atlas (1852), p. 6, pl. vi, figs. 40–48.

Family—ANATINIDÆ, *Gray*.

Genus—PLECTOMYA, *P. de Loriol*, 1868.

(De Loriol and Cotteau, 'Mon. Paléont. Géol. Portlandien de l'Yonne,' p. 89.)

PLECTOMYA ANGLICA, sp. nov. Plate XXXIX, fig. 1 *a*, *b*.

Description.—Shell elongate-oval, slightly inequilateral, compressed; anterior and posterior ends rounded; ventral margin slightly convex. Umbones broad, with a slight posterior curvature.

The part of the shell in front of a line drawn from the umbo to the opposite ventral margin is ornamented with strong concentric ribs separated by broad furrows; these ribs become nearly or quite obsolete on the posterior middle part of the shell (except near the umbo), but re-appear on the postero-dorsal part. The entire surface of the shell is ornamented with numerous radial rows of granules. Length 49 mm.; height 27 mm.

Affinities.—This species is similar in general character to *Plectomya Agassizi* (d'Orbigny[1]), but the shell is less elongate, the ribs on the anterior part of the shell cut the margin and the growth-lines obliquely, and on the posterior median part the ribs are almost obsolete. It also shows some resemblance to *P. Rhodani* (Pictet and Roux[2]).

Remarks.—Of this species I have seen only two examples, neither of which shows the interior, so that I am unable to express an opinion as to affinities of the genus *Plectomya*.

Distribution.—Lower Greensand (Crackers) of Atherfield.[3]

Genus—ANATINA, *Lamarck*, 1809.

('Philosoph. Zool.,' vol. i, p. 319; 'Hist. nat. Anim. sans Vert.,' vol. v, 1818, p. 462.)

Sub-genus—CERCOMYA, *L. Agassiz*, 1842.

('Études crit. Moll. Foss.,' Myes, p. 143.)

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 371, pl. cccIxix, figs. 1, 2; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 99, pl. cvii, fig. 1.

[2] 'Moll. Foss. Grès verts de Genève' (1852), p. 410, pl. xxix, fig. 4.

[3] An imperfect specimen from the Lower Greensand of Atherfield is probably an example of *Plectomya marullensis* (d'Orbigny), op. cit., p. 376, pl. cccIxxi, figs. 3, 4; Pictet and Campiche, op. cit., p. 101, pl. cvii, figs. 2, 3.

ANATINA (CERCOMYA) GURGITIS, *Pictet and Campiche*, 1865. Plate XXXIX, figs. 2—4.

1855. ANATINA ROBINALDINA, *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 63, pl. vii, fig. 1. (Non *A. Robinaldina*, d'Orbigny, 1845.)

1865. GURGITIS, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 105, pl. cvii, figs. 6—8.

1870. — (CERCOMYA) GURGITIS, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 74.

Description.—Shell elongate, compressed, inequilateral, highest in front of the umbones, tapering posteriorly. Anterior margin rounded. Umbones inconspicuous, with a carina extending to the posterior extremity. A very shallow sulcus passes from the umbo obliquely forwards across the valve. In front of this sulcus the ornamentation consists of narrow, sharp, concentric ribs separated by broad interspaces; both ribs and interspaces are crossed by numerous radial rows of very small pointed projections. Behind the sulcus the concentric ribs become less distinct or represented by growth-rings only.

Affinities.—This species is allied to *A.* (*Cercomya*) *Robinaldina*, d'Orbigny,[1] but the posterior part of the shell is more elongate.

Remarks.—I have seen only three examples of this species. Pictet and Campiche state that the part of the shell just in front of the carina is ornamented with radial rows of punctate striæ; these are not seen on the English specimens, probably on account of their somewhat imperfect preservation. One of our specimens (Plate XXXIX, fig. 3) agrees very closely, both in the form of the shell and in the character of the ornamentation, with the figure given by Pictet and Renevier; the others (figs. 2, 4) approach more nearly the examples figured by Pictet and Campiche, but the anterior part of the shell is rather higher.

Type.—From the Aptian of the Perte-du-Rhône.

Distribution.—Lower Greensand (Crackers) of Atherfield.

ANATINA (CERCOMYA), sp. Plate XXXIX, fig. 5*a*, *b*.

Description.—Shell very long, compressed, considerably inequilateral, highest in front of the umbones; posterior part tapering, and curved upwards. Anterior margin rounded; ventral margin convex; postero-dorsal margin concave. Umbones curved posteriorly, with a carina and a shallow furrow extending to the

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 374, pl. cclxx, figs. 6—8.

posterior extremity. On the anterior part of the shell the ornamentation consists of narrow, sharp, concentric ribs, which become less distinct on the median and posterior parts.

Remarks.—Only one specimen—an internal cast—has been seen. It resembles *A.* (*Cercomya*) *gurgitis*, but is more inequilateral and more elongate.

Distribution.—Upper Greensand of the Isle of Wight.

ANATINA (CERCOMYA), sp. Plate XXXIX, fig. 6.

Imperfect specimens of a species of *Anatina* (*Cercomya*) have been found in the Upper Greensand of Warminster and in the Cenomanian (Bed 10) of Dunscombe, South Devon. In shape they resemble *A.* (*Cercomya*) *producta*, Zittel.[1]

Genus—THRACIA, *Leach* in *H. M. D. de Blainville*, 1824.
('Dict. Sci. nat.,' vol. xxxii, p. 347.)

THRACIA PHILLIPSI, *Römer*, 1841. Plate XXXIX, figs. 7—9.

1829.	MYA DEPRESSA, *J. Phillips.*	Geol. Yorks., p. 121, pl. ii, fig. 8 (non *M. depressa*, Sowerby, 1823).
1841.	THRACIA PHILLIPSII, *F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 74, pl. x, fig. 1.
1850.	— RECURVA, *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 117. (? *T. subdepressa*, p. 74.)
1854.	— PHILLIPSI, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 227.
1865.	— — *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 120.
—	— RECURVA, *Pictet and Campiche.*	Ibid., p. 120.
1870.	— — *F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 72 (*Corimya* ?).
1875.	— PHILLIPSII, *Phillips.*	Op. cit., ed. 3, p. 254, pl. ii, fig 8.
1900.	— PHILLIPSI, *A. Wollemann.*	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 139, pl. vi, fig. 6.
1905.	— — *E. Harbort.*	Die Fauna d. Schaumburg-Lippe'schen Kreidemulde (ibid., pt. 45), p. 77.
1908.	— — *Wollemann.*	Jahrb. d. k. preuss. geol. Landesanst., für 1908, vol. xxix, p. 166.

Description.—Shell thin, more or less ovate in outline, moderately convex, the right valve a little more convex than the left, slightly inequilateral. Antero-dorsal

[1] 'Die Bivalv. d. Gosaugeb.,' pt. 1 (1864), p. 10 [114], pl. i, fig. 6.

margin nearly straight, with a considerable ventral slope; anterior margin rounded, passing gradually into the convex ventral margin; posterior margin rather short, oblique, more or less truncated, forming a rounded angle with the nearly straight and ventrally sloping postero-dorsal margin. Umbones rather prominent, curved inwards and slightly backwards. Postero-dorsal part of valves compressed, sometimes with a small carina. Surface with numerous small concentric growth-ridges.

Measurements:

	(1)	(2)	(3)	
Length	68	64	49	mm.
Height	52	46	38	,,
Thickness	30	28	22	,,

(1—3) Speeton.

Affinities.—It is probable, as maintained by Harbort,[1] that *Thracia striata*, Weerth,[2] is not specifically distinct from *T. Phillipsi*.

Remarks.—The greater part of the shell has disappeared from most of the examples found at Speeton, and usually some part of the margin of the cast has also been lost. I have not seen sufficient examples to enable me to determine whether the variation of this species in England is as great as in the case of the specimens found in Schaumburg-Lippe and described by Harbort.

Type.—From Speeton, in the York Museum.

Distribution.—Speeton Clay (zone of *Belemnites jaculum*) of Speeton.

THRACIA ROTUNDATA (*Sowerby*), 1836. Plate XXXIX, fig. 10*a*, *b*.

1836. PANOPÆA ROTUNDATA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 129, 337, pl. xiii, fig. 2.
1850. LYONSIA SUBROTUNDATA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 74.
1854. MYACITES ROTUNDATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 214.
1865. THRACIA SUBROTUNDATA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 120.
1870. CORIMYA ROTUNDATA, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 72.

Description.—Shell regularly convex, oval, slightly inequivalve and inequilateral. Anterior and ventral margins convex, forming a regular curve. Dorsal part of posterior margin oblique, forming an angle with the ventral part. Umbones broad, in contact, with a narrow, sharp, curved carina extending to the posterior angle and limiting a triangular, concave, postero-dorsal area, which is ornamented with fine ribs running parallel to the posterior margin. Sides of valves with similar ribs extending in a radial direction.

[1] 'Die Fauna d. Schaumburg-Lippe'schen Kreidemulde' (1905), p. 78.

[2] 'Neocomsandst. im Teutoburg. Walde' ('Palæont. Abhandl.' II, 1884), p. 40, pl. viii, fig. 10. Wollemann, 'Die Bivalv. u. Gastrop. d. deutsch. u. holländ. Neocoms' (1900), p. 140, pl. vii, fig. 1.

Measurements:

	(1)	(2)	
Length	40	32	mm.
Height	32	27	,,
Thickness	22	17	,,

(1, 2) Lympne.

Affinities.—This species is allied to *T. rotunda*, Pictet and Roux,[1] from the Gault of the Perte-du-Rhône and Sainte Croix, but is distinguished by its more rounded outline, smaller postero-dorsal area, and less distinct concentric ornament. It is also allied to *T. carinifera* (p. 244).

Remarks.—Two internal casts of this species from Lympne are in the Museum of Practical Geology (23470, 23471); the larger agrees closely with Sowerby's figure, and may perhaps be the type, but the locality given by Sowerby is Court-at-Street, 1¼ miles west of Lympne. A small, somewhat crushed example from the Atherfield Clay at Dover colliery probably belongs to this species. No other specimens have been seen. The specimens recorded by Topley as *T. carinifera* probably belong to *T. rotundata*.

Distribution.—Hythe Beds of Lympne and Court-at-Street.[2]

THRACIA ROBINALDINA? (*d'Orbigny*), 1845. Plate XL, figs. 1—3.

Description.—Shell oval, nearly equilateral; right valve more convex than the left; posterior part not quite so high as the anterior part; postero-dorsal part compressed. Anterior margin rounded; ventral margin moderately convex; posterior margin slightly curved; postero-dorsal margin nearly straight. Umbones rather prominent, curved posteriorly. Surface smooth, except for growth-lines.

Measurements:

	(1)	(2)	(3)	
Length	36	26	15	mm.
Height	23	17	9	,,
Breadth	13	10	6	,,

(1) *Perna*-bed, (2, 3) Crackers, Atherfield.

Remarks.—In the English specimens, which are here provisionally referred to *T. Robinaldina*, the shell is preserved, but the examples of that species figured by d'Orbigny[3] and by Pictet and Campiche[4] are internal casts, and it is consequently

[1] 'Moll. Foss. Grès verts de Genève' (1852), p. 414, pl. xxix, fig. 6. Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 117.

[2] *Thracia Nicoleti* (Agassiz) has been recorded by Morris and by Topley from the Hythe Beds of Hythe, but I have not seen any British examples of that species.

[3] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 380, pl. cccIxxii, figs. 1, 2.

[4] 'Foss. Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 114, pl. cviii, figs. 5, 6.

difficult, especially without the opportunity of comparing specimens, to establish the identification. Professor Boule informs me that the type is a poorly preserved specimen, but that its outline is satisfactorily represented in d'Orbigny's figure; the specimen is now in the Natural History Museum, Paris. *T. Robinaldina* is allied to *T. neocomiensis* (d'Orbigny),[1] but is said to differ from the latter by the greater curvature of the ventral margin and by its relatively shorter shell.

Distribution.—Lower Greensand (*Perna*-bed and Crackers) of Atherfield. Atherfield Beds of Redhill, Reigate.

THRACIA SANCTÆ-CRUCIS, *Pictet and Campiche*, 1865. Plate XL, figs. 4—6.

1865. THRACIA SANCTÆ-CRUCIS, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 117, pl. cviii, fig. 8.

1870. — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 72.

Description.—Shell oblong, compressed, inequilateral. Anterior margin rounded; ventral margin slightly curved; posterior margin truncated, slightly convex, forming an angle with the postero-dorsal margin. A carina extends in a curve from the umbo to the postero-ventral angle and cuts off a concave postero-dorsal area. The surface of the shell is ornamented with growth-rings.

Measurements:

	(1)	(2)	
Length	43	39	mm.
Height	20	16	,,

(1) Gault, Folkestone.
(2) Gault, Black Ven.

Affinities.—It seems doubtful whether this species is distinct from *T. simplex* (d'Orbigny), of which casts only are figured by d'Orbigny[2] and by Pictet and Campiche[3]; but the latter authors state that it differs from *T. simplex* by the absence of an internal rib, the presence of a carina, and by the more acuminate anterior end.

Type.—From the Upper Gault of Ste. Croix.

Distribution.—Gault of Folkestone and Black Ven.

THRACIA, sp. Plate XL, figs. 7—9.

Some examples of *Thracia*, usually of rather large size, appear at first sight to be distinct from *T. Sanctæ-Crucis* on account of their relatively greater height and

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 381, pl. ccclxxii, figs. 3, 4. Pictet and Campiche, op. cit., p. 115, pl. cviii, figs. 3, 4.

[2] Op. cit., p. 382, pl. ccclxxii, figs. 5, 6.

[3] 'Foss. Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 116, pl. cviii, fig. 7.

less distinct carina. When, however, a considerable number of specimens are compared it is difficult to draw any line of separation between these forms and *T. Sanctæ-Crucis*. But since, in most cases, the original shape of the shell has been more or less considerably modified by pressure, it is not easy to come to a definite conclusion in this matter; moreover, in both *T. Sanctæ-Crucis* and the larger forms there is clearly some variation in relative height and length of the shells, and in the distinctness of the carina.[1]

Distribution.—Gault of Black Ven and Folkestone. Upper Greensand of Blackdown and Devizes.

THRACIA CARINIFERA (*Sowerby*), 1826. Plate XL, figs. 10—13.

1826. LUTRARIA? CARINIFERA, *J. de C. Sowerby*. Min. Conch., vol. vi, p. 66, pl. dxxxiv, fig. 2.
1832. — — *A. Passy*. Descript. géol. de la Seine-Inférr., Atlas, p. 6, pl. xiii, figs. 6, 7.
1842. CORIMYA CARINIFERA, *L. Agassiz*. Études crit. Moll. Foss., Myes, p. 264.
1845. LYONSIA CARINIFERA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 385, pl. cccIxxiii, figs. 1, 2.
1850. — — *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 158.
1852. — — *R. Kner*. Denkschr. d. k. Akad. d. Wissensch. Wien, Math.-nat. Cl., vol. iii, p. 311.
1854. LUTRARIA CARINIFERA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 208 (? *Thracia*).
1865. THRACIA CARINIFERA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 121.
1870. — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 72.
1893. LYONSIA CARINIFERA, *A. Fritsch*. Stud. im Gebiete der böhm. Kreideformat. v. Priesen. Schicht., p. 97, fig. 115.

Description.—Shell thin, oval, of moderate convexity, slightly inequivalve and inequilateral. Anterior margin rounded, passing gradually into the regularly convex ventral margin. Posterior margin truncated, straight or slightly concave. Postero-dorsal margin nearly straight. Umbones broad, incurved close together, with a sharp carina passing to the postero-ventral angle and limiting a flattened or slightly concave postero-dorsal area, which is divided in the middle by a shallow, longitudinal furrow. Just in front of the carina is a broad, shallow, concave depression.

Ornamentation consists of broad, slightly raised, concentric folds which are more distinct on the anterior part than elsewhere. On the postero-dorsal area are

[1] A similar case of distortion and variation is furnished by *Thracia semiplanata*, Whiteaves, 'Mesozoic Foss.' ('Geol. Surv. Canada'), vol. i (1884), p. 221, pl. xxix, fig. 5.

numerous, fine, regular ribs parallel with the posterior margin; on the remainder of the shell similar ribs, but running in a radial direction, occur.

Measurements:

	(1)	(2)	(3)	(4)	
Length .	37	33	30	20	mm.
Height .	23	22	21	14	,,
Thickness	15	14	—	10	,,

(1) Chalk Marl, Chard.
(2, 4) Chloritic Marl, Devizes.
(3) Chalk Marl, Ventnor.

Affinities.—In this species the shell is more elongate and less convex, the carina more prominent, and the postero-dorsal area larger than in *T. rotundata* (p. 241). *T. carinifera* is closely allied to *T. elegans* (d'Orbigny),[1] from the Cenomanian of St. Sauveur, but is less elongate. *T. Germari* (Geinitz)[2] from the Senonian, is regarded by Brauns[3] as a synonym of *T. carinifera*; but without seeing specimens of the former it is difficult to express an opinion of its relationship.

Remarks.—The specimens vary considerably in the proportion of length to height, but in some cases the differences are probably due partly to crushing. The shell itself is seldom preserved.

Type.—The type came from the Cenomanian of Dowlands (South Devon) and was originally in the collection of Sir H. T. De la Beche, but cannot now be found.

Distribution.—Chloritic Marl of Devizes and Maiden Bradley. Chalk Marl of Ventnor, Evershot, and Chard.

Family—PHOLADOMYIDÆ, *Gray.*

Genus—Pholadomya, *G. B. Sowerby*, 1825.

('Genera Rec. and Foss. Shells,' no. xix, pl. xxxvii.)

Pholadomya Cornueliana (*d'Orbigny*), 1844. Plate XLI, figs. 2*a*, *b*, 3.

1844. Cardium Cornuelianum, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 23, pl. cclvi, figs. 1, 2.
1845. — — *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 243.
1850. Pholadomya Cornueliana, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 117.
1854. Cardium Cornuelianum, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 192.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 386, pl. cccIxxiii, figs. 3–5.

[2] 'Quadersandst. oder Kreidegeb. in Deutschland' (1850), p. 150, pl. x, figs. 9–11.

[3] 'Senon. Mergel d. Salzberges,' Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi (1876), p. 359, pl. x, figs. 18, 19.

1855. Pholadomya Cornueliana, *F. J. Pictet and E. Renevier.* Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 59, pl. vi, fig. 6.
1865. *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 87.
— — *H. Coquand.* Aptien de l'Espagne, p. 93.
1870. *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 75.
1875. — *G. Moesch.* Mon. Pholadomyen, p. 96, pl. xxxiii, fig. 8 (? pl. xxxvi, fig. 4).

Description.—Shell small, short, oval, inflated, compressed posteriorly, moderately inequilateral with a small gape at the posterior end. Margins rounded. Umbones prominent, incurved.

Ornamentation consists of strong, rounded, radial ribs. The grooves between the ribs are shallow, and broader than the ribs. Concentric ribs cross the grooves and ribs, giving to the latter a granulate or tuberculate appearance. Near the posterior and anterior margins radial ribs are absent.

Measurements:

	(1)	(2)
Length	20	13 mm.
Height	16	10 ,,

(1, 2) Atherfield.

Affinities.—This species resembles *P. Sancti-Sabæ* (Römer)[1] from Texas and *P. Vignesi*, Lartet,[2] from Palestine, Syria, and Zululand, and *P. sublineusis* (d'Orbigny),[3] from the Cenomanian of Le Mans.

Type.—From the Aptian of Wassy (Haute-Marne).

Distribution.—Lower Greensand (Crackers) of Atherfield. Recorded by Topley from the Atherfield Beds of Peasemarsh and Shalford.

Pholadomya gigantea (*Sowerby*), 1836. Plate XL, fig. 14; Plate XLI, fig. 1.

1708. *C. N. Lang*, Hist. lapidum figuratorum, p. 146, pl. xliv, fig. 1.
1718. *J. J. Scheuchzer*, Helvetiæ hist. nat., pt. 3, p. 307, fig. 113.
1742. *L. Bourguet*, Traité des Petrific., pl. xxiv, fig. 145.

[1] 'Kreidebild. v. Texas' (1852), p. 48, pl. vi, fig. 7. *P. Cornueliana* has been compared with *Corbula æquivalvis*, Goldfuss, by Pictet and Renevier, Pictet and Campiche, and Moesch, but Holzapfel has shown that Goldfuss' species belongs to the genus *Liopistha*. Holzapfel, 'Die Mollusk. Aachen. Kreide' ('Palæontographica,' vol. xxxv, 1889), p. 150, pl. ix, figs. 4—6; Müller, 'Mollusk. d. Untersenon v. Braunschweig u. Ilsede' (1898), p. 76, pl. x, fig. 9.

[2] 'Explor. géol. de la Mer Morte' (1877), p. 126, pl. xi, fig. 9; Blanckenhorn, 'Beitr. z. Geol. Syriens' (1890), p. 94, pl. v, figs. 14—17; Kossmat, 'Denkschr. d. k. Akad. Wiss., Wien,' vol. lxxi (1902), p. 55, pl. iv, fig. 9; Newton, 'Trans. Roy. Soc. S. Africa,' vol. i (1909), p 79, pl. vi, figs. 3—6.

[3] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 38, pl. ccl, figs. 1—3. An internal cast resembling *P. sublineusis* has been found by Mr. J. Scanes in the Chloritic Marl of Maiden Bradley.

1836. PHOLAS GIGANTEUS, *J. de C. Sowerby.* Trans. Geol. Soc., ser. 2, vol. iv, pp. 130, 338, pl. xvi, fig. 1.

1840. PHOLADOMYA ELONGATA, *A. Goldfuss.* Petref. Germ., vol. ii, p. 270, pl. clvii, fig. 3.

1842. — — *L. Agassiz.* Études crit. Moll. Foss., Myes, p. 57, pl. i, figs. 16, 17.

— — SCHEUCHZERI, *Agassiz.* Ibid., p. 58, pl. ii[1], figs. 3—7, pl. ii[11], fig. 7.

— — FAVRINA, *Agassiz.* Ibid., p. 59, pl. ii[1], figs. 1, 2.

— — LANGII, *Voltz*, in *Leymerie.* Mém. Soc. géol. de France, ser. 2, vol. v, p. 24.

1845. — ELONGATA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 350, pl. cccIxii.

— — GIGANTEA, *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 238.

1850. — ELONGATA, *d'Orbigny.* Prodr. de Pal., vol. ii, p. 73.

1852. — FAVRINA, *F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, pp. 403, 546, pl. xxix, fig. 1.

1854. — GIGANTEA, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 220.

1855. — ELONGATA, *G. Cotteau.* Moll. Foss. de l'Yonne, p. 55.

— — — *F. J. Pictet and E. Renevier.* Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 61.

1858. — — *J. Vilanova-y-Piera.* Mem. geog.-agric. de Castellon, pl. iii, fig. 16.

1861. — — *P. de Loriol.* Anim. Invert. Foss. Mt. Salève, p. 56.

1864—65. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 74, pl. civ, figs. 1—4.

1870. — GIGANTEA et ELONGATA, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 74.

1875. — GIGANTEA, *C. Moesch.* Mon. Pholadomyen, p. 82, pl xxx, fig. 6; pl. xxxi, figs. 2—4.

1884. — cf. GIGANTEA, *O. Weerth.* Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 34, pl. viii, figs. 2, 3.

1895. — WEERTHII, *F. Vogel.* Holländisch. Kreide, p. 59.

— — ELONGATA, *G. Maas.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 279, pl. ix, figs. 1, 2.

1896. — — *A. Wollemann.* Ibid., vol. xlviii, p. 850.

1900. — — *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 133

— — — *G. Müller.* Deutsch-Ost-Afrika, vol. vii, p. 557, pl. xxi, fig. 1.

1903. — — *C. Burckhardt.* Palæontographica, vol. l, p. 76, pl. xv, figs. 1, 2.

1908. — — *A. Stojanoff.* Ann. géol. et min. de la Russie, vol. x, p. 116.

Description.—Shell large, elongate, somewhat arched, convex, but with the sides of the posterior part more or less flattened, very inequilateral, with a large gape at the posterior end. Anterior part short, with a rounded margin. Ventral margin curved. Posterior margin subtruncate, rounded. Postero-dorsal margin long, slightly concave or almost straight. Umbones broad. Near the umbones the antero-dorsal and postero-dorsal marginal parts of the shell are depressed.

Ornamentation consists of numerous narrow, sharp, prominent and sometimes slightly serrate radial ribs, which are straight or slightly curved. Near the anterior and the postero-dorsal margins ribs are absent; on the postero-dorsal part of the shell they are rather more widely separated and rather more prominent than on the median part. Between the ribs are broad, concave furrows which are crossed by numerous growth-lines.

Measurements:

	(1)	(2)
Length	126	122 mm.
Height	63	60 ,,

(1, 2) Crackers, Atherfield.

Affinities.—The elongate form and numerous sharp ribs distinguish this from other Cretaceous species of *Pholadomya*.

Remarks.—The foreign examples of this species show considerable variation in length, in the curvature of the shell, and in the number of ribs. Some of the varieties have been described as distinct species, but Pictet and Campiche have shown that there are numerous transitions between the different varieties. The English examples agree in most cases with the type of the species, but some approach the variety described by Agassiz as *P. Scheuchzeri*. A specimen figured by Moesch shows the large pallial sinus.

Type.—The type came from the Hythe Beds of Court-at-Street, but cannot now be found.

Distribution.—Lower Greensand (Crackers) of Atherfield. Atherfield Beds of East Shalford. Hythe Beds of Court-at-Street and Lympne.

PHOLADOMYA SPEETONENSIS, sp. nov. Plate XLI, fig. 4*a*, *b*.

Description.—Shell large, oval, short, inflated, very inequilateral. Anterior margin rounded; ventral margin convex. Umbones broad, incurved.

Ornamentation consists of numerous (usually about twenty-one) strong, radial ribs, separated by broad, slightly concave interspaces. Secondary ribs are introduced at a short distance from the umbo, and usually soon become as large as the primary ribs. The ribs are more or less nodular. Concentric growth-lines are present. Two or three of the anterior ribs are more widely separated than the others. On the postero-dorsal and the anterior parts of the shell ribs are absent.

Affinities.—By some authors this species has been identified with *P. Martini*, Forbes. With the material at present available it is difficult to make a satisfactory comparison; but the specimens from Speeton are of considerably larger size, with broader and less prominent umbones, and with the posterior part of the shell less compressed than in *P. Martini*.

In form this species resembles *P. alternans*, Römer,[1] but the umbones are relatively higher, and the radial ribs more numerous. The ribs are not so numerous as in *P. Eberti*, Wollemann.[2]

Remarks.—The specimens from the clays are considerably crushed, whilst in those from the hard nodular beds a more or less considerable portion of the marginal part of the shell is missing.

Distribution.—Speeton Clay (zones of *Belemnites lateralis*, *B. jaculum*, and *B. brunsvicensis*) of Speeton.

PHOLADOMYA MARTINI, *Forbes*, 1845. Plate XLI, fig. 5.

1845.	PHOLADOMYA MARTINI,	*E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 233, pl. ii, fig. 3.
1850.	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 117.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 220.
1865.		—	*F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 92.
? 1908.	—	—	*A. Wollemann.* Jahrb. d. k. preuss. geol. Landesanst. für 1908, vol. xxix, p. 165, pl. x, fig. 3.

Description.—Shell rather small, oval, very inequilateral, anterior part inflated, posterior part compressed. Umbones prominent. Escutcheon deep. Ornamentation consists of numerous radial ribs, which are more or less tuberculate, and are more widely separated anteriorly than on the median part; on the anterior and postero-dorsal parts ribs are indistinct or absent. Concentric ribs and growth-lines are present.

Remarks.—It is difficult to give a satisfactory description of this species, since the specimens seen are few in number, imperfectly preserved, and usually crushed. *P. Martini* appears to be closely allied to *P. Fabrina*, d'Orbigny (see below). It also resembles *P. hispanica*, Coquand.[3]

[1] Wollemann, 'Die Biv. u. Gastrop. d. deutsch. u. holländisch. Neocoms' (1900), p. 134, pl. v, figs. 9, 10; pl. vi, fig. 3. Specimens with fewer ribs from the Spilsby Sandstone and the Claxby Ironstone of Lincolnshire approach *P. alternans* more nearly than do the specimens from Speeton

[2] Ibid., p. 136, pl. vi, fig. 4.

[3] 'Mon. Aptien de l'Espagne' (1865), p. 92, pl. vii, figs. 5, 6.

Type.—From the Hythe Beds of Pulborough. A specimen which is believed to be the type, but which is more crushed dorso-ventrally than is indicated by the figure, is in the Museum of the Geological Society (No. 2197).

Distribution.—Lower Greensand (*Perna*-bed and Crackers) of Atherfield. Hythe Beds of Pulborough.

PHOLADOMYA FABRINA, *d'Orbigny*, 1845. Plate XLI, fig. 6.

1845.	PHOLADOMYA FABRINA, *A. d'Orbigny.*		Pal. Franç. Terr. Crét., vol. iii, p. 354, pl. cccIxiii, figs. 6, 7. (Non *P. Favrina*, Agassiz, Pictet and Roux.)
1850.	—	*d'Orbigny.*	Prodr. de Pal., vol. ii, p. 135.
1865.	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 92.
1897.	—	FAVRINA ?, *R. B. Newton.*	Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 92.
? Non 1874.	—	FABRINA, *C. Moesch.*	Mon. Pholadomyen, p. 94, pl. xxxii, fig. 1.

Remarks.—Some crushed specimens found in the Gault are probably examples of *P. Fabrina*, d'Orbigny. They resemble *P. Martini*, but have coarser and more distinctly tuberculate ribs, and the concentric rings appear to be more conspicuous.

Distribution.—Gault of Black Ven, Okeford Fitzpaine, and Folkestone.

PHOLADOMYA DECUSSATA (*Mantell*), 1822. Plate XLI, figs. 7—9; Plate XLII, fig. 1.

1822.	CARDIUM ? DECUSSATUM, *G. Mantell.*		Foss. S. Downs, p. 126, pl. xxv, fig. 3.
1827.	—	—	*J. de C. Sowerby.* Min. Conch., vol. vi, p. 99, pl. dlii, fig. 1.
1837.	—	—	*A. Goldfuss.* Petref. Germ., vol. ii, p. 222, pl. cxlv, fig. 2.
—	PHOLADOMYA DECUSSATA, *G. G. Pusch.*		Polens Paläont., p. 87.
1841.	CARDIUM DECUSSATUM, *F. A. Römer.*		Die Verstein. d. nord-deutsch. Kreidegeb., p. 71.
1846.	PHOLADOMYA DECUSSATA, *A. E. Reuss.*		Die Verstein. der böhm. Kreideformat., pt. 2, p. 17.
1850.	—	—	*J. de C. Sowerby*, in *F. Dixon.* Geol. Sussex, p. 355 (p. 385, ed. 2), pl. xxix, fig. 6.
—	—	—	*H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 146.
		—	*R. Kner.* Verstein. d. Kreidemergels v. Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 24.

1850.	PHOLADOMYA DECUSSATA,	*A. Alth.*	Geogn.-palæont. Beschreib. v. Lemberg (ibid.), p. 236.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 220.
1861.	—	—	*var.* TRIANGULARIS, *H. G. Seeley.* Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 122.
1863.	—	(CARDIUM) DECUSSATA,	*A. v. Strombeck.* Zeitschr. der deutsch. geol. Gesellsch., vol. xv, p. 143.
1865.	—	DECUSSATA,	*F. J. Pictet and G. Campiche.* Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 94.
1869.	—	—	*E. Favre.* Moll. Foss. de la Craie de Lemberg, p. 106.
1875.	—	—	*A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. xxxi, p. 300.
—	—	—	*C. Moesch.* Mon. Pholadomyen, p. 107, pl. xxxii, figs. 5 ?, 6 ; pl. xxxvi, figs. 5, 6.
1876.	—	—	*D. Brauns.* Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 361.
? 1889.	—	—	*E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 154, pl. xiv, figs. 3, 4.
1891.	—	—	*J. Böhm.* Kreidebildung. d. Fürbergs u. Sulzbergs (Palæontographica, vol. xxxviii), p. 73.
1893.	—	—	*A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat. v. Priesen. Schicht., p. 97, fig. 116.
? 1898.	—	—	*G. Müller.* Mollusk. d. Untersen. v. Braunschweig u. Ilsede, p. 74, pl. x, fig. 3.
1901.	—	—	*A. Wollemann.* Jahrb. d. k. preuss. geol. Landesanst. für 1900, vol. xxi, p. 22.
1902.	—	—	*A. Wollemann.* Lüneburg. Kreide, p. 79.
Non 1829.	—	—	*J. Phillips.* Geol. Yorks., pp. 122, 186 (p. 255, ed. 3), pl. ii, fig. 9.
— 1842.	—	—	*L. Agassiz.* Études crit. Moll. Foss., Myes, p. 74, pl. iv, figs. 9, 10 ; pl. iv[1], figs. 7—11.
— 1843—50.	—	—	*G. P. Deshayes.* Traité Elément. de Conchyliol., vol. i, pt. 2, p. 158, pl. v, fig. 5.
— 1849.	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. i, p. 335.

Distribution.—Shell large, inflated, with the greatest diameter at the anterior end, outline semi-ovate (sometimes sub-trigonal), wedge-shaped behind, extremely inequilateral, with a small posterior gape; height and length often nearly equal. Ventral margin slightly curved. Posterior margin rounded. Anterior part of the shell very short, flattened, with cordate outline, nearly perpendicular to the plane between the valves, and forming almost a right angle with the sides of the valves; the margin of the anterior part is more or less angular, and just within is a shallow concave part parallel to the margin, whilst the median part is convex, and

that near the umbones is depressed. Umbones curved considerably inwards and more or less forwards. Escutcheon depressed.

Ornamentation consists of narrow radial ribs separated by broad, shallow depressions. Ribs are absent from the posterior part of the shell, and from the anterior flattened part, except near its margin; they become smaller or disappear altogether near the ventral margin. Well-marked growth-rings occur over the entire surface of the shell, but are more distinct near the umbones than ventrally, and give a granular or nodular appearance to the radial ribs, especially on the dorsal part of the shell.

Measurements:

	(1)	(2)	(3)	
Length	98	60	54	mm.
Height	74	59	52	,,
Thickness . .	65	51	49	,,

(1, 2) Chalk Marl, Ventnor.
(3) Chalk Marl, Eastbourne.

Affinities.—The smaller forms of this species show some resemblance to *P. genevensis*, Pictet and Roux,[1] from the Gault, but the concentric rings are less prominent, and the valves more inflated and less distinctly triangular. Another similar form is *P. Malbosi*, Pictet.[2] See also *P. cordata* (below).

The specimens from the Cambridge Greensand were regarded by Seeley as constituting a variety (*P. decussata* var. *triangularis*), but, as was pointed out by Jukes-Browne, they agree in all essential characters with *P. decussata*, differing only in their smaller size. Specimens of *P. decussata* found in the Gault of Folkestone are larger than those found in the Cambridge Greensand, but not so large as the examples in the Chalk.

Remarks.—In England this species has not been found above the Cenomanian (zone of *H. subglobosus*), but on the Continent it appears to range up into the Senonian. In many of the English specimens the original shape has been modified by crushing, and that also appears to be the case with some of the examples figured by foreign authors.

Type.—The type from the Lower Chalk near Brighton, and the specimen figured by Sowerby from the Chalk Marl of Hamsey, and the one figured by Dixon, cannot now be found.

Distribution.—Gault of Folkestone. Cambridge Greensand. Chalk Marl of Ventnor, Culver Cliff, Eastbourne, Hamsey, Middleham, Offham, Glynde and Folkestone. Totternhoe Stone (zone of *Holaster subglobosus*) of Arlesey and Burwell.

[1] 'Moll. Foss. Grès verts de Genève' (1852), p. 405, pl. xxix, fig. 2. Moesch, 'Mon. Pholadomyen' (1875), p. 97, pl. xxxii, figs. 2–4.

[2] 'Mélanges Paléont.' (1868), p. 92, pl. xix, fig. 3. Moesch, op. cit., p. 88, pl. xxx, fig. 5, pl. xxxv, fig. 1.

PHOLADOMYA CORDATA, *Tate*, 1865. Plate XLII, fig. 2 *a*—*c*.

1865. PHOLADOMYA CORDATA, *R. Tate*. Quart. Journ. Geol. Soc., vol. xxi, p. 40, pl. iv, fig. 1.

Remarks.—A specimen found in the Upper Chalk (zone of *Belemnitella mucronata*), now in the Norwich Museum (No. 3339), is probably an example of *P. cordata*, but unfortunately the anterior part of the shell is imperfect. In this species the anterior curvature of the umbones is greater and the depression in front of them deeper than in *P. decussata*; also the anterior flattened part is relatively smaller, since the greatest diameter of the shell occurs at about one third of the length from the anterior end. The types of *P. cordata* from the Upper Chalk of Ireland are in the Museum of Practical Geology (Nos. 23,628; 23,629).

Genus—MYOPHOLAS, *H. Douvillé*, 1907.

('Bull. Soc. géol. de France,' ser. 4, vol. vii, p. 107.)

MYOPHOLAS, sp. *cf.* SEMICOSTATA (*Agassiz*), 1842. Plate XLII, fig. 3*a*, *b*.

Description.—Shell oval, short, considerably inequilateral, anterior part convex, posterior part compressed; anterior and posterior margins rounded. Umbones curved inwards and forwards. Rather more than half of the shell—the anterior part—is ornamented with thirteen narrow, sharp, radial ribs, which are separated by broad, flat, or slightly concave interspaces; posteriorly these ribs become smaller and less widely separated; on the middle part of the shell a few indistinct concentric ribs are seen. The posterior part of the shell is nearly smooth, and is separated from the ribbed area by a slight depression; a curved carina extends from the posterior side of the umbo towards the postero-ventral extremity.

Affinities.—Only one specimen has been seen; it resembles closely *M. semicostata* (Agassiz[1]), but is rather shorter, and the posterior limit of the ribbed area is more sharply defined than in most examples of *M. semicostata*. Judging from

[1] 'Etudes crit. Moll. Foss.,' Myes (1842), p. 51, pl. ii, figs. 1, 2, pl. iii[1], fig. 11. Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 77, pl. cv, figs. 1, 2. Moesch, 'Mon. Pholadomyen' (1874), p. 85, pl. xxx, fig. 4, pl. xxxiii, figs. 3, 4, pl. xxxvi, fig. 1. Douvillé, 'Bull. Soc. géol. de France,' ser. 4, vol. vii (1907), p. 112, pl. ii, fig. 8. Moesch includes as a synonym *Pholadomya Triboleti*, Pictet and Campiche, op. cit., p. 89, pl. cvi, fig. 8. Pictet and Campiche include *P. Moreana*, Buvignier, 'Statist. géol., etc., de la Meuse' (1852), Atlas, p. 8, pl. viii, figs. 21, 22.

the figures given by several authors, that species varies considerably, so that it seems probable that when more English specimens have been obtained it will be possible to refer them definitely to *M. semicostata*.

Distribution.—Lower Greensand of Furze Hill, Faringdon.

Genus—GONIOMYA, *L. Agassiz*, 1842.

('Etudes crit. Moll. Foss.,' Myes, pp. xii, 1.)

GONIOMYA ARCHIACI (*Pictet and Renevier*), 1855. Plate XLII, figs. 4, 5.

1855–6. THRACIA ARCHIACI, *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 67, pl. vii, fig. 5.

1858. — *Pictet and Renevier*. Ibid., p. 176.

1865. PHOLADOMYA THRACIOIDES, *F. J. Pictet and G. Campiche*. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 92 (*Goniomya*).

1870. GONIOMYA ARCHIACI, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 75.

Description.—Shell oblong, convex, nearly equilateral. Anterior margin rounded. Ventral margin slightly convex or nearly straight, nearly parallel with the dorsal margin. Posterior margin truncated, oblique, slightly convex, forming a rounded angle with the ventral margin and an obtuse angle with the postero-dorsal margin. Umbones of moderate size, with a faint rounded carina extending postero-ventrally, above which the shell is compressed; lunule and escutcheon elongate, depressed, limited by carinæ.

Ornamentation: Anteriorly to the umbones there is a ribbed area in which the ribs extend obliquely backwards; posteriorly to the umbones is another ribbed area in which the ribs are nearly perpendicular to the postero-dorsal margin, but slightly curved ventrally. The anterior, ventral, and postero-dorsal parts of the shell are without ribs, and show growth-lines only. Near the umbo the ribs of the two areas are connected by horizontal ribs, but ventrally these horizontal ribs are absent or indistinct. Some parts of the shell are marked by rows of small pits.

Measurements:

	(1)	(2)	(3)
Length	33	28	19 mm.
Height	19	16	11 „

(1—3) Crackers, Atherfield.

Affinities.—This species is less inequilateral, and the ribs are less extensively developed than in *G. caudata*, Agassiz.[1]

Remarks.—English examples of this species were identified by Pictet and Renevier, who state that the forms referred by Forbes[2] to *Pholadomya Agassizi* are really specimens of *G. Archiaci*.

Type.—From the Aptian of the Perte-du-Rhône.

Distribution.—Lower Greensand (Crackers) of Atherfield.[3]

GONIOMYA MAILLEANA (*d'Orbigny*), 1845. Plate XLII, figs. 6, 7.

1845. PHOLADOMYA MAILLEANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 355, pl. cccIxiv, figs. 1, 2.
1845. GONIOMYA MAILLEANA, *L. Agassiz*. Études. crit. Moll. Foss., Myes, p. xiv.
1850. PHOLADOMIA MAILLEANA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 157.
1854. PHOLADOMYA MAILLEANA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 220.
1865. — — *F. J. Pictet and G. Campiche*. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 93 (*Goniomya*).
? 1868. PHOLADOMYA MAILLEANA, *A. Briart and F. L. Cornet*. Meule de Braequegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 83, pl. vi, fig. 12.
1870. GONIOMYA MAILLEANA, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 75.
? 1885. PHOLADOMYA (GONIOMYA) MAILLEANA, *F. Nötling*. Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 36, pl. vi, fig. 9.

Description.—Shell elongate, subquadrate, convex, very inequilateral. Anterior part not so high as the posterior part, compressed, with rounded margin. Antero-dorsal margin concave. Postero-dorsal margin long, nearly straight, and nearly parallel to the slightly convex ventral margin. Posterior margin truncated, oblique, forming a rounded angle with the ventral margin, and an obtuse angle with the postero-dorsal margin. Umbones pointed, directed anteriorly. Lunule concave, elongate-ovate, limited by a carina. Escutcheon long, deep near the umbones, limited by a carina. Between the carina of the escutcheon and a rounded ridge extending from the umbo towards the postero-ventral margin the shell is concave.

[1] 'Etudes crit. Moll. Foss.,' Myes (1842), p. 22, pl. 1*b*, figs. 1—3, pl. i, fig. 1. *Pholadomya Agassizi*, d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii, p. 352, pl. cccIxiii, figs. 1, 2; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 84, pl. cvi, figs. 4—6.

[2] 'Quart. Journ. Geol. Soc.,' vol. i (1845), p. 239. Morris, 'Cat. Brit. Foss.,' ed. 2 (1854), p. 176.

[3] An imperfect specimen of *Goniomya* from the Tealby Limestone of Claxby is in the Sedgwick Museum, Cambridge.

Ornamentation consists of rounded ribs; those in front of the umbones are nearly straight and slope obliquely backwards and downwards; those behind the umbones are curved and more or less nearly parallel to the posterior and postero-dorsal margins; near the ventral margin the ribs become more nearly concentric and are often less distinct (especially on the median part) than on the dorsal portion of the shell.

Affinities.—This species differs from *G. designata* (Goldfuss)[1] in the smaller curvature of the ventral margin, and in the truncated form of the posterior margin. It is closely allied to *G. consignata*, Römer,[2] but the anterior curvature of the umbones is more marked.

Remarks.—This species has been identified by comparison with a specimen given me by M. Raoul Fortin from the same locality as the type.

Type.—From the Cenomanian of Mte. Ste. Catherine, Rouen.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown, Devizes, and near Maiden Bradley. Base of Chalk Marl of Chard.[3]

Family—PLEUROMYIDÆ, *Zittel.*

Genus—PLEUROMYA, *L. Agassiz*, 1842.
('Études crit. Moll. Foss.,' Myes, p. 231.)

PLEUROMYA ORBIGNIANA (*Rouillier*), 1847. Plate XLIII, figs. 1, 2 *a*—*c*.

1847. PANOPÆA ORBIGNIANA, *C. Rouillier*. Bull. Soc. Imp. Nat. Moscou, vol. xx, p. 407; vol. xxi (1848), p. 281, pl. G, fig. 24.

Description.—Shell oval, convex, inequilateral, with a small posterior gape. Anterior and posterior margins rounded. Ventral margin considerably convex. Umbones moderately prominent, incurved. Shell depressed in front of and behind the umbones. Surface nearly smooth, but ornamented with linear, radial ribs, which are sometimes parallel, sometimes irregular; in some places the ribs are replaced by rows of minute tubercles.

Affinities.—The English specimens agree closely with examples from the Lower

[1] 'Petref. Germ.,' vol. ii (1840), p. 264, pl. cliv, fig. 13. Holzapfel, 'Mollusk. Aachen. Kreide' (Palæontographica, vol. xxxv, 1889), p. 153.

[2] 'Die Verstein. d. nord-deutsch. Kreidegeb.' (1841), p. 75, pl. x, fig. 3. Müller, 'Mollusk. Untersen. v. Braunschweig u. Ilsede' (1898), p. 71, pl. x, fig. 7.

[3] A small specimen of *Goniomya* has been found in the Chalk of Trimingham by Mr. R. M. Brydone.

Volgian of Moscow, which were identified by Prof. Pavlow, but their resemblance to Rouillier's figure is not quite so close. Some of the smaller specimens approach *P. peregrina* (d'Orbigny[1]), which is said to differ from *P. Orbigniana* by smaller curvature of the ventral margin, the presence of a shallow depression extending to the ventral margin below the umbones, and by the ornamentation consisting of radial rows of minute tubercles instead of linear ribs. One specimen from Spilsby, however, shows both types of ornamentation, suggesting that the two species are not really distinct. The hinge is not seen in any of the English specimens of *P. Orbigniana*, but the figure given by Rouillier, although not quite satisfactory, is suggestive of *Panopea*; the form of the shell, however, resembles that of some Jurassic species of *Pleuromya*.

Distribution.—Spilsby Sandstone (zone of *Belemnites lateralis*) of Donnington.

Family—POROMYACIDÆ, *Dall.*

Genus—LIOPISTHA, *F. B. Meek*, 1864.

('Check List Invert. Foss. N. America,' pp. 12, 32; T. A. Conrad in Kerr's 'Report Geol. Survey N. Carolina,' vol. i, 1875, Appendix A, p. 28; Meek, 'Invert. Cret. and Tert. Foss. U. Missouri,' 1876, p. 227.)

Section—PSILOMYA, *Meek*, 1876.

(Ibid., p. 229.)

LIOPISTHA (PSILOMYA) GIGANTEA (*Sowerby*), 1818. Plate XLIII, figs. 3, 4; Plate XLIV, figs. 1, 2.

1811.	CORBULA ?,	*J. Parkinson.*	Organic Remains, vol. iii, p. 226.
1818.	— GIGANTEA,	*J. Sowerby.*	Min. Conch., vol. iii, p. 13, pl. ccix, figs. 5—7.
1850.	PHOLADOMYA —	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 157.
1854.	THETIS —	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 227.
1865.	— ? —	*F. J. Pictet and G. Campiche.*	Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pp. 199, 210.
1870.	POROMYA ?	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 42.
1882.	LIOPISTHA	*P. de Loriol.*	Gault de Cosne, p. 45, pl. vi, figs. 1—5.

[1] Murchison, Verneuil, and Keyserling, 'Géol. de la Russie de l'Europe,' vol. ii (1845), p. 468, pl. xl, figs. 10—12. The hinge is figured by Zittel, 'Handbuch d. Paläont.,' vol. ii, p. 125, fig. 179, and 'Grundzüge d. Paläont.,' ed. 2 (1903), p. 330, fig. 732.

Description.—Shell large, rather thick, oval, elongate, inflated, the posterior part compressed, very inequilateral. Anterior part very short, with rounded margin, but its dorsal part only slightly curved. Ventral margin forming a considerable curve. Posterior margin obliquely truncated, more or less rounded. Postero-dorsal margin nearly straight. Umbones large, prominent, pointed, inrolled, and with a more or less considerable forward curvature. A rounded carina extends from the front of the umbones to the middle of the anterior margin and forms the boundary of a deeply excavated area in front of the umbones.

Ornamentation consists of broad, rounded, concentric ribs on the dorsal part of the valves except on the anterior excavated area. In passing ventrally these ribs become less prominent and are soon represented by concentric lines. Rather widely separated radial rows of minute tubercles are present and leave small pits when broken off. Near the umbo small radial ribs are present.

Measurements:

	(1)	(2)	(3)
Length	128	110	90 mm.
Height	89	82	68 ,,

(1—3) Blackdown.

Affinities.—This species resembles *L.* (*Psilomya*) *superba* (Stoliczka[1]), but differs in outline, in the concentric ribs being confined to the dorsal part of the shell, and in the less inflated form of the valves.

Remarks.—In the small examples of this species the shell is relatively shorter and more nearly orbicular in outline and the concentric ribs cover the whole or nearly the whole of the valves. The radial ribs near the umbo are seen in only a few specimens.

Type.—From Blackdown, in the British Museum.

Distribution.—Upper Greensand (zone of *Schlenbachia rostrata*) of Blackdown.

LIOPISTHA, sp. Plate XLIII, fig. 5*a*—*c*.

Description.—Shell oval, slightly inequilateral, inflated, posterior part compressed, with a shallow furrow near the postero-dorsal margin, concave in front of the umbones. Anterior and posterior margins rounded; ventral margin considerably convex. Umbones prominent, curved inwards and forwards.

Ornamentation consists of numerous (about twenty-nine), narrow radial ribs bearing small tubercles, and separated by concave interspaces of greater breath than the ribs. On the postero-dorsal part of the shell ribs are absent. The ribs are crossed by faintly marked concentric rings.

Remarks.—The only example of this species which has been seen does not

[1] 'Palæont. Indica, Cret. Fauna S. India' (1870), p. 48, pl. iii, figs. 2—4.

show the hinge, but it is provisionally referred to *Liopistha* on account of its external resemblance to some species of that genus.[1] It should be noted, however, that it is also similar to some species which are believed to belong to the genus *Pholadomya*.[2]

Distribution.—Red Limestone of Hunstanton.

Family—CUSPIDARIIDÆ, *Dall.*

Genus—Cuspidaria, *G. D. Nardo*, 1840.

('Ann. Sci. Lombardo-Veneto,' vol. x, p. 49.)

Cuspidaria Sabaudiana (*Pictet and Campiche*), 1864. Plate XLIII, fig. 6*a*, *b*; Plate XLIV, fig. 3*a*, *b*.

1864. Neæra Sabaudiana, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 40, pl. c, figs. 5—7.

Description.—Shell inflated, oval, oblique, slightly inequivalve, anterior part sloping rapidly to the margin, posterior part compressed and produced into a pointed beak. Anterior margin rounded; ventral margin convex, curving upwards and passing gradually into the posterior margin. Umbones curved inwards and slightly backwards. A narrow postero-dorsal area is bent at an angle with the sides of the shell, and is limited by a carina.

Ornamentation consists of strong, concentric ribs, most of which are continued on to the posterior beak, where they become rather smaller and closer together; on the sides of the ribs and in the furrows are a few faint concentric lines. Length 14 mm.; height 11 mm.

Affinities.—This species is more inflated, the anterior part is more rounded, and the concentric ribs are stronger than in *C. pulchra* (Sowerby).

Type.—From the Gault of the Perte-du-Rhône.

Distribution.—Lower Gault of Folkestone.

[1] See, for example, Stoliczka, 'Cret. Fauna S. India,' vol. iii (1870), pl. ii, figs. 10, 11; Moesch, 'Mon. Pholadomyen' (1874), pl. xxxv, fig. 5; Geinitz, 'Das Elbthalgeb. in Sachsen' ('Palæontographica,' vol. xx, pt. 2, 1873), pl. xix, figs. 6, 7; Weller, 'Cret. Pal. New Jersey,' vol. iv (1907), pl. lviii, figs. 3—9.

[2] E. g. *P. subdinensis* (d'Orbigny), 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 38, pl. ccl, figs. 1—3, and 'Prodr. de Pal.,' vol. ii (1850), p. 157.

CUSPIDARIA UNDULATA (*Sowerby*), 1827. Plate XLIV, fig. 4.

1827. NUCULA UNDULATA, *J. de C. Sowerby*. Min. Conch., vol. vi, p. 104, pl. dliv, fig. 3.
1854. NEÆRA? — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 216.
1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 421.
1871. — — *F. Stolickza*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 322.

Remarks.—A few specimens resembling Sowerby's figure of *C. undulata* have been found. They appear to differ from *C. Sabaudiana* only in the less oblique form of the shell and the more convex postero-ventral margin. More specimens are needed in order to determine whether *C. Sabaudiana* and *C. undulata* are really distinct or only varieties of one species.

Type.—The type was preserved in pyrites, and came from Folkestone; it was formerly in the British Museum, but has now perished.

Distribution.—Gault of Folkestone.

CUSPIDARIA PULCHRA (*Sowerby*), 1850. Plate XLIV, figs. 5, 6.

1850. LEDA PULCHRA, *J. de C. Sowerby* in *F. Dixon*. Geol. Sussex, p. 346 (p. 382, ed. 2), pl. xxviii, fig. 10.
1854. — ? — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 205.
1897. CUSPIDARIA CAUDATA, *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 393, pl. xxviii, figs. 19, 20.

Description.—Shell convex, with the posterior and antero-dorsal parts compressed; sub-triangular, oblique, somewhat inequilateral, highest in front of the umbones. Dorsal margin nearly straight. Anterior margin slightly convex. Antero-ventral margin rounded. Ventral margin curving upwards and passing gradually into the posterior margin, which forms an acute angle with the postero-dorsal margin. Umbones pointed, curved inwards and slightly backwards. Ornamentation consists of regular, concentric ribs which become indistinct on the antero-dorsal and postero-dorsal parts.

Measurements:

	(1)	(2)
Length	27	22 mm.
Height	19	15 ,,
Thickness	14	11 ,,

(1, 2) Upper Chalk, Norwich.

Palæontographical Society, 1910.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. II. PART VII.

INOCERAMUS.

PAGES 261–284, PLATES XLV–L.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY

JANUARY, 1911.

Affinities.—When describing the Mollusca of the Chalk Rock in 1897 only an imperfect specimen of *C. pulchra* was available for study, and I identified it with *C. caudata* (Nilsson). Two better specimens from Norwich have now been seen, and a new figure of Nilsson's type has been published by Hennig.[1] The English form—figured by Sowerby as *Leda pulchra*—differs from the type of *C. caudata* in the relatively greater height of the anterior part of the shell, the more nearly posterior position of the umbones, and in the posterior rostrum proceeding from the level of the hinge-line instead of below it. *C. pulchra* approaches closely the specimen figured by Goldfuss[2] as *C. caudata*, and it was chiefly on account of this resemblance that I identified the English form with Nilsson's species. Stoliczka[3] and Hennig, however, consider that Goldfuss' specimen is not an example of *C. caudata*. If all the specimens figured by foreign writers as *C. caudata* really belong to that species then it is obviously extremely variable and might well include *C. pulchra*. Without an opportunity of studying a series of foreign specimens and a larger number of English examples it seems, at present, preferable to regard *C. pulchra* as distinct from *C. caudata*. None of the English specimens shows evidence of the existence of such a long posterior beak as is present in the type of *C. caudata*.

A specimen of *Cuspidaria* from the Upper Greensand of Devizes (Plate XLIV, fig. 7) resembles some specimens of *C. pulchra* and may be provisionally referred to that species.

Type.—The type, from the "Chalk of Kent," cannot now be found.

Distribution.—Chalk Rock of Cuckhamsley, Berkshire, and Henley Park. Upper Chalk (zone of *Belemnitella mucronata*) of St. Giles' Gate and Horstead, near Norwich.

[1] 'Revis. Lamellibr. i Nilsson's Petrific. Suecana Format. Cret.' (1897), p. 62, pl. iii, fig. 28; Ravn, 'Mollusk. i Danmarks Kridtafl. I. Lamellibr.' (1902), p. 65 [133], pl. iv, fig. 24.

[2] 'Petref. Germ.,' vol. ii (1840), p. 251, pl. cli, fig. 17. Compare also Wollemann, 'Senons v. Biewende' ('Jahrb. d. k. preuss. geol. Landesanst.,' für 1900), p. 23, fig. 5; Müller, 'Mollusk. d. Untersen. v. Braunschweig u. Ilsede' (1898), p. 77, pl. x, figs. 10, 11; Wollemann, 'Fauna der Lüneburg. Kreide' (1902), p. 80.

[3] 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1870), p. 41.

Family—PERNIDÆ, *Zittel.*

(*Continued from page* 95.)

Genus—INOCERAMUS, *J. Sowerby*,[1] 1819.

(J. Parkinson [*ex* Sowerby MS.], 'Trans. Geol. Soc.,' ser. 1, vol. v, 1819, p. 55. J. Sowerby, 'Trans. Linn. Soc.,' vol. xiii, 1822, p. 455.)

INOCERAMUS NEOCOMIENSIS, *d'Orbigny*, 1846. Plate XLV, figs. 1, 2.

1846.	INOCERAMUS NEOCOMIENSIS,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 503, pl. ccccliii, figs. 1, 2.
1850.	—	*d'Orbigny.*	Prodr. de Pal., vol. ii, p. 83.
1854.		*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 170.
1855.		*G. Cotteau.*	Moll. Foss. de l'Yonne, p. 107.
1869.		*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 104.
1900.		*A. Wollemann.*	Die Bivalv. u. Gastrop. d. deutsch. u. holländ. Neocoms, p. 60.
? 1905.		*E. Harbort.*	Die Fauna d. Schaumburg-Lippe'schen Kreidemulde, p. 44, pl. ix, figs. 4–6.

Description.—Shell inequivalve, very inequilateral, a little higher than long. Valves convex, with flattened sides, and the posterior part compressed. Anterior margin nearly straight; posterior and ventral margins rounded. Posterior margin forming an obtuse angle with the hinge-line. Anterior part nearly perpendicular to the plane of the valves and excavated near the umbones. Umbones terminal, curved inwards and forwards. Hinge-line equal to more than half the height of the shell, and making an angle of about 100° with the anterior margin.

Ornamentation consists of narrow, regular, concentric ribs with an unsymmetrical curvature; the interspaces are broad and regularly concave.

[1] In rearranging the collection of *Inoceramí* in the British Museum, Mr. R. B. Newton and Mr. C. D. Sherborn have found several type-specimens, the existence of which had not been previously recognised; this discovery has greatly facilitated my work. I am also indebted to Mr. Newton and Mr. Sherborn for assistance in selecting specimens for figuring. I wish to thank Mr. C. P. Chatwin for information respecting the zonal distribution of the species of *Inoceramus* in the Chalk and for other assistance Dr. Blackmore, Dr. Rowe, and Mr. G. E. Dibley have helped by the loan of numerous specimens from their collections.

Affinities.—See *I. anglicus* (p. 264).

I. neocomiensis appears to be allied to *I. Ewaldi*, Schlüter,[1] of which only one figure has yet been published. The differences seen are in the greater relative height, the more inequilateral form, and the greater convexity of the curve of the ribs of *I. neocomiensis*.[2]

Remarks.—This species was first recorded in England by Fitton. Only a few specimens have been seen; they agree fairly well with d'Orbigny's figure, but the ribs appear to be better defined, and usually the posterior ear-like part is less distinctly limited. The English specimens are not sufficient to show whether the inequality of the valves is as great as in d'Orbigny's figure.

Type.—Prof. Boule informs me that d'Orbigny's figures are restorations based on two specimens from the Barremian of Bettancourt. The types are in the Natural History Museum, Paris.

Distribution.—Lower Greensand (Fitton's Bed 13) of Atherfield. Hythe Beds of Lympne. Lower Greensand of Nutfield.

INOCERAMUS, sp.

A few specimens of *Inoceramus*, not sufficiently perfect for description, have been found in the Speeton Clay (zone of *Belemnites lateralis*) and in the Spilsby Sandstone of Holton and Acre House.

INOCERAMUS SALOMONI, *d'Orbigny*, 1850. Plate XLV, figs. 3—7.

1850.	INOCERAMUS SALOMONI,	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 139.
1853.	—	*F. J. Pictet and W. Roux.*	Moll. Foss. Grès verts de Genève, p. 501, pl. xlii, fig. 3.
1855.	—	*G. Cotteau.*	Moll. Foss. de l'Yonne, p. 107.
1869.	—	*F. J. Pictet and G. Campiche.*	Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 109, pl. clx, figs. 5—8.

Description.—Left valve inflated, subquadrate, very inequilateral. Length and height nearly equal. Anterior half of valve very convex; posterior half compressed. Anterior end of valve more or less nearly perpendicular to the plane between the valves, and concave near the umbo. Umbo anterior, prominent, pointed, incurved.

[1] See footnote on p. 267.

[2] Compare also forms described by Schmidt as allied to *I. neocomiensis*, 'Mém. Acad. Imp. Sci. St. Pétersb.,' ser. 7, vol. xviii (1872), pp. 155–161, pl. ii, fig. 8, pl. iii, figs. 6—9.

A broad, usually shallow sulcus extends from below the umbo to the ventral margin, where it produces a slight sinuosity; usually the sulcus starts at some distance from the umbo, and may consequently be absent in small specimens. Ornamentation consists of small, narrow, somewhat irregular concentric ribs, separated by broad, shallow, concave interspaces.

Affinities.—This species is related to *I. concentricus*, Parkinson, but is distinguished by its subquadrate outline, by the length and height being nearly equal, and by the presence of the sulcus.

Remarks.—All the specimens seen are internal casts of left valves. The examples figured by Pictet and Roux and by Pictet and Campiche are also left valves.

Type.—D'Orbigny's specimens came from the Albian of Novion, Clar, Géraudot, and Saint Florentin.

Distribution.—*Mammillatus* bed of Copt Point, Folkestone.

INOCERAMUS ANGLICUS, sp. nov. Plate XLV, figs. 8—10. Text-fig. 29.

1822. INOCERAMUS, sp., *G. Mantell.* Foss. S. Downs, p. 96, pl. xix, fig. 20.
1859. — CRISPII, *T. Wiltshire.* The Red Chalk of England (Geol. Assoc.), p. 16, pl. i, fig. 4.
1875. CONCENTRICUS, *A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. xxxi, p. 299.

Description.—Shell equivalve or nearly equivalve, very inequilateral. Anterior part of shell convex, the convexity decreasing with age; posterior part compressed, flattened. Anterior slope of valves steep. Anterior margin moderately convex; ventral margin very convex; posterior margin curved, and forming an obtuse angle with the hinge-line. Length of hinge equal to rather more than a third of the height of the shell. Umbones nearly terminal, with a small anterior curvature.

Ornamentation consists of strong, regular, concentric ribs, which have a subsymmetrical curvature, and become less distinct on the posterior flattened part of the shell. The ribs have rounded summits, and are separated by broad rounded furrows with symmetrical slopes. Some of the ribs bifurcate, some may be discontinuous, or new ribs may be intercalated.

Affinities.—The equal size of the valves, the greater convexity of the curve of the ribs, the convex form of the anterior margin, and the outward slope of the anterior part of the valves distinguish this species from *I. neocomiensis*, d'Orbigny (p. 262).

I. anglicus also resembles *I. Ewaldi*, Schlüter,[1] but is relatively higher, more inequilateral, and the ribs are more strongly curved.

Remarks.—This species has been usually identified as *I. concentricus*, Parkinson, but the equal size of the valves and other characters readily distinguish it from

Fig. 29.—*Inoceramus anglicus*, sp. nov. Red Limestone, Hunstanton. Sedgwick Museum, Cambridge. Part of right valve. Natural size.

that species. An example from Hunstanton was figured by Wiltshire as *I. Crispii* (= *Crippsi*), Mantell.

Distribution.—Red Limestone of Hunstanton. Gault of Folkestone. Cambridge Greensand (derived from the Gault). Marl in the Gault of Roydon, West Norfolk. Upper Greensand of Haldon, the Isle of Wight, and Devizes.

Inoceramus concentricus, *Parkinson*, 1819. Plate XLV, fig. 11; Plate XLVI, figs. 1—10; Plate XLVII, figs. 1, 2.

1819.	Inoceramus concentricus,	*J. Parkinson.*	Trans. Geol. Soc., ser. 1, vol. v, p. 58, pl. i, fig. 4.
1821.	—	*J. Sowerby.*	Min. Conch., vol. iii, p. 183, pl. cccv, figs. 1—6.
1822.	—	*G. Mantell.*	Foss. S. Downs, p. 95, pl. xix, figs. 15, 19.
—	—	*A. Brongniart* in *Cuvier.*	Ossemens Foss., vol. ii, pt. 2, pp. 333, 336, 609, pl. vi, fig. 11.
1828.	— gryphæoides,	*J. de C. Sowerby.*	Min. Conch., vol. vi, p. 161, pl. dlxxxiv, fig. 1.

[1] See footnote on p. 267.

1833. CATILLUS PYRIFORMIS, *H. Michelin.* Magasin de Zoologie, iii, Classe 5, pl. xxxii.

1836. INOCERAMUS CONCENTRICUS, *A. Goldfuss.* Petref. Germ., vol. ii, p. 111, pl. cix, figs. 8*a*, *b*, *c*, (non 8*d*, *e*, *f*).

? 1842. -- *P. Matheron.* Catal. Foss. des Bouches-du-Rhone, p 173.

1846. *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 506, pl. cccciv.

-- -- *A. Leymerie.* Statist. geol et min. de l'Aube, Atlas, pl. v, fig. 12.

1850. -- *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 174.

— *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 138.

1853. -- -- *F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, p. 500, pl. xlii, fig. 2.

1854. - -- *J. Morris.* Cat. Brit. Foss., ed. 2, p. 169.

— - GRYPHÆOIDES, *J. Morris.* Ibid., p. 169.

1855. CONCENTRICUS, *G. Cotteau.* Moll. Foss. de l'Yonne, p. 107.

1869. — *F. J. Pictet and G. Campiche.* Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 107.

1876. - *J. F. Whiteaves.* Mesozoic Fossils (Geol. Surv. Canada), vol. i, pp. 79, 241.

1877. -- *C. Schlüter.* Palæontographica, vol. xxiv, p. 255.

— — — *G. Böhm.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix, p. 238.

1897. -- *R. B. Newton.* Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 88, pl. iii, fig. 12.

1906. *A. Wollemann.* Jahrb. d. k. preuss. geol. Landesanst. für 1906, vol. xxvii, p. 271.

Non 1837. -- -- *G. Fischer de Waldheim.* Oryctogr. de Moscou, p. 177, pl. xx, figs. 1—3. (= *Aucella Keyserlingiana*, Trautschold).

1841. *F. A. Römer.* Die Verstein d. nord-deutsch. Kreidegeb., p. 61.

1845. *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 247 (*I. neocomiensis*, d'Orb.)

1846. -- — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 24.

-- 1847. -- -- *J. Müller.* Petref. der Aachen. Kreidef., pt. 1, p. 30.

Non 1875. Inoceramus concentricus, *A. J. Jukes-Browne*. Quart. Journ. Geol. Soc., vol. xxxi, p. 299.

Description.—Shell more or less ovate, much higher than long, very inequilateral and inequivalve. Anterior part of valves flattened or concave, often more or less nearly perpendicular to the plane between the valves. Posterior part of the valves somewhat expanded and less convex than the part below the umbones. Postero-dorsal part forming a small wing. Left valve very convex, with a high, narrow, pointed, terminal umbo which is considerably incurved and bends forwards. Right valve considerably less convex than the left valve, with a small, terminal umbo curved forwards but only slightly inwards. Hinge-line less than half the height of the shell.

When the shell is perfect the surface is nearly smooth except for numerous regular growth-rings. When the outer layer of the shell is wanting concentric undulations or ribs having an unsymmetrical curvature are seen, and are separated by concave furrows.

Affinities.—*I. concentricus* has been compared by Wollemann with *I. Ewaldi*, Schlüter,[1] but the prominent umbo and other characters readily distinguish it from that species. See also *I. concentricus* var. *subsulcatus*, and *I. sulcatus* (below).

Remarks.—Whilst the left valve in the specimens from the Blackdown Greensand agrees closely with that of specimens found in the Gault, the right valve in many (but not all) cases is relatively more convex, especially between the umbo and the postero-ventral extremity, and the ribs are more sharply curved. A similar modification is seen in the examples from the Red Limestone of Hunstanton. There seems no reason for regarding the specimens with these characters as forming more than a local variety dependent on the fact that they lived under conditions different from those which prevailed where the Gault was deposited.

I. gryphæoides, Sowerby, was founded on an internal cast of *I. concentricus* from the Upper Greensand; in such casts the ribs are more prominent than on the surface of the shell itself.

All the examples from the Cambridge Greensand which have been recorded as *I. concentricus* appear to belong to *I. anglicus* (p. 264).

Types.—The type, which came from the Gault of Folkestone, cannot now be found. The specimens from the same locality figured by Sowerby and by Mantell, and the type of *I. gryphæoides* from the Upper Greensand near Lyme Regis, are in the British Museum.

Distribution.—In all zones of the Gault of Folkestone. Gault of Aylesford,

[1] 'Monatsber. d. k. preuss. Akad. Wissensch., Berlin' (1860), p. 345. Schlüter, 'Palæontographica,' vol. xxiv (1877), p. 255. Wollemann, "Bivalv. u. Gastrop. d. norddeutsch. Gaults" ('Jahrb. d. k. preuss. geol. Landesanst.,' vol. xxvii, 1906), p. 272, pl. vi, fig. 9.

Dunton Green (Kent), Black Ven, and Okeford Fitzpaine. Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown, Sidmouth, Lyme Regis, and Potterne near Devizes. Limestone in the Gault of West Bilney, Roydon, and Grimston (West Norfolk). Red Limestone of Hunstanton.

INOCERAMUS CONCENTRICUS var. SUBSULCATUS, *Wiltshire*, 1869. Plate XLVII, figs. 3—14.

1853.	INOCERAMUS SULCATUS, *F. J. Pictet and W. Roux.*	Moll. Foss. Grès verts de Genève, p. 499, pl. xlii, figs. 1 *d*, *e*, *f*.
1869.	SUBSULCATUS, *T. Wiltshire.*	Quart. Journ. Geol. Soc., vol. xxv, pp. 188, 190.
1879.	-- *F. G. H. Price.*	The Gault, p. 54.

In the lowest zone of the Upper Gault there occur forms of *Inoceramus* which differ from *I. concentricus* only in the fact that radial plications are more or less extensively developed. In these forms every stage can be traced between *I. concentricus* without plications into forms in which the plications are almost as complete as in *I. sulcatus*. A specimen, which differs from *I. concentricus* only in the occurrence of one shallow plication, is shown in fig. 3 (Plate XLVII); others are similar, but possess two or three plications (Plate XLVII, figs. 4, 5). In most cases the early part of the shell agrees entirely with *I. concentricus*; but the duration of this stage varies considerably in different individuals, and sooner or later either a few or many plications are developed. When the plications are numerous and start from near the umbo the shell closely resembles *I. sulcatus*, but may usually be distinguished by the rounded (instead of angular) form of the plications, and by the presence of concentric ribs. For these forms, which characterise a definite horizon in the Gault, it will be convenient to adopt as a varietal designation the name *subsulcatus*, given by Wiltshire in 1869.

From a study of many forms of this variety it seems evident that *I. sulcatus* has been derived from *I. concentricus* by the gradual development of plications, and this view is in accordance with stratigraphical distribution, since *I. concentricus* is the earlier of the two species, being found throughout the Gault, whilst *I. sulcatus* occurs in the upper part of the Gault only.

If *I. sulcatus* has been derived from *I. concentricus*, then it is clearly more nearly related to that than to any other species of *Inoceramus*, and cannot therefore be placed in a separate genus or sub-genus (*Actinoceramus*), as was proposed by Meek.[1] Further, in the early stages of the variety *subsulcatus* the shell is a typical

[1] 'Check List Cret. Foss. N. Amer.' ('Smithsn. Miscell. Coll.,' No. 177, 1864), p. 32. Stoliczka, 'Cret. Fauna S. India,' vol. iii (1871), p. 393. Meek and Hayden, 'Invert. Cret. Tert. Foss. U. Missouri' (1876), p. 39.

Inoceramus, but subsequently it possesses the characters of *Actinoceramus*. Also it appears that a somewhat similar plication has originated independently in *I. Salomoni* (p. 263), and probably too in *I. radians*, Schlüter,[1] and *I. fasciatus*, Müller.[2]

Pictet and Roux regarded *subsulcatus* as a variety of *I. sulcatus* in which the number of plications had decreased; the stratigraphical distribution and also the evidence of the extensive series of specimens of *subsulcatus* which has now been obtained are opposed to this view.

Distribution.—Lowest zone of the Upper Gault of Folkestone. Upper Greensand of Blackdown. Red Limestone of Hunstanton.

INOCERAMUS SULCATUS, *Parkinson*, 1819. Plate XLVII, figs. 15—20.

1819. INOCERAMUS SULCATUS, *J. Parkinson*. Trans. Geol. Soc., ser. 1, vol. v, p. 59, pl. i, fig. 5.
1821. — — *J. Sowerby*. Min. Conch., vol. iii, p. 184, pl. cccvi, figs. 1—7.
1822. — — *G. Mantell*. Foss. S. Downs, p. 95, pl. xix, fig. 16.
— — — *A. Brongniart* in *Cuvier*. Ossemens Foss., vol. ii, pt. ii, pp. 333, 336, pl. vi, fig. 12.
1836. — *A. Goldfuss*. Petref. Germ., vol. ii, p. 112, pl. cx, fig. 1.
1837. — — *W. Hisinger*. Lethæa Suecica, p. 56, pl. xvii, fig. 9.
1846. — — *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 504, pl. cccciii, figs. 3—5.
1850. — — *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 139.
1853. — — *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 499, pl. xlii, figs. 1*a–c* (not *d–f*).
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 170.
1855. — — *G. Cotteau*. Moll. Foss. de l'Yonne, p. 107.
1864. ACTINOCERAMUS SULCATUS, *F. B. Meek*. Check List Cret. Foss. N. Amer. (Smithson. Miscell. Coll., No. 177), p. 32.
1869. INOCERAMUS SULCATUS, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 105.
1875. — — *A. J. Jukes-Browne*. Quart. Journ. Geol. Soc., vol. xxxi, p. 298.
1877. — *C. Schlüter*. Palæontographica, vol. xxiv, p. 256.
1884. — (ACTINOCERAMUS) SULCATUS, *J. F. Whiteaves*. Mesozoic Fossils, vol. i (Geol. Surv. Canada), p. 241, pl. xxxii, fig. 3.

[1] 'Palæontographica,' vol. xxiv (1877), p. 270, pl. iii, fig. 2.
[2] 'Jahrb. d. k. preuss. geol. Landesanst. für' 1887 (1888), p. 416, pl. xviii, fig. 3.

1906. INOCERAMUS SULCATUS, *A. Wollemann*. Jahrb. d. k. preuss. geol. Landesanst. für 1906, vol. xxvii, p. 273, pl. vi, fig. 10.

Non 1827. — — *S. Nilsson*. Petrif. Suecana, p. 18.

Description.—Shell more or less ovate, much higher than long, very inequilateral, more or less considerably inequivalve. Anterior part of valves flattened

FIG. 30.—*Inoceramus*, sp. Gault, Folkestone. Sedgwick Museum, Cambridge. Internal cast of right valve. × ⅓.

or concave. Posterior part somewhat expanded and less convex than the part below the umbones. Left valve very convex, with a high, narrow, pointed anterior umbo which is considerably incurved and bends forwards. Right valve rather less convex than the left valve, with a smaller umbo which bends forwards and slightly inwards.

Ornamentation consists of strong angular radial ridges (plications), usually from eight to ten on each valve, which are often unequal in size and are separated

by deep furrows. The ridges are often at unequal distances from one another; some of them start from the umbo, others may be intercalated or may arise by bifurcation. Fine concentric lines cover the shell and are folded where they cross the ridges and furrows.

Affinities.—Although the radial plications give a distinctive appearance to this species, yet the form of the shell closely resembles that of *I. concentricus*, the main difference being that in the former the difference in the convexity of the two valves is usually less marked than in the latter.

Types.—The type, from the Gault of Folkestone, is in the British Museum. The specimens from near Lewes, Folkestone (except figs. 1 and 2), and Clophill figured by Sowerby, and the specimens figured by Mantell are in the British Museum.

Distribution.—Gault of Folkestone, Aylesford, Ringmer, Eastbourne, the Isle of Wight, and Leighton Buzzard. Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown, Sidmouth, Black Ven, and Lulworth. Red Limestone of Hunstanton, South Willingham (Lincolnshire), and Speeton.

INOCERAMUS, sp. Text-fig. 30.

Specimens of a large, slightly convex *Inoceramus* are found in the Gault of Folkestone and the Upper Greensand of Potterne (Devizes) and the Isle of Wight, but are not sufficiently perfect for determination. The umbones are terminal, and the hinge-line is nearly at right angles to the anterior margin. The anterior parts of the valves slope steeply to the margin. Small and rather distant concentric ribs are present. This form shows some resemblance to *I. pictus* (p. 279), but is less convex, and possesses fewer ribs.

INOCERAMUS TENUIS, *Mantell*, 1822. Plate XLVIII, fig. 1. Text-figs. 31, 32.

1822. INOCERAMUS TENUIS, *G. Mantell.* Foss. S. Downs, p. 132.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 170.
? 1859. — — *T. Wiltshire.* Red Chalk of England (Geol. Assoc.), p. 16, pl. i, fig. 5.
1866. PERNA LISSA, *H. G. Seeley.* Ann. Mag. Nat. Hist., ser. 3, vol. xvii, p. 178.

Non 1841. INOCERAMUS TENUIS? *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 62, pl. viii, fig. 11.

Description.—Shell inequivalve, very inequilateral, convex; postero-dorsal part compressed; antero-dorsal part excavated and more or less nearly perpen-

dicular to the plane of the valves; height greater than length. Hinge-line equal to about two-thirds of the height of the shell. Ventral margin very convex; posterior margin forming an obtuse angle with the hinge-line. Umbones terminal, curved inwards and forwards, the left umbo larger and more prominent than the right. Surface smooth, except for growth-rings.

Affinities.—*I. tenuis* resembles *I. concentricus*, but the left umbo is less

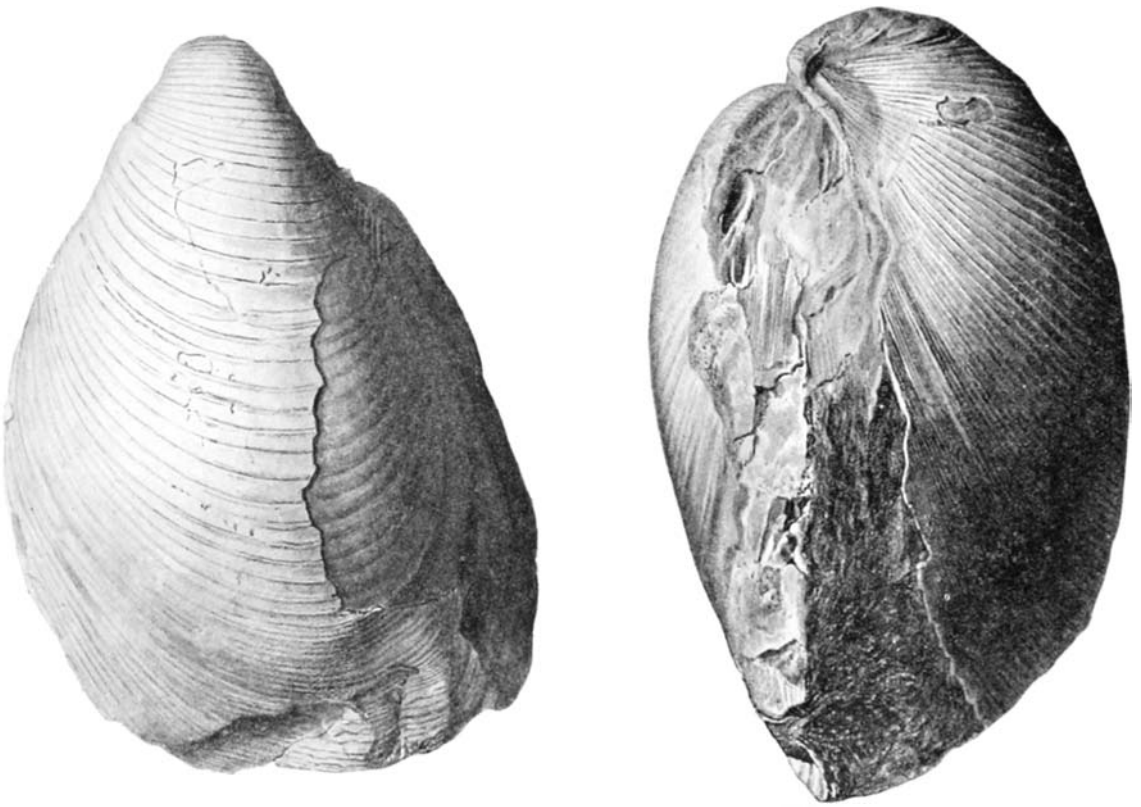


Fig. 31.—*Inoceramus tenuis*, Mantell. Chalk Marl, Hamsey. The type, No. 5890, British Museum (Nat. Hist.). The specimen is somewhat compressed from front to back. Left valve and anterior view of both valves. Right valve shown in the next figure.

prominent, the length of the shell is relatively greater, and the concentric rings are less prominent.

The fragmentary specimens described by Seeley as *Perna lissa* appear to belong to this species.[1]

Types.—In the British Museum (No. 5890) from the Chalk Marl of Hamsey. A fragment, from the Red Limestone of Hunstanton, which appears to be one of

[1] The form from the Red Limestone of Hunstanton which was named *Perna transversa* by Seeley is at present known only by an imperfect left valve. It is perhaps allied to *I. tenuis*, but is remarkable in being much longer than high. The type is in the Sedgwick Museum, Cambridge. Seeley, 'Ann. Mag. Nat. Hist.,' ser. 3, vol. xvii (1866), p. 179.

the specimens on which Seeley's description of *Perna lissa* was based, is in the Sedgwick Museum, Cambridge.

Fig. 32.—*Inoceramus tenuis*, Mantell. Right valve. See Fig. 31.

Distribution.—Red Limestone of Hunstanton, Louth, and Speeton. Upper Greensand of Ventnor and Potterne. Chalk Marl of Hamsey.

INOCERAMUS CRIPPSI, *Mantell*, 1822. Plate XLVIII, figs. 2, 3. Text-figs. 33—35.

1822.	INOCERAMUS CRIPSII, *G. Mantell.*	Foss. S. Downs, p. 133, pl. xxvii, fig. 11.
1836.	LATUS, *A. Goldfuss.*	Petref. Germ., vol. ii, p. 117, pl. cxii, fig. 5 (*non* Mantell).
1846.	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 513, pl. cccviii, figs. 1, 2.
1854.	— CRISPII, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 169.
1904.	— LATUS, *E. T. Newton and A. J. Jukes-Browne.*	In Jukes-Browne, Cret. Rocks of Britain, vol. iii, p. 449.
1909.	CRIPPSI, *J. Böhm.*	Subhercyn. Kreidemulde (Abhandl. d. k. preuss. geol. Landesanst., N.F., 56), p. 41, pl. ix, fig. 1.

Non 1822. INOCERAMUS LATUS, *G. Mantell.* Foss S. Downs, p. 216, pl. xxvii, fig. 10.
— 1828. — — *J. de C. Sowerby.* Min. Conch., vol. vi, p. 159, pl. dlxxxii, fig. 1.
1836. CRISPII, *A. Goldfuss.* Petref. Germ., vol. ii, p. 116, pl. cxii, fig. 4.
— 1840. — — *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 27.
1841. — LATUS, *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 61.
— — — CRIPSII, *Römer.* Ibid., p. 63.
— 1846. — — *H. B. Geinitz.* Grundr. d. Verstein., p. 464.
— LATUS, *Geinitz.* Ibid., p. 463.
— — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 25.
— — CRIPSII, *Reuss.* Ibid., p. 25, pl. xxxvii, figs. 10, 12.
— 1847. — — *J. Müller.* Petref. der Aachen. Kreidef., pt. 1, p. 30.
1852. — — *F. Römer.* Kreidebild. v. Texas, p. 56, pl. vii, fig. 2.
— — — LATUS, *Römer.* Ibid., p. 60.
1859. — CRISPII, *T. Wiltshire.* Red Chalk of England (Geol. Assoc.), p. 16, pl. i, fig. 4.
— 1863. — CRIPSI, *A. v. Strombeck.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 152.
— 1866. — — *K. A. Zittel.* Bivalv. d. Gosaugeb., ii (Denkschr. d. k. Akad. Wissensch., Wien, Math.-nat. Cl., vol. xxv), p. 95, pl. xiv, figs. 1—5, pl. xv, figs. 1—5.
— — — LATUS, *Zittel.* Ibid., p. 100, pl. xiii, fig. 7.
1869. — CRIPSI, *E. Favre.* Moll. Foss. de la Craie de Lemberg, p. 132.
1870. — LATUS, *F. Römer.* Geol. Oberschles., p. 316, pl. xxxiv, fig. 12.
— — — CRIPSII, *Römer.* Ibid., p. 356, pl. xxxix, fig. 9.
1871. — CRISPIANUS, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, p. 405, pl. xxvii, figs. 1—3, pl. xxviii, fig. 2 (not pl. xxvii, fig. 3, *I. Heberti*, Fallot).
1872. — CRIPSI, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 49, pl. xiii, figs. 11–15.
— — LATUS, *Geinitz.* Ibid., p. 45, pl. xiii, figs. 4, 5.
1873. — — *Geinitz.* Neues Jahrb. für Min., etc., p. 11.
— — CRIPSI, *Geinitz.* Ibid., p. 16.
1875. — LATUS, *C. Décocq.* Assoc. Franç. Avanc. Sci. (Lille), p. 369.
1876. — CRIPSII, *D. Brauns.* Zeitschr. f. d. gesammt. Naturwissensch., vol. xlvi, p. 378.
— — — ? var. BARABINI, *F. B. Meek.* Invert. Cret. Tert. Foss. U. Missouri, p. 49, pl. xii, fig. 3, pl. xiii, fig. 1.
— — — ? var. SUBUNDATUS, *F. B. Meek.* Bull. U.S. Geol. and Geogr. Surv. Territories, vol. ii, p. 358, pl. iii, figs. 1, 3.

Non 1877. Inoceramus Cripsii, *C. Schlüter.* Palæontographica, vol. xxiv, p. 277.
— 1878. — latus, *C. Barrois.* Ann. Soc. géol. Nord, vol. v, pp. 407, 475.
— 1879. — Cripsii, vars. proximus, suciensis, Barabini, *J. F. Whiteaves.* Mesozoic Foss., vol. i (Geol. Surv. Canada), pp. 172—174.
— 1882. — — *H. Schröder.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 273.
— 1885. — Cripsi, *E. Fallot.* Ann. Sci. géol., vol. xviii, p. 250.
— 1887. — Cripsii, *A. Peron.* Hist. Terr. Craie S.E. du Bassin Anglo-Parisien, p. 158.
— 1888. — — *G. Müller.* Jahrb. d. k. preuss. geol. Landesanst. für 1887, p. 416.
— 1889. — — *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 222.
— — — Cripsi, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., iv, Teplitz. Schicht., p. 82, fig. 73.
— — — — *O. Griepenkerl.* Senon. v. Königslutter (Palæont. Abhandl., vol. iv), p. 50.
— 1891. — Cripsii, *J. Böhm.* Palæontographica, vol. xxxviii, p. 81.
— 1892. — — *K. Futterer.* Ober. Kreidebild. St. Croce (Palæont. Abhandl., vol. vi), p. 80.
— — — Cripsi, *E. Stolley.* Kreide Schleswig-Holsteins (Mittheil. Min. Institut. Universit. Kiel, vol. i), p. 241.
— 1894. — Crippsi, *B. Lundgren.* Mammilatus och Mucronata zonerna (K. Svenska Vet.-Akad. Handl., n.f., vol. xxvi, No. 6), p. 45.
1897. — Cripsii, *R. Leonhard.* Palæontographica, vol. xliv, p. 49.
— — — latus, *Leonhard.* Ibid., p. 49.
— 1898. — Cripsii, *G. Müller.* Mollusk. Untersen. v. Braunschweig u. Ilsede (Abhandl. d. k. preuss. geol. Landesanst., n.f., 25), p. 45, fig. 12.
— 1899. — — *G. de Alessandri.* Palæont. Ital., vol. iv, p. 194, pl. xvi, fig. 9.
— — — latus, *Alessandri.* Ibid., p. 196.
— 1900. — Cripsi, *A. Wollemann.* Jahrb. d. k. preuss. geol. Landesanst. für 1900, vol. xxi, p. 18.
— 1901. — latus, *F. Sturm.* Ibid., vol. xxi, p. 93, pl. x, fig. 2.
— — — Cripsi, *H. Imkeller.* Palæontographica, vol. xlviii, p. 33.
— 1902. — — var. radiosa, *A. Quaas.* Ibid., vol. xxx, 2, p. 170, pl. xx, figs. 9, 10.
— — — — *A. Wollemann.* Luneburg. Kreide (Abhandl. d. k. preuss. geol. Landesanst., n.f., 37), p. 72.
— 1903. — latus, *W. Petrascheck.* Jahrb. d. k. k. geol. Reichsanst., vol. liii, p. 165.

Non 1905. Inoceramus Cripsi, *T. Wegner*. Zeitschr. d. deutsch. geol. Gesellsch., vol. lvii, p. 161.
1906. — Crispianus, *J. Petho*. Palæontographica, vol. lii, p. 232.
1908. — Cripsii, *A. Stojanoff*. Ann. géol. min. Russie, vol. x, p. 121.

Description.—Shell thin, equivalve, moderately inequilateral, convex between the umbo and the ventral margin; postero-dorsal part compressed and flattened; antero-dorsal marginal part nearly perpendicular to the plane of the valves and

Fig. 33.

Fig. 34.

Fig. 33.—*Inoceramus Cripsi*, Mantell. The type, British Museum (Nat. Hist.) No. 5893. Chalk Marl, Offham. Internal cast. Natural size.
Fig. 34.—*Inoceramus Cripsi*, Mantell. Chalk Marl. Internal cast of a left valve similar to the type. British Museum (Nat. Hist.) No. 5895. Natural size.

nearly straight. Ventral margin convex; posterior margin only slightly convex, and forming more than a right angle with the hinge-line. Hinge-line forms an angle of about 140° with the antero-dorsal margin. Umbones inconspicuous, pointed, not curved, at about a third of the length of the hinge from the anterior end; in front of the umbones is a small, obtusely triangular ear.

Ornamentation consists of broad, rounded, rather irregular concentric ribs, which are strong anteriorly, and become weaker posteriorly. The curvature of the ribs is unsymmetrical; the anterior part curves rapidly, the postero-dorsal part is only slightly curved.

Affinities.—A species from the Senonian was figured and described by Goldfuss

as *I. Crippsi*, Mantell, and that identification has been accepted by many later writers. The type of *I. Crippsi* came from the Chalk Marl (zone of *Schlænbachia varians*). From a study of a cast of the type, Petrascheck and J. Böhm[1] came to the conclusion that the Senonian species is quite distinct from *I. Crippsi*, and Böhm has named the former *I. balticus*. Böhm also supports the view first suggested by Messrs. E. T. Newton and A. J. Jukes-Browne, and confirmed by

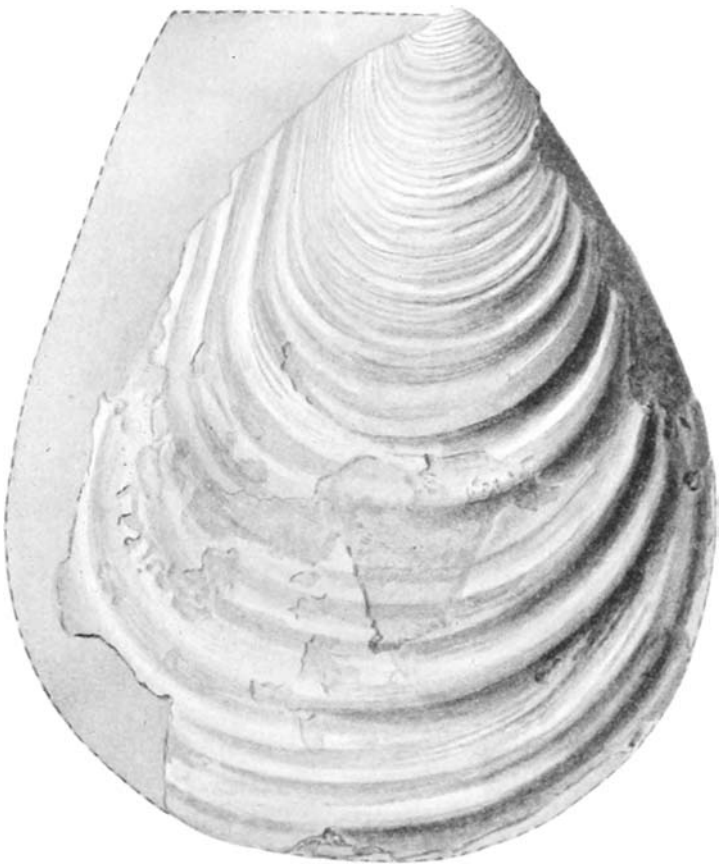


Fig. 35.—*Inoceramus Crippsi*, Mantell. Upper Greensand, Haldon. Right valve. British Museum (Nat. Hist.), No. L17201. Natural size.

Petrascheck, that *I. latus* of Goldfuss and of d'Orbigny (but not of Mantell) is identical with *I. Crippsi*, Mantell. After a careful study of the type and other similar specimens of *I. Crippsi*, and of specimens of *I. latus*, I can fully support these conclusions.

I. cuneiformis, d'Orbigny,[2] is allied to *I. Crippsi*, but is relatively higher. One specimen found in the Upper Greensand of Warminster (Plate XLVIII, fig. 3),

[1] 'Subhercyn. Kreidemulde' (1909), pp. 41—46; Petrascheck, "Inoceram. a. d. Gosau," 'Jahrb. d. k. k. geol. Reichsanst.,' vol. lvi (1906), p. 155.

[2] 'Pal. Franc. Terr. Crét.,' vol. iii (1846), p. 512, pl. cccvii.

shows some resemblance to *I. cuneiformis*, but is probably only a rather high form of *I. Crippsi*, with which species it is found associated.

I. orbicularis, Goldfuss,[1] is regarded by Böhm as a small form of *I. Crippsi*, Mantell.

Type.—In the British Museum (fig. 33) from the Chalk Marl (zone of *Schlœnbachia varians*) of Offham.

Distribution.—Upper Greensand of Haldon. Upper Greensand (zone of *Pecten asper*) of Warminster and Devizes. Chalk Marl (zone of *Schlœnbachia varians*) of Ringmer, Hamsey, Offham, Maiden Newton, Eggardon Hill, Pyrton, Chalton, Arlesey, Hunstanton, and Donnington (Lincolnshire). Cenomanian of Wilmington (Devon). Lower Chalk (zone of *Holaster subglobosus*) of Totternhoe, Burham, and Cherry Hinton.

INOCERAMUS CRIPPSI *var.* REACHENSIS, *Etheridge*, 1881. Plate XLVIII, figs. 4, 5; Plate XLIX, fig. 1.

1881. INOCERAMUS LATUS var. REACHENSIS, *R. Etheridge*. In Penning and Jukes-Browne, Geol. Cambridge, p. 142, pl. i, fig. 3.

Remarks.—In this form, which is mainly characteristic of the zone of *Holaster subglobosus*, the ribs are more sharply defined, their ventral curvature is greater, and their posterior part is less nearly straight than in *I. Crippsi*.

Type.—From the Totternhoe Stone of Burwell, in the Sedgwick Museum, Cambridge.

Distribution.—Chalk Marl of Blue Bell Hill, Burham. Zone of *Holaster subglobosus* of Merstham and Blue Bell Hill, Burham. Totternhoe Stone (zone of *H. subglobosus*) of Burwell. Recorded by Etheridge from the Chalk Marl of Reach.

INOCERAMUS ETHERIDGEI, *nom. nov.* Plate XLIX, figs. 2—4.

1881. INOCERAMUS CONVEXUS, *R. Etheridge*. In Penning and Jukes-Browne, Geol. Cambridge, p. 143, pl. ii, fig. 6.

— — — var. QUADRATUS, *Etheridge*. Ibid., p. 143, pl. ii, fig. 7.

— STRIATUS var. CONVEXUS, *A. J. Jukes-Browne*. Cret. Rocks of Britain, vol. iii, p. 476.

[1] 'Petref. Germ.,' vol. ii (1836), p. 117, pl. cxiii, fig. 2. Böhm, 'Subhercyn. Kreidemulde' (1909), p. 46, pl. xi, fig. 1.

Non 1855. INOCERAMUS CONVEXUS, *J. Hall* and *F. B. Meek*. Foss. Cret. Nebraska (Mem. Amer. Acad. Arts and Sci., vol. v), p. 386, pl. ii, fig. 2.

Description.—Valves nearly equal, considerably inequilateral, tumid, compressed near the postero-dorsal margin; height greater than length. Antero-dorsal margin nearly straight; ventral margin usually very convex; posterior margin slightly or moderately convex, forming an obtuse angle with the hinge-line. Anterior marginal parts more or less nearly perpendicular to the plane of the valves, sometimes concave near the umbo. Umbones terminal, curved inwards and forwards. Angle between the hinge-line and the anterior margin is about 115°. The height of the shell is nearly twice the length of the hinge.

Ornamentation consists of faintly marked concentric undulations and numerous growth-lines.

Affinities.—In this species the antero-dorsal margin is relatively longer and more nearly straight, and the postero-dorsal part of the shell less compressed than in *I. tenuis*, Mantell.

I. convexus var. *quadratus*, Etheridge, was founded on a specimen in which the anterior part of the shell is pressed in, giving rise to the appearance of a carina at the upper margin of the antero-dorsal slope.

Types.—From the Totternhoe Stone of Burwell, in the Sedgwick Museum, Cambridge.

Distribution.—Upper Greensand (zone of *Pecten asper*) of Warminster. Cenomanian of Wilmington, Devon. Chalk Marl of Branscombe, Beer Head, Titherleigh (near Chard) and Hunstanton. Totternhoe Stone (zone of *Holaster subglobosus*) of Burwell.

INOCERAMUS PICTUS, *Sowerby*, 1829. Plate XLIX, figs. 5, 6. Text-fig. 36.

1829. INOCERAMUS PICTUS, *J. de C. Sowerby*. Min. Conch., vol. vi, p. 215, pl. dcv, fig. 1.

1854. — PICTUS, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 170.

1867. — ANGULATUS, *E. Guéranger*. Album Paléont. de la Sarthe, p. 20, pl. xxv, fig. 7 (? I. ANGULATUS, *d'Orbigny*, 1846).

1904. - PICTUS, *E. T. Newton* and *A. J. Jukes-Browne*. In Jukes-Browne, Cret. Rocks of Britain, vol. iii, p. 450.

Description.—Shell equivalve, very inequilateral, slightly or moderately convex with flattened sides; the postero-dorsal part compressed. Antero-dorsal marginal

part flattened or concave, and more or less nearly perpendicular to the plane of the valves. Ventral margin very convex; posterior margin moderately convex. Umbones terminal, incurved. Hinge-line nearly at right angles to the anterior margin. Ornamentation consists of numerous strong, somewhat irregular concentric ribs, separated by concave interspaces. The curvature of the ribs is unsymmetrical, and the ribs become less distinct on the antero-dorsal and postero-dorsal parts of the valves.

Affinities.—This species shows some resemblance to *I. anglicus*, but possesses more numerous ribs, and also differs in the anterior part of the shell being flat or

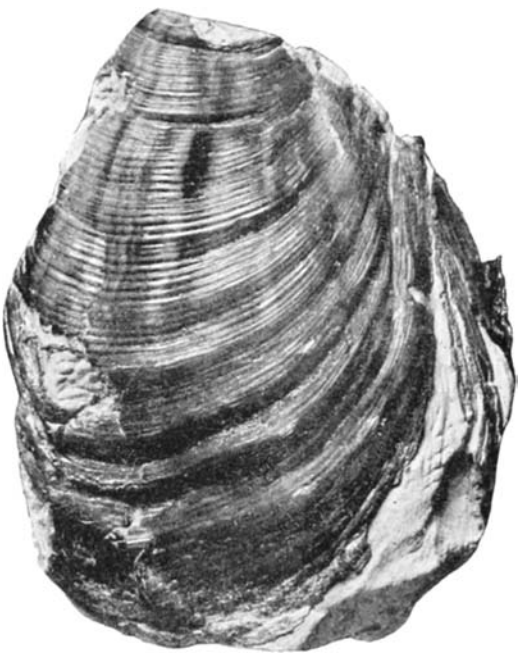


Fig. 36.—*Inoceramus pictus*, Sow. Chalk Marl, Guildford. British Museum No. 43272. The Type. Natural size.

concave. The type and some other specimens (*e. g.* No. 73339, British Museum) show traces of the original colouring of the shell. An example of this species was figured by Guéranger as *I. angulatus*, d'Orbigny,[1] but appears to be quite distinct from that form.

Type.—From the Chalk Marl of Guildford, in the British Museum (Natural History).

Distribution.—Lower Chalk (zone of *Holaster subglobosus*) of Beachy Head, Burham, Rochester, and the Gog-ma-gogs, near Cambridge. Chalk Marl of Burham and Guildford.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1846), p. 515, pl. cccviii, figs. 3, 4. In the text the spelling is *angulosus*.

INOCERAMUS LABIATUS (*Schlotheim*), 1813. Plate L. Text-fig. 37.

1768. OSTRACITES, *J. E. I. Walch.* Die Naturgesch. Verstein z. Erläut. d. Knorrischen Samml. v. Merkwürdigk. d. Natur., II, p. 84, pl. B II *b**, fig. 2; p. 152, pl. dx, figs. 1, 2.

1813. — LABIATUS, *E. F. v. Schlotheim.* In Leonhard's Taschenbuch für Min., vol. vii, p. 93.

— PINNITES DILUVIANUS, *Schlotheim.* Ibid., p. 93.

1820. — — *Schlotheim.* Petrefactenk., p. 303.

1822. MYTILOIDES LABIATUS, *A. Brongniart.* In Cuvier, Ossemens Fossil s, vol. ii, pt. 2, pp. 320, 597, pl. iii, fig. 4.

1822. INOCERAMUS MYTILLOIDES, *G. Mantell.* Foss. S. Downs, p. 215, pl. xxvii, fig. 3; pl. xxviii, fig. 2.

1823. — MYTILOIDES, *J. de C. Sowerby.* Min. Conch., vol. v, p. 62, pl. cccexlii (not the two smaller figures).

1827. CATILLUM SCHLOTHEIMI, *S. Nilsson.* Petrif. Suecana, p. 19.

1836. INOCERAMUS MYTILOIDES, *A. Goldfuss.* Petref. Germ., vol. ii, p. 118, pl. cxiii, fig. 4.

? 1837. CATILLUS MYTILOIDES, *G. G. Pusch.* Polens Paläont., p. 45.

1841. INOCERAMUS MYTILOIDES, *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 63.

1846. — PROBLEMATICUS, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 510, pl. cccevi, figs. 1—7 (Non. *I. problematicus*, v. Schlotheim).

— — MYTILOIDES, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat , pt. 2, p. 26, pl. xxxvii, fig. 16.

— — — *H. B. Geinitz.* Grundr. d. Verstein., p. 463.

? 1847. — — *A. d'Archiac.* Mém. Soc. géol. de France, ser. 2, vol. ii, p. 307.

1850. PROBLEMATICUS, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 197.

— MYTILOIDES, *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 176.

? 1852. — — *F. Römer.* Kreidebild. v. Texas, p. 60, pl. vii, fig. 5.

1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 170 (*partim*).

1863. — — *A. v. Strombeck.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 119.

? 1870. — LATUS, *F. Römer.* Geol. v. Oberschles., p. 316, pl. xxxiv, fig. 12.

1871. — LABIATUS, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 408, pl. xxix, fig. 1.

1872.	Inoceramus labiatus,	*H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 46, pl. xii, figs. 1—3.
1873.	-	*Geinitz.*	Neues Jahrb. für Min., etc., p. 13.
1877.	-	*C. Schlüter.*	Palæontographica, vol. xxiv, p. 262.
—		*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. ii, Weissenberg. u. Malnitz. Schicht., p. 130, fig. 112.
? 1888.		*S. Nikitin.*	Les Vestiges Crét. Russ. centrale (Mém. Comité géol. Russ., vol. v, no. 2), p. 34, pl. 5, figs. 10, 11.
1888.		— *A. Peron.*	Hist. Terr. de Craie dans le S.E. du Bassin Anglo-Parisien, p. 158.
1893.		— *R. Michael.*	Zeitschr. der deutsch. geol. Gesellsch., vol. xlv, p. 241.
-	-	*T. W. Stanton.*	The Colorado Formation (Bull. U.S. Geol. Surv., No. 106), p. 77, pl. x, fig. 4; pl. xiv, fig. 2.
? 1897.	-	— *R. Leonhard.*	Kreideformat. in Oberschles. (Palæontographica, vol. xliv), p. 48.
1903.	-	— *W. Petrascheck.*	Jahrb. d. k. k. geol. Reichsanst., vol. liii, p. 156.
? Non 1868.	-	mytiloides, *E. Eichwald.*	Lethæa Rossica, vol ii, p. 492, pl. xxi, fig. 6.
- 1881.	-	(Mytilites) problematicus, *R. Etheridge.*	In Penning and Jukes-Browne, Geol. Cambridge, p. 143, pl. iii, figs. 9—11.

Description.—Shell mytiliform, nearly equivalve, extremely inequilateral, oblique, much elongated between the umbo and the postero-ventral extremity, convex, with a small posterior ear; antero-dorsal part sloping steeply and sometimes concave. Angle formed by the hinge with the antero-dorsal margin about 90°. Umbones terminal, with a slight anterior curvature. Anterior margin gently curved; postero-ventral extremity very convex; posterior margin nearly straight.

Ornamentation consists of small, fairly regular concentric undulations, which have an unsymmetrical curvature in the young, but become more nearly symmetrical in older specimens. On the old parts of the shell the undulations become less distinct.

Affinities.—It seems probable that this species is related to *I. Crippsi* var. *reachensis* (p. 278), but the height of the shell is relatively greater, the length of the hinge-line is less, and the direction of growth is oblique to the hinge-line.

I. propinquus, Goldfuss,[1] from the Quader-sandstone of Schandau, was regarded by Geinitz as a synonym of *I. labiatus*.

[1] 'Petref. Germ.,' vol. ii (1836) p. 112, pl. cix, fig. 9.

D'Orbigny identified this species with *I. problematicus*, von Schlotheim, which comes from the Senonian, and has been shown by Böhm to be distinct from the Turonian form.[1]

Remarks.—This species is mainly characteristic of the zone of *Rhynchonella Cuvieri*. In the zone of *Terebratulina lata* it is not common, and the shell is usually relatively longer than in typical forms of the species.

Types.—The type came from the Turonian of Pirna. The specimens figured by Mantell from the zone of *Rhynchonella Cuvieri* of Plumpton are in the British Museum. The large specimen figured by Sowerby from Warminster cannot be found.

Distribution.—Zone of *Rhynchonella Cuvieri* of the Devon and Dorset coasts, the Isle of Wight, Winchester, Eastbourne, Lewes, Plumpton, Dover, Blue Bell Hill (Burham), Betchworth, Watlington (Berkshire), Hitchin, Cherry Hinton, South Thoresby, South Ferriby (Lincolnshire), and the Yorkshire coast. Zone of *Terebratulina lata* of the Devon and Dorset coasts, Winchester, Eastbourne, and Dover.

Recorded by Jukes-Browne from the zone of *Holaster subglobosus* of Cambridge-

Fig. 37.

Fig. 38.

Fig. 37.—*Inoceramus labiatus* (Schloth). The type of *Inoceramus mytiloides*, Mantell, 'Foss. S. Downs,' p. 215, pl. xxviii, fig. 2. Zone of *Rhynchonella Cuvieri*, Plumpton. British Museum. Natural size.
Fig. 38.—*Inoceramus labiatus* var. *latus*, Sow. Zone of *Holaster planus*, Purley Junction Station. British Museum, No. L21194. Natural size.

[1] J. Böhm, 'Monatsber. d. deutsch. geol. Gesellsch.' (1909), p. 117.

shire and West Norfolk; and by Rowe from the zone of *Holaster planus* of Dover and the Sussex coast, and from the zone of *Micraster cor-testudinarium* of Dover.

Fig. 39. Fig. 40.

Fig. 39.—*Inoceramus labiatus* var *latus*, Sow. Zone of *Holaster planus*, Swaffham, Norfolk. Norwich Museum, No. 3296. Right valve and anterior view. Natural size.
Fig. 40.—*Inoceramus labiatus* var. *latus*, Sow. One of the types of *Inoceramus latus*, Sowerby, 'Min. Conch.,' vol. vi, p. 159, pl. dlxxxii, fig. 1 (lower figure). Swaffham. British Museum, No. 43266. Natural size.

INOCERAMUS LABIATUS *var.* LATUS, *Sowerby*, 1828. Text-figs. 38—40.

1828. INOCERAMUS LATUS, *J. de C. Sowerby*. Min. Conch., vol. vi, p. 159, pl. dlxxxii, fig. 1. (Non *I. latus*, Mantell).
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 170 (*partim*).

Remarks.—This variety differs from *I. labiatus* in the much greater length of the hinge-line in proportion to the height of the shell, in the greater convexity of the anterior margin, the smaller convexity of the ventral margin, and the less oblique form of the shell. On account of the greater length of the hinge-line the curvature of the ribs and growth-lines is broader than in *I. labiatus*.

This variety appears to be confined to the zone of *Holaster planus*, and is common in the neighbourhood of Swaffham, Norfolk. The larger specimens which I have seen are not sufficiently perfect for figuring, but a characteristic example is figured by Sowerby.

Types.—From the zone of *Holaster planus* of Swaffham. The smaller specimen figured by Sowerby is in the British Museum (Fig. 40), but the larger specimen cannot be found.

Distribution.—Zone of *Holaster planus* of Purley Junction Station, Surrey, and Swaffham, Norfolk.

Palæontographical Society, 1911.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. II. PART VIII.

INOCERAMUS (*continued*).

PAGES 285—340; PLATES LI—LIV.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1912.

Fig. 41.—*Inoceramus labiatus* var. *latus*, Sow. Zone of *Holaster planus*, Coombe Bissett. Dr. Blackmore's Collection. Right valve. Natural size.

INOCERAMUS INCONSTANS, sp. nov. Plate LI, figs. 1—4. Text-figs. 39, 42—49.

1822.	INOCERAMUS BRONGNIARTI, var., *G. Mantell.*	Foss. S. Downs, p. 215, pl. xxviii, fig. 3.
—	— sp. *Mantell.*	Ibid., p. 217, pl. xxvii, fig. 9.
1850.	— LAMARCKII, *J. de C. Sowerby* in *F. Dixon.*	Geol. Sussex, p. 355 (p. 385, ed. 2), pl. xxviii, fig. 29.
1904.	— BRONGNIARTII, *C. Airaghi.*	Boll. Soc. geol. Italiana, vol. xxiii, p. 192, pl. iv, figs. 3—5.

Description.—Shell extremely inequilateral, moderately or slightly inequivalve; the early part of the shell slightly convex or nearly flat, the later part much more convex and sometimes growing nearly perpendicularly to or forming a large angle with the early part, so that in old individuals the shell becomes more inflated; in other cases the convexity increases more gradually from the earlier to the later stages of growth and a nearly globose shell results. Height of the shell often rather greater than the length. Hinge-line long, forming rather more than a right angle with the anterior margin, which is usually more or less nearly straight. Ventral and posterior margins rounded. Umbones terminal, small, pointed, only slightly curved. Anterior marginal part of the valve usually flattened, but not definitely limited from the sides of the shell. Posterior ear developed but not distinctly limited.

Concentric folds are usually well developed, but become indistinct on the anterior flattened area, on the posterior ear, and on the later part of the valve of old individuals. The concentric folds have a very unsymmetrical curvature.

Remarks.—The forms included in this species vary considerably, owing mainly to the length of duration of the flattened stage, which in some individuals forms a

small part (Figs. 43, 48, 49) but in others a large part (Plate LI, fig. 2, Text-figs. 45, 46) of the entire shell.[1] Also the passage from one stage to the other is sometimes gradual, so that the section of the shell forms a fairly uniform curve (Fig. 48), but generally the change is abrupt, so that the later part of the valve is

Fig. 42.—*Inoceramus inconstans*, sp. nov. The original of *Inoceramus* sp., Mantell, 'Foss. S. Downs,' p. 217, pl. xxvii, fig. 9. Upper Chalk, Lewes. British Museum, No. 4765. Left valve and posterior view. Natural size.

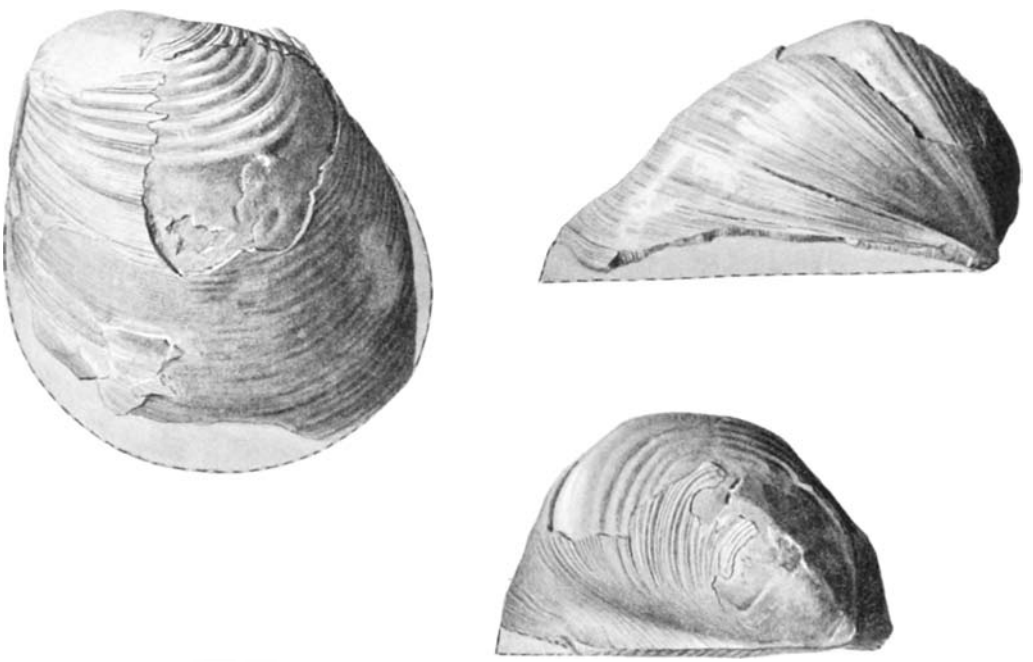


Fig. 43.—*Inoceramus inconstans*, sp. nov. Zone of *Holaster planus*, Swaffham, Norfolk. Norwich Museum. Left valve, and posterior and dorsal views of the same. Natural size.

bent at an angle with the earlier part (Figs. 42, 43). The length of the hinge-line in proportion to the height of the shell shows some variation and consequently the

[1] The larger specimen of *I. latus*, Sowerby ('Min. Conch.,' vol. vi, pl. dlxxxii, upper figure), which cannot now be found, is probably an example of this.

Fig. 45.

Fig. 44.

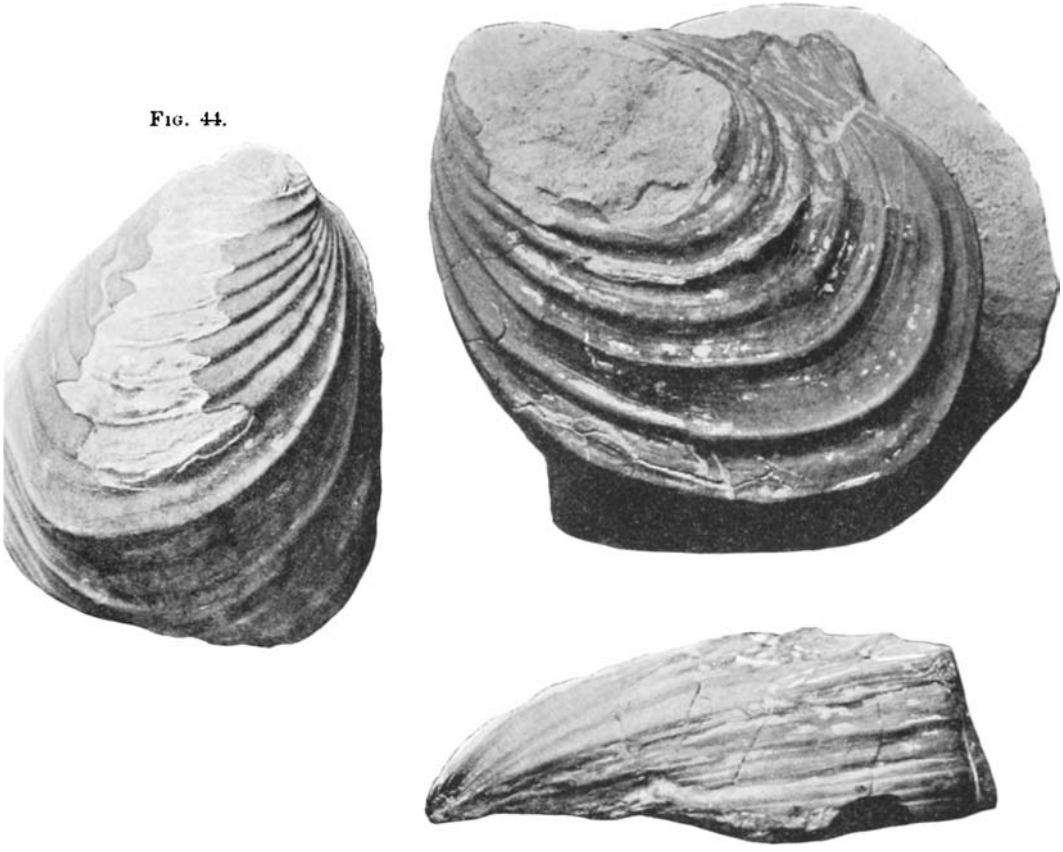


Fig. 44.—*Inoceramus inconstans*, sp. nov. The original of *I. Brongniarti*, var., Mantell, 'Foss. S. Downs,' p. 215, pl. xxviii, fig. 3. Upper Chalk (probably zone of *Micraster cor-anguinum*), Southeram. British Museum, No. 5878. Right valve. Natural size.

Fig. 45.—*Inoceramus inconstans*, sp. nov. Upper Chalk, Sussex. British Museum, No. 5866. Left valve and anterior view. Natural size.

Fig. 46.—*Inoceramus inconstans*, sp. nov. Zone of *Holaster planus*, Swaffham, Norfolk. Norwich Museum. Right valve. Natural size.

curvature of the ribs varies. In some specimens (often of large size) the shell is thinner than usual and has sharp and ridge-like folds similar to those of *I. Lamarcki* var. *Websteri*, Mant. (p. 318). Further work may show that it is desirable to give names to some of the varieties of *I. inconstans*.

Affinities.—This species is closely allied to *I. labiatus* var. *latus*, Sowerby;[1] but the hinge is relatively longer and the height of the shell less, the anterior flattened area is larger, the later part of the shell is more convex, the umbones are less prominent and the posterior ear more distinct.

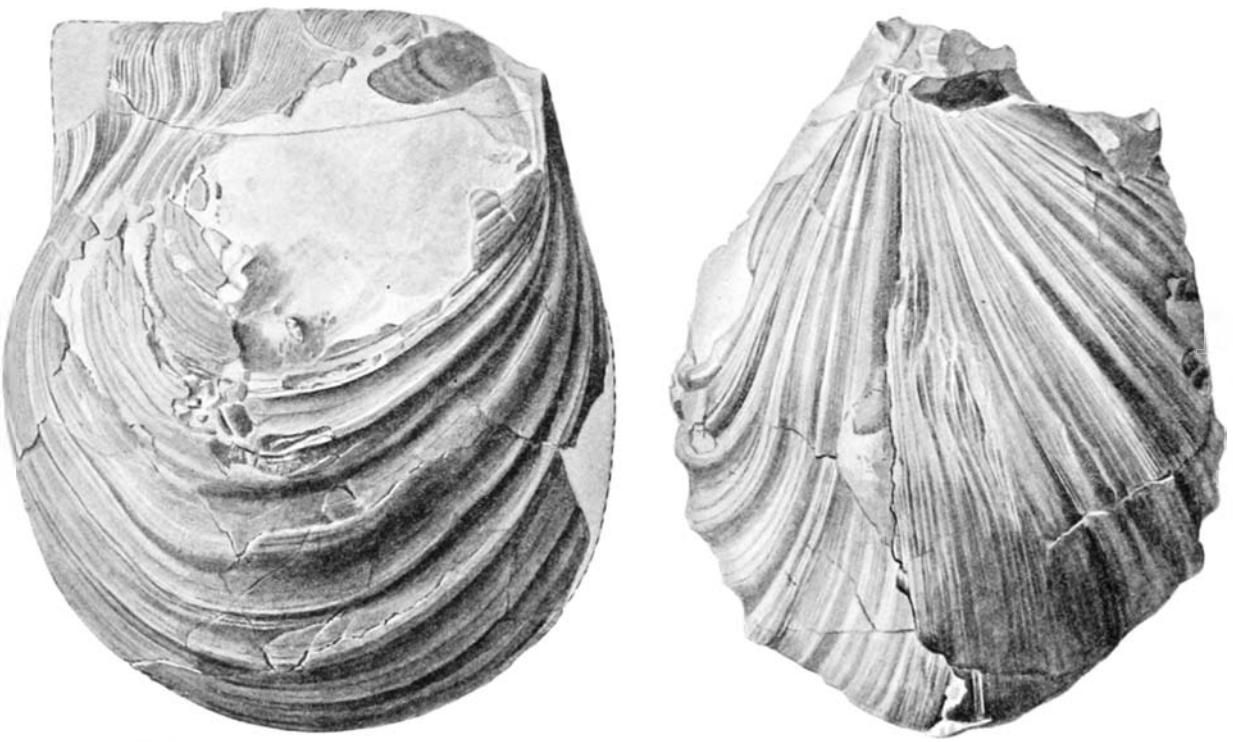


Fig. 47.—*Inoceramus inconstans*, sp. nov. Upper Chalk (zone of *Actinocamax quadratus*), Brighton. Brighton Museum, No. 336. Right valve and anterior view. Natural size.

I. inconstans is distinguished from *I. Lamarcki*, Parkinson (p. 307), by the relatively longer hinge-line, the more unsymmetrical curvature of the folds, the flattened form of the early part of the shell, the less prominent umbones, and the smaller difference in the size of the valves. *I. Cuvieri* of Andert[2] appears to be a flat form of *I. inconstans*. Another specimen figured by Andert[3] is allied to *I. inconstans*, but its axis of growth is more oblique and its hinge longer than usual.

[1] *Erratum* on p. 284 (fig. 39): for *Inoceramus labiatus* var. *latus*, Sow., read *Inoceramus inconstans*, sp. nov. A specimen figured by Andert ('Inoceramen d. Kreibitz-Zittauer Sandsteingeb.,' 1911, p. 45, pl. i, fig. 5) as *I. Cuvieri* var. *planus* appears to be intermediate between *I. labiatus* and *I. labiatus* var. *latus*.

[2] *Loc. cit.*, pl. ii, fig. 2.

[3] *Loc. cit.*, pl. i, fig. 2, pl. vii, fig. 8 (*I. Cuvieri* var. *planus*).

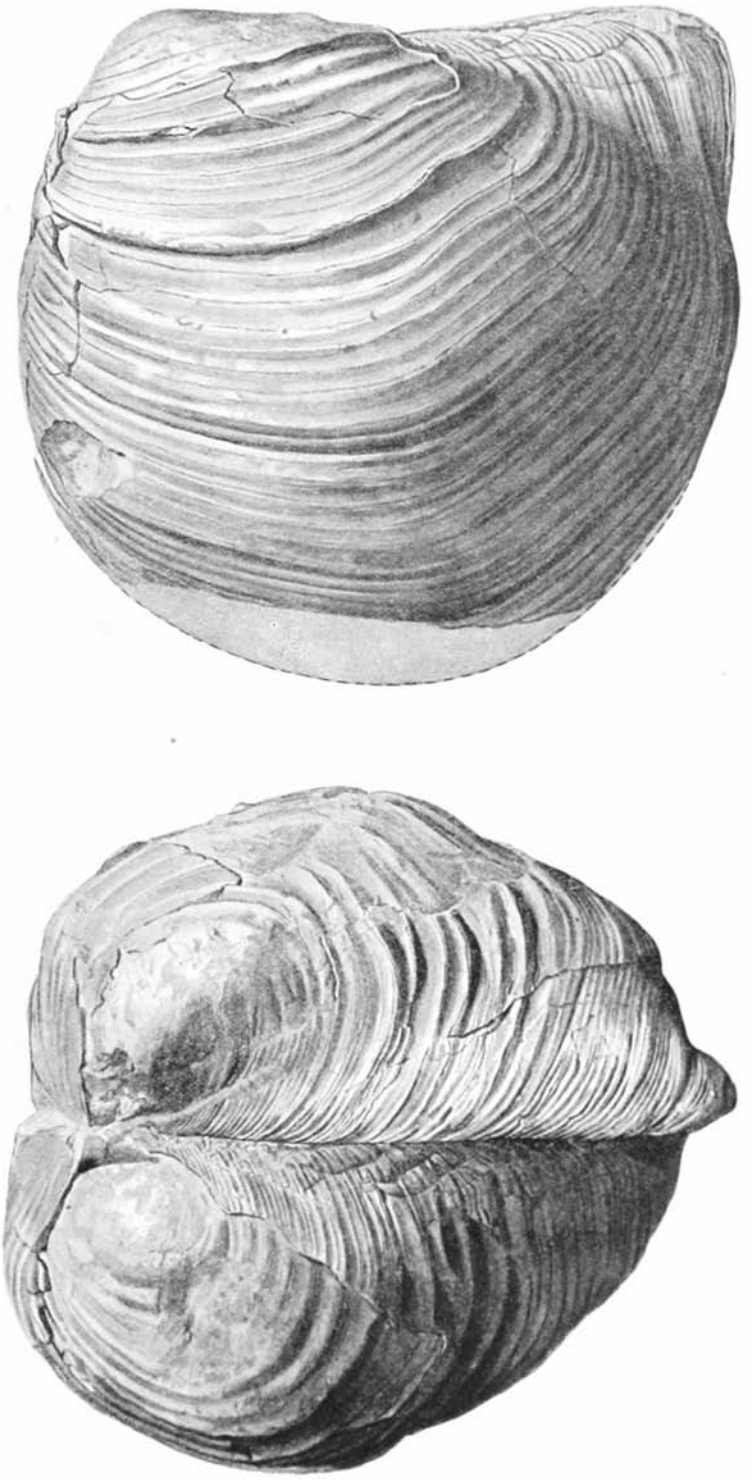


FIG. 48.—*Inoceramus inconstans*, sp. nov. Upper Chalk. Locality unknown. British Museum, No. 30882. Left valve and dorsal view. × ½.

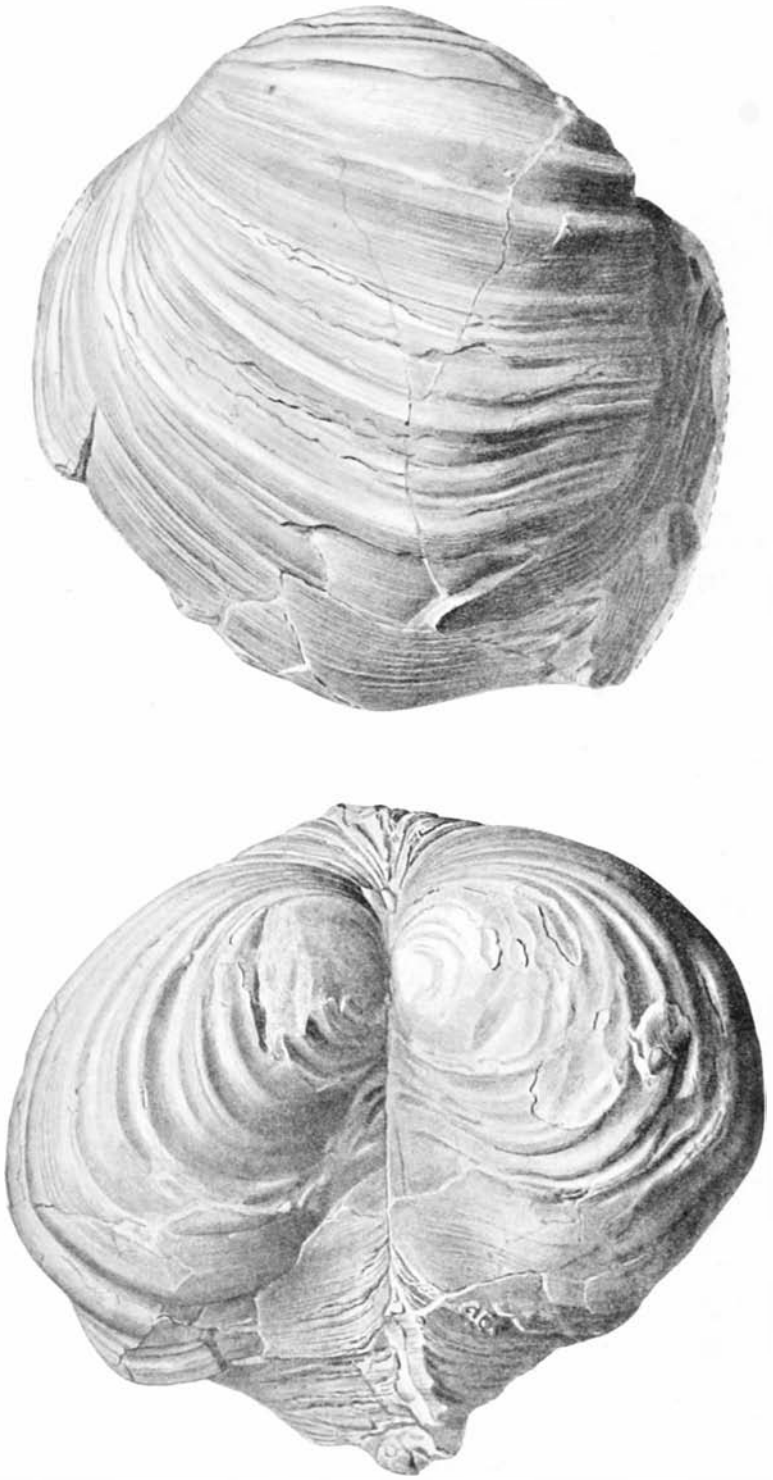


FIG. 49.—*Inoceramus inconstans*, sp. nov. Zone of *Actinocamax quadratus*, East Harnham, Salisbury. Dr. Blackmore's Collection. Left valve and dorsal view. Natural size.

Types.—The specimen figured by Mantell as *I. Bronguiarti* var., from the Upper Chalk (probably zone of *Micraster cor-anguinum*) of Southeram (Lewes), and the one figured as *Inoceramus* sp. by the same author from Lewes, and *I. Lamarcki*, Sowerby (in Dixon), from the Chalk, Sussex (probably zone of *Terebratulina lata* of Malling), are in the British Museum, Nos. 5878, 4765, L20955 respectively.

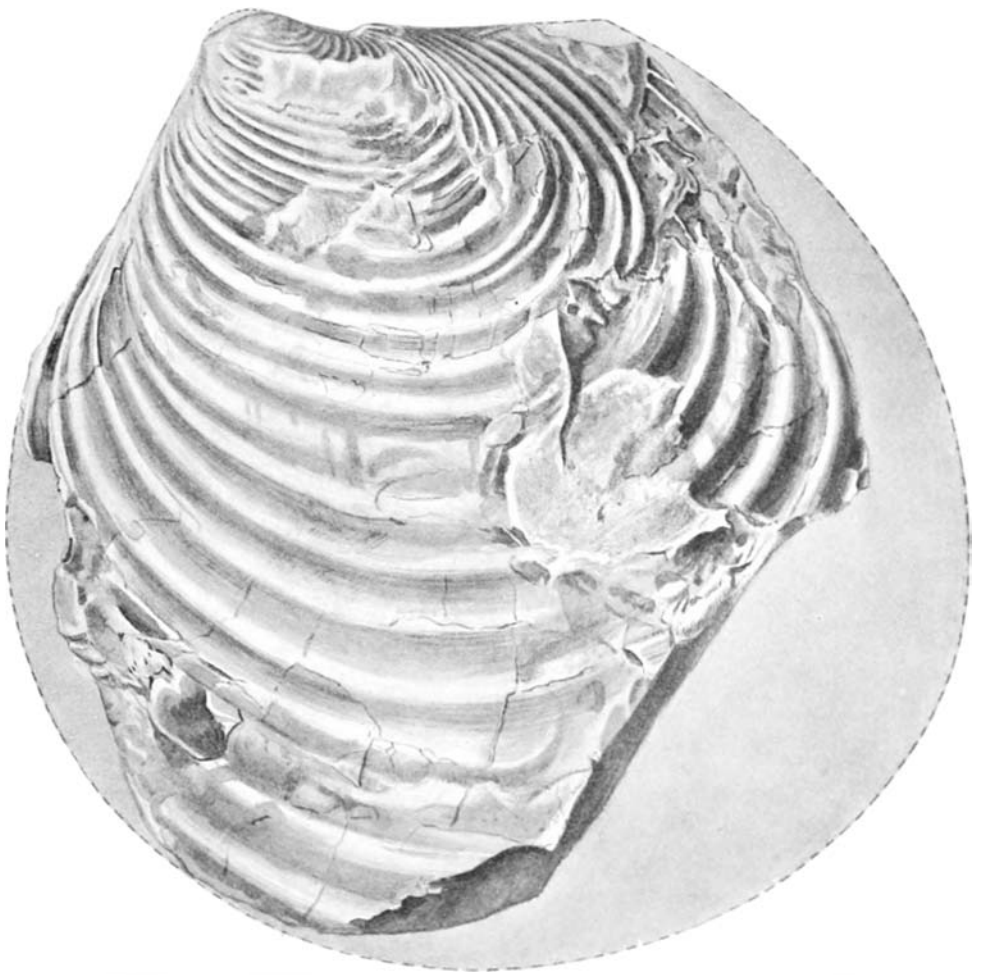


Fig. 50—*Inoceramus inconstans*, sp. nov. *var.* Senonian, Haldon. British Museum, No. L17380. Left valve. A large flat form resembling *I. cycloides*, Wegner. Compare with Fig. 46. × ⅓.

Distribution.—Zone of *Holaster planus* of Twyford, Swaffham (Norfolk), and Strood. Zone of *Micraster cor-testudinarium* of Chatham, Guilford Colliery (Coldred near Dover), and Wharram (Yorkshire). Zone of *Micraster cor-anguinum* of Southeram (Lewes). Zone of *Actinocamax quadratus* of East Harnham (Salisbury) and Brighton. Zone of *Belemnitella mucronata* of Shide (Isle of Wight). Probably also in the zone of *Terebratulina lata*.

INOCERAMUS INCONSTANS *var.* STRIATUS, *Mantell*, 1822. Plate LI, fig. 5; Plate LII, fig. 1.

	1822.	INOCERAMUS STRIATUS,	*G. Mantell.*	Foss. S. Downs, p. 217, pl. xxvii, fig. 5.
	1828.	—	*J. de C. Sowerby.*	Min. Conch., vol. vi, p. 160, pl. dlxxxii, fig. 2.
	1854.	—	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 170 (*partim*).
Non	1836.	—	*A. Goldfuss.*	Petref. Germ., vol. ii, p. 115, pl. cxii, fig. 2.
—	1841.	—	*F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 62.
? —	1846.	—	*A. E. Reuss.*	Die Verstein. der böhm. Kreideformat., pt. 2, p. 25.
—	1846.	—	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 508, pl. cccev.
—	1850.	—	*d'Orbigny.*	Prodr. de Pal., vol. ii, p. 168.
—	1852.	—	*F. Römer.*	Kreidebild. v. Texas, p. 60.
—	1863.	—	*A. v. Strombeck.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 108.
—	1863.	—	*A. Kunth.*	Ibid., vol. xv, p. 727.
—	1870.	—	*F. Römer.*	Geol. v. Oberschlesien, p. 340, pl. xxix, fig. 6.
—	1872–73.	—	*H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1). p. 210, pl. xlvi, figs. 9—13; (ibid., pt. 2), p. 41, pl. xiii, figs. 1, 2, 9, 10.
—	1873.	—	*Geinitz.*	Neues Jahrb. für Min., etc., p. 7.
—	1877.	—	*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. ii, Weissenberg. u. Maluitz. Schicht., p. 129.
? —	1881.	—	*J. Kiesow.*	Schrift. nat. Gesellsch. Dantzig, vol. v, p. 413.
—	1885.	—	*F. Nötling.*	Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 23, pl. iii, figs. 11, 12.
—	1893.	—	*R. Michael.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 233.
—	1895.	—	*E. Tiessen.*	Ibid., vol. xlvii, p. 480.
—	1897.	—	*H. Woods.*	Quart. Journ. Geol. Soc., vol. liii, p. 381, pl. xxvii, fig. 13.
—	1911.	—	*A. Fritsch.*	Stud. im Gebiete böhm. Kreideformat. (Ergänzung zu Bd. I, Korycaner Schicht.), p. 42, fig. 190.

Remarks.—This variety, which is uncommon and of small size, is distinguished by the strongly inflated valves, the large angle between the hinge-line and the anterior border, the absence of folds, and the absence or indistinct character of the anterior flattened area and of the posterior ear.

Types.—The type, from the zone of *Micraster cor-anguinum* of Southeram, Lewes, is in the British Museum, No. 4768 (Plate LI, fig. 5). The specimen figured by Sowerby from the Upper Chalk (probably zone of *Holaster planus*) of Heytesbury is also in the British Museum, No. 43267.

Distribution.—Zone of *Holaster planus* of Stonehall siding near Dover, and Swaffham, Norfolk. Zone of *Micraster cor-anguinum* of Southeram. Upper Chalk (probably zone of *Holaster planus*), Heytesbury.

INOCERAMUS INCONSTANS *var.* SARUMENSIS, *var. nov.* Plate LII, figs. 2, 3.

A variety found in the zone of *Actinocamax quadratus* of East Harnham (Salisbury), Mottisfont, and West Meon (Hampshire), is distinguished by the umbones being more prominent and not terminal, by the regular convexity and equal size of the valves, the absence of the anterior flattened area, and the absence or indistinct character of the concentric folds. This variety is connected with typical forms of the species by some examples (Fig. 49) in which the early part of the shell is less convex and possesses distinct folds, but the umbones are not quite terminal and the anterior flattened area is not present. *I. inconstans* var. *sarumensis* appears to resemble *I. Brancoi*, Wegner,[1] of which good figures have not yet been published.

INOCERAMUS BALTICUS, *Böhm*, 1907. Text-figs. 51—53.

1836. INOCERAMUS CRIPSII, *A. Goldfuss*. Petref. Germ., vol. ii, p. 116, pl. cxii, fig. 4*b*. (Non *I. Crippsi*, Mantell, 1822).

1870. — — var. SULCATA, *F. Römer*. Geol. v. Oberschles., p. 356, pl. xxxix, fig. 9.

1907. — BALTICUS, *J. Böhm*. Zeitschr. d. deutsch. geol. Gesellsch., vol. lix, Monatsber., p. 113.

1909. — *Böhm*. Subhercyn. Kreidemulde (Abhandl. d. k. preuss. geol. Landesanst; N.F. 56), p. 47, pl. xi, fig. 2*a*, pl. xii, fig. 1*a*.

1910. — — *J. Nowak*. Bull. Internat. Acad. Sci. Cracovie (1909), p. 875.

[1] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. lvii (1905), p. 159, fig. 4.

Description.—Shell equivalve, very inequilateral, slightly or moderately convex, becoming very convex in old specimens, in which the later part of the shell grows either perpendicularly to or at an obtuse angle with the earlier part; posterior

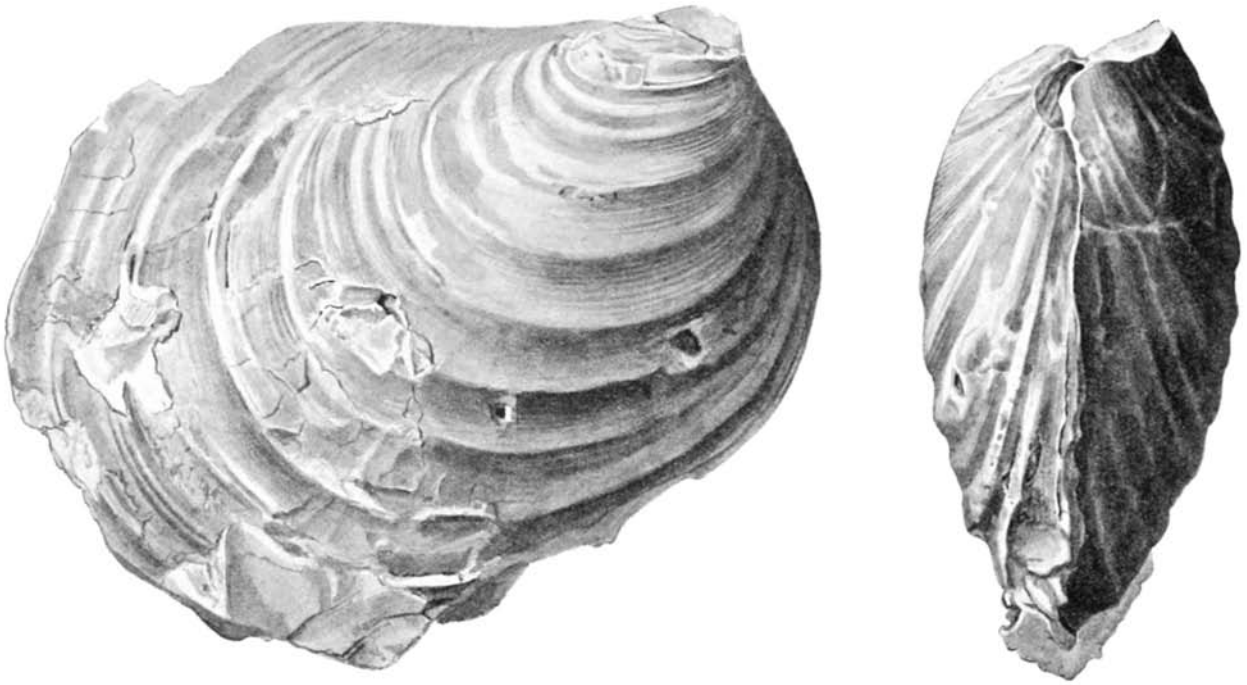


Fig. 51.—*Inoceramus balticus*, Böhm. Senonian, Worbarrow Bay, Dorset. British Museum, No. L22177. Flint cast. Right valve and anterior view. Natural size.

Fig. 52.—*Inoceramus balticus*, Böhm. Anterior view of specimen shown in Fig. 53. × ⅓.

and postero-dorsal parts compressed; length greater than height, the difference increasing with age. Anterior and ventral margins rounded; posterior margin forming an obtuse angle with the hinge. Hinge-line long. Umbones rather small, nearly terminal.

Concentric ribs strong, sharp, narrow, with a very unsymmetrical curvature; a few ribs may come off from the sides of other ribs; between the ribs are broad concave interspaces. On the marginal parts of old specimens ribs are absent.

Affinities.—*I. balticus* is closely allied to *I. inconstans*, from which it has

Fig. 53.—*Inoceramus balticus*, Böhm. Upper Chalk (probably zone of *Marsupites testudinarius*), Brighton. Museum of Practical Geology, No. 25509. Left valve and dorsal view. × ⅓.

probably been derived; it differs from that species by its longer hinge and the longer shell, with the umbones not quite terminal. The length of duration of the slightly convex stage varies in the same way as in *I. inconstans*. The specimen of *I. inconstans* shown in Fig. 45 makes, on account of its longer hinge, some approach to *I. balticus*.[1]

[1] See also Böhm, loc. cit., pl. xii, fig. 1*a*.

I. regularis, d'Orbigny,[1] differs from *I. balticus* in the outline of the shell, in its uniform convexity, and in the broader and less sharp ribs.

Some of the forms from Gosau referred by Zittel to *I. Crippsi* resemble closely *I. balticus*.[2]

Type.—From the Lower *Quadratus* beds of Dülmen, in the Palæontological Institute of the University of Bonn.

Distribution.—Senonian of Haldon, and Worbarrow Bay (Dorset), and Brighton (probably zone of *Marsupites testudinarius*). Zone of *Actinocamax quadratus* of Mottisfont, Ropley (Hants), East Harnham (Salisbury), Mount Pleasant near Andover, Driffield, and Sewerby (Yorkshire). Zone of *Belemnitella mucronata* of Clarendon and Fareham (Hants), Alum Bay and Shide (Isle of Wight), and Norwich.

INOCERAMUS LOBATUS, *Goldfuss*, 1836. Text-figs. 54, 55.

1836.	INOCERAMUS LOBATUS, *A. Goldfuss.*		Petref. Germ., vol. ii, p. 113, pl. cx, fig. 3.
1877.	—	— *C. Schlüter.*	Palæontographica, vol. xxiv, p. 275, pl. xxxix, figs. 1, 2.
1882.	—	— *H. Schröder.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 272.
? 1888.	—	aff. LOBATUS, *S. Nikitin.*	Les Vestiges Crét. dans la Russie Centrale (Mém. Comité Géol., vol. v, no. 2), p. 34, pl. v, fig. 12.
—	—	LOBATUS, *G. Müller.*	Jahrb. d. k. preuss. geol. Landesanst. fur. 1887, p. 415.
1889.	—	— *E. Holzapfel.*	Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 223.
? 1894.	—	aff. LOBATUS, *K. Jimbō.*	Kreideformat. v. Hokkaidō (Palæont. Abhandl., vol. vi), p. 44, pl. viii, fig. 11.
1898.	—	LOBATUS, *G. Müller.*	Mollusk. Untersen. v. Braunschweig. u. Ilsede (Abhandl. d. k. preuss. geol. Landesanst., N.F., 25), p. 43, fig. 10.
? 1901.	—	cf. LOBATUS, *F. Sturm.*	Jahrb. d. k. preuss. geol. Landesanst. für 1900, vol. xxi, p. 93, pl. x, fig. 3.
1902.	—	LOBATUS, *A. Wollemann*,	Lüneburg. Kreide (Abhandl. d. k. preuss. geol. Landesanst., N.F., 37), p. 71.

[1] 'Pal. Franç. Terr. Cret.,' vol. iii (1846), p. 516, pl. cccex.

[2] Compare also *I. Cripsi* var. *sulcata*, Römer, 'Kreidebild. v. Texas' (1852), p. 56, pl. vii, fig. 2, and *I. Cripsianus*, Stoliczka, 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1871), p. 405, pl. xxvii, figs. 1—3; pl. xxviii, fig. 2, and *I. crassus*, Petrascheck, 'Jahrb. d. k. k. geol. Reichsanst.,' vol. liii (1903), p. 164, pl. viii, fig. 4, and Andert, 'Inoceramen d. Kreibitz-Zittauer Sandsteingeb.' (1911), p. 46, pl. iii, fig. 4, pl. vi, figs. 1, 2.

1902. Inoceramus lobatus *J. P. J. Ravn.* Mollusk. i Danmarks Kridtafl. I. Lamellibr., p. 103.

1905. — — *T. Wegner.* Zeitschr. d. deutsch. geol. Gesellsch., vol. lvii, p. 164, fig. 7, pl. x, figs. 1, 2, and text-fig. 7.

1906. — — *G. Smoleński.* Bull. Internat. Acad. Sci. Cracovie, p. 722, pl. xxvii, figs. 16–18.

1909. — — *J. Nowak.* Ibid (1909), p. 875.

Fig. 54.—*Inoceramus lobatus*, Goldf. Zone of *Actinocamax quadratus*, East Leys, Yorkshire. British Museum, No. L23910. Internal cast of right valve; posterior wing missing. × ½.

Description.—Shell very inequilateral, oblique, compressed, slightly convex—the anterior part more convex than the posterior part; much higher than long. Antero-dorsal marginal part sloping steeply. Ventral margin convex, with a

shallow sinus near the postero-ventral angle. Posterior margin nearly straight, somewhat oblique, forming an angle with the ventral margin. A broad shallow depression extends from behind the umbo to the postero-ventral sinuosity; posteriorly this depression is limited by an angular ridge. Behind the ridge is a

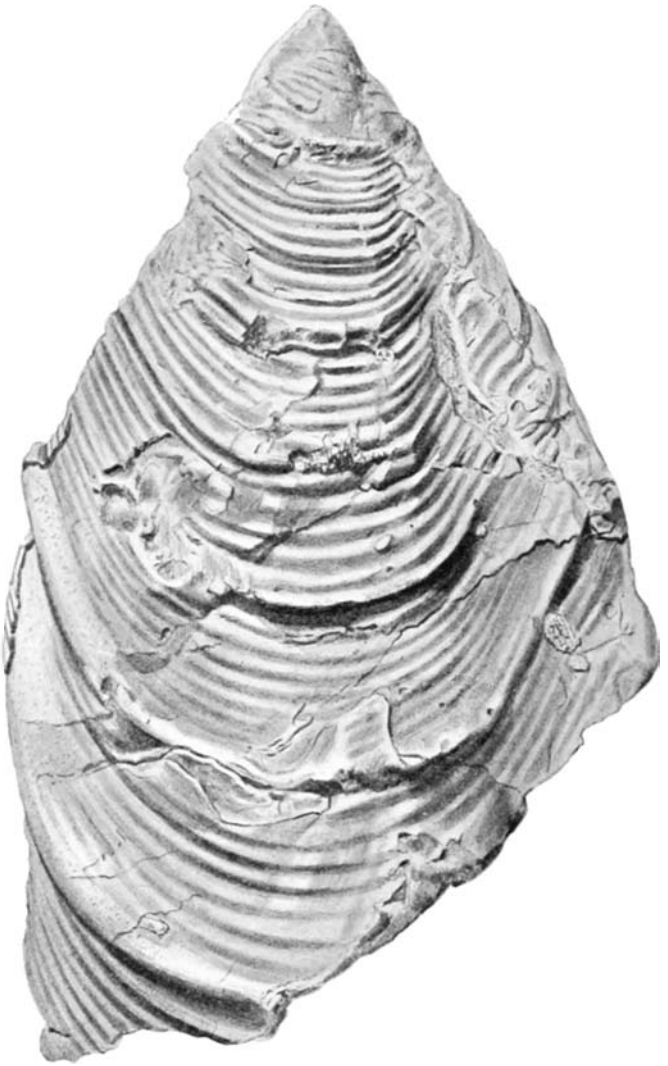


Fig. 55.—*Inoceramus lobatus*, Goldf. Zone of *Actinocamax quadratus*, Yorkshire. York Museum. Part of left valve. × ⅓.

flattened or slightly concave wing-like part which, owing to the thinness of the shell, is often not preserved. Umbones acute, near the anterior end.

Ornamentation consists of concentric ribs with an unsymmetrical curvature; in the posterior depression the ribs bend upwards, forming a sinuosity, and on the wing the ribs bend upwards and are less distinct than elsewhere. The concentric ribs are of two sizes; large ribs occur at intervals and between these are several smaller ribs.

Affinities.—*Inoceramus nasutus*, Wegner,[1] from the Senonian of Bossendorf and Dülmen, is allied to *I. lobatus*. See also *I. lingua*, *I. cardissoides*, and *I. tuberculatus* (below).

Remarks.—Only imperfect casts of this species have been seen, but it is abundant in Yorkshire. In North Germany this species occurs also in the zone of *Marsupites testudinarius*.

Type.—From the Lower Senonian of Quedlinburg.

Distribution.—Zone of *Actinocamax quadratus* of Sewerby, Bessingby and other localities in Yorkshire.

INOCERAMUS LINGUA, *Goldfuss*, 1836. Text-fig. 56.

1836.	INOCERAMUS LINGUA,	*A. Goldfuss.*	Petref. Germ., vol. ii, p. 113, pl. cx, fig. 5.
1877.	—	— *C. Schlüter.*	Palæontographica, vol. xxiv, p. 276, pl. xxxix, figs. 3, 4.
1898.	—	— *G. Müller.*	Mollusk. Untersen. v. Braunschweig. u. Ilsede (Abhandl. d. k. preuss. geol. Landesanst., N.F., 25), p. 45, pl. v, fig. 8.
1899.	—	— *V. Popovici-Hatzeg.*	Mém. Soc. géol de France, Paléont., vol. viii, pt. 3, p 7.
1902.	—	— *J. P. J. Ravn.*	Mollusk. Danmarks Kridtafl., I. Lamellibr., p. 102.
1905.	—	— *T. Wegner.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. lvii, p. 168.
1909.	—	— *J. Nowak.*	Bull. Internat. Acad. Sci. Cracovie, p. 875.

Remarks.—This species is closely allied to *I. lobatus*, Goldfuss, but the specimens at present available are not sufficiently perfect to enable me to make a close comparison. *I. lingua* appears to differ from *I. lobatus* in the absence of the ridge between the umbo and the postero-ventral angle, in the absence or indistinct character of the radial depression in front of the ridge, in the greater relative length of the shell, and in the ribs being either of uniform size or of two sizes less distinctly marked than in *I. lobatus*.

Type.—From the Senonian of Dülmen.

Distribution.—Upper Chalk of Birdsall, Yorkshire. Zone of *Belemnitella*

[1] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. lvii (1905), p. 167, pl. x, fig. 3, text-fig. 8.

mucronata of Norwich. Recorded by Barrois from the zone of *Marsupites testudinarius* of Rottingdean.

Fig. 56.—*Inoceramus lingua*, Goldf. Zone of *Belemnitella mucronata*, Norwich. British Museum, No. L20956. Part of right valve. Natural size.

Inoceramus cardissoides, *Goldfuss*, 1836. Text-figs. 57, 58.

1836.	Inoceramus cardissoides, *A. Goldfuss.*		Petref. Germ., vol. ii, p. 112, pl. cx, fig. 2.
1841.	—	lobatus var. *β.* cardissoides, *F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 63.
1876.	—	cardissoides, *D. Brauns.*	Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 377.
1877.	—	—	*C. Schlüter.* Palæontographica, vol. xxiv, p. 274.
1888.	—	—	*G. Müller.* Jahrb. d. k. preuss. geol. Landesanst. für 1887, p. 415.
1898.	—	—	*G. Müller.* Mollusk. Untersen. v. Braunschweig u. Ilsede (Abhandl. d. k. preuss. geol. Landesanst., N.F., 25), p. 44, fig. 11.
1902.	—	—	*A. Wollemann.* Lüneburg. Kreide (Ib'd., 37), p. 71.
1905.	—	—	*T. Wegner.* Zeitschr. d. deutsch. geol. Gesellsch., vol. lvii, p. 169.

Non 1882. INOCERAMUS CARDISSOIDES, *H. Schröder*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 271, pl. xvi, fig. 1.

Description.—Shell very inequilateral, oblique, moderately convex, with the anterior marginal part sloping rapidly. Height considerably greater than length.

FIG. 57.

FIG. 58.

FIG. 57.—*Inoceramus cardissoides*, Goldf. Upper Chalk (probably zone of *Actinocamax quadratus*), near Speeton. Sedgwick Museum. Left valve. Posterior wing missing. Natural size.
FIG. 58.—*Inoceramus cardissoides*, Goldf. Upper Chalk, probably Kent. British Museum, No. 98209. Part of left valve. Natural size.

Ventral margin convex; anterior margin slightly curved. A broad concave depression extends from behind the umbo to the postero-ventral extremity, and is limited posteriorly by a straight, sharp ridge, behind which is a wing-like part of the shell.

Ornamentation consists of strong, widely separated concentric ribs, with a steep ventral slope and a more gentle dorsal slope; in the interspaces are small concentric ribs, which are crossed by small radial ribs giving a more or less distinctly

tuberculate character to the larger concentric ribs. On the posterior part of the shell the concentric ribs bend sharply upwards.

Remarks.—Only two imperfect specimens of this species have been seen; it is closely allied to *I. lobatus* (p. 296), but differs in the presence of radial ribs, the greater development of the larger concentric ribs, and in the greater convexity of the valves.

Type.—From the Senonian of Quedlinburg.

Distribution.—Upper Chalk (probably zone of *Actinocamax quadratus*) near Speeton, and the south of England (probably Kent).

INOCERAMUS TUBERCULATUS, sp. nov. Plate LIV, fig. 8. Text-fig. 59.

1882. INOCERAMUS CARDISSOIDES, *H. Schröder.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 271, pl. xvi, fig. 1 (*Non* Goldfuss).

Description.—Shell very inequilateral, oblique, much higher than long; dorsal part moderately convex, ventral part only slightly convex. Umbones relatively small, nearly terminal. Antero-dorsal area flattened, nearly smooth. A rounded depression, separated from the posterior wing-like part, passes from the umbo to the postero-ventral extremity. Hinge-line forms less than a right angle with the anterior margin.

Ornamentation consists of numerous concentric ribs which, at a short distance from the umbo, are crossed by radial furrows, so that the ribs appear then to consist of rows of tubercles; on the sides of the shell the radial furrows, and consequently also the tubercles, are less distinct than on the middle of the shell.

Affinities.—This species is allied to *I. lobatus* and *I. cardissoides*, but differs in the greater development of the radial ribs, which give rise to a tuberculate type of ornamentation; also the stronger concentric ribs which occur in *I. cardissoides* are small or altogether wanting. The English specimens agree fairly closely with the example figured by Schröder as *I. cardissoides*.

Type.—In Dr. Rowe's Collection.

Distribution.—Upper Chalk (zone of *Actinocamax quadratus*) of Brighton, and Sewerby (Yorkshire).

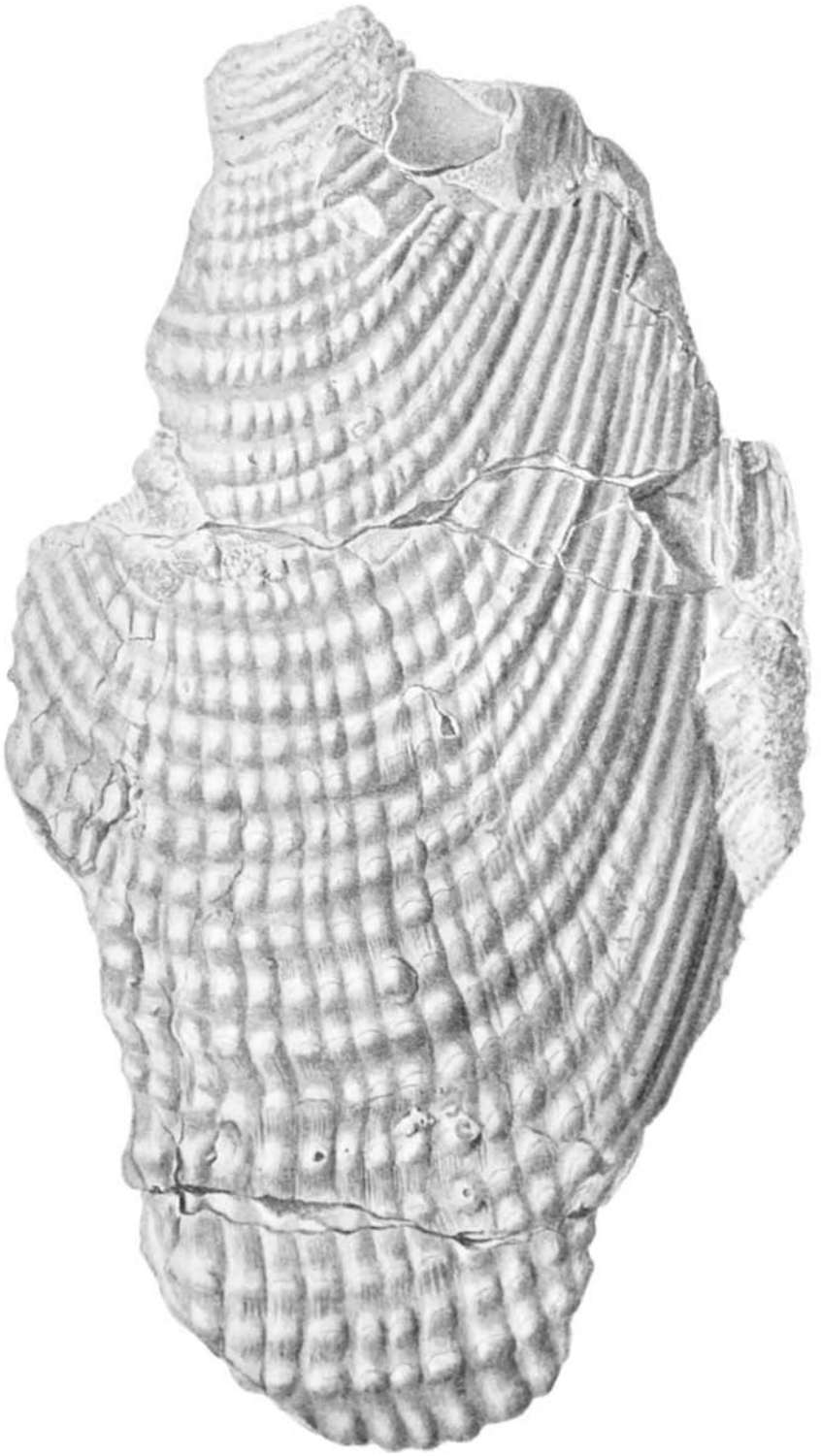


Fig. 59.—*Inoceramus tuberculatus*, sp. nov. Zone of *Actinocamax quadratus* of Sewerby, Yorkshire. Dr. A. W. Rowe's Collection. Part of right valve. Natural size.

INOCERAMUS UNDULATO-PLICATUS, *Römer*, 1852. Text-figs. 60, 61.

1852.	INOCERAMUS UNDULATO-PLICATUS,	*F. Römer.*	Kreidebild. v. Texas, p. 59, pl. vii, fig. 1.
1865.	— DIGITATUS,	*F. A. Römer.*	Palæontographica, vol. xiii, p. 196, pl. xxxii, fig. 6.
1873.	— —	*F. Schmidt.*	Mém. Acad. Imp. Sci. de St. Pétersb., ser. 7, vol. xix, no. 3, p. 25 (*partim*), pl. v, figs. 10, 11; pl. vi, fig. 1, 2, 4, 6, 7; pl. vii; pl. viii, figs. 9—15.
1877.	— UNDULATO-PLICATUS,	*C. Schlüter.*	Palæontographica, vol. xxiv, p. 270, pl. xxxviii, fig. 1.
1878.	— —	*C. Barrois.*	Ann. Soc. géol. du Nord, vol. v, p. 475.
1894.	— DIGITATUS,	*K. Jimbō.*	Palæont. Abhandl., vol. vi, p. 43, pl. viii, figs. 8—10.
1899.	— SCHMIDTI,	*R. Michael.*	Jahrb. d. k. preuss. geol. Landesanst. für 1898, vol. xix, p. 162, figs. 1—4.

Description.—Shell ovate, much higher than long, very inequilateral; the early part of the shell of small or moderate convexity, the later part only slightly convex or nearly flat. Hinge-line forming more than a right angle with the anterior margin. Umbones terminal, small, curved anteriorly.

Ornamentation consists of concentric and radial ribs; the former are more distinct on the early part of the shell, the latter on the later part. The radial ribs curve outwards from a line between the umbo and the postero-ventral extremity; they have rounded summits, and are separated by broad shallow interspaces; a tubercle or rounded elevation may be developed where the concentric ribs cross the radial ribs.

Affinities.—This species is closely allied to *I. digitatus*, Schlüter (*non* Sowerby).

The fact that in some specimens the early part of the shell is ornamented with concentric folds only, and the radial ribs appear on the later parts, suggests that this species has been derived from one with concentric folds only, in a manner similar to that in which *I. sulcatus* has arisen from *I. concentricus* (see p. 268); the specimens at present available, however, do not enable us to trace the origin of *I. undulato-plicatus*, but it seems probable that it has descended from a flat variety of *I. inconstans*.

Forms from Vancouver Island with a similar type of ornamentation have been

referred to *I. undulato-plicatus* by Whiteaves,[1] but White[2] doubts the correctness of the identification. *I. diversus*, Stoliczka,[3] is another allied form.

Michael does not accept Schmidt's and Schlüter's identification of the specimens from Saghalien and North Germany with Römer's *I. undulato-plicatus*, but regards them as belonging to a distinct species for which he proposes the name *I. Schmidti*. He, however, regards *I. diversus*, Stoliczka, as an example of

Fig. 60.

Fig. 61.

Fig. 60.—*Inoceramus undulato-plicatus*, Röm. Senonian, Haldon. British Museum, No. L17371. Flint cast of part of right valve. Natural size.

Fig. 61.—*Inoceramus undulato-plicatus*, Röm. Senonian, Haldon. British Museum, No. L17369. × ⅓.

this species, consequently it was unnecessary to introduce a new name. The English specimens show a good deal of variation, and after comparing them with Römer's and other figures I do not feel able to accept Michael's view.

Type.—From the Chalk of Texas.

Distribution.—Senonian of Haldon.

[1] 'Geol. Surv. Canada, Mesoz. Foss.,' vol. i (1879), p. 168, pl. xx, fig. 2, and *I. digitatus* (ibid., 1903), p. 395; also 'Trans. Roy. Soc. Canada,' ser. 2, vol. i (1895), p. 121.

[2] 'Bull. U. S. Geol. Surv.,' no. 51 (1889), p. 37.

[3] 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1871), p. 407, pl. xxvii, fig. 6.

FIG. 62.—*Inoceramus undulato-plicatus* var. *digitatus*, Schlüt. Zone of *Micraster cor-anguinum*, Snowdown Colliery Shaft, Nonington, near Dover. British Museum, No. L20844 (discovered and presented by Dr. Malcolm Burr). Cast of part of left valve. × ¾.

INOCERAMUS UNDULATO-PLICATUS *var.* DIGITATUS, *Schlüter*, 1877. Text-fig. 62.

1873. INOCERAMUS DIGITATUS, *F. Schmidt*. Mém. Acad. Imp. Sci. de St. Pétersb., ser. 7, vol. xix, no. 3, p. 25 (*partim*), pl. vi, figs. 3, 5.
1877. — — *C. Schlüter*. Palæontographica, vol. xxiv, p. 267, pl. xxxvi.
1878. — — *C. Barrois*. Ann. Soc. géol. du Nord, vol. v, p. 475.
1902. — — *A. Wollemann*. Lüneburg. Kreide (Abhandl. d. k. preuss. geol. Landesanst., N.F., 37), p. 70.

Remarks.—As was pointed out by Schlüter, this form is very closely allied to, and perhaps not separable from, *I. undulato-plicatus*; it differs from the latter mainly in that the posterior ribs are stronger and fewer in number than the anterior ribs, but the early parts of the shell are very similar in the two forms. Until more specimens have been obtained the exact relationships of the two forms cannot be determined, and for the present it seems best to regard *I. digitatus* of Schlüter (*non* Sowerby) as a variety of *I. undulato-plicatus*.

Distribution.—Zone of *Micraster cor-anguinum* of Charlton, Snowdown Colliery Shaft, Nonington near Dover, Preston near Faversham, and Salisbury. Zone of *Actinocamax quadratus* of Salisbury.

INOCERAMUS LAMARCKI, *Parkinson*, 1819. Plate LII, figs. 4—6; Plate LIII, figs. 1—7. Text-figs. 63—85.

1768. OSTREOPINNITES, *J. E. I. Walch*. Naturgeschichte d. Verstein., vol. ii, p. 142, pl. DI**, figs. 1—5.
1819. INOCERAMUS LAMARCKII, *J. Parkinson*. Trans. Geol. Soc., ser. 1, vol. v, p. 55, pl. i, fig. 3.
1822. — CUVIERI, *J. Sowerby*. Trans. Linn. Soc., vol. xiii, p. 453, pl. xxv.
— — LAMARCKII, *G. Mantell*. Foss. S. Downs, p. 214, pl. xxvii, fig. 1.
— — CUVIERI, *Mantell*. Ibid., p. 213, pl. xxvii, fig. 4, pl. xxviii, figs. 1, 4.
— — BRONGNIARTI, *Mantell*. Ibid, p. 214, pl. xxvii, fig. 8.
— — WEBSTERI, *Mantell*. Ibid., p. 216, pl. xxvii, fig. 2.
— — UNDULATUS, *Mantell*. Ibid., p. 217, pl. xxvii, fig. 6.
— — LATUS, *Mantell*. Ibid., p. 216, pl. xxvii, fig. 10.
— CATILLUS CUVIERI, *A. Brongniart*. In Cuvier's Ossemens Foss., vol. ii, p. 601, pl. iv., fig. 10.

1823. INOCERAMUS CUVIERI, *J. de C. Sowerby.* Min. Conch., vol. v, p. 59, pl. cccexli, fig. 1.
— — BRONGNIARTI, *Sowerby.* Ibid., vol. v, p. 60, pl. cccexli, figs. 2, 3.
1836. — LAMARCKII, *A. Goldfuss.* Petref. Germ., vol. ii., p. 114, pl. cxi, fig. 2.
— — CUVIERI, *Goldfuss.* Ibid., vol. ii, p. 114, pl. cxi, fig. 1.
— — BRONGNIARTI, *Goldfuss.* Ibid., vol. ii, p. 115, pl. cxi, fig. 3.
— — STRIATUS, *Goldfuss.* Ibid., p. 115, pl. cxii, fig. 2.
1837. CATILLUS LAMARCKI, *F. Dujardin.* Mém. Soc. géol. de France, vol. ii, p. 225.
1837. — CUVIERI, *Dujardin.* Ibid., vol. ii, p. 225.
— INOCERAMUS BRONGNIARTI, *W. Hisinger.* Lethæa Suecica, p. 56, pl. xvii, fig. 11.
— — CUVIERI, *Hisinger.* Ibid., p. 56, pl. xvii, fig. 10.
1841. — LAMARCKII, *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 62.
— — CUVIERI, *Römer.* Ibid., p. 62.
— — BRONGNIARTI, *Römer.* Ibid., p. 61.
? — — UNDULATUS, *Römer.* Ibid., p. 63, pl. viii, fig. 12.
1846. — CUVIERI, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 25.
— — BRONGNIARTI, *Reuss.* Ibid., pt. 2, p. 24.
? — — CUVIERI, *A. Leymerie.* Statist. géol. min. de l'Aube, Atlas, pl. iv, fig. 7.
— — ANNULATUS, *Leymerie.* Ibid., pl. iv, fig. 4.
— — CUVIERI, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 520.
1850. — BRONGNIARTI, *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 172.
? — — CUVIERI, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 250.
1850. — — *R. Kner.* Kreidemerg. v. Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 28.
1854. — LAMARCKII, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 169.
— — CUVIERI, *Morris.* Ibid., p. 169 (*partim*).
— — BRONGNIARTII, *Morris.* Ibid., p. 169.
— — UNDULATUS, *Morris.* Ibid., p. 170.
— — WEBSTERII, *Morris.* Ibid., p. 170.
1863. — CUVIERI, *A. v. Strombeck.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 124.
— — BRONGNIARTI, *Strombeck.* Ibid., vol. xv, p. 121.
— — — *R. Drescher.* Ibid., vol. xv, p. 352.
? 1869. — LAMARKI, *E. Favre.* Moll. Foss. de la Craie de Lemberg, p. 134.
1870. INOCERAMUS BRONGNIARTI, *F. Römer.* Geol. v. Oberschles., p. 316, pl. xxxiv, fig. 13.

1872. INOCERAMUS BRONGNIARTI, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 43, pl. xi, figs. 3—10, pl. xiii, fig. 3.

? — — CUVIERI, *Geinitz.* Ibid., p. 48 (*partim*), pl. xiii, fig. 8.

1873. — BRONGNIARTI, *Geinitz.* Neues Jahrb. für Min., etc., p. 10.

? — — CUVIERI, *Geinitz.* Ibid., p. 15.

? — — LAMARCKI, *Geinitz.* Ibid., p. 18.

? 1875. — LATUS, *C. Décoq.* Assoc. Franç. Avanc. Sci. (Lille, 1874), p. 369.

1877. — CUVIERI, *C. Schlüter.* Palæontographica, vol. xxiv, p. 266.

— — BRONGNIARTI, *C. Schlüter.* Ibid., vol. xxiv, p. 263.

— — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., ii, Weissenberg. u. Malnitz. Schicht., p. 130, fig. 111.

1878. — — *G. Behrens.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxx, p. 256.

? — — UNDULATUS, *C. Barrois.* Ann. Soc. géol. du Nord, vol. v, p. 407.

1881. — (MYTILITES) PROBLEMATICUS, *R. Etheridge*, in Penning and Jukes-Browne, Geol. Cambridge, p. 143, pl. iii, figs. 9, 10, 11.

? 1883. — BRONGNIARTI, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., iii Iserschicht., p. 110, fig. 80.

1888. — CUVIERI, *A. Peron.* Hist. Terr. Craie S.E. Bassin Anglo-Parisien, p. 156.

— — BRONGNIARTI, *Peron.* Ibid., p. 157.

— — UNDULATUS, *Peron.* Ibid., p. 157.

? 1889. — CUVIERI, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., iv, Teplitz. Schicht., p. 82, fig. 74.

? — — BRONGNIARTI, *Fritsch.* Ibid., p. 81, fig. 72.

1892. — CUVIERI, *E. Stolley.* Die Kreide Schleswig-Holsteins (Mittheil. a. d. min. Institut Kiel, vol. i.), p. 241.

1893. — BRONGNIARTI, *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 242.

1897. — STRIATUS, *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 381, pl. xxvii, fig. 13.

— — CUVIERI, *R. Leonhard.* Palæontographica, vol. xliv, p. 49.

— — BRONGNIARTI, *Leonhard.* Ibid., vol. xliv, p. 47.

1899. — — *J. Simionescu.* Fauna Cret. Super. Ürmös, p. 27.

? — — CUVIERI, *Simionescu.* Ibid., p. 27, pl. ii, figs. 8, 9.

? 1901. — aff. CUVIERI, *H. Imkeller.* Palæontographica, vol. xlviii, p. 34.

1901. INOCERAMUS CUVIERI, *F. Sturm.* Jahrb. d. k. preuss. geol. Landesanst., für 1900, vol. xxi, p. 92, pl. x, fig. 1.

1902. — — *A. Wollemann.* Lüneburg. Kreide (Abhandl. d. k. preuss. geol. Landesanst., N.F., 37), p. 67.

— — BRONGNIARTI, *Wollemann.* Ibid., p. 66.

1903. — — *W. Petrascheck.* Jahrb. d. k. geol. Reichsanst., vol. liii, p. 161.

— — CUVIERI, *Petrascheck.* Ibid., p. 162.

1904. — LATUS, *E. T. Newton* and *A. J. Jukes-Browne.* In Jukes-Browne, Cret. Rocks of Britain, vol. iii, p. 448 (*partim*).

— — CORDIFORMIS, *C. Airaghi.* Boll. Soc. geol. Italiana, vol. xxiii, p. 189, pl. iv, figs. 6—9.

1908. — CUVIERI, *A. Stojanoff.* Ann. géol. min. Russie, vol. x, p. 121.

1909. — — *J. Nowak.* Bull. Internat. Acad. Sci. Cracovie, p. 875.

1911. — LATUS, *W. Rogala.* Ibid. (1911), p. 172, pl. iv, figs. 9, 10.

— — KOEGLERI, *H. Andert.* Inoceramen d. Kreibitz-Zittauer Sandsteingeb., p. 57, pl. v, fig. 6, pl. i, fig. 6.

Non 1827. — CUVIERI, *S. Nilsson.* Petrific. Suecana, p. 19.

? — — CATILLUS BRONGNIARTI, *Nilsson.* Ibid., p. 19.

— 1832. INOCERAMUS UNDULATUS, *C. H. v. Zieten.* Verstein. Württembergs, p. 96, pl. lxxii, fig. 7.

— 1846. — LAMARCKII, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 518, pl. cccxii, figs. 1—3.

? — 1847. — CUVIERI, *J. Müller.* Petref. der Aachen. Kreidef., pt. 1, p. 31.

? — — — BRONGNIARTI, *Müller.* Ibid., pt. 1, p. 30.

— 1850. — LAMARCKII, *J. de C. Sowerby.* In *F. Dixon*, Geol. Sussex, p. 355 (p. 385, ed. 2), pl. xxviii, fig. 29 (= *I. inconstans*).

— 1866. — LAMARCKI, *K. A. Zittel.* Bivalv. d. Gosaugeb. (Denkschr. d. k. Akad. d. Wissensch. Wien, Math.-nat. Cl., vol. xxiv), pt. 2, p. 99 [23], pl. xv, fig. 6.

— 1872. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 50, pl. xiv, fig. 1 (fig. 4 = *saxonicus*, Petrascheck).

— — — CUVIERI, *Geinitz.* Ibid., p. 48, pl. xiii, figs. 6, 7.

? — 1872—3. — STRIATUS, *Geinitz.* Ibid., pt. 1, p. 210, pl. xlvi, figs. 9—13; pt. 2, p. 41, pl. xiii, figs. 1, 2, 9, 10.

— 1899. — UNDULATUS, *J. Simionescu.* Fauna Cret. super. Ürmös, p. 26, pl. iii, fig. 2.

— 1904. — BRONGNIARTII, *C. Airaghi.* Boll. Soc. geol. Italiana, vol. xxiii, p. 192, pl. iv, figs. 3—5.

— 1911. — CUVIERI, *H. Andert.* Inoceramen d. Kreibitz-Zittauer Sandsteingeb., p. 44, pl. ii, fig. 2.

Description.—Shell inequivalve, very inequilateral, of slight, moderate or considerable convexity, sometimes inflated. Height greater than length. Hinge-line of variable length in proportion to the height of the shell, forming more than a right-angle with the anterior margin. Umbones terminal, curved inwards and more or less forwards; the left umbo more prominent than the right. Anterior marginal part of valves flattened, more or less nearly perpendicular to the plane of the valves, either limited by a sharp edge from the flanks or without a definite boundary. Anterior ear developed in some flat varieties.

The concentric folds may be absent, indistinct, or moderately or strongly developed, with the dorsal and ventral slopes similar or with the ventral slope steeper than the dorsal. Usually the folds are regular, but are not continued on to the posterior ear. The curvature of the folds is often nearly symmetrical; its convexity on the convex and on some of the flat forms is small, but is greater on the flat forms with a relatively short hinge. The growth-lines are distinct and variable in number, and are sinuous where they pass on to the posterior ear.

Remarks.—The forms included in this species show a great amount of variation, and seem in that respect comparable with some species of *Micraster* and *Echinocorys*. Several of the varieties have been described as distinct species, but the study of a large series of specimens has shown so many intermediate forms that one can only regard the varieties as modifications of a very plastic species. The features in which variation is most marked are the convexity of the valves, the number, strength, and curvature of the concentric folds, the distance between the growth-lines, the size and distinctness of the posterior ear, and the height of the shell.

Some forms of this species are only slightly convex (Plate LIII, fig. 7, Text-figs. 73—83), so that in large specimens considerable portions of the shell approach flatness. In other forms the valves are moderately or considerably convex, and sometimes inflated (Plate LII, figs. 4, 5, Text-figs. 63—68). The amount of convexity may remain nearly uniform throughout the growth of the shell, or the earlier part may be only slightly convex and the later part very convex—in such cases the early part resembles the adult shell of the large flat varieties (Figs. 64, 65). The two valves may be of nearly equal convexity (Plate LII, fig. 5), or the left valve may be very convex whilst the right valve is only slightly convex (Plate LII, fig. 6).

The concentric folds vary in strength, number, form, curvature and regularity. In the majority of cases the folds are prominent and form strong ridges (Figs. 68, 69, 78, 82, 84), but they may become only gentle undulations (Figs. 74, 77, 81), and are sometimes indistinct or absent (Figs. 73, 75, 76, 79). The dorsal and ventral surfaces of the folds may slope equally, or the ventral slope may be steeper than the dorsal, giving a step-like appearance. The crest of the fold is

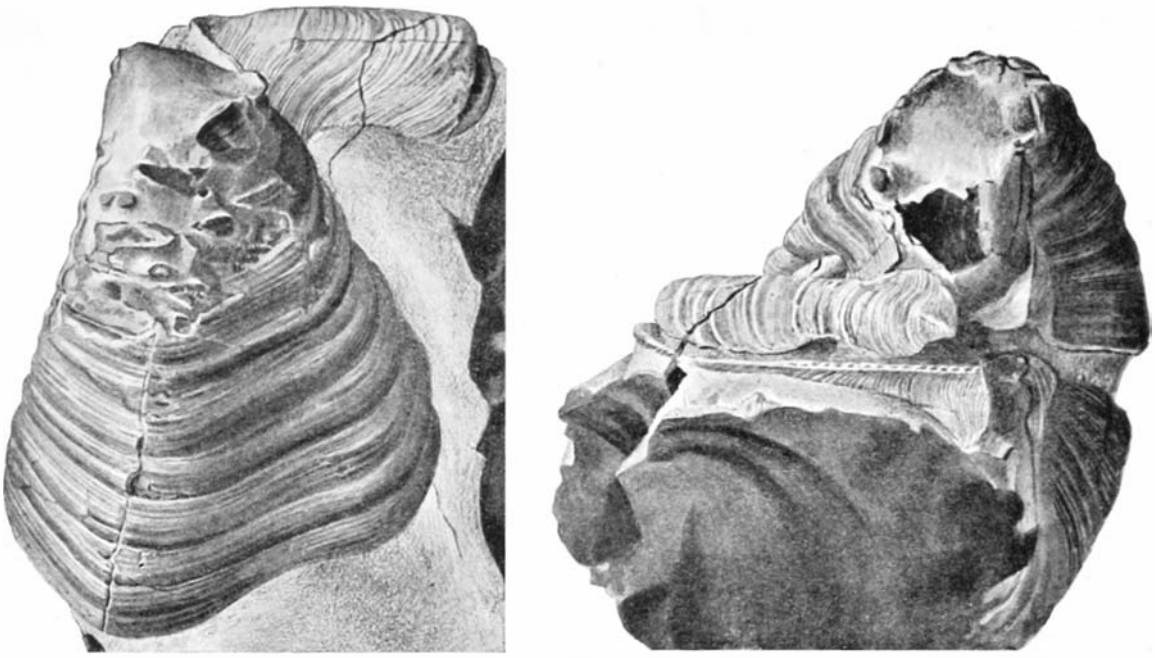


FIG. 63.—*Inoceramus Lamarcki*, Park. The type. Upper Chalk (probably zone of *Micraster cor-anguinum*), near Dover. British Museum, No. L9801. Left valve and dorsal view. Part of the posterior ear is concealed by flint. Natural size.

FIG. 64.—*Inoceramus Lamarcki*, Park. Anterior view of specimen shown in Fig. 65. × $\frac{1}{8}$.

Fig. 65.

Fig. 67.

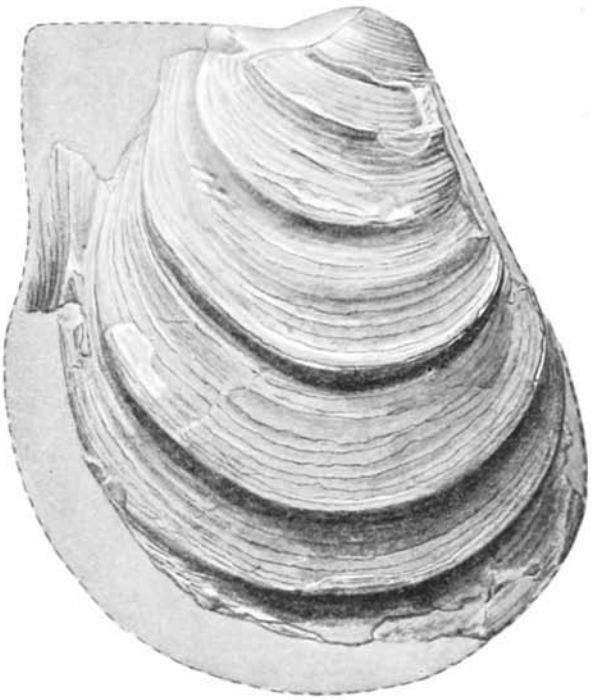


Fig. 65.—*Inoceramus Lamarcki*, Park. Upper Chalk (probably zone of *Holaster planus*), Swaffham, Norfolk. Norwich Museum, No. 3354. Right valve. × ½.

Fig. 67.—*Inoceramus Lamarcki*, Park. Upper Chalk (zone of *Holaster planus*), Newmarket. Sedgwick Museum, Cambridge. Right valve. Natural size.

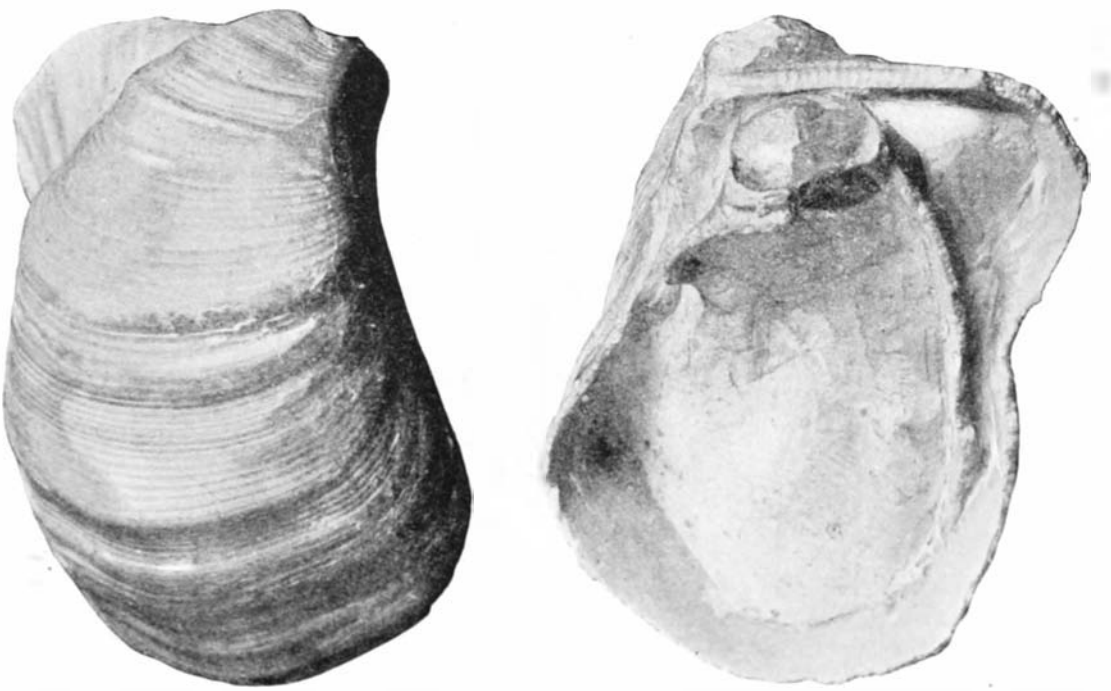


Fig. 66.—*Inoceramus Lamarcki*, Park. The original of *I. Lamarcki*, Mantell, 'Foss. S. Downs,' p. 214, pl. xxvii, fig. 1. Middle Chalk (probably zone of *Terebratulina lata*), near Lewes (probably Malling). British Museum, No. 4753. Right valve. Natural size.

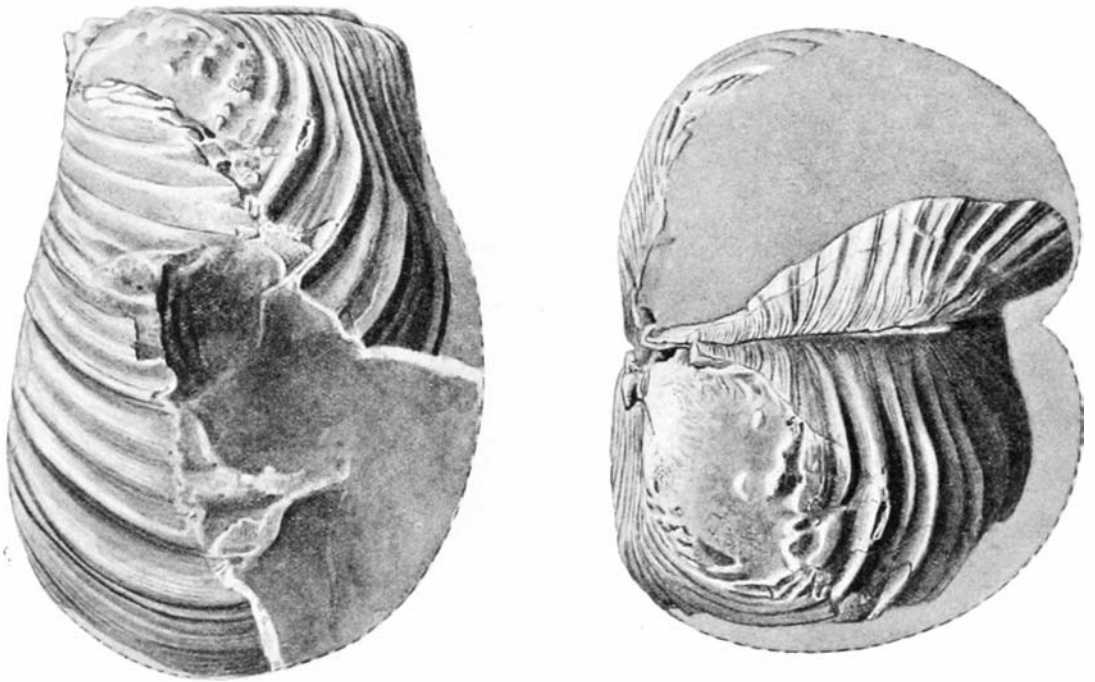


Fig. 68.—*Inoceramus Lamarcki*, Park. The type of *I. Bronguiarti*, Mantell, 'Foss. S. Downs,' p. 214, pl. xxvii, fig. 8. From Lewes or Brighton, probably zone of *Micraster cor-anguinum*. British Museum, No. 4751. Left valve and dorsal view. Natural size.

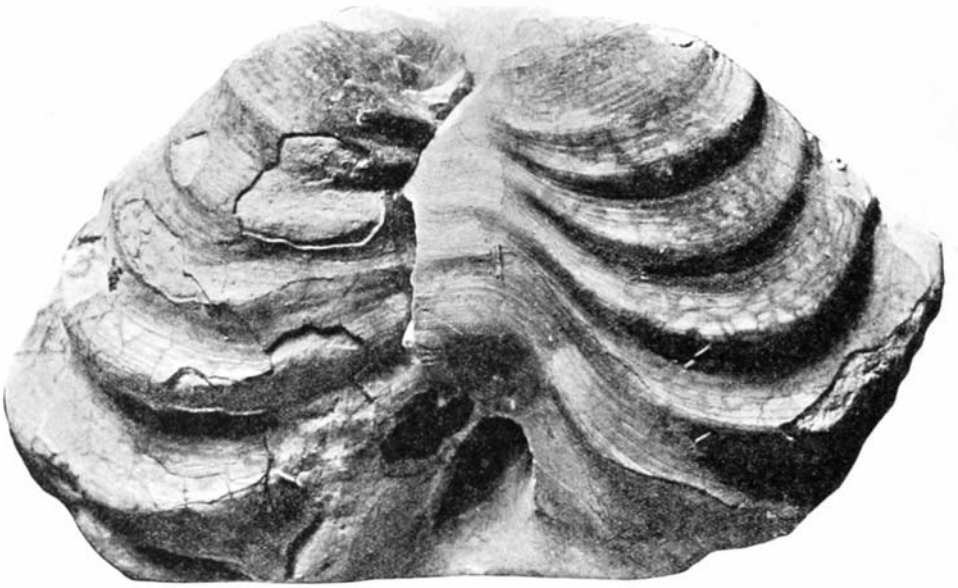


Fig. 69.—*Inoceramus Lamarcki*, Park. The original of *I. Cuvieri*, Mantell, 'Foss. S. Downs,' p. 213, pl. xxviii, fig. 4. Zone of *Micraster cor-anguinum*, Southeram. British Museum, No. L22094. × $\frac{7}{8}$.

Fig. 70.

Fig. 71.

Fig. 70.—*Inoceramus Lamarcki*, Park. The original of *I. Brongniarti*, Sowerby, 'Min. Conch.,' vol. v, p. 60, pl. cccexli, fig. 2. Chalk. Locality and horizon unknown. British Museum, No. 43265. Right valve. Natural size.

Fig. 71.—*Inoceramus Lamarcki* var. *Websteri*, Mant. The type of *I. Websteri*, Mantell, 'Foss. S. Downs,' p. 216, pl. xxvii, fig. 2. Upper Chalk (probably zone of *Micraster cor-testudinarium*), South Street, Lewes. British Museum, No. 4759. Left valve. Natural size.

Fig. 73.

Fig. 72.

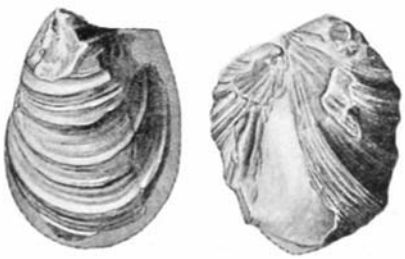


Fig. 72.—*Inoceramus Lamarcki* var. *Websteri*, Mant. Upper Chalk, Swaffham, Norfolk. Norwich Museum, No. 3298. Left valve and anterior view. Natural size.

Fig. 73.—*Inoceramus Lamarcki* var. *Cuvieri*, Sow. The type of *Inoceramus Cuvieri*, Sowerby, 'Trans. Linn. Soc.,' vol. xiii (1822), p. 453, pl. xxv, figs. 2, 3, and 'Min. Conch.,' vol. v (1823), p. 59, pl. cccexli, fig. 1. Middle Chalk (zone of *Terebratulina lata*), Royston. British Museum, No. 43264. Left valve. Natural size.

usually rounded, but in one variety (*Websteri*, Mantell, Plate LIII. figs. 1, 2, Text-figs. 71, 72) it possesses a sharp edge. When the folds are absent the growth-rings become more regular. The curvature of the folds is usually small in the more convex specimens, but often greater in the less convex forms. The curvature is often nearly symmetrical, but when the posterior ear is indistinctly limited it tends to become unsymmetrical.

The degree of development of the posterior ear varies considerably. In some forms it is only indistinctly limited (Plate LIII, fig. 7, Text-fig. 68), and then the

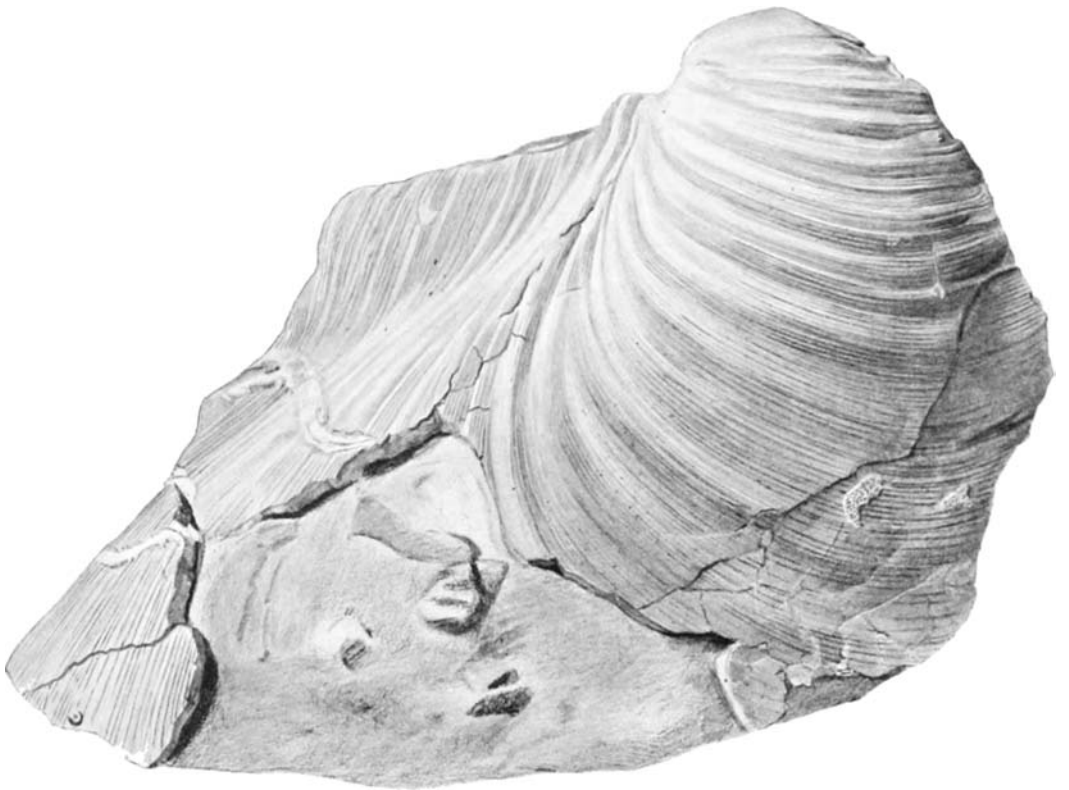


FIG. 74.—*Inoceramus Lamarcki* var. *Cuvieri*, Sow. Upper Chalk (zone of *Micraster cor-anguinum*), Camp Hill, near Salisbury. Dr. Blackmore's Collection. Portion of a large left valve; posterior and ventral parts missing. × ⅓.

folds and growth-lines are continued with but little alteration in curvature on to the ear. In other cases the ear is larger and more or less distinctly limited from the rest of the valve (Plate LII, fig. 4, Text-figs. 63, 65, 66, 79, 81, 82); in such cases the folds and growth-lines bend inwards at the limit, and the umbonal part of the valve is often narrower and more acute. In a few large, flat forms, an anterior ear is developed (Fig. 74).

The anterior flattened area varies in size and in the distinctness of its boundary. It may be nearly perpendicular to the plane between the valves (Fig. 81), or may be slightly concave (Figs. 63, 66, 79), or slope outwards (Figs.

74, 79). In some varieties the area forms a sharp edge with the sides of the valve (Fig. 81), in others the boundary is curved and the limit of the area is indistinct (Fig. 85).

In the type of *I. Lamarcki*, Parkinson (Fig. 63), the shell is inflated, and the posterior ear well developed and sharply limited. In forms like *I. Brongniarti* Sowerby (Fig. 70, Pl. LII, fig. 4), the posterior ear is also well developed, but

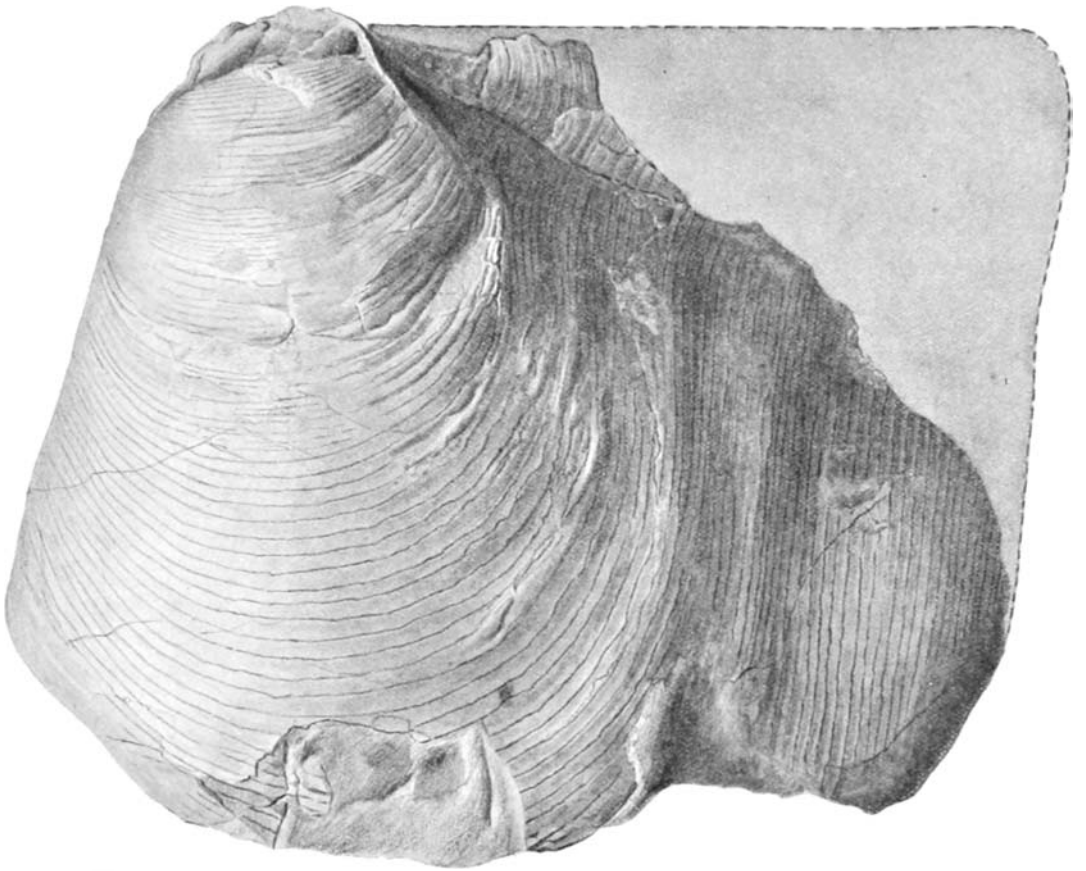


Fig. 75.—*Inoceramus Lamarcki* var. *Curieri*, Sow. Upper Chalk, Southeram, Lewes. Brighton Museum, No. 340. Portion of a left valve resembling the type of *I. latus*, Mant. × ⅓.

not so sharply limited as in the type of *I. Lamarcki*. Mantell's *I. Lamarcki* (Fig. 66) is similar to *I. Brongniarti*, Sowerby, but has less prominent folds and a more concave anterior border. *I. Brongniarti*, Sowerby, passes gradually into forms like the type of *I. Brongniarti*, Mantell (Fig. 68), in which the limit of the posterior ear is somewhat indistinct. Other varieties possess similar strong folds but have less convex[1] valves (as in *I. Curieri*, Mantell, Figs. 69, 84), and these

[1] In some cases the smaller convexity may be due to pressure which gradually changed the shape of the shell. When no fractures are seen, flattening appears to be indicated in some cases by the growth-lines cutting the folds obliquely.

pass into forms with indistinct folds like the type of *I. Cuvieri*, Sowerby (Fig 73), and in some cases the folds disappear altogether.

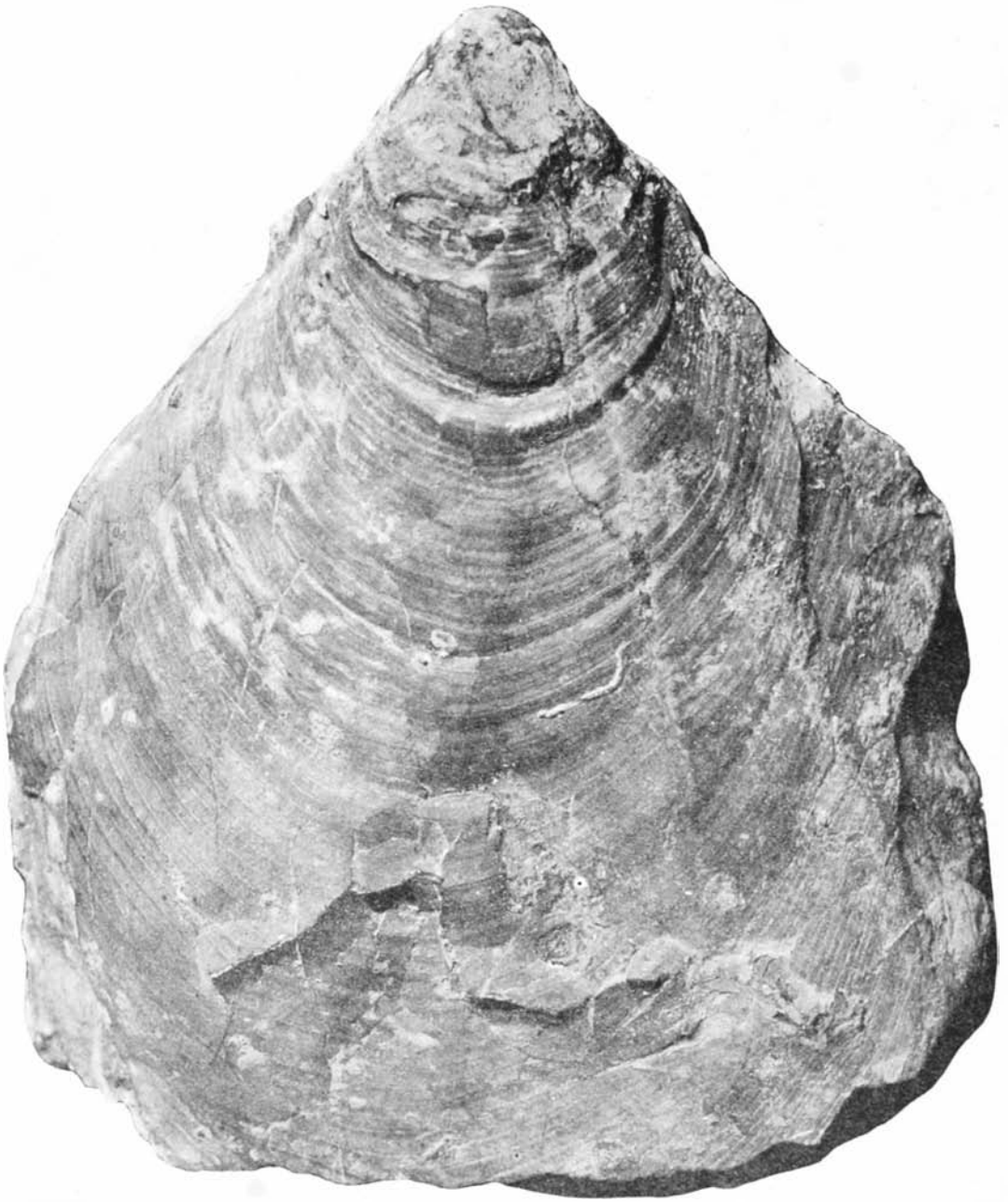


Fig. 76.—*Inoceramus Lamarcki* var. *Cuvieri*, Sow. The type of *Inoceramus latus*, Mantell. 'Foss. S. Downs,' p. 216, pl. xxvii, fig. 10. Upper Chalk, near Brighton. British Museum, No. 5818. Left valve. Natural size.

I. Websteri, Mantell (Figs. 71, 72), has the posterior ear fairly well developed, but not distinctly limited, and resembles *I. Brongniarti* of Mantell; it is characterised by the thinness of the shell and the sharp ridge-like folds, but forms

intermediate between this type and those with rounded folds occur. It may be convenient to adopt for this variety the name *I. Lamarcki* var. *Websteri*. It appears to occur mainly in the zone of *Micraster cor-testudinarium*.

I. undulatus, Mantell (Pl. LIII, fig. 3), resembles small forms of *I. Brongniarti*, Sowerby, but the folds are much smaller, more numerous, and less conspicuous, and the shell is thicker than usual.

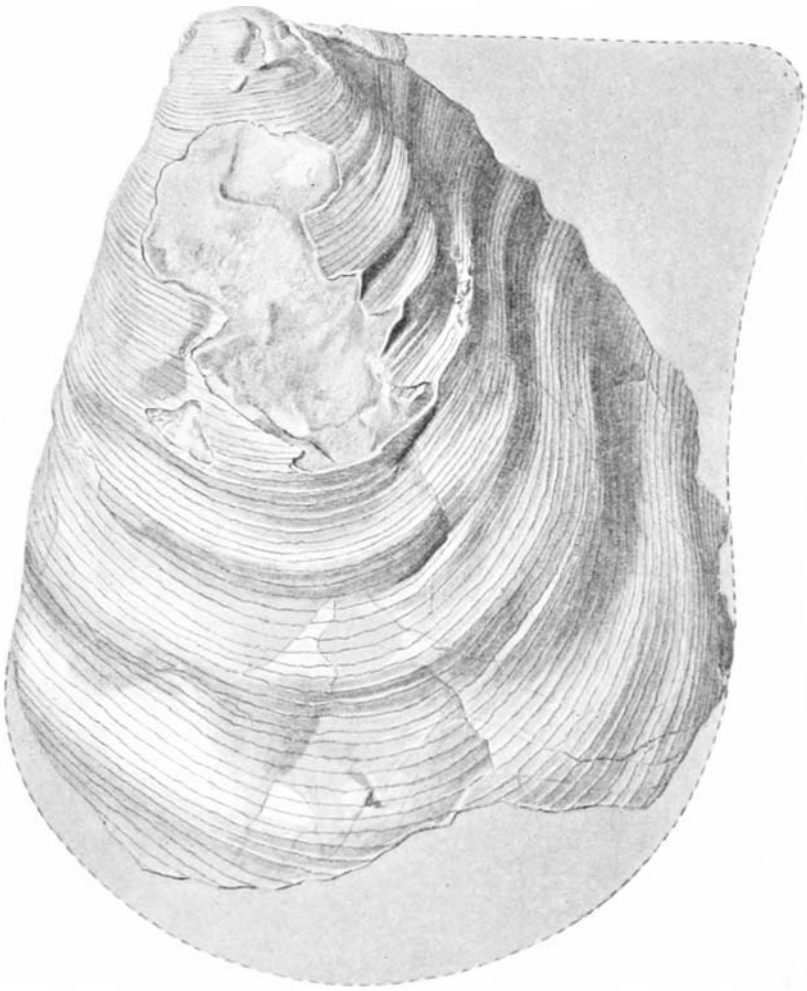


Fig. 77.—*Inoceramus Lamarcki* var. *Curieri*, Sow. Upper Chalk (zone of *Holaster planus*), Swaffham, Norfolk. Norwich Museum. Left valve. × ⅓.

Some small forms (Pl. LIII, figs. 4—6), found in the Middle Chalk and in the zone of *Holaster planus*, which may be named *I. Lamarcki* var. *apicalis*,[1] have nearly equal valves, more prominent and more distinctly incurved umbones, with the folds indistinct or absent, but these forms pass into others with distinct folds. In some of these small forms the umbo is curved anteriorly (Plate LIII, fig. 4).

[1] An example of this from the Chalk Rock was figured in the 'Quart. Journ. Geol. Soc.,' vol. liii (1897), p. 381, pl. xxvii, fig. 13.

I. latus, Mantell (Fig. 76) is a large, slightly convex form in which the folds have almost disappeared. In the type (Fig. 76) the postero-dorsal part of the valve is missing, so that in Mantell's figure the umbonal part of the valve appears to be more acute than it really is (compare Fig. 75).

I. Cuvieri, Sowerby (Fig. 73) is only slightly convex, with indistinct folds, and is often of large size. The angle formed by the anterior margin and the hinge-line is rather larger than usual, and an anterior ear may be developed; other forms

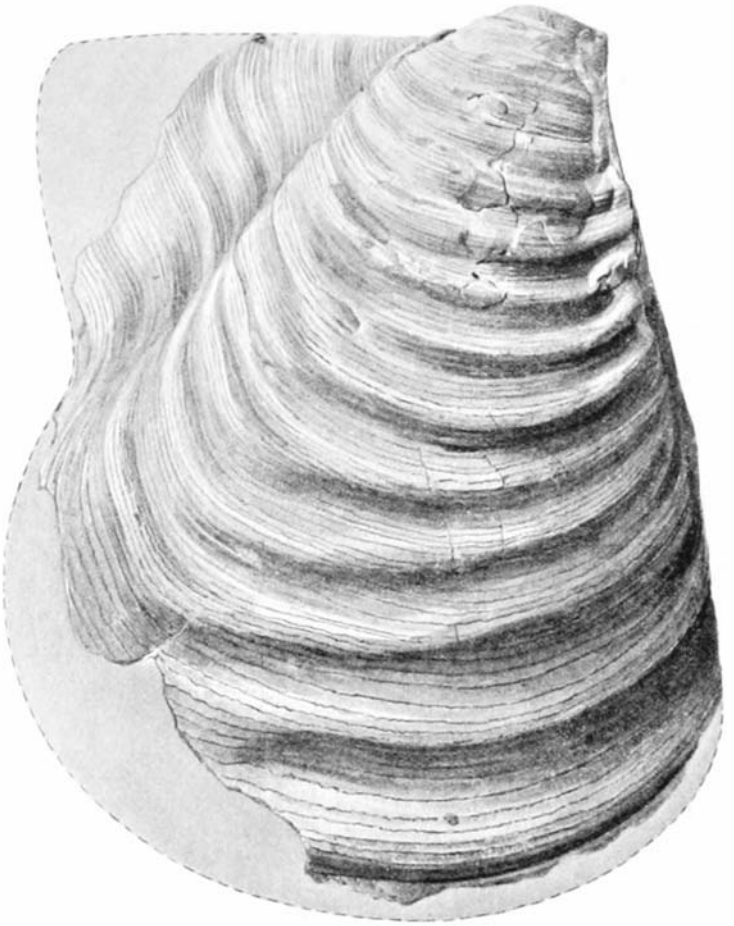


Fig. 78.—*Inoceramus Lamarcki* var. *Cuvieri*, Sow. Upper Chalk, Lewes. Sedgwick Museum, Cambridge. Right valve. Natural size.

are similar (Fig. 79), but have a smaller angle between the anterior margin and the hinge, and these pass into forms with more distinct and eventually with strong folds (Figs. 77, 78, 82). The varieties similar in form to Sowerby's type, but with or without folds, may be termed *I. Lamarcki* var. *Cuvieri* (Plate LIII, fig. 7, Text-figs. 73—84). The hinge in large specimens of this variety (Fig. 80) is of great thickness, and portions of it are often found separately. It is thickest near the umbo, and becomes thinner towards the posterior end. The ligament pits are numerous, shallow, and two, three, or more times higher than long,

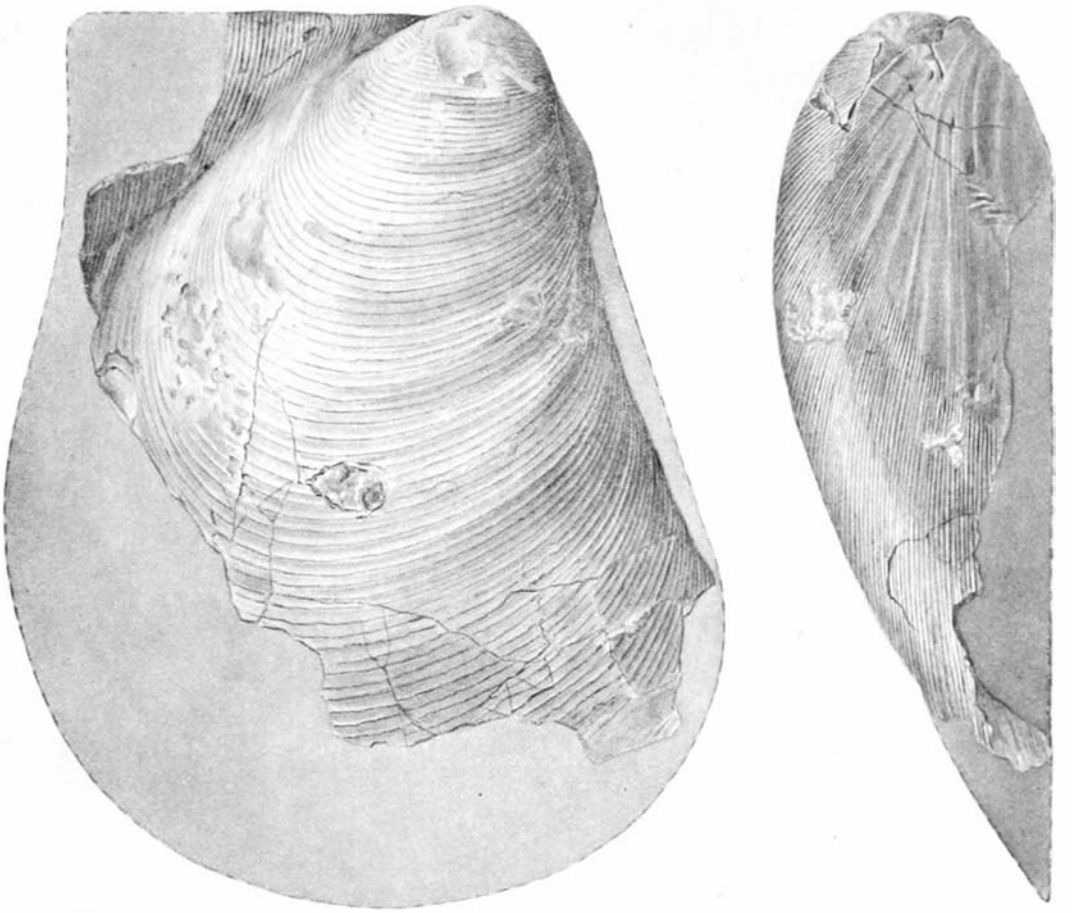


Fig. 79.—*Inoceramus Lamarcki* var. *Cuvieri*, Sow. Zone of *Holaster planus*, Borstal. Mr. Dibley's Collection. Right valve and anterior view. × ½.

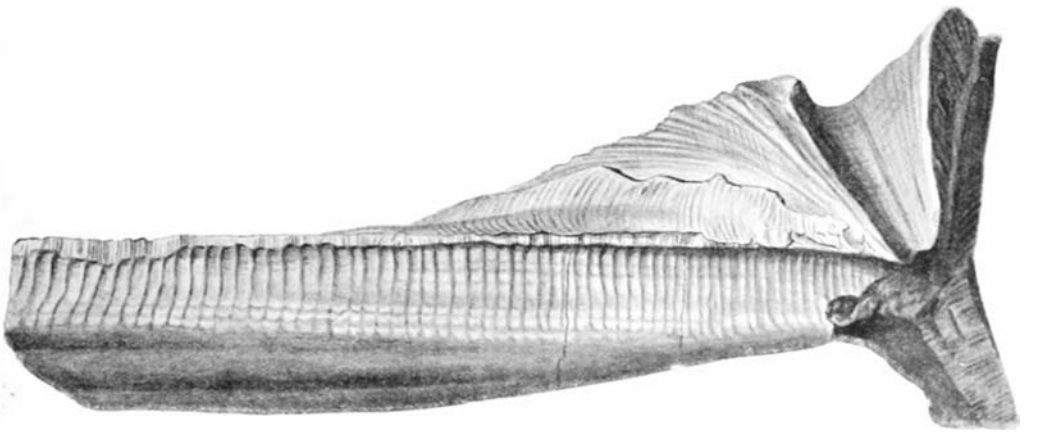


Fig. 80.—*Inoceramus Lamarcki* var. *Cuvieri*, Sow. Zone of *Terebratulina lata*, Royston. Sedgwick Museum, Cambridge. Portion of left hinge. Natural size.

reaching their maximum height not far from the umbo. The variety *Curieri* ranges from the zone of *Terebratulina lata* to the zone of *Micraster cor-anguinum*.

I. Mantelli, de Mercey,[1] from the zone of *Micraster cor-anguinum*, appears to be a large form of *I. Lamarcki* var. *Cuvieri*, in which an anterior ear is developed; it is similar to a specimen (Fig. 74) obtained by Dr. Blackmore from the zone of *Micraster cor-anguinum* of Camp Hill near Salisbury.

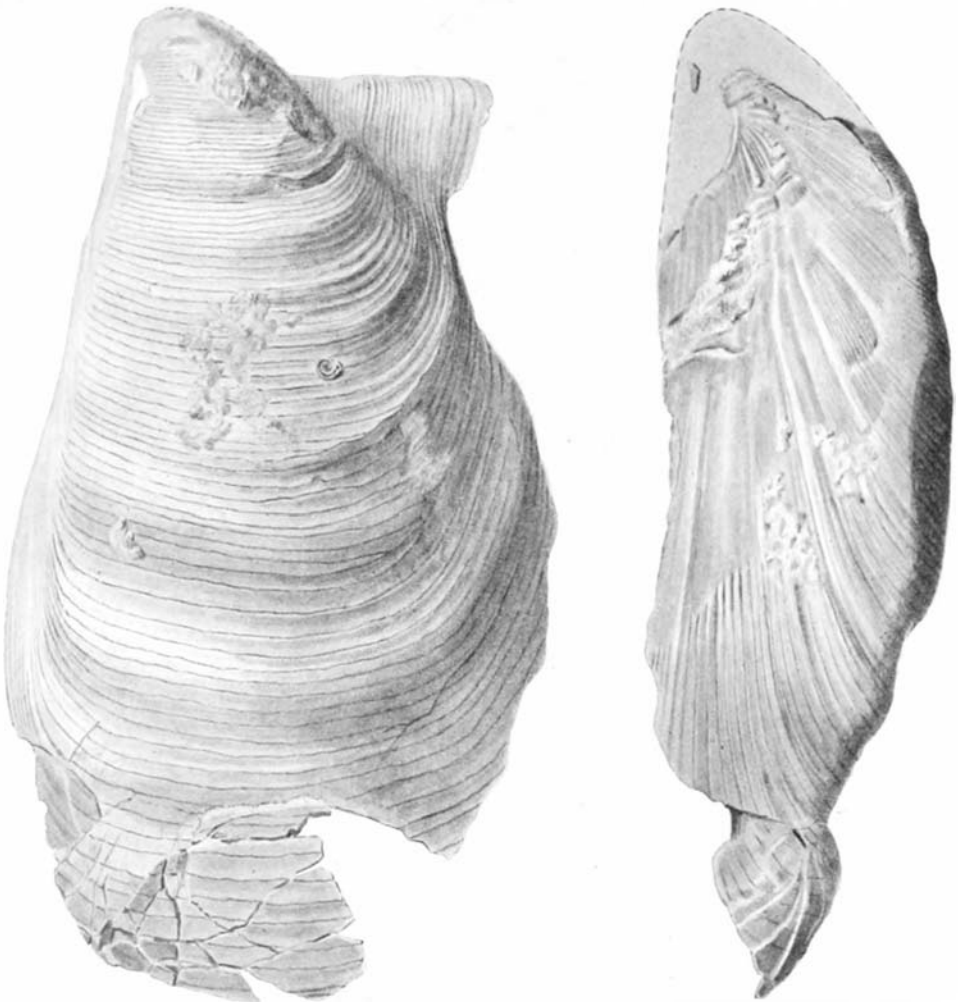


Fig. 81.—*Inoceramus Lamarcki* var. *Cuvieri*, Sow. Zone of *Terebratulina lata*, Blue Bell Hill, Burham. Mr. Dibley's Collection. Left valve with posterior part missing; anterior view of the same valve. × ⅓.

I. percostatus, Müller[2] (especially the example figured by Petrascheck[3]), seems to be closely allied to *I. Lamarcki* var. *Websteri*.

Types.—*I. Lamarcki*, Parkinson (Fig. 63), from near Dover (probably zone of

[1] 'Mém. Soc. Linn. Nord de la France,' vol. iv (1877), p. 324. pls. i, ii. Barrois, 'Ann. Soc. géol. Nord,' vol. vi (1879), p. 454, pl. iv.

[2] 'Jahrb. d. k. preuss. geol. Landesanst. u. Bergakad. für 1887' (1888), p. 413, pl. xvii, fig. 3.

[3] 'Jahrb. d. k. k. geol. Reichsanst.,' vol. lvi (1906), p. 163, fig. 2. Also *I. Glatziæ* and *I. Kleini*, Andert, 'Inoceramen d. Kreibitz-Zittauer Sandsteingeb.' (1911), pp. 48, 52, pl. i, fig. 3, pl. ii, fig. 8.

Micraster cor-anguinum); in the British Museum, No. L9801. This specimen was first recognised as the original of Parkinson's figure by Mr. C. D. Sherborn.

Fig. 82.—*Inoceramus Lamarcki* var. *Cuvieri*, Sow. Chalk; locality and horizon unknown. British Museum, No. L23909. Right valve. × ½.

I. Cuvieri, Sowerby (Fig. 73), from the Middle Chalk of Royston (zone of *Terebratulina lata*); in the British Museum, No. 43264.

I. Lamarcki, Mantell (Fig. 66), from the Middle Chalk near Lewes (probably from Malling, zone of *Terebratulina lata*); in the British Museum, No. 4753.

I. Curieri, Mantell (Figs. 69, 84), both from the zone of *Micraster cor-anguinum* of Southeram; in the British Museum, Nos. 5845, L22094.

I. Brongniarti, Mantell (Fig. 68), from Lewes or Brighton (probably zone of *Micraster cor-anguinum*); in the British Museum, No. 4751.

Fig. 83.—Anterior view of specimen shown in Fig. 82. × ½.

I. Websteri, Mantell (Fig. 71), from South Street [= Southeram], Lewes (probably zone of *Micraster cor-testudinarium*); in the British Museum, No. 4759.

I. undulatus, Mantell (Plate LIII, fig. 3), from Southeram, Lewes (probably zone of *Holaster planus*); in the British Museum, No. 4767.

Fig. 84.—*Inoceramus Lamarcki* var. *Cuvieri*, Sow. The original of *I. Cuvieri*, Mantell, 'Foss. S. Downs,' p. 213, pl. xxviii, fig. 1. Zone of *Micraster cor-anguinum* of Southeram. British Museum, No. 5845. × ½.

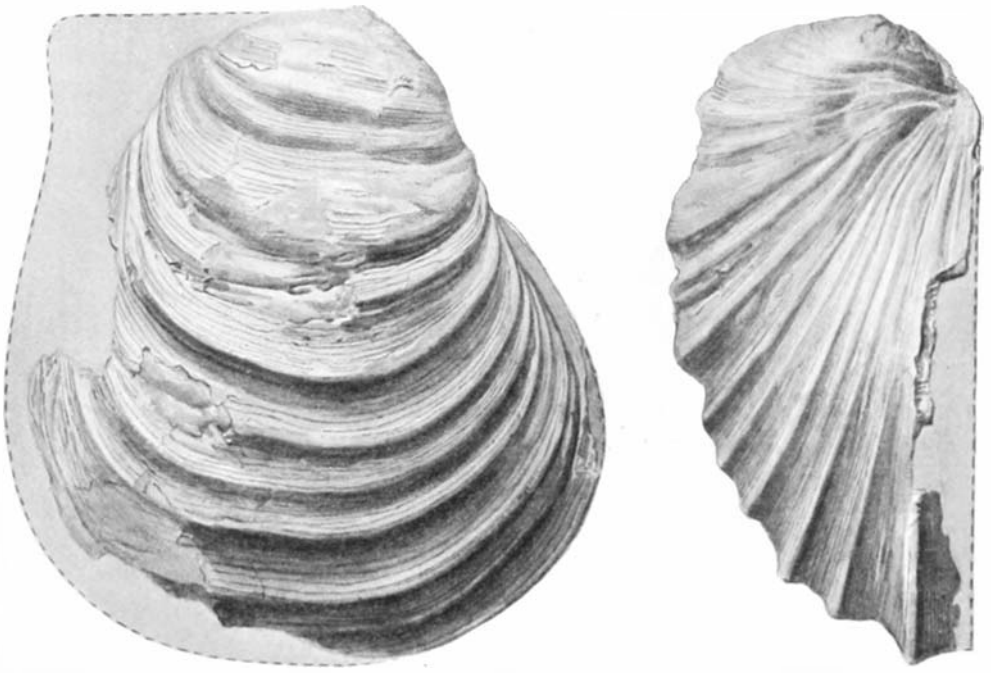


Fig. 85.—*Inoceramus Lamarcki*, Park. Upper Chalk (? zone of *Holaster planus*), locality unknown. Museum of Practical Geology, No. 21237. Variety with concave anterior area. Right valve and anterior view. × ½.

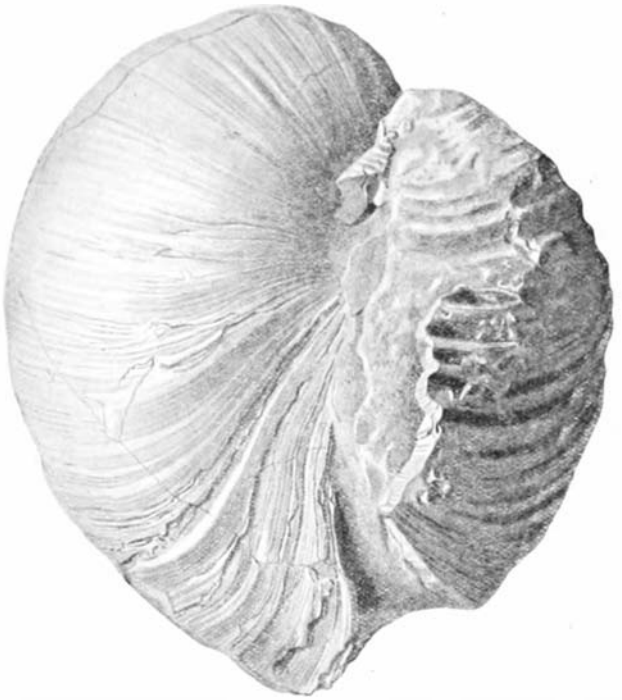


Fig. 86.—*Inoceramus.* A variety connecting *I. Lamarcki* with *I. involutus.* Upper Chalk, probably Kent. Sedgwick Museum Right valve displaced. Posterior view. × ⅓.

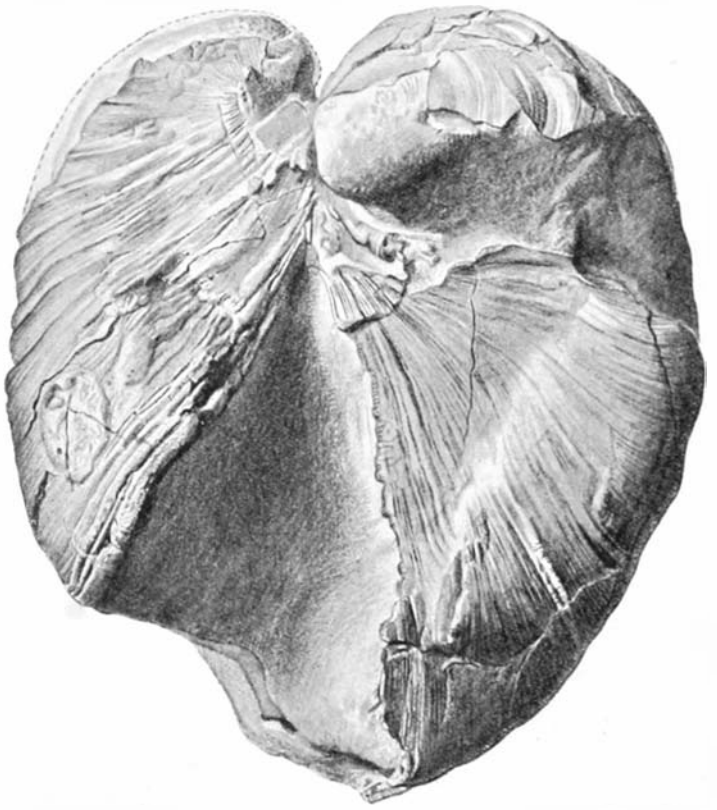


Fig. 87.—Anterior view of specimen shown in Fig. 86. Natural size.

I. latus, Mantell (Fig. 76), from the Upper Chalk near Brighton; in the British Museum, No. 5848.

I. Brongniarti, Sowerby, 1823 (Fig. 70). Locality and horizon unknown; in the British Museum, No. 43265.

The small specimens from the zone of *Rhynchonella Cuvieri* near Cambridge, figured by Etheridge as *Inoceramus problematicus*, are in the Museum of Practical Geology (Nos. 21230—21232).

Distribution.—*I. Lamarcki* ranges from the zone of *Rhynchonella Cuvieri* to the zone of *Micraster cor-anguinum*.[1]

Zone of *Rhynchonella Cuvieri*: St. Catherine's Hill (Winchester), the Isle of Wight, Cuxton, Burham, Dunton Green, the Sussex coast, Dover, Hitchin, Foulbourn near Cambridge, the Yorkshire coast.

Zone of *Terebratulina lata*: Hooken (South Devon), the Isle of Wight, Cuxton, Blue Bell Hill (Burham), Dunton Green, Kenley, Westerham, Lewes, the Sussex coast, Holborough near Rochester, Dover, Guilford Colliery (Coldred near Dover), Hitchin, Royston, the Yorkshire coast.

Zone of *Holaster planus*: The South Devon and Dorset coasts, the Isle of Wight, Winchester, Homington (Salisbury), Cuxton, Borstal, Whyteleaf (Warlingham), the Sussex coast, Dover, Newmarket, Swaffham (Norfolk), Westacre, Narborough, the Yorkshire coast. Chalk Rock of Cuckhamsley.

Zone of *Micraster cor-testudinarium*: The South Devon and Dorset coasts, the Isle of Wight, Borstal Fort, Borstal Manor pit, Chatham, Lewes, the Sussex coast, Dover, Wharram Percy, the Yorkshire coast.

Zone of *Micraster cor-anguinum*: The Dorset coast, the Isle of Wight, Camp Hill (Salisbury), Micheldever, Harefield, Southeram, the Sussex coast, St. Margaret's, Thanet, the Yorkshire coast.

Senonian of Haldon.

INOCERAMUS INVOLUTUS, *Sowerby*, 1828. Text-figs. 88—94.

1828.	INOCERAMUS INVOLUTUS, *J. de C. Sowerby.*	Min. Conch., vol. vi, p. 160, pl. dlxxxiii, figs. 1—3.
1841.	— — *F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 61.
1846.	— *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 529, pl. cccxiii, figs. 1—3.
—	LAMARCKII, *d'Orbigny.*	Ibid., p. 518, pl. cccxii.
1850.	— INVOLUTUS, *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 250.

[1] Some authors have recorded this species from the zones of *Marsupites testudinarius*, *Actinocamax quadratus* and *Belemnitella mucronata*, but I have not sufficient evidence to confirm these records.

1850.	Inoceramus involutus,	*J. de C. Sowerby*,	in *F. Dixon*. Geol. Sussex, p. 355 (p. 386, ed. 2), pl. xxviii, fig. 32.
1854.	—	—	*J. Morris*. Cat. Brit. Foss., ed. 2, p. 169.
1863.	—	—	*A. v. Strombeck*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 127.
1871.	—	(Volviceramus) involutus,	*F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, pp. 394, 401.
1875.	—	involutus,	*C. Décoq*. Assoc. Franç. Avanc. Sci. (Lille, 1874), p. 367.
1876.	—	—	*D. Brauns*. Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 379.
1877.	—	—	*C. Schlüter*. Palæontographica, vol. xxiv, p. 272.
1878.	—	—	*C. Barrois*. Ann. Soc. géol. du Nord, vol. v, p. 475.
1888.	—	(Volviceramus) involutus,	*G. Müller*. Jahrb. d. k. preuss. geol. Landesanst. für 1887, p. 411, pl. xvi, figs. 3, 4.
—	—	involutus,	*A. Peron*. Hist. Terr. Craie S.E. du Bassin Anglo-Parisien, p. 157.
1901.	—	—	*F. Sturm*. Jahrb. d. k. preuss. geol. Landesanst. für 1900, vol. xxi, p. 91, pl. ix, fig. 4.
1902.	—	—	*A. Wollemann*. Lüneburg. Kreide (Abhandl. d. k. preuss. geol. Landesanst. N.F., 37), p. 68, pl. i, fig. 4; pl. ii, figs. 7, 8.
1906.	—	—	*G. Smoleński*. Bull. Intern. Acad. Sci. Cracovie, p. 721.
1909.	—	—	*J. Nowak*. Ibid., p. 874, pl. xlvi, figs. 4, 5.
1910.	—	—	*J. Böhm*. Centralbl. für Min., etc., p. 741.

Description.—Shell very inequivalve and very inequilateral. Right valve oval or semi-oval in outline; usually slightly convex, but sometimes either more convex or nearly flat, with the marginal part in old specimens forming an obtuse angle with the earlier part. Length greater than height. Anterior and ventral margins rounded; posterior margin forming usually an obtuse angle but sometimes nearly a right angle with the hinge. Umbo usually inconspicuous, at or near the anterior end of the hinge-line. Hinge-line equals about three-quarters of the length of the valve. Postero-dorsal marginal part convex near the hinge and separated by a sharp furrow from the remainder of the valve. Ornamentation consists of strong, somewhat irregular concentric folds, with an unsymmetrical curvature; the folds are separated by broad, concave interspaces. In casts of this valve, and sometimes in the shell itself, radial markings are seen in the concave interspaces.

Left valve much larger than the right, inflated, more or less considerably

Fig. 88.—*Inoceramus involutus*, Sow. Upper Chalk, locality unknown. The type. British Museum, No. 43268. Left valve. Natural size.

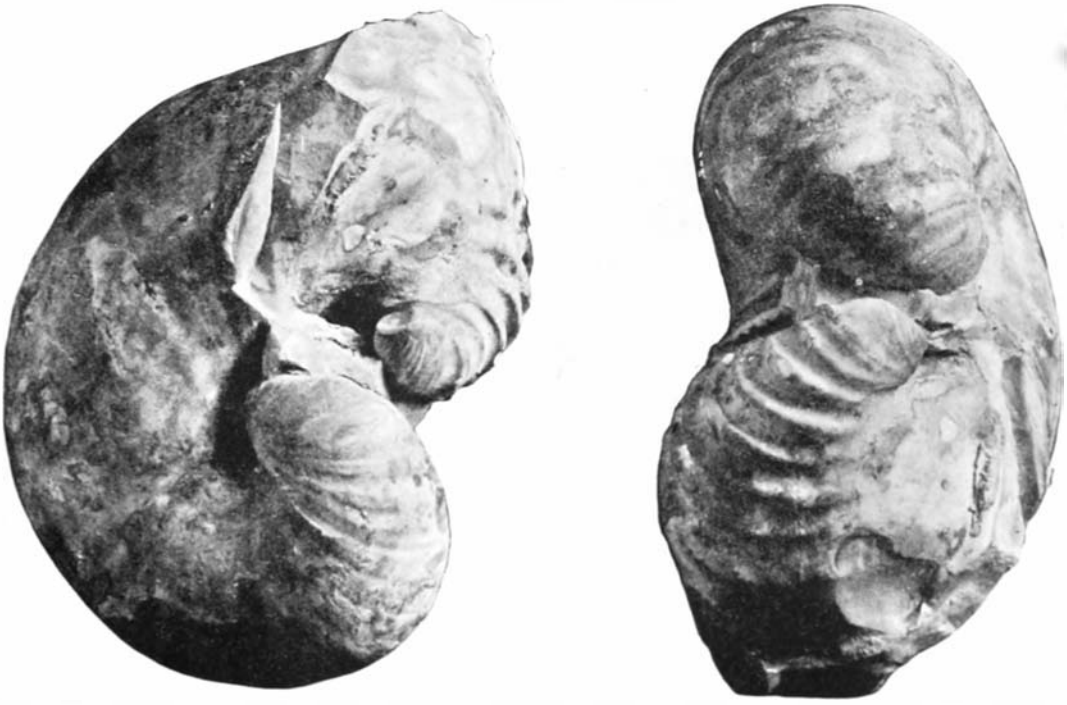


Fig. 89.—*Inoceramus involutus*, Sow. The original of the specimen figured in Dixon's 'Geol. Sussex,' pl. xxviii, fig. 32. Upper Chalk, Charing. Flint cast. British Museum, No. L83. Natural size.

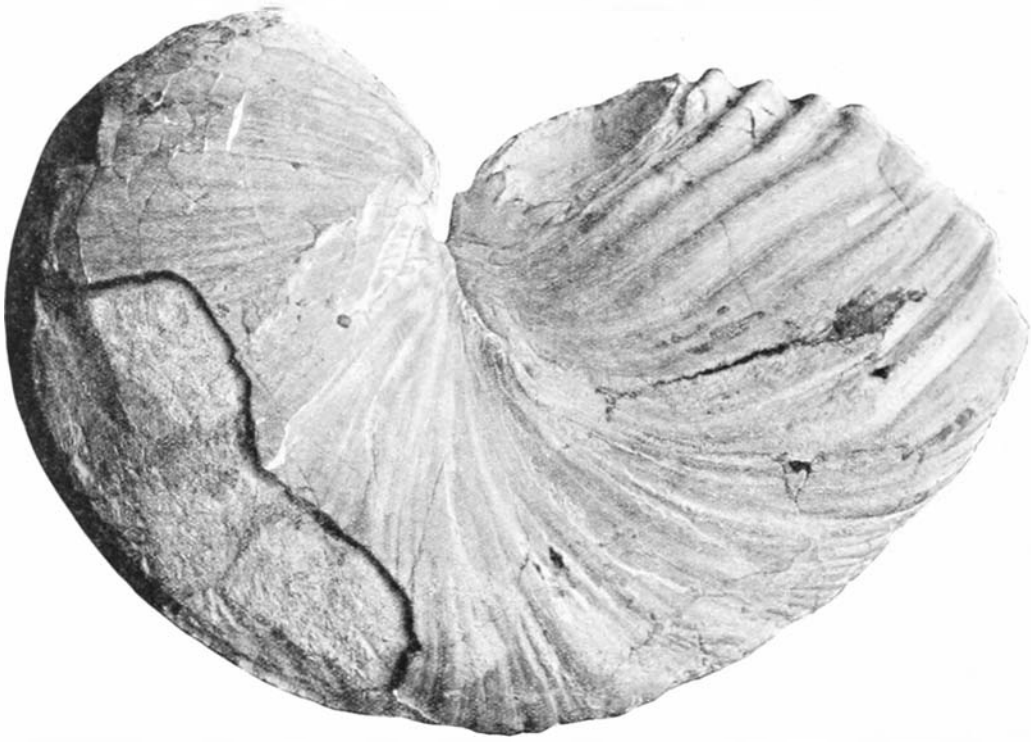


Fig. 90.—*Inoceramus involutus*, Sow. Upper Chalk, probably Kent. British Museum, No. L4917. Posterior view. Umbonal part of left valve missing. Natural size.

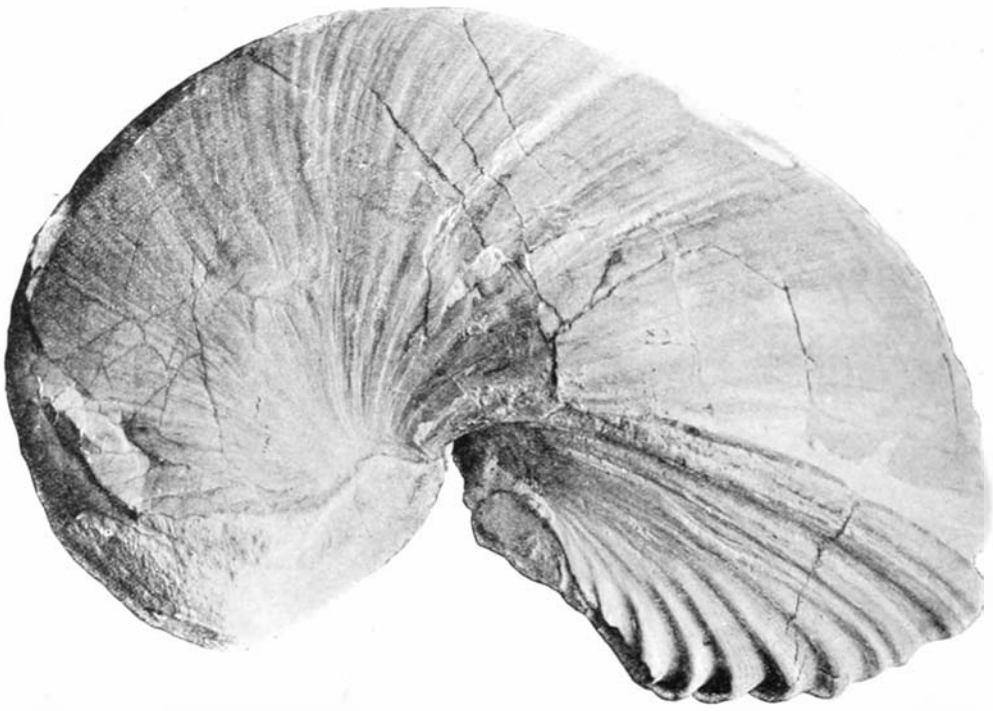


Fig. 91.—Anterior view of specimen shown in Fig. 90. Natural size.

spiral; with a very large umbo near the anterior end, curved inwards and forwards. Surface nearly smooth, except for the presence of growth-lines.

The hinge (Fig. 94) curves at either end; it is thinnest near the umbo and becomes thicker towards the posterior end. The ligament-pits are deep, almost square, but sometimes oblong, and increase in height from the umbo posteriorly.

Fig. 92.—Right valve and part of left valve of specimen shown in Figs. 90, 91.

Affinities.—*I. involutus* is the type of the genus or sub-genus *Volviceramus* of Stoliczka. In general appearance this differs considerably from other species of *Inoceramus*, so that its separation as a distinct genus or sub-genus seems at first sight quite justifiable; but the study of a large number of specimens of *I. involutus* and *I. Lamarcki* shows that these two species are very closely allied, and that the former has almost certainly descended from the latter. Such being the case it follows that these two species are more nearly related to one another than are

several species which are placed by all writers in the genus *Inoceramus*. In this respect *Volviceramus* is exactly comparable with *Actinoceramus* (p. 268).

A fairly complete passage can be traced from *I. Lamarcki* to *I. involutus*. In some forms of *I. Lamarcki* the valves become more unequal than usual, the left

Fig. 93.—*Inoceramus involutus*, Sow. Upper Chalk, locality unknown. British Museum, No. L21005. Anterior view of left valve. × ⅔.

valve being relatively larger and with less distinct folds, and the right relatively less convex and its anterior area slightly concave (Fig. 85). These are connected with some varieties of *I. involutus* by intermediate forms (Figs. 86, 87) in which the left valve possesses nearly all the characters of *I. involutus* but is less curved and possesses a concave anterior area, whilst on the right valve the folds are almost as prominent as in *I. involutus*, but the flattened or concave anterior area

and a relatively short hinge are still retained, and the right valve is still convex and has a concave anterior area. A variety of *I. involutus* links such intermediate forms with typical examples of *involutus*; in that variety the right valve is rather more convex than in typical forms, the left valve is not so distinctly spiral, some trace of the anterior flattened or concave area is still retained, and the hinge-line is rather shorter relatively.

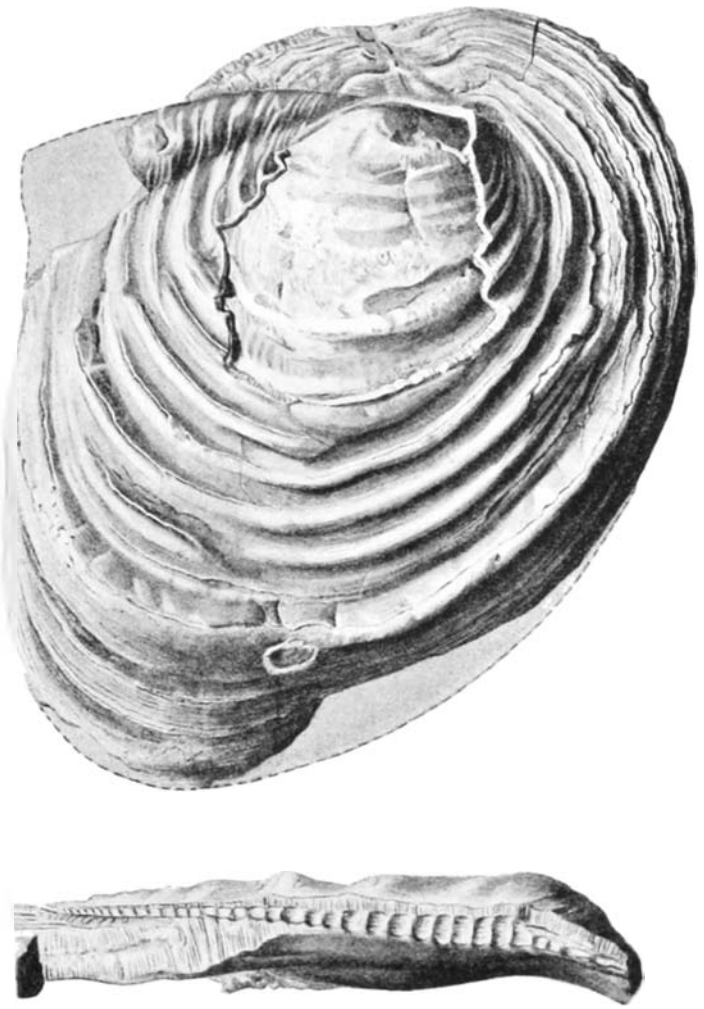


FIG. 94.—*Inoceramus involutus*, Sow. Upper figure: Zone of *Micraster cor-anguinum*, Gravesend. Sedgwick Museum, Cambridge. Right valve with marginal growth round the hinge. × ⅓.
Lower figure: Hinge of right valve: Upper Chalk, Norfolk. Norwich Museum, No. 3355. The anterior part of the hinge is partly concealed by the marginal growth of the shell. × ⅓.

I. umbonatus, Meek and Hayden,[1] from Fort Benton, Missouri, is, as stated by Meek, very closely allied to, and perhaps identical with, *I. involutus*. Another related form is *I. exogyroides*, Meek and Hayden.[2] Both are regarded as synonyms

[1] 'Invert. Cret. and Tert. Foss. U. Missouri' (1876), p. 44, pl. iii, fig. 1: pl. iv, figs. 1, 2.

[2] Ibid., p. 46, pl. v, fig. 3.

of *I. involutus* by Barrois. *I. Koeneni*, Müller,[1] is probably a variety of *I. involutus* in which the right valve is more convex and its umbo more prominent than usual.

The right valve of the specimen figured by d'Orbigny (1846, pl. cccexii, figs. 1, 2) as *I. Lamarcki* is an example of *I. involutus*; but the left valve (fig. 3), if it belongs to the same individual, is probably incorrectly drawn.

Remarks.—Examples of this species often reach a large size, and in such cases the hinge (Fig. 94) may attain a considerable thickness, but portions of it are not often found separately. In old specimens the marginal part of the right valve grows obliquely or almost at right angles to the earlier part, and the folds become indistinct or disappear altogether; and in the right valve this marginal growth sometimes occurs along the hinge, owing no doubt to the increase in size of the left valve in which it then fits like an operculum (Fig. 94). The length varies in proportion to the height, so that in some forms the right valve becomes nearly circular.

Types.—The type (Fig. 88) is in the British Museum, No. 43268; its locality is unknown. The specimen figured in Dixon's 'Geology of Sussex' (Fig. 89) is also in the British Museum, No. L83; it is a flint cast and came from the Upper Chalk of Charing.

Distribution.—*I. involutus* is found in the zone of *Micraster cor-testudinarium* and the lower part of the zone of *M. cor-anguinum*, being particularly common at the latter horizon.[2]

Zone of *M. cor-testudinarium:* Chatham, Dover, and Seaford, Sussex.

Zone of *M. cor-anguinum:* Winchester, Quidhampton, Mapledurham, Thanet, St. Margaret's, Guilford Colliery (Coldred near Dover), the Sussex coast, Lewes, Haling pit (South Croydon), Strood, New Brompton (Chatham), Gravesend, Harefield near Rickmansworth, Bury St. Edmunds, Saham Toney, Thetford, Brancaster, and other places in Norfolk. Between the zones of *M. cor-testudinarium* and *M. cor-anguinum* near Beverley, Yorkshire. Senonian of Haldon.

INOCERAMUS CORDIFORMIS, *Sowerby*, 1823. Plate LIII, fig. 8. Plate LIV, figs. 2—4.

1823.	INOCERAMUS CORDIFORMIS,	*J. de C. Sowerby.*	Min. Conch., vol. v, p. 61. pl. cccexl.
1836.	—	—	*A. Goldfuss.*	Petref. Germ., vol. ii, p. 113, pl. cx, fig. 6*b* (not 6*a*).

[1] 'Jahrb. d. k. preuss. geol. Landesanst.' für 1887 (1888), p. 412, pl. xvii, fig. 1.

[2] This species has been recorded by Griffith and Brydone from the *Uintacrinus* band of the *Marsupites* zone of Ropley, Hampshire; and by Barrois from the zone of *Actinocamax quadratus* of Newhaven.

1854.	INOCERAMUS CORDIFORMIS, *J. Morris.*		Cat. Brit. Foss., ed. 2, p. 169.
1897.	—	*R. Leonhard.*	Palæontographica, vol. xliv, p. 48.
1898.	HAENLEINI, *G. Müller.*		Mollusk. Untersen. v. Braunschweig u. Ilsede (Abhandl. d. k. preuss. geol. Landesanst., N.F., 25), p. 41, pl. v, fig. 7; pl. vi, figs. 1, 2.
? 1911.	—	CORDIFORMIS, *W. Rogala.*	Bull. Internat. Acad. Sci. Cracovie, p. 170, pl. iv, fig. 2.
Non 1904.	—	— *C. Airaghi.*	Boll. Soc. geol. Italiana, vol. xxiii, p. 189, pl. iv, figs. 6—9.

Description.—Shell inflated, equivalve, very inequilateral, rounded. Anterior margin more or less nearly straight or undulating, but rounded in large specimens. Ventral and posterior margins more or less sinuous. Anterior part of valves more or less flattened and often nearly perpendicular to the plane between the valves. Postero-dorsal part of valves much compressed and usually wing-like. Hinge equal to more than half the height of the shell. Umbones terminal, large, prominent, curved inwards and forwards. A broad, shallow sulcus extends from behind the umbo to the postero-ventral extremity and separates two broad, rounded ridges. A similar sulcus may extend from the front of the umbo to the opposite ventral margin.

Ornamentation consists of broad, rounded, concentric folds, which bend upwards where they cross the two radial sulci. The folds become less distinct on the anterior and postero-dorsal parts than on the sides of the shell. Numerous close-set growth-lines are present.

Affinities.—*I. Haenleini*, Müller,[1] from the lower part of the Lower Senonian of Brunswick and Ilsede, seems to be hardly distinct from *I. cordiformis*. The smaller English specimens agree very closely with one of the examples figured by Müller (pl. v, fig. 7).

I. cordiformis resembles some of the more convex forms of *I. Lamarcki*, Parkinson, from which it is distinguished by the equal size of the valves and the presence of radial sulci. The specimen, figured (Pl. LIV, fig. 1), connects this species with *I. Lamarcki*.

Remarks.—Goldfuss' fig. 6*b* is a copy of Sowerby's figure; his fig. 6*a* is the type of *I. saxonicus*, Petrascheck.

Type.—In the British Museum, No. 43277, from the Upper Chalk (zone of *Micraster cor-anguinum*) of Gravesend (Pl. LIII, fig. 8).

Distribution.—Zone of *Micraster cor-testudinarium* of Clanfield (Hampshire), and Wharram Percy (Yorkshire). Zone of *Micraster cor-anguinum* of Gravesend, Micheldever, and Porton. *Uintacrinus* band of Salisbury. Senonian of Haldon.

[1] 'Mollusk. Untersen. v. Braunschweig u. Ilsede' (1898), p. 41, pl. v, fig. 7; pl. vi, figs. 1, 2.

INOCERAMUS COSTELLATUS, sp. nov. Plate LIV, figs. 5—7.

1897. INOCERAMUS, sp., *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 381, pl. xxvii, figs. 14—17.

Description.—Shell small, very inequilateral, rather higher than long, of moderate convexity—the greatest convexity being between the umbones and the postero-ventral extremity. Umbones terminal. Hinge equal to about three-quarters of the length of the shell, and forming more than a right angle with the anterior margin. Anterior margin moderately convex, ventral margin very convex, posterior margin slightly convex.

Right valve with a small, pointed, slightly curved umbo. Posterior and postero-dorsal parts of the valve flattened. A small, flattened antero-dorsal area is nearly perpendicular to the plane of the valves.

Left valve more convex than the right; postero-dorsal part compressed, but not forming a definite ear. Umbo narrow, pointed, curved inwards, larger and more prominent than the umbo of the right valve. Antero-dorsal area larger than on the right valve.

Concentric ribs narrow, sharp, usually widely separated; interspaces broad and shallow. The curvature of the ribs is very unsymmetrical; the ventral part is very convex, the posterior part only slightly convex.

Remarks.—This species is fairly common in the Chalk Rock. All the specimens seen are casts. Some examples, which appear to be a variety of this species, have small ribs of uniform size.

Affinities.—This species appears to be related to some forms of *I. Lamarcki*, Parkinson, but the left umbo is narrower, more pointed, and less curved; the line of greatest convexity is more oblique to the hinge-line, and the posterior and postero-dorsal parts of the valves are more compressed.[1]

Type.—From the Chalk Rock of Cuckhamsley, in the Sedgwick Museum, Cambridge.

Distribution.—Chalk Rock of Dover, Guilford Colliery (Coldred near Dover), the Sussex Coast, south-east of Calstone Willington, Cuckhamsley, Blount's Farm near Marlow, Luton, Wallington near Baldock, Barley near Royston, and Underwood Hall near Dullingham. Zone of *Holaster planus* of South Devon, the Dorset Coast, the Isle of Wight, Lichfield (Hants), Winchester, etc.[2]

[1] Compare also *I. undulatus*, Rogala, 'Bull. Internat. Acad. Sci. Cracovie' (1911), p. 171, pl. iv, fig. 7, and *I. Frechi*, Andert, 'Inoceramen d. Kreibitz-Zittauer Sandsteingeb.' (1911), p. 51, pl. i, fig. 8.

[2] Recorded by Rowe from the zones of *Terebratulina lata* and *Micraster cor-anguinum* of Dover.

INOCERAMUS DIGITATUS, *Sowerby*, 1829. Text-fig. 95.

1829.	INOCERAMUS DIGITATUS.	*J. de C. Sowerby.* Min. Conch., vol. vi, p. 215, pl. dciv, fig. 2.
1854.		*J. Morris.* Cat. Brit. Foss., ed. 2, p. 169.
? 1875.		*C. Décocq.* Assoc. Franç. Avanc. Sci. (Lille, 1874), p. 368.

Remarks.—This species attains a large size, but is known only by small

FIG. 95.—*Inoceramus digitatus*, Sow. The type. From the Drift (derived from the Chalk). British Museum, No. 43273. × ⅓.

portions of the shell of which the exact horizon cannot be determined. The ornamentation consists of broad, rounded, radial folds, which diverge very gradually and are separated by broad rounded interspaces. Small concentric ribs occur, and at distant intervals, broad, gentle, concentric folds can be traced. The form referred to *I. digitatus* by Schlüter differs from that species in having

diverging and distinctly curved ribs. *I. digitatus* appears to be closely allied to *I. subcardissoides*, Schlüter.

Type.—From the Drift (derived from the Chalk); locality unknown. In the British Museum, No. 43,273.

Distribution.—No undoubted specimens obtained directly from the Chalk have been seen.

INOCERAMUS PINNIFORMIS, *Willett*, 1871. Text-fig. 96.

1871. INOCERAMUS PINNIFORMIS, *H. Willett*. Cat. Cret. Foss., Brighton Mus., p. 40, no. 342.

Description.—Shell very large, much higher than long, of moderate convexity, with a posterior wing-like part.

Ornamentation consists of broad, strong, widely separated concentric folds which have a nearly symmetrical curvature; the ventral slopes of the folds are rather steeper than the dorsal; in the interspaces are small (sometimes indistinct) concentric folds, which give a more or less marked tuberculate character to the radial ribs. The latter are rounded, rather numerous, sometimes partly or completely divided by a median furrow, and are continued on to the dorsal surfaces of the strong concentric folds, but are absent or indistinct on the ventral surfaces.

Remarks.—A portion of a large *Inoceramus* named *I. pinniformis* by Willett resembles *I. subcardissoides*, Schlüter,[1] but differs from that species by the more numerous radial ribs and the absence of a broad furrow extending from the umbo in a postero-ventral direction.

Type.—In the Brighton Museum.

Distribution.—Upper Chalk (zone of *Actinocamax quadratus*) of Brighton, and three miles east of Sledmere, Yorkshire.

[1] 'Palæontographica,' vol. xxiv (1877), p. 271, pl. xxxvii; Barrois, 'Ann. Soc. géol. Nord.,' vol. v (1878), p. 474; Wollemann, 'Lüneburg. Kreide' (1902), p. 70; Wegner, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. lvii (1905), p. 169; *I. Gosseleti*, Décocq, 'Assoc. Franç. Avanc. Sci.,' 1874 (1875), p. 371.

Fig. 96.—*Inoceramus pinniformis*, Willett. Upper Chalk (zone of *Actinocamax quadratus*), Brighton. Brighton Museum, No. 342. Portion of right valve. × ½.

INOCERAMUS CORRUGATUS, sp. nov. Text-fig. 97.

Remarks.—This species is at present known only by a small portion of one valve. It is of the same general type as *I. digitatus*, Sowerby, *I. pinniformis*, Willett, and *I. subcardissoides*, Schlüter, but owing to the presence of broad, strong radial folds the radial ribs are arranged in groups of four or five. The

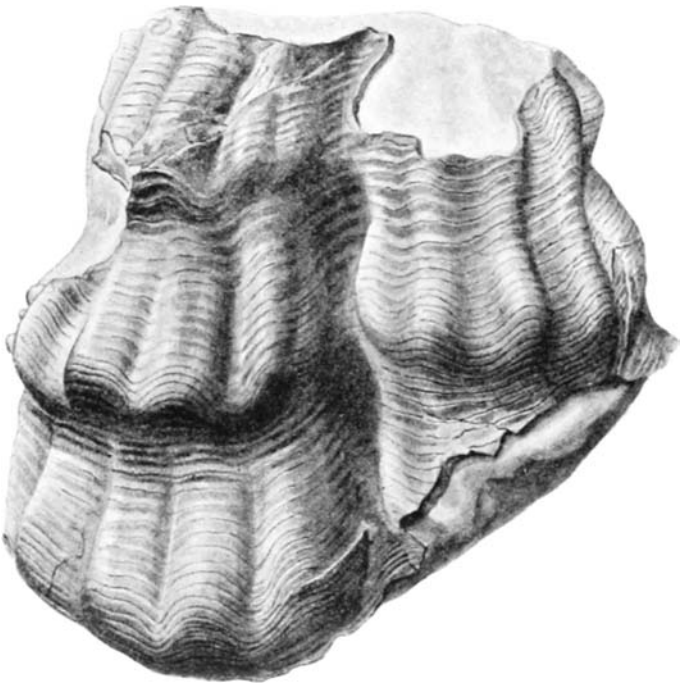


FIG. 97.—*Inoceramus corrugatus*, sp. nov. Upper Chalk, Wouldham Cement Quarry, Grays. British Museum, No. L22528 (discovered and presented by Col. C. E. Shepherd). Natural size.

concentric folds are strong and have a steep ventral, and a gentle dorsal slope. The growth-lines are distinct and regular. *I. corrugatus* and the other species mentioned may be compared with *I. lezennensis*, Décocq,[1] which is of the same type as *I. Lamarcki* but possesses two radial folds due to the presence of a medial sulcus.

Distribution.—Upper Chalk, Wouldham Cement Company's Quarry, Grays, Essex.

[1] Barrois, 'Ann. Soc. géol. du Nord,' vol. vi (1879), p. 455, pl. 5, figs. 1, 2.

Palæontographical Society, 1912.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. II. PART IX.

OSTREIDÆ, RADIOLITIDÆ, ADDITIONS, DISTRIBUTION, BIBLIOGRAPHY, INDEX.

PAGES 341—473; PLATES LV—LXII.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1913.

Family—OSTREIDÆ, *Lamarck.*

[Omitted from Vol. I, p. 223.]

The great difficulties in the systematic study of the Ostreidæ have been felt by nearly all writers,[1] and are due mainly to the extraordinary variation in the form of the shell. This variation has been brought about by changes in the physical conditions of habitat, and particularly by differences in the character of the surface to which the left valve is fixed; it is found that the mode of growth and ultimate shape of the shell are determined mainly by the size, shape, and position of the attached surface, so that commonly any one species shows an amazing variety of forms which can, however, be linked together by large series of specimens. A further difficulty in the systematic study of oysters is due to the fact that the shell usually possesses little or no ornamentation.

Various generic or sub-generic divisions have been proposed for the Ostreidæ, *e. g. Ostrea*, *Lopha* (= *Alectryonia*), *Arctostrea*, *Exogyra*, *Amphidonta*, *Gryphæa*, *Pycnodonta*, *Gryphæostrea;* but it appears to me that the phylogenetic relationship of the species of oysters is more complex than is represented by these divisions, and that a natural grouping can only be established when more is known of the evolution of the species. The forms with radial folds have usually been grouped together under the name *Alectryonia;* but there can be no doubt that such folds have originated independently in more than one line of descent, and their presence does not necessarily indicate close relationship. Thus, for example, *Ostrea semiplana*, which has been commonly referred to *Alectryonia*, appears to be more closely allied to *Ostrea vesicularis* than to any species of *Alectryonia*. The Cretaceous forms which have been referred to *Gryphæa* clearly owe their grypheate character to the small size of the attached surface,[2] and can be traced into forms having the characters of *Ostrea*. In studying the Upper Cretaceous oysters of Tunis, Peron[3] has already noticed that some individuals of a species may present the characters of *Ostrea*, whilst others are exogyriform or grypheate. In the Chalk of England *Ostrea semiplana* is usually ostreiform, but occasionally, when the attached surface is behind the umbo, the shell is at first exogyriform, but afterwards becomes ostreiform.

[1] See, for example, the remarks of Hill and Vaughan, "Lower Cretaceous Gryphæas of the Texas Region" ('Bull. U.S. Geol. Survey,' No. 151, 1898), p. 24; and Peron, "Descript. Brach., etc., Terr. Crét. Tunisie" (1890—91), pp. 105—109.

[2] See R. T. Jackson, "Phylogeny of the Pelecypoda. The Aviculidæ and their Allies" ('Mem. Boston Soc. Nat. Hist.,' vol. iv. 1890), p. 317; H. Douvillé, 'Bull. Soc. géol. France,' ser. 4, vol. x (1910), pp. 635, 642.

[3] Op cit., p. 107.

In this work *Exogyra* is retained as a genus since the species dealt with seem to be genetically related, but it is probable that the exogyriform type has originated independently in some earlier deposits. It is even possible that a few species referred to *Ostrea* may have arisen from an exogyriform type by the increase in the size of the attached surface, and the gradual loss of the spiral character of the umbo.

In the Ostreidæ, perhaps even more than in the case of *Inoceramus*, the number of figures which can be given is altogether insufficient to convey an adequate idea of the great variability of the species. It is only by the study of very extensive collections of specimens that one can hope to arrive at satisfactory conclusions.

Genus—OSTREA, *Linnæus*, 1758.

('Syst. Nat.,' ed. 10, p. 696.)

OSTREA DILUVIANA, *L.* Text-figures 98–138.

1767. OSTREA DILUVIANA, *Linnæus*. Syst. Nat., ed. 12, p. 1148.
1768. *G. W. Knorr and J. E. M. Walch*. Recueil. Mon. Catastr. Pétrificat., vol. ii, p. 123, pl. D ii, figs. 5, 6.
1779. "GRYPHITE," *B. Faujas-St.-Fond*. Hist. nat. Mont. St. Pierre de Maestricht, p. 151, pl. xxiv, figs. 1, 2.
1806. OSTREA PECTINATA, *Lamarck*. Ann. du Muséum, vol. viii, p. 165; vol. xiv, 1809, pl. xxiii, f. 1.
— — CARINATA, *Lamarck*. Ibid., vol. viii, p. 166.
1811. — FRONS, *J. Parkinson*. Organic Remains, vol. iii, p. 217, pl. xv, fig. 4.
1813. OSTRACITES PLICATISSIMUS, *E. T. v. Schlotheim*. In Leonhard's Taschenb. für Min., vol. vii, p. 112.
1819. OSTREA COLUBRINA, *Lamarck*. Anim. sans Vert., vol. vi, p. 216 (*non* Goldfuss).
— — CARINATA, *Lamarck*. Ibid., p. 216.
— — DILUVIANA, *Lamarck*. Ibid., p. 214.
1821. OSTRACITES DILUVIANUS, *G. Wahlenberg*. Petrific. Tellur. Suecanæ, p. 58.
1822. OSTREA CARINATA, *J. Sowerby*. Min. Conch., vol. iv, p. 89, pl. cccLxv.
— — — *G. B. Sowerby*. Genera Recent and Foss. Shells, No. vi, fig. 1.
— — SERRATA, *G. Cuvier and A. Brongniart*. In Cuvier's Ossemens Foss., vol. ii, pt. 2, pp. 251, 599, pl. iii, fig. 10.
— — CARINATA, *Cuvier and Brongniart*. Ibid., pp. 320, 599, pl. iii, fig. 11.
1824. — MACROPTERA, *J. de C. Sowerby*. Min. Conch., vol. v, p. 105, pl. cccclxviii, figs. 2, 3.

1827. OSTREA DILUVIANA, *S. Nilsson.* Petrific. Suecana, p. 32, pl. vi, figs. 1, 2.
— — — *G. P. Deshayes.* Hist. nat. Vers et Mollusques (Encycl. méthod.), vol. iv, pl. clxxxvii, figs. 1, 2; pl. clxxxviii, figs. 1, 2.
1832. — CARINATA, *Deshayes.* Ibid., vol. ii, p. 301; Planches, vol. iv, pl. clxxxvii, figs. 3—5.
1833. — — *A. Goldfuss.* Petref. Germ., vol. ii, p. 9, pl. lxxiv, fig. 6.
— — PECTINATA, *Goldfuss.* Ibid., p. 9, pl. lxxiv, fig. 7.
— — PRIONOTA, *Goldfuss.* Ibid., p. 10, pl. lxxiv, fig. 8.
— — SERRATA, *Goldfuss.* Ibid., p. 10, pl. lxxiv, fig. 9.
— — DILUVIANA, *Goldfuss.* Ibid., p. 11, pl. lxxv, fig. 4.
1835. ALECTRYONIA DEFRANCII, *G. Fischer de Waldheim.* Bull. Soc. Impér. Nat. Moscou, vol. viii, p. 113, pl. iii.
? — — FERUSSACI, *Fischer de Waldheim.* Ibid., p. 111, pl. iv.
1836. OSTREA RETUSA, *J. de C. Sowerby.* Trans. Geol. Soc., ser. 2, vol. iv, pp. 338, 361, pl. xiv, fig. 4.
1837. — DILUVIANA, *W. Hisinger.* Lethæa Suecica, p. 49, pl. xiv, fig. 5.
— — — *F. Dujardin.* Mém. Soc. géol. de France, vol. ii, p. 230.
? — — GREGARIA, *F. C. L. Koch and W. Dunker.* Beitr. nord-deutsch. Oolithgebild., p. 50, pl. vi, fig. 2.
1839. — RECTANGULARIS, *F. A. Römer.* Verstein. nord-deutsch. Oolithengeb., Nachtrag, p. 24, pl. xviii, fig. 15.
— — DILUVIANA?, *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 19.
1841. — MACROPTERA, *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 45.
— — CARINATA, *Römer.* Ibid., p. 45.
— — SERRATA, *Römer.* Ibid., p. 45.
1845. — CARINATA ET O. PRIONOTA, *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 250.
1845–6. — DILUVIANA, *H. B. Geinitz.* Grundr. d. Verstein., p. 478.
1846. — CARINATA, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 38.
— — DILUVIANA, *Reuss.* Ibid., p. 38, pl. xxx, figs. 16, 17; pl. xli, fig. 1; pl. xlv, fig. 1.
— — CARINATA, *A. Leymerie.* Statist. géol. min. de l'Aube, Atlas, pl. v, fig. 19.
— — PES-LEONIS, *E. Forbes.* Trans. Geol. Soc., ser. 2, vol. vii, p. 156, pl. xviii, fig. 5.
1847. — MACROPTERA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 695, pl. cccclxv.
— — CARINATA, *d'Orbigny.* Ibid., vol. iii, p. 714, pl. cccclxxiv, figs. 1—5.

1847. OSTREA FRONS, *d'Orbigny*. Ibid., vol. iii, p. 733, pl. cccclxxxiii.
— — MILLETIANA, *d'Orbigny*. Ibid., p. 712, pl. cccclxxii, figs. 5—7.
— — DILUVIANA, *d'Orbigny*. Ibid., p. 728, pl. cccclxxx.
1849. — MACROPTERA, *T. Brown*. Illustr. Foss. Conch. Gt. Brit. and Ireland, p. 146, pl. lviii, figs. 1, 2.
— — CARINATA, *Brown*. Ibid., p. 146, pl. lix, fig. 6.
1850. — — *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 170.
— — FRONS, *d'Orbigny*. Ibid., p. 255.
— — MACROPTERA, *d'Orbigny*. Ibid., pp. 84, 120.
— — RICORDEANA, *d'Orbigny*. Ibid., p. 171.
— — MILLETIANA, *d'Orbigny*. Ibid., p. 139.
— — DILUVIANA, *d'Orbigny*. Ibid., pp. 171, 198.
— — FRONS ET CARINATA, *H. B. Geinitz*. Das Quadersandst. oder Kreidegeb. in Deutschland, p. 196.
— — DILUVIANA, *Geinitz*. Ibid., p. 198.
1852. — CARINATA, *F. Römer*. Kreidebild. v. Texas, p. 75, pl. ix, fig. 5.
1851-2. — — *H. G. Bronn*. Lethæa Geogn., ed. 3, vol. ii, p. 262, pl. xxxii, fig. 2.
1853. — MILLETIANA, *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 525, pl. xlix, fig. 3.
1854. — MACROPTERA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 173.
— — FRONS, *Morris*. Ibid., ed. 2, p. 173.
1855. — MACROPTERA, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 122.
? 1859. — FRONS, *T. Wiltshire*. Red Chalk of England (Geol. Assoc.), p. 16, pl. ii, fig. 4.
1863. — DILUVIANA, *A. Kunth*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 724.
1868. — — *E. Eichwald*. Lethæa Rossica, vol. ii, p. 365.
— — FRONS, *Eichwald*. Ibid., p. 366.
— — CARINATA, *Eichwald*. Ibid., p. 367.
— — RECTANGULARIS, *F. J. Pictet*. Mélanges paléont., p. 263, pl. xl, fig. 9.
1869. — MACROPTERA, *H. Coquand*. Mon. Ostrea, Terr. Crét., p. 164, pl. lxxii, figs. 1—4.
— — RECTANGULARIS, *Coquand*. Ibid., p. 187, pl. lxxii, figs. 5—12.
— — PECTINATA, *Coquand*. Ibid., p. 76, pl. xxix, figs. 1—7 (*O. colubrina*).
— — SERRATA, *Coquand*. Ibid., p. 79, pl. xvii, fig. 3; pl. xxx, figs. 1—5.
— — CARINATA, *Coquand*. Ibid., p. 129, pl. xlix, figs. 3—9.
— — RICORDEANA, *Coquand*. Ibid., p. 148, pl. liii, figs. 8—12.
— — MILLETIANA, *Coquand*. Ibid., p. 155, pl. lix, figs. 11—16.
— — DILUVIANA, *Coquand*. Ibid., p. 120, pl. xl, figs. 1—4.
— — RECTANGULARIS, *P. de Loriol and V. Gilliéron*. Urgon. infér. de Landeron, p. 25, pl. i, figs. 20—22.
? 1870. — CARINATA, *F. Römer*. Geol. v. Oberschlesien, p. 333.

1871. OSTREA [ALECTRYONIA] CARINATA, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 468, pl. xlviii, fig. 5; pl. xlix, figs. 1—2.

— — — PECTINATA, *Stoliczka.* Ibid., p. 469, pl. xlviii, figs. 1, 2.

— — — DILUVIANA, *Stoliczka.* Ibid., p. 466, pl. xlvi, figs. 1, 2; pl. xlvii, figs. 1, 2.

— — MACROPTERA, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 300, pl. clxxxiv, fig. 5.

— — RECTANGULARIS, *Pictet and Campiche.* Ibid., p. 275, pl. clxxxiv, figs. 1—4.

— — MILLETIANA, *Pictet and Campiche.* Ibid., p. 309, pl. cxciv, figs. 7—9.

— — PECTINATA, *Pictet and Campiche.* Ibid., p. 321.

1872. — CARINATA, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 174, pl. xxxix, figs. 6—11.

— — DILUVIANA, *Geinitz.* Ibid., pt. 1, p. 176, pl. xxxix, figs. 1—5.

? — — FRONS, *Geinitz.* Ibid., pt. 2, p. 30, pl. viii, fig. 12.

1875. — DILUVIANA, *E. Hébert and E. Munier-Chalmas.* Annal. Sci. géol., vol. vi, p. 119.

— — FRONS, *A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. xxxi, p. 295.

1876. — (ALECTRYONIA) DILUVIANA, *D. Brauns.* Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 392.

1878. ALECTRYONIA ZEILLERI, *E. Bayle.* Explicat. Carte géol. France, vol. iv. Atlas, pt. 1, pl. clxvi, figs. 1—4.

— — CARINATA, *Bayle.* Ibid., pl. cxlvii, figs. 1—7.

1881. OSTREA CARINATA, *J. Gosselet.* Esquisse géol. du Nord, iii, pl. xvii, fig. 4.

? 1882. ALECTRYONIA FRONS, *H. Schröder.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 261.

1883. OSTREA DILUVIANA, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., iii, Iserschicht., p. 120, fig. 95.

— — FRONS *var.* MACROPTERA, *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 102.

— — — *var.* CARINATA, *Keeping.* Ibid., p. 103.

1884. — MACROPTERA, *O. Weerth.* Neocomsandst. im Teutoburg.-Walde (Palæont. Abhandl., vol. ii), p. 55.

— — RECTANGULARIS, *Weerth.* Ibid., p. 54.

— — CARINATA, *C. A. White.* Foss. Ostreidæ N. America (4th Ann. Rep. U. S. Geol. Surv.), p. 293, pl. xliii, figs. 1—4.

1886. ALECTRYONIA MACROPTERA, *H. Trautschold.* Neocom. Sably (Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xv), p. 133.

1888. OSTREA (ALECTRYONIA) DILUVIANA, *G. Müller.* Jahrb. d. k. preuss. geol. Landesanst. für 1887, p. 400.

? 1889. — FRONS, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., iv, Teplitz. Schicht., p. 87, fig. 86.

— — (ALECTRYONIA) FRONS, *O. Griepenkerl.* Senon. v. Königslutter (Palæont. Abhandl., vol. iv), p. 33.

? 1890. ALLECTRYONIA *cf.* CARINATA, *M. Yokoyama.* Palæontographica, vol. xxxvi, p. 198.

1893. OSTREA FRONS, *S. Meunier.* Le Naturaliste, p. 175, fig. 1.

— — CARINATA, *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 238.

— — sp. *cf.* DILUVIANA, *Michael.* Ibid., p. 239.

1894. — DILUVIANA, *B. Lundgren.* Mollusk. i *Mammillatus* och *mucronata* zonerna, p. 36.

1895. — (ALECTRYONIA) CARINATA, *E. Tiessen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 462.

— — — *cf.* DILUVIANA, *Tiessen.* Ibid., p. 463.

— — MACROPTERA, *G. Maas.* Ibid., vol. xlvii, p. 271.

— — — *A. Wollemann.* Ibid., vol. xlviii, p. 834.

1897. — CARINATA, *U. Söhle.* Geognost. Jahresh. (1896), p. 40.

— — — *R. Leonhard.* Palæontographica, vol. xliv, p. 27.

— — DILUVIANA, *A. Hennig.* Revis. Lamellibr. i Nilssons's 'Petrif. Suecana,' p. 16, pl. ii, figs. 1, 2, 5.

— — (ALECTRYONIA) PECTINATA, *F. Nötling.* U. Cret. (Maestrichtian) Mari Hills (Palæont. Indica, ser. xvi, vol. i), p. 38, pl. ix, figs. 2, 3.

— — — FRONS, *A. Rutot.* Bull. Soc. Belge Géol. Paléont. et Hydrol., vol. x, p. 24.

? — — FRONS, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., vi, Chlomek. Schicht., p. 68.

1898. — PECTINATA, *G. Müller.* Mollusk. Untersen. v. Braunschweig u. Ilsede (Abhandl. d. k. preuss. geol. Landesanst., N.F., 25), p. 13, pl. i, fig. 6.

1900. — MACROPTERA, *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (ibid., N.F., pt. 31), p. 16.

1904. ALECTRYONIA ZEILLERI, *H. Douvillé.* Mission Scient. Perse (J. de Morgan), vol. iii, pt. vi, Paléont., p. 277, pl. xxxvi, fig. 16.

1905. OSTREA DILUVIANA, *T. Wegner.* Zeitschr. d. deutsch. geol. Gesellsch., vol. lvii, p. 182.

1908. OSTREA (ALECTRYONIA) MACROPTERA, *P. A. Peron.* Compte rendu Assoc. Franç. Avanc. Sci., vol. xxxvi (1907), p. 308.

1910. — — CARINATA, *E. Böse.* Mon. geol. paléont. Cerro de Muleros (Bol. Instit. geol. México, No. 25), p. 104, pl. xvi, figs. 13, 14.

1911. — (ALECTRONIA) CARINATA, *A. Fritsch.* Stud. im Gebiete der bohm. Kreideformat., Korycaner Schicht., p. 48, fig. 218.

— — DILUVIANA, *Fritsch.* Ibid., p. 48, fig. 216.

— ALECTRYONIA DILUVIANA, *K. Vogel v. Falckenstein.* Zeitschr. d. deutsch. geol. Gesellsch., vol. lxii, p. 559.

? — — *cfr.* FRONS, *Vogel v. Falckenstein.* Ibid., p. 559.

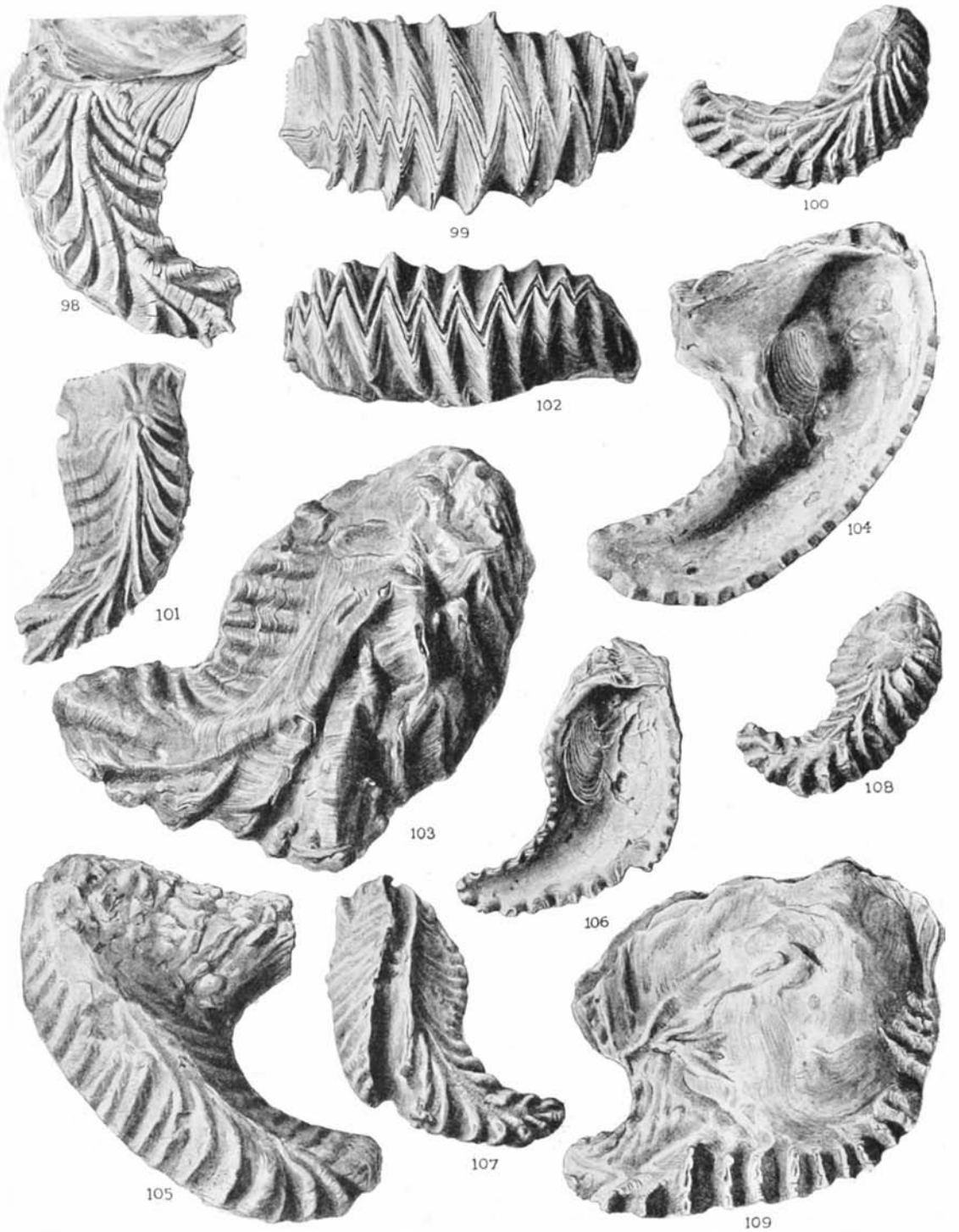
Non 1847. OSTREA CARINATA, *J. Müller.* Petref. der Aachen. Kreidef., pt. 1, p. 38, (= *O. Goldfussi*, Holzapfel).

— 1850. — — *J. de C. Sowerby*, in *F. Dixon.* Geol. Sussex, p. 357 (*O. frons*, p. 386, ed. 2), pl. xxvii, fig. 2.

— 1852. — FRONS? *R. Kner.* Denkschr. k. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. iii, p. 319, pl. xvii, fig. 10.

— 1883. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., iii, Iserschicht., p. 121, fig. 96.

Description.—Shell nearly equivalve; the valves similar except for the attached surface of the left valve. The proportion of height to length varies, but usually the height is much greater than the length, the difference becoming greater with age. Valves usually more or less tapering towards the postero-ventral extremity, but occasionally expanding at the end; slightly, moderately, or considerably curved, occasionally forming a nearly complete volution; sides flattened, so that in the elongate forms each valve is roof-like in section. The thickness (or depth) of the valves increases with age, and in old individuals the shell becomes very thick and possesses a vesicular structure. Umbones small, with a slight or moderate posterior curvature. A posterior wing or ear is usually present, and is of small or moderate size when the attached surface is small, but of large size when the attached surface is large and mainly posterior to the umbo. A small anterior wing is often present, and is best developed in specimens which have a small attached surface. When the attached surface is small or narrow the shell becomes elongate, but when the attached surface is large and broad the shell becomes rounded or oval instead of elongate, and then the posterior ear is usually not distinctly defined.

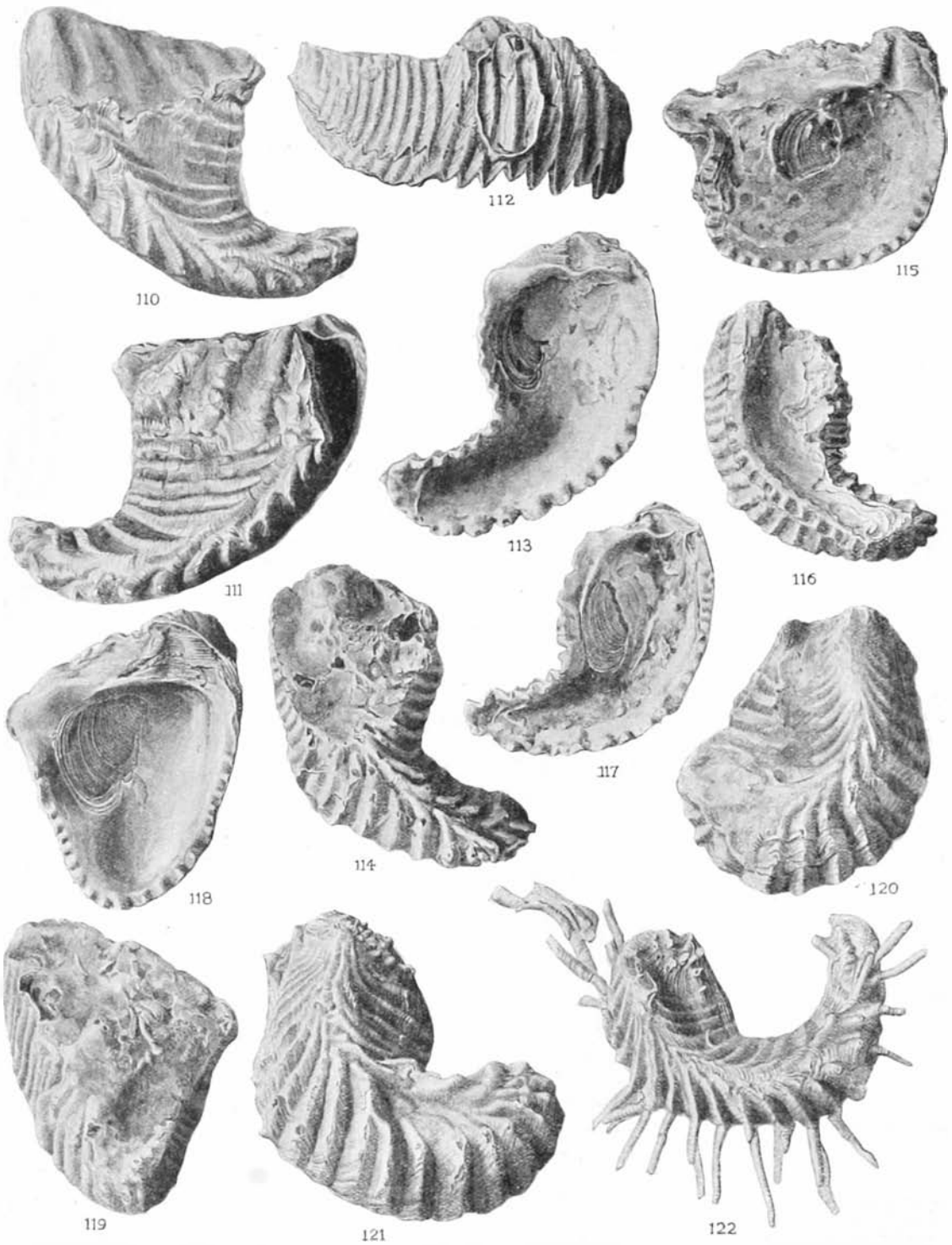


FIGS. 98–109.—*Ostrea diluviana*, L98, 99. Claxby Ironstone, Goulsby. Bristol Museum. Left valve and anterior view. 100–102, Lower Greensand, Atherfield. Museum of Practical Geology, Nos. 25802, 25790, 25795. Right valves and anterior view. 103, Crackers, Atherfield. Same museum, No. 25793. Right valve. 104, 105, Lower Greensand, Upware. Sedgwick Museum. Interior and exterior of a left valve. 106–108, Lower Greensand, Faringdon. 106, 107, Bristol Museum. Left valve. 108, Mr. Treacher's Collection. Right valve. 109, Ferruginous Sands, Shanklin. Sedgwick Museum. Right valve. All × ⅓.

Valves with strong, usually angular folds which, in the elongate forms, extend from the median line to the margin; the folds are usually somewhat curved, but may be almost straight; the amount of their curvature decreases in passing from the earlier to the later part of the shell. The margins of the two valves interlock by means of sharply pointed tooth-like projections formed by the interspaces between the folds. On the median ridge of the valves the folds are usually irregular, and may bear on each side of the ridge short spines; near the margins of the valves long tubular outgrowths occur in some specimens. The number and size of the folds vary considerably in different individuals; often the later folds are stronger than the earlier ones, and those on the convex side stronger than those on the concave side. The part of the right valve near the umbo is smooth and without folds so long as the corresponding part of the left valve is attached; this portion is commonly small, but becomes extensive when the attached surface of the left valve is large, and then the folds are limited to the relatively small marginal part of the valves. The triangular ligament-pit may be slightly or considerably curved. The adductor impression is oval, and usually not far from the hinge-line.

Affinities.—The examples of this species found in the Lower Cretaceous have been named *O. rectangularis*, Römer, and *O. macroptera*, Römer. Pictet and Campiche, de Loriol, and Weerth regard *O. macroptera* as distinct from *O. rectangularis*, and state that the former differs from the latter principally in the relatively smaller height of the shell, the larger posterior wing, and the larger ribs. D'Orbigny, Maas and Wollemann, on the other hand, consider that the two forms cannot be separated. The last author, after studying a large collection of specimens, states that the height of the shell depends mainly on the age of the individual; that the size of the posterior wing varies greatly, being in some cases quite small, in others very large, and between the two extremes every gradation may be found. The size of the ribs likewise varies. The study of numerous English specimens leads me to endorse Wollemann's view. Pictet and Campiche figured as *O. macroptera* a small example from the Lower Greensand of Atherfield, but larger specimens from the same horizon possess a higher shell like *O. rectangularis*, and cannot be separated from *O. macroptera*.

The examples found in the Lower Cretaceous deposits have been generally regarded as distinct from those in the Upper Cretaceous, which in this country have been usually named *O. frons* or *O. carinata*. The principal distinction is said to be the larger posterior wing in the Lower Cretaceous form. But the study of a large series of specimens shows that in both the Upper and the Lower Cretaceous the size of the wing varies greatly, as well as the height and curvature of the shell, and the number and coarseness of the ribs. As a rule, however, the posterior wing is better developed in the Lower than in the Upper Cretaceous examples,



FIGS. 110-122.—*Ostrea diluviana*, L. Sedgwick Museum, except 120, 121. 110, 111, Lower Greensand, Upware. Left and right valves. 112-119, Lower Greensand, Faringdon. Left valves. 112-114, anterior, interior and exterior of a left valve. 116, 117, interior and exterior of a left valve. 118, 119, interior and exterior of a left valve. 120, 121, zone of *Pecten asper*, Devizes. Museum of Practical Geology, Nos. 25814, 25812. 120, right valve. 121, left valve. 122, Chalk Marl, Folkestone. Left valve. All × $\frac{5}{6}$.

but in some of the former it is small,[1] while in some of the latter it attains a large size (fig. 123), and such specimens are indistinguishable from *O. macroptera*. It seems, therefore, that no line can be drawn between *O. macroptera* and the Upper Cretaceous forms, especially since it is found that the size of the wing is directly related to that of the attached surface of the left valve which was almost certainly determined by external conditions. When the attached surface is large and mainly posterior to the umbo, then the *macroptera* type with a large wing arises.

The examples of this species (here known as *O. diluviana*, L.), found in the Upper Cretaceous deposits, have received numerous names, of which the principal are *O. pectinata*, Lamarck, *O. carinata*, Lamarck, *O. colubrina*, Lamarck, *O. frons*, Parkinson, *O. serrata*, Brongniart, *O. prionota*, Goldfuss, *O. Milletiana*, d'Orbigny, *O. Ricordeana*, d'Orbigny, *O. Zeilleri* (Bayle). In the Upper Cretaceous of England this species is not known to occur above the zone of *Holaster subglobosus* and has been usually named *O. frons* or *O. carinata*, but on the continent of Europe and in other parts of the world it is represented in the higher parts of the Chalk. D'Orbigny and Coquand, believing in the principle that specimens found at different horizons belong to different species, have regarded as distinct forms the following amongst others: *O. Milletiana* from the Gault, *O. carinata* from the Cenomanian, *O. pectinata* (*O. frons*) from the Lower Senonian, *O. serrata* from the Upper Senonian. But later authors have found the greatest difficulty in distinguishing these "species." An examination of a large number of specimens, even when collected from one locality and one horizon only, shows that the shell is extraordinarily variable, and that every gradation is found between the different types; apart from variation in the number and size of the ribs, the curvature of the shell, etc., there are differences which are obviously due to the size, shape and position of the attached surface. Similar modifications occur at all horizons, and it seems impossible to separate as distinct species the forms found at different levels. Sometimes at one locality or in one kind of deposit a particular form of the shell may be more common than others, and may, if only a small number of specimens are available, give the impression of being a distinct species, but whenever a large collection is made other varieties are found which make it impossible to regard as a species the form which at first sight appeared to be distinct. The difficulty of separating these supposed species is shown by the fact that although d'Orbigny states that *O. frons* is characteristic of the Senonian, yet he includes in his synonymy the specimens figured by Sowerby from the Upper Greensand and Chalk Marl. Similarly, in quoting foreign examples of a "species," authors have sometimes unconsciously cited them from horizons in which they believed the species did not occur.

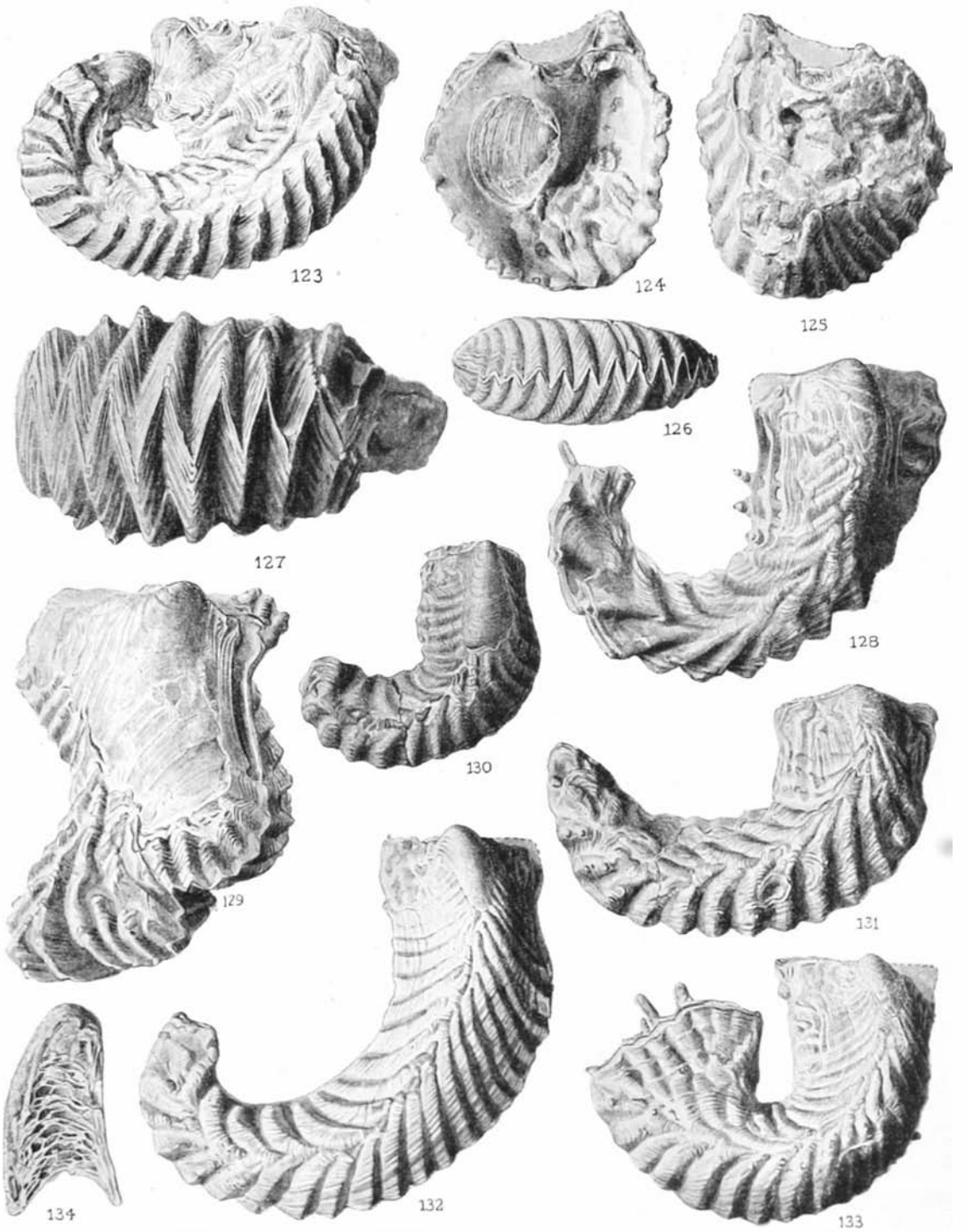
[1] See, for example, a specimen from the Lower Greensand of Faringdon (figs. 106, 107), in which the left valve was attached to a long narrow object, and the posterior wing is not developed.

Peron (1908) has already recognised that these "species" cannot be accepted. He states that the detailed analysis of the characters attributed to each of the species and the study of their synonymy shows that the *enchaînement* of these diverse forms is complete, and that usually the difference of names corresponds only to difference of stratigraphical horizon.

The form found in the Gault, which was named *O. Milletiana* by d'Orbigny, is considered by Pictet and Campiche to be identical with *O. carinata* of Sowerby from the Upper Greensand and Chalk Marl, which, as already mentioned, is included by d'Orbigny in *O. frons* of the Senonian. Pictet and Campiche quote *O. Milletiana* from the Cambridge Greensand, but this is included by Jukes-Browne in *O. frons*.

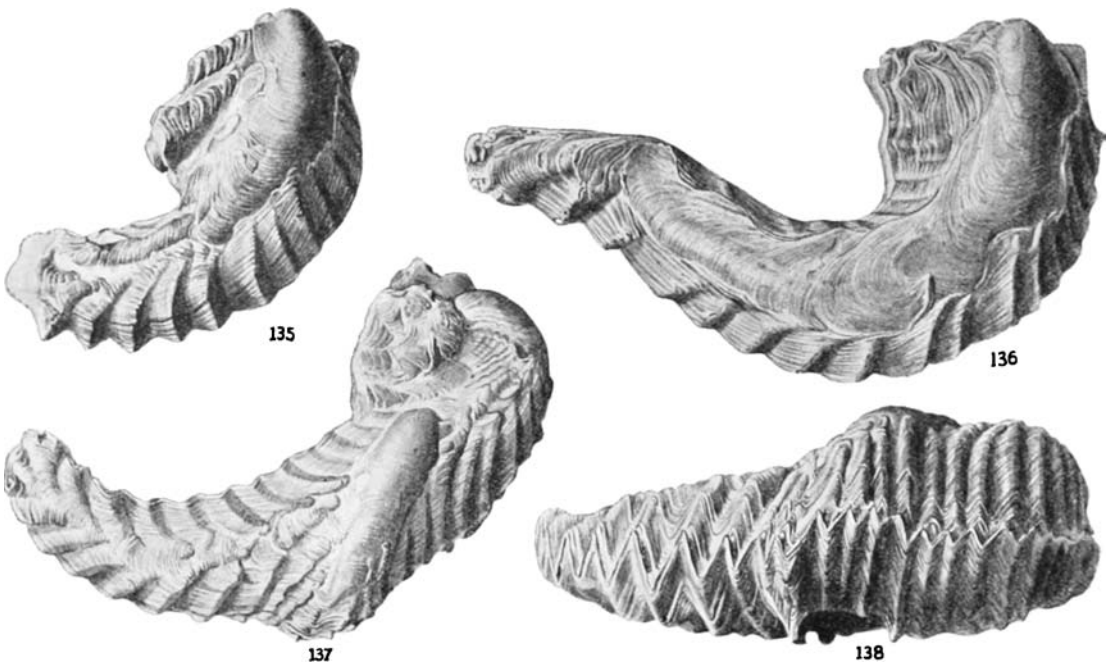
O. diluviana, Linnæus, from the Upper Chalk of Sweden, was figured first by Nilsson, and more recently other figures of Swedish specimens have been given by Hennig (1897). D'Orbigny and Coquand recognised that the specimens figured by Nilsson as *O. diluviana* could not be separated from *O. frons*, and the same view is held by Brauns, Lundgren, and Hennig. The two last-named authors state that Nilsson's figures certainly represent Linnæus' species, and Brauns also takes them as types of *O. diluviana*, but excludes the figures given by d'Orbigny, Coquand, Goldfuss and Geinitz. D'Orbigny, on the other hand, takes Hisinger's figure of a specimen from the Upper Chalk of Sweden as the type of Linnæus' *O. diluviana*, and excludes from that species the forms figured by Nilsson, which he regards as belonging to *O. frons*. The examples of *O. diluviana* figured by d'Orbigny, Coquand and Geinitz come from the Cenomanian. In *O. diluviana*, as understood by those authors, the shell is oval or rounded in form instead of being elongate as in the common forms of *O. frons*; at first sight it appears to be quite distinct, and being easily recognisable it has been commonly regarded as a separate species,[1] but Lundgren and Hennig have found in the Swedish Chalk a large number of intermediate forms which link together *O. diluviana* as interpreted by d'Orbigny and *O. diluviana* as figured by Nilsson and Hennig, consequently these two types cannot be any longer regarded as distinct species. Geinitz, although keeping the forms distinct, nevertheless recognises in the Cenomanian of Saxony the existence of intermediate forms, and the same fact is shown by Goldfuss' figures. An oval or rounded form, closely resembling *O. diluviana* as understood by d'Orbigny, is found in the Lower Greensand of Faringdon (figs. 115, 118, 119), and is certainly inseparable from the common elongate form which has been usually named *O. macroptera*; similar remarks apply to a rounded form found occasionally in the Upper Greensand and Chalk Marl of England (figs. 124, 125).

[1] H. Douvillé places this in the "genus" *Lopha* (= *Alectryonia*), and refers the elongate forms (*frons*, *carinata*, etc.) to the "genus" *Arctostrea*. See 'Bull. Soc. géol. de France,' ser. 4, vol. x (1910), pp. 636, 637.



Figs. 123–134.—*Ostrea diluviana*, L123, zone of *Schlœnbachia rostrata*, Devizes. Museum of Practical Geology, No. 25820. Right valve. 124, 125, Upper Greensand, Sidmouth. British Museum, L3326. Left valve. 126–130, Chalk Marl, Folkestone. Sedgwick Museum. 126, anterior view. 128–130, right valves. 127, anterior view of 128. 131–133, Base of Chalk Marl, Haslingfield. Sedgwick Museum. Right valves. 134, Cenomanian Sandstone, Wilmington. Sedgwick Museum. Vertical section of left valve. All × $\frac{2}{3}$.

So that this type occurs at three horizons: Aptian, Cenomanian, and Senonian, and its features are obviously due to the large size and rounded form of the attached surface; the shell was attached for such a long period that when it eventually grew free it was unable to develop its usual elongate form, and its ultimate outline was only a little different from that of its attached surface. The coarseness of the ribs varies in the same way as in the elongate forms. In some places, as, for instance, in the Cenomanian of Gamighügel in Saxony, the shell attains a great thickness, but the elongate forms likewise sometimes become very thick.



FIGS. 135–138.—*Ostrea diluviana*, L135, zone of *Holaster subglobosus*, Cherry Hinton. Right valve. 136–138, Base of Chalk Marl, Haslingfield, Cambs. 136, 137, Right valves. 138, anterior view of 137. Sedgwick Museum. All × $\frac{1}{2}$.

O. santonensis, d'Orbigny, and *O. carantonensis*, d'Orbigny, are similar to d'Orbigny's *O. diluviana*, and are included by Geinitz in that species.

Remarks.—The shell varies greatly in its curvature, some examples being only slightly bent, while others form almost a complete volution (fig. 123), and between these extremes every gradation is found. The variation in the coarseness of the ribs seems, in some cases at any rate, to be connected with the nature and depth of the sea-floor on which the individuals lived; for example, most of the specimens found in the Chalk Marl have coarse ribs, but those found in the Cenomanian sandstone of Wilmington in Devon have smaller and more numerous ribs. Occasionally folds or ribs are developed on the posterior ear (fig. 135). The long regular outgrowths from the margin of the valves (fig. 122) occur in specimens

from the Chalk Marl, and were no doubt developed for the purpose of fixation in the soft sediment of the sea floor.

In all cases the right valve starts with a smooth stage, and folds are developed later. The smooth stage corresponds with the attached surface of the left valve, since folding does not begin until the margin of that valve grows free from the rock or body to which the shell is fixed. Occasionally, after folding has gone on for some time, a second smooth stage appears on the right valve; this is due to the left valve becoming again attached to a foreign body (fig. 137).

Types.—*O. diluviana*, L., from the Senonian of Sweden. *O. pectinata*, Lamarck, is said to have come from near Dreux (Eure-et-Loire). *O. carinata*, Lamarck, from Carry (Seine-Inférieure). *O. frons*, Parkinson, from France; the locality and horizon are unknown, and the specimen cannot now be found. *O. carinata*, Sowerby, from the Upper Greensand of Chute Farm, near Longleat Park, and from the Chalk Marl of Folkestone, are in the British Museum. *O. serrata*, Cuvier and Brongniart, came from Dreux. *O. macroptera*, Sowerby, from the Lower Greensand of Folkestone, is in the British Museum. *O. retusa*, Sowerby, from the Lower Greensand of Atherfield, cannot be traced.

Distribution.—Claxby Ironstone (zone of *Belemnites lateralis*) of South Willingham. Tealby Limestone (zone of *Belemnites brunsvicensis*) of North Willingham, Lincolnshire. *Perna*-bed of Atherfield. Ferruginous Sands of Atherfield and Shanklin. Recorded by Topley from the Sandgate Beds and Folkestone Beds of Folkestone. Lower Greensand of Faringdon, Brickhill, Potton and Upware.

Upper Gault of Folkestone. Cambridge Greensand. Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown, Devizes, Warminster and Ventnor. Upper Greensand (zone of *Pecten asper*) of Devizes. Chalk Marl (zone of *Schlœnbachia varians*) of Ventnor, Folkestone, Haslingfield, Burwell, etc. Cenomanian Sandstone of Wilmington. Cenomanian (Meÿer's Bed 12) of Dunscombe. Zone of *Holaster subglobosus* of Cherry Hinton and Burwell.

OSTREA LEYMERII, *Leymerie* [ex Deshayes], 1842. Text-figs. 139, 140.

1842.	OSTREA LEYMERII, [Deshayes, MS.],	*A. Leymerie.*	Mém. Soc. géol. de France, vol. v, pp. 11, 28, pl. xiii, fig. 4.
1845.	—	— *E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 250.
1843.	—	— *A. Leymerie.*	Statist. géol. min. de l'Aube, Atlas, pl. vii, fig. 2.
1847.	—	— *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 704, pl. cccclxix, figs. 1—3.
1850.	—	— *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 108.
1854.	—	LEYMERIEI, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 173.

1855. Ostrea Leymerii, *G. Cotteau.* Moll. Foss. de l'Yonne, p. 122.
1860. — — *A. Gaudry.* Bull. Soc. géol. de France, ser. 2, vol. xvii, p. 30.
? 1861. — — *P. de Loriol.* Anim. Invert. Foss. Mt. Salève, p. 112.

Fig. 139.—*Ostrea Leymerii*, Leym. *Mammillatus*-bed, Okeford Fitzpaine. British Museum, No. L11597. Right valve. × ⅓.

1869. — — *H. Coquand.* Mon. Ostrea, Terr. Crét., p. 179, pl. lxx, figs. 14—17; pl. lxxi, figs. 6, 7.
— — Leymeriei, *P. de Loriol and V. Gillieron.* Urgon. Infér. du Landeron, p. 27.
1871. — Leymerii, *F. J. Pictet and G. Campiche.* Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 296, pl. cc, figs. 1, 2.

1878. Ostreum Leymeriei, *E. Bayle*. Explicat. Carte géol. de France, vol. iv, Atlas, pt. 1, pl. cxxx, figs. 1, 2.

1897. Ostrea Leymeriei, *R. B. Newton*. Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 73, pl. i, fig. 3.

Description.—Shell large, very thick in old specimens, higher than long; usually slightly or only moderately inequilateral; outline ovate, oval, subtrigonal or subquadrate. Left valve slightly or moderately convex; right valve often flattened. Umbonal part sometimes narrow, sometimes broad. Umbo straight or

Fig. 140.—*Ostrea Leymerii*, Leym. *Mammillatus*-bed, Okeford Fitzpaine. British Museum, No. L. 11591. Interior of part of right valve. × ⅔.

slightly curved; area large, high. Surface of valves sometimes smooth, except for growth-lamellæ, sometimes with radial folds. Attached surface of variable size.

Affinities.—This species seems to be related to *O. Germaini*, Coquand. It also, as de Loriol pointed out, shows some resemblance to some forms of *Exogyra sinuata* in which the umbo is only slightly curved; but whether it has any real relationship to that species cannot at present be determined. See also *O. cunabula* (below).

Type.—From the Barremian of Aube.

Distribution.—Hythe Beds of Aylesford, Kent. *Mammillatus*-bed of Okeford Fitzpaine, Dorset. Recorded by Fitton from the *Perna*-bed and Ferruginous Sands of Atherfield. Recorded by Topley from the Atherfield Beds of Peasmarsh and Sevenoaks.

OSTREA CUNABULA, *Seeley*, 1861. Text-figs. 141, 142.

1861. OSTREA CUNABULA, *H. G. Seeley*. Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 117, pl. v, fig. 1.
— — LAGENA, *Seeley*. Ibid., p. 117, pl. v, fig. 2.

Description.—Shell higher than long, either nearly equilateral or slightly or

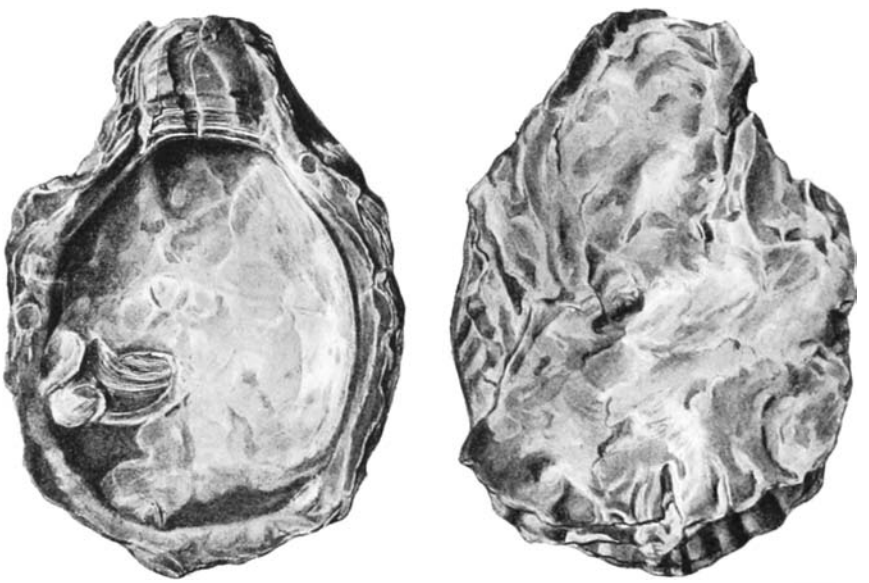


FIG. 141.—*Ostrea cunabula*, Seel. Cambridge Greensand (base of Chalk Marl). Sedgwick Museum. Cambridge. The type of *O. lagena*, Seel. Interior and exterior of left valve. × $\frac{3}{4}$.

moderately inequilateral; when nearly equilateral the outline is often ovate or oval.

Left valve with the attached surface either small and near the umbo only, or large—sometimes extending to the greater part of the valve; in the former case the valve is very convex, in the latter slightly convex or flattened. Umbonal part usually narrow and pointed. Area large, usually higher than long; sometimes in the plane of the valves and nearly symmetrical; in other cases curving inwards, outwards or backwards. Surface usually with numerous, rounded, radiating ribs crossed by growth-ridges. Adductor impression deep, near the posterior margin, oval or more or less quadrate. Right valve nearly flat, with growth-lines only.

Affinities.—*O. cunabula* is closely allied to and may be only a variety of

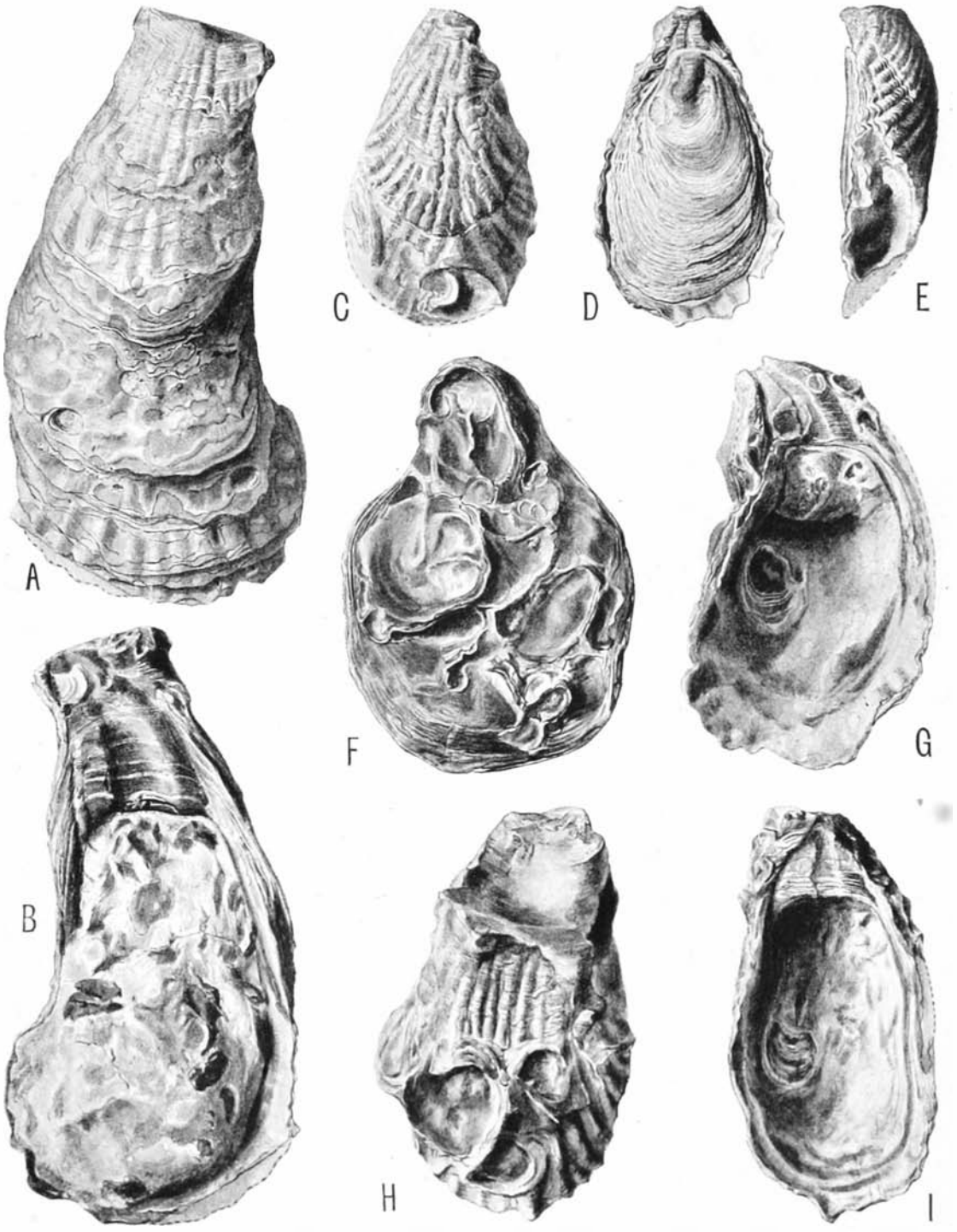


Fig. 142.—*Ostrea cunabula*, Seel. Cambridge Greensand (base of Chalk Marl). A, B, British Museum, No. 67740. C–I, Sedgwick Museum. A, B, left valve. C, left; D, right valve; E, anterior view of C, D. F, right valve with other oysters on the surface. G, left valve. H, I, exterior and interior of a left valve. All × ⅓.

O. Leymerii, from which it appears to differ in its somewhat smaller ribs. The forms with a small surface of attachment resemble *O. haissunensis*, Böhm,[1] but have coarser and less regular ribs. *O. lagena*, Seeley (fig. 141), is a form of *O. cunabula* with a very large attached surface, and consequently a less convex left valve.

Types.—From the Cambridge Greensand (indigenous). The type of *O. lagena* is in the Sedgwick Museum, Cambridge; the type of *O. cunabula* cannot be found, but other specimens named by Seeley are in the Sedgwick Museum.

Distribution.—Cambridge Greensand (base of Chalk Marl), Cambridge. Chalk Marl of Burwell.

OSTREA WALKERI, *Keeping*, 1883. Plate LV, figs. 1—3.

1883. OSTREA WALKERI, *W. Keeping*. Foss., etc., Neoc. Upware and Brickhill, p. 103, pl. iv, fig. 4.

Remarks.—This form is similar to *O. Germaini* and *O. Leymerii*; the chief difference mentioned by Keeping—the inequality of the valves—is not constant, and is determined by the size of the attached surface. Harbort regards *O. Walkeri* as a synonym of *O. Germaini*, Coquand,[2] but the material available is hardly sufficient for definite determination. Some of the specimens with a large attached surface resemble *O. Osmana*, Wollemann.[3]

Type.—In the Sedgwick Museum, Cambridge.

Distribution.—Lower Greensand of Upware.

OSTREA VESICULARIS, *Lamarck*, 1806. Plate LV, figs. 4—9. Text-figures. 143—182.

1779. — *B. Faujas-St.-Fond.* Hist. nat. Mte. St. Pierre de Maestricht, pl. xxii, fig. 4; pl. xxv, figs. 2, 5.

1806. OSTREA VESICULARIS, *Lamarck*. Ann. Mus. Hist. nat., vol. viii, p. 160, and vol. xiv (1809), p. 375, pl. xxii, fig. 3.

— — DELTOIDEA, *Lamarck*. Ibid., p. 160; vol. xiv (1809), p. 374, pl. xxi, fig. 3 (non *deltoidea*, Sowerby).

1816. — , *W. Smith*. Strata identif. Organised Fossils, p. 7, pl. iii, figs. 5—7.

1819. — VESICULARIS, *Lamarck*. Animaux sans Vert., vol. vi, p. 219.

1820. — CONVEXA, *T. Say*. Amer. Journ. Sci., vol. ii, p. 42.

[1] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. li (1899), p. 466, pl. xxix, figs. 1—3.

[2] Coquand, 'Mon. Ostrea, Terr. Crét.' (1869), p. 191, pl. lxvi, figs. 14—16. Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 5, 1871), p. 295, pl. clxxxix, figs. 1—6. Wollemann, 'Bivalv. u. Gastrop. deutsch. u. holländisch. Neocoms' (1900), p. 18, pl. i, fig. 4. Harbort, 'Fauna Schaumburg-Lippe'schen Kreidemulde' (1905), p. 28.

[3] Op. cit. (1900), p. 19, pl. i, fig. 5, pl. ii, fig. 1.

1822. Ostrea vesicularis, *A. Brongniart.* In Cuvier, Ossemens Foss., vol. ii, p. 598, pl. iii, fig. 5.

1823. Gryphæa globosa, *J. de C. Sowerby.* Min. Conch., vol. iv, p. 127, pl. cccxcii.

1827. Ostrea vesicularis, *S. Nilsson.* Petrific. Suecana, p. 29, pl. vii, figs. 3—5; pl. viii, figs. 5, 6.

— — hippopodium, *Nilsson.* Ibid., p. 30, pl. vii, fig. 1.

— — clavata, *Nilsson.* Ibid., p. 30, pl. vii, fig. 2.

1828. Gryphæa convexa, *S. G. Morton.* Journ. Acad. Nat. Sci. Philad., vol. vi, p. 79, pl. iv, figs. 1, 2.

— — mutabilis, *Morton.* Ibid., p. 81, pl. iv, fig. 3.

1832. — expansa, *J. de C. Sowerby.* In Sedgwick and Murchison, Trans. Geol. Soc., ser. 2, vol. iii, pp. 349, 418, pl. xxxviii, fig. 5.

— Ostrea vesicularis, *G. P. Deshayes.* Hist. nat. Vers et Mollusques (Encycl. méthod.), vol. ii, p. 291.

1833. — — *A. Goldfuss.* Petref. Germ., vol. ii, p. 23, pl. lxxxi, fig. 2.

— — hippopodium, *Goldfuss.* Ibid., p. 23, pl. lxxxi, fig. 1.

1834. Gryphæa convexa, *S. G. Morton.* Synopsis Org. Remains Cret. U. States, p. 53, pl. iv, figs. 1, 2.

— — mutabilis, *Morton.* Ibid., p. 53, pl. iv, fig. 3.

? 1835. Pycnodonte radiata, *G. Fischer de Waldheim.* Bull. Soc. Imp. Nat. Moscou, vol. viii, p. 119, pl. i.

1837. Ostrea vesicularis, *W. Hisinger.* Lethæa Suecica, p. 46, pl. xii, fig. 2.

— — hippopodium, *Hisinger.* Ibid., p. 47, pl. xiii, fig. 4.

— — clavata, *Hisinger.* Ibid., p. 47, pl. xiii, fig. 3.

— Gryphæa similis, *G. G. Pusch.* Polens Paläont., p. 34, pl. iv, fig. 12.

— Ostrea vesicularis, *A. d'Archiac.* Mém. Soc. géol. de France, vol. ii, p. 183.

? — — proboscidea, *d'Archiac.* Ibid., p. 184, pl. xi, fig. 9.

? — — vesicularis, *F. Dujardin.* Ibid., vol. ii, p. 229.

1838. Gryphæa vesicularis, *H. G. Bronn.* Lethæa Geogn., vol. ii, p. 264, pl. xxxii, fig. 1.

1842. — (Ostrea) vesicularis, *F. v. Hagenow.* Neues Jahrb. für Min., etc., p. 548.

1845. Gryphæa vesicularis, *H. B. Geinitz.* Grundr. d. Verstein., p. 483, pl. xx, figs. 17, 18.

1845. Ostrea vesicularis, *A. d'Orbigny.* In Murchison, de Verneuil and de Keyserling, Géol. Russie de l'Europe, vol. ii, p. 491.

1846. — — *A. Leymerie.* Statist. géol. min. de l'Aube, Atlas, pl. iv, fig. 1.

— — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 37, pl. xxix, figs. 21, 22; pl. xxx, figs. 1—8.

— hippopodium, *Reuss.* Ibid., p. 39, pl. xxviii, figs. 10—15, 17, 18 pl. xxix, figs. 1—18; pl. xxx, figs. 13, 14 (? *partim*).

1847. OSTREA HIPPOPODIUM, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 731, pl. cccclxxxi, figs. 4—6; pl. cccclxxxii.

" VESICULARIS, *d'Orbigny*. Ibid., p. 742, pl. cccclxxxvii.

" — *J. Müller*. Petref. der Aachen. Kreidef., pt. 1, p. 37.

" HIPPOPODIUM, *Müller*. Ibid., p. 39.

1849. GRYPHÆA GLOBOSA, *J. Brown*. Illustr. Foss. Conch. Great Britain and Ireland, p. 148, pl. lxi, fig. 2.

1850. — — *var.* DEPRESSA, *J. de C. Sowerby*, in *F. Dixon*. Geol. Sussex, p. 357, pl. xxvii, fig. 3.

— OSTREA SP., *Sowerby*. Ibid., p. 357, pl. xxviii, figs. 22, 23.

— GRYPHÆA VESICULARIS, *R. Kner*. Kreidemerg. v. Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 30.

— OSTREA VESICULARIS, *A. Alth*. Geogn.-palæont. Beschreib. v. Lemberg (ibid., vol. iii, pt. 2), p. 252.

? — — HIPPOPODIUM, *Alth*. Ibid., p. 253, pl. xiii, fig. 3.

— — VESICULARIS, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 256.

— — LESUEURI, *d'Orbigny*. Ibid., p. 171.

? 1851. — NILSSONI, *J. Müller*. Petrefact. Aachen. Kreideformat., pt. 2, p. 70.

— VESICULARIS, *A. Leymerie*. Mém. Soc. géol. de France, ser. 2, vol. iv, p. 202, pl. x, figs. 2, 3.

1851–2. GRYPHÆA VESICULARIS, *H. G. Bronn* and *F. Römer*. Lethæa Geogn., ed. 3, vol. ii, pt. 5, p. 264, pl. xxxii, fig. 1.

1852. — — *R. Kner*. Denkschr. Akad. Wissensch. Wien, Math.-nat. Cl., vol. iii, p. 319.

? — OSTREA VESICULARIS *var.* AUCELLA, *F. Römer*. Kreidebild. v. Texas, p. 74, pl. ix, fig. 4.

1854. — HIPPOPODIUM, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 173.

— — VESICULARIS, *Morris*. Ibid., p. 174.

1863. GRYPHÆA VESICULARIS, *K. E. Schafhäutl*. Süd-Bayerns Lethæa Geogn., p. 143, pl. xli, figs. 5, 6.

— OSTREA VESICULARIS, *A. v. Strombeck*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, pp. 127, 157.

1864. — VESICULOSA, *S. P. Woodward*. Geol. Mag., vol. i, p. 112, pl. v, fig. 6.

1865. — UNCINELLA, *A. Leymerie*. Bull. Soc. géol. de France, ser. 2, vol. xxii, p. 367.

1866. — (GRYPHÆA) VESICULARIS, *K. A. Zittel*. Bivalv. d. Gosaugeb. (Denkschr. Akad. Wissensch. Wien, Math.-nat. Cl., vol. xxv, pt. ii), p. 123 [47], pl. xix, fig. 6 (? *partim*).

1867. — VESICULARIS, *B. Lundgren*. Palæont. Iakttag. Fäxekalk. Limhamn, p. 23.

? — — — *O. Fraas*. Aus dem Orient, i, p. 88.

? 1868. — HIPPOPODIUM, *E. Eichwald*. Lethæa Rossica, vol. ii, p. 387, pl. xix, fig. 5.

— GRYPHÆA VESICULARIS, *Eichwald*. Ibid., p. 394.

1869. OSTREA VESICULARIS, *H. Coquand.* Mon. Ostrea, Terr. Crét., p. 35, pl. xiii, figs. 2—10.

— — HIPPOPODIUM, *Coquand.* Ibid., p. 100, pl. xviii, figs. 1, 4, 5; pl. xix; pl. xx, figs. 1—8.

— — LESUEURI, *Coquand.* Ibid., p. 146, pl. xli, figs. 1—4.

— — PROBOSCIDEA, *Coquand.* Ibid., p. 72, pl. xv, fig. 10; pl. xvi, figs. 1—12; pl. xviii, figs. 1—5.

— — VESICULARIS, *E. Favre.* Moll. Foss. de Lemberg, p. 160.

— — HIPPOPODIUM, *Favre.* Ibid., p. 161.

1870. — — — *F. Römer.* Geol. v. Oberschles., p. 315, pl. xxxvii, fig. 7.

— — VESICULARIS, *H. Credner.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxii, p. 225.

— — — — *C. Schlüter.* Neues Jahrb. für Min., etc., p. 952.

1871. GRYPHÆA VESICULARIS, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 465, pl. xlii, figs. 2—4; pl. xliii, fig. 1; pl. xlv, figs. 7—12.

1872. OSTREA HIPPOPODIUM, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 177, pl. xxxix, figs. 12—27; pl. xl, figs. 1—3; pt. 2, pl. viii, figs. 5—7.

1873. — VESICULARIS, *J. I. Lahusen.* Foss. White Chalk of Simbirsk (Imp. Russ. Min. Corps Instit.), pt. 2, p. 249.

— — — *var.* JUDAICA, *L. Lartet.* Annal. Sci. géol., vol. iii, p. 69, pl. xi, figs. 8—10.

1875. — — *A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. xxxi, p. 295 (*partim*).

? 1876. GRYPHÆA VESICULARIS (?), *F. B. Meek.* Invert. Cret. and Tert. Foss. U. Missouri, p. 20, pl. xi, fig. 2; pl. xvi, fig. 8.

— OSTREA HIPPOPODIUM, *D. Brauns.* Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 394.

1877. — — *A. Fritsch.* Stud. im Geb. böhmisch. Kreideformat., ii, Weissenberg. u. Malnitz. Schicht., p. 140, fig. 137.

? 1878. — VESICULARIS, *O. Fraas.* Aus dem Orient, ii, p. 86.

— — — *J. de C. Sowerby,* in *F. Dixon.* Geol. Sussex, ed. 2, p. 386, pl. xxvii, fig. 3.

— PYCNODONTA VESICULARIS, *E. Bayle.* Explic. Carte géol. France, vol. iv, Atlas, pt. 1, pl. cxxxv, figs. 1—7.

— PROBOSCIDEA, *Bayle.* Ibid., pl. cxxxvi, figs. 1, 2.

— OSTREA HIPPOPODIUM, *C. Barrois.* Ann. Soc. géol. Nord, vol. v, p. 407.

— — — *G. Behrens.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxx, p. 260.

1881. AVICULA FILATA, *R. Etheridge,* in *Penning* and *Jukes-Browne.* Geol. Cambridge, p. 144, pl. ii, fig. 3.

? 1882. OSTREA *cf.* HIPPOPODIUM, *R. Windmöller.* Jahrb. d. k. preuss. geol. Landesanst., für 1881, p. 29.

1882. GRYPHÆA VESICULARIS, *H. Schröder.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 259.
— OSTREA HIPPOPODIUM, *Schröder.* Ibid., p. 259.
1883. — — *A. Fritsch.* Stud. im Geb. böhmisch. Kreideformat., iii, Iserschicht., p. 122, fig. 98.
1884. GRYPHÆA VESICULARIS, *C. A. White.* 4th Ann. Rep. U. S. Geol. Survey, p. 303, pl. xlviii, figs. 1—5.
1885. — — *R. P. Whitfield.* Brach. and Lamellibr. Raritan Clays (Mon. U. S. Geol. Surv., vol. ix), p. 36, pl. iii, figs. 15, 16; pl. iv, figs. 1—3; pl. v.
1888. — — *G. Müller.* Jahrb. d. k. preuss. geol. Landesanst., für 1887, p. 401.
— OSTREA VESICULARIS, *A. Peron.* Hist. Terr. Craie S.E. Bassin Anglo-Parisien, p. 179.
1889. — (GRYPHÆA) VESICULARIS, *O. Griepenkerl.* Palæont. Abhandl., vol. iv, p. 37.
— — HIPPOPODIUM, *E. Holzapfel.* Die Mollusk. Aachen Kreide (Palæontographica, vol. xxxv), p. 252, pl. xxix, figs. 3—7.
— GRYPHÆA VESICULARIS, *Holzapfel.* Ibid., p. 253, pl. xxix, figs. 1, 2.
1890. — — *M. Blanckenhorn.* Beitr. Geol. Syriens, p. 75.
1890–91. OSTREA HIPPOPODIUM, *A. Peron.* Brachiopodes etc., Terr. Crét. Hauts-Plateaux de la Tunisie, p. 152.
— — VESICULARIS, *Peron.* Ibid., p. 175.
? 1891. GRYPHÆA VESICULARIS, *J. Böhm.* Palæontographica, vol. xxxviii, p. 91, pl. iv, fig. 3.
— OSTREA HIPPOPODIUM, *Böhm.* Ibid., p. 92, pl. iv, fig. 12.
1892. — — *E. Stolley.* Mittheil. a. d. Min. Institut. Univ. Kiel, vol. i, p. 235.
— GRYPHÆA VESICULARIS, *Stolley.* Ibid., p. 236.
— OSTREA VESICULARIS, *F. Vogel.* Verhandl. nat. Vereins preuss. Rheinl., vol. xlix, p. 51.
1894. — — *A. Hennig.* Geol. Fören. i Stockholm Förhandl., vol. xvi, p. 513.
— HIPPOPODIUM, *Hennig.* Ibid., p. 514.
— VESICULARIS, *B. Lundgren.* Mollusk. i *Mammillatus* och *Mucronata* zonerna, p. 35.
— — HIPPOPODIUM, *Lundgren.* Ibid., p. 36.
1895. — (GRYPHÆA) VESICULARIS, *F. Vogel.* Holländisch. Kreide, p. 7.
— — HIPPOPODIUM, *Vogel.* Ibid., p. 7.
— (GRYPHÆA) HIPPOPODIUM, *E. Tiessen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 464.
? — GRYPHÆA VESICULARIS, *J. F. Whiteaves.* Trans. Roy. Soc. Canada, ser. 2, vol. i, p. 120.
1897. OSTREA HIPPOPODIUM, *A. Hennig.* Revis. Lamellibr. Nilsson's "Petrif. Suecana," p. 6, pl. i, figs. 1—6, 8, 9.
— — VESICULARIS, *Hennig.* Ibid., p. 18.
— — HIPPOPODIUM, *R. Leonard.* Palæontographica, vol. xliv, p. 51.

1897. GRYPHÆA VESICULARIS, *F. Nötling.* U. Cret. (Mæstrichtian) Mari Hills (Palæont. Indica, ser. xvi, vol. i), p. 39, pl. x, figs. 1, 2.

— OSTREA VESICULARIS, *A. Rutot.* Bull. Soc. Belge Géol. Pal. et Hydrol., vol. x, p. 26.

— — HIPPOPODIUM, *Rutot.* Ibid., p. 26.

1898. — — *G. Müller.* Molluskenfauna Untersen. v. Braunschweig u. Ilsede, p. 14, pl. iii, figs. 10—15; pl. iv, figs. 1, 2.

1899. — — *G. de Alessandri.* Palæontogr. Italica, vol. iv, p. 200.

— OSTREA HIPPOPODIUM, *Alessandri.* Ibid., p. 199.

1900. OSTREA (GRYPHÆA) VESICULARIS, *C. Mayer-Eymar.* Eclogæ Geol. Helvet., vol. vi, p. 121.

1901. GRYPHÆA VESICULARIS, *A. Wollemann.* Jahrb. d. k. preuss. geol. Landesanst., vol. xxi, p. 14.

1901. GRYPHÆA VESICULARIS, *H. Imkeller.* Palæontographica, vol. xlviii, p. 40, pl. ii, figs. 2—4; pl. iii, figs. 7—9.

1901–02. OSTREA (PYCNODONTA) VESICULARIS, *P. Choffat.* Faun. Crét. Portugal, vol. i, ser. 3, p. 103, pl. ii, fig. 18.

1902. GRYPHÆA VESICULARIS, *A. Wollemann.* Lüneburg. Kreide (Abhandl. d. k. preuss. geol. Landesanst., N.F., 37), p. 52.

— OSTREA HIPPOPODIUM, *J. P. J. Ravn.* Mollusk. i Danmarks Kridtafl. I. Lamellibr., p. 114.

— GRYPHÆA VESICULARIS, *Ravn.* Ibid., p. 116.

— — — *J. Wanner.* Palæontographica, vol. xxx (2), p. 119, pl. xvii, figs. 10—12.

— — — *E. Dacqué.* Ibid., p. 188, pl. xxii, figs. 1, 2.

— — — *J. A. Taff.* Chalk of S. W. Arkansas (22nd Ann. Rep. U.S. Geol. Surv., pt. iii), pls. l—lii.

1903. OSTREA VESICULARIS, *R. Fortau.* Bull. Inst. Égyptien, ser. 4, vol. iv, p. 308.

? — GRYPHÆA VESICULARIS, *J. F. Whiteaves.* Mesoz. Foss. (Geol. Surv. Canada), vol. i, p. 401.

1904. PYCNODONTA VESICULARIS, *H. Douvillé.* Mission Scient. en Perse par J. de Morgan, vol. iii, pt. 4, Paléont., p. 278, pl. xxxvi, fig. 23.

1905. GRYPHÆA VESICULARIS, *T. Wegner.* Zeitschr. d. deutsch. geol. Gesellsch., vol. lvii, p. 184.

— OSTREA VESICULARIS, *A. D. Arkhangelsky.* Ann. géol. min. Russie, vol. vii, pp. 190, 205, pl. iv, figs. 1, 2.

1906. GRYPHÆA VESICULARIS, *E. Böse.* Fauna Senon. Cárdenas (Bol. Instit. geol. México, No. 24), p. 49, pl. iv, figs. 1—3; pl. vii, fig. 2; pl. ix, fig. 4; pl. xii, fig. 6.

1906. Ostrea (Gryphæa) vesicularis, *M. Boule* and *A. Thevenin*. Annal. Paléont., vol. i, p. 49 [7], pl. ii, fig. 3.

? — Gryphæa vesicularis, *J. Pethö*. Palæontographica, vol. lii, p. 188, pl. xii, figs. 2, 3.

1907. — convexa, *S. Weller*. Cret. Pal. New Jersey, p. 451, pl. xlv.

1910. — vesicularis, *F. Frech*. Neues Jahrb. für Min., etc., i, p. 6, pl. ii, fig. 1.

? — Ostrea vesicularis, *H. Brüggen*. Ibid., Beil.-Band xxx, p. 744.

1911. — hippopodium, *A. Fritsch*. Stud. im Geb. böhmisch. Kreideformat., Korycaner Schicht., p. 48, fig. 217.

? — Gryphea vesicularis, *M. E. Vadász*. Mitteil. Jahrb. ungarisch. geol. Reichsanst., vol. xix, p. 110, pl. iii, fig. 3.

— Ostrea hippopodium, *W. Rogala*. Bull. Internat. Acad. Sci. Cracovie, p. 167.

— — — *K. Vogel von Falckenstein*. Zeitschr. d. deutsch. geol. Gesellsch., vol. lxii, p. 558.

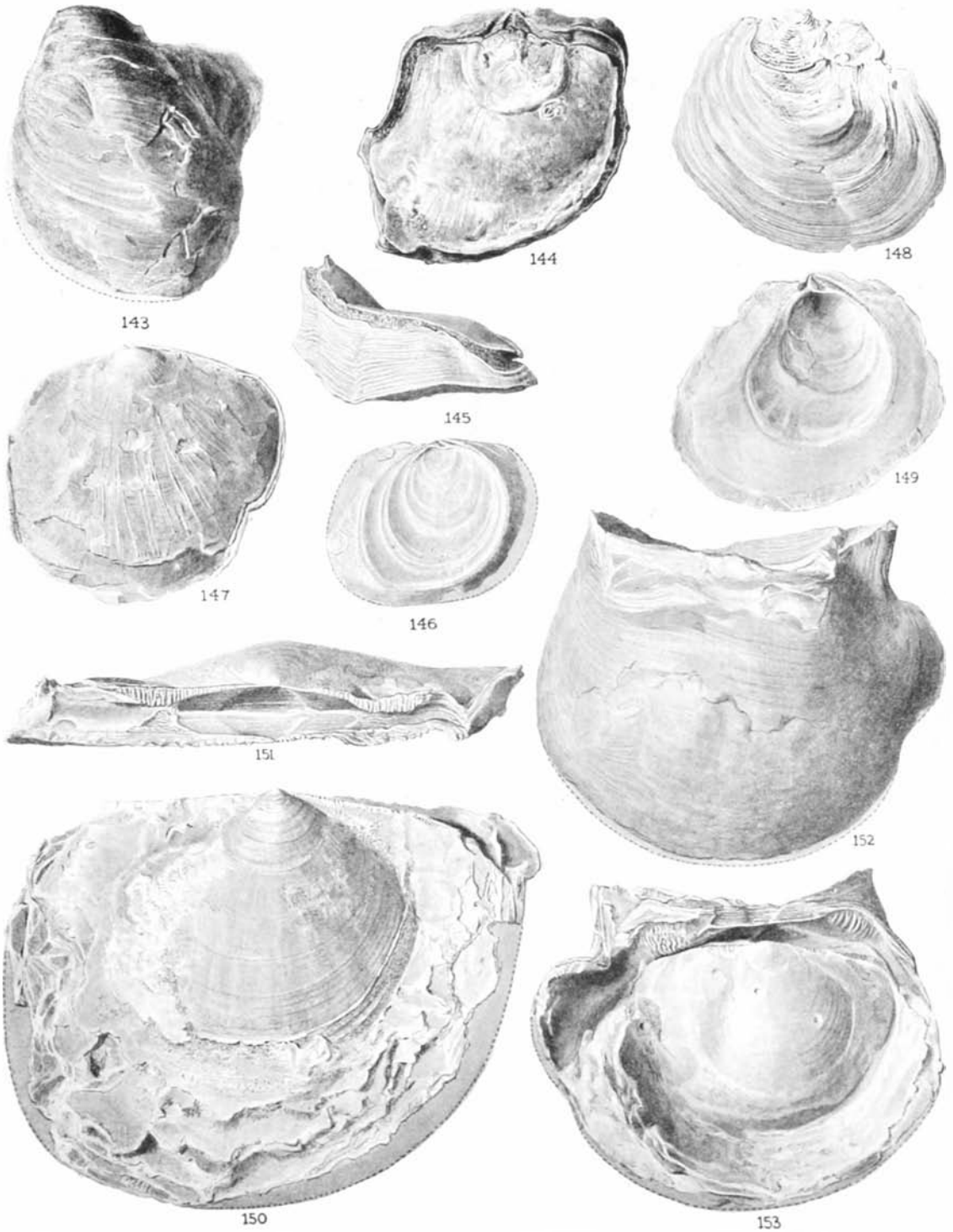
— Gryphæa vesicularis, *v. Falckenstein*. Ibid., p. 560.

Non 1859. Ostrea vesicularis, *T. Wiltshire*. Red Chalk of England (Geol. Assoc.), p. 16, pl. ii, fig. 5.

Description.—The *left* valve, when attached by only a very small part of the umbo, has a grypheate form, being usually very convex, and with the umbo prominent and incurved; the outline of the valve is rounded, but the posterior part is more or less produced; the postero-dorsal part is often convex and sometimes distinctly limited from the remainder of the valve; this convex part when strongly developed may be produced backwards in a wing-like form. In large specimens of the grypheate form this valve becomes very thick.

When the left valve is attached to a larger surface of more or less rounded outline it is still grypheate in form, but with the umbonal region truncated owing to the attached surface being flat or concave. When the attached surface is still larger, relatively to the entire shell, the free marginal part possesses the same character as the corresponding part of the grypheate form, and this free part grows upwards from the attached surface. When nearly all the valve is attached then only a narrow rim grows upwards at the margin; lastly, in some cases the entire valve is attached so that the whole of it is flat or concave; in the interior of such forms a few distinct concentric ridges are often found at intervals, and from the outermost of these the marginal part of the valve becomes gradually thinner and usually shows a porous structure.

When the left valve is attached to a cylindrical or other elongate object, the form of the shell depends on the direction of the long axis of the attached surface. If the axis is nearly perpendicular to or forms a considerable angle with the plane



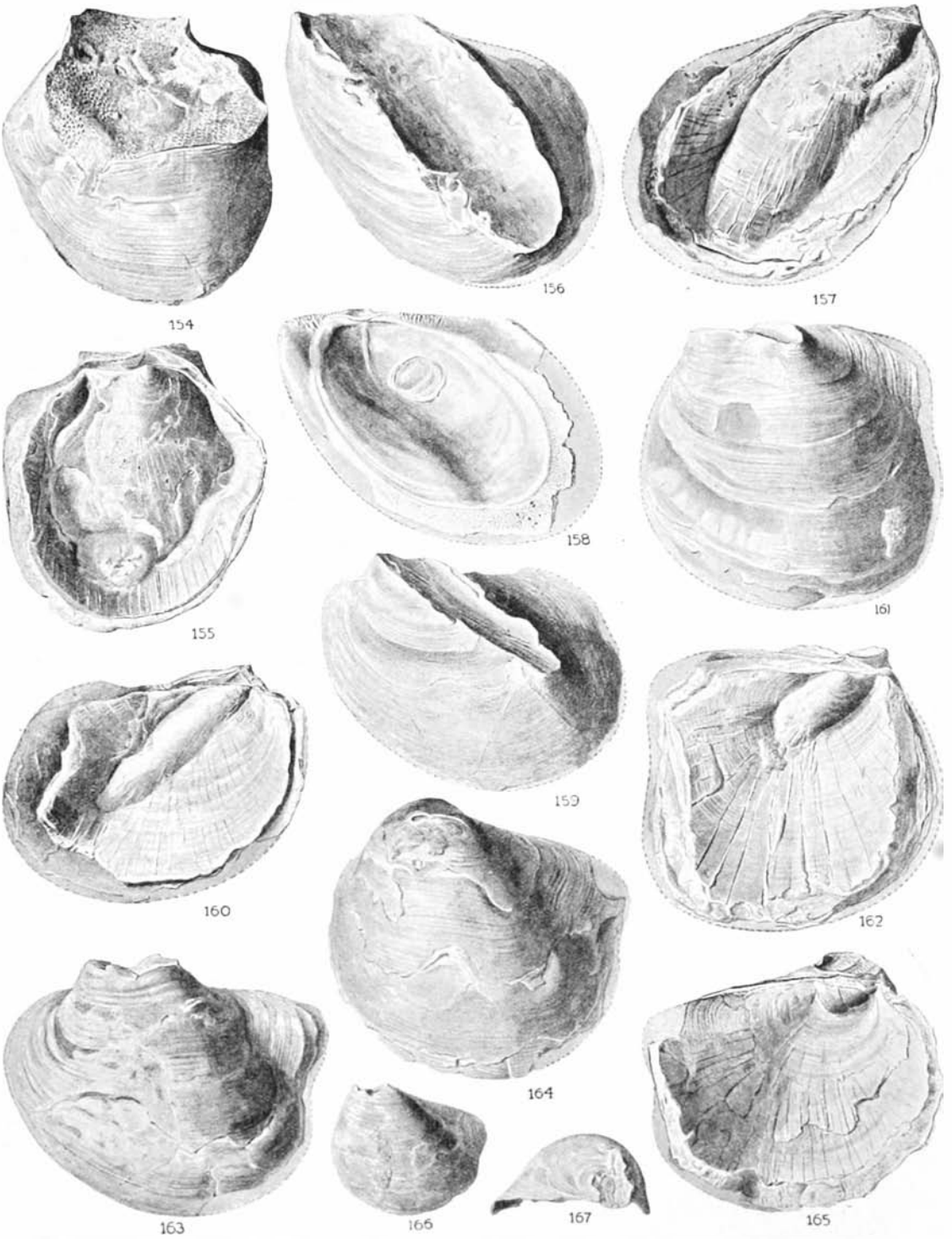
FIGS. 143–153.—*Ostrea vesicularis*, Lam. 143–145. Upper Greensand (zone of *P. asper*), Warminster. Museum of Practical Geology, Nos. 25948, 25950. 143, left valve. 144, right valve. 145, anterior view of 144 showing both valves. 146. Zone of *Micraster cor-anguinum*, Witherington, Dr. Blackmore's Collection. Interior of left valve. 147. Zone of *Actinocamax quadratus*, East Harnham. Same Collection. Right valve. The left valve is entirely attached to the convex surface of an echinoid. 148, 149. Zone of *Micraster cor-anguinum*, Gravesend. British Museum, No. L. 20991. Exterior and interior of a left valve. 150–153. Zone of *Belemnitella mucronata*, Norwich. 150, right valve, British Museum, No. L. 20616. 151, Dorsal view of 150 showing both valves; the left valve entirely attached to a nearly flat surface. 152, 153. Sedgwick Museum. Left and right valves. 146, 147, natural size. Other figures × $\frac{5}{6}$.

of the valves the left valve becomes convex; if the axis is more or less parallel to the plane of the valves and to the hinge-line the left valve is less convex; and if in such cases the attached surface is mainly in front of the umbo then the anterior part of the shell becomes elongated, whereas, when the attached surface is mainly posterior to the umbo the posterior part of the shell become elongated and the shell more inequilateral; if the long axis of the attached surface extends from the umbo in a postero-ventral direction the shell becomes oblique and very inequilateral. Occasionally the left valve shows two surfaces of attachment, one at the umbo, the other at some distance from it. Since the direction of growth depends mainly on the position of the attached surface, it is obvious that the relative length and height will be determined in the same way.

The surface of the free part of the left valve is smooth except for growth-lines. The form and direction of the umbo, area and ligament-pit depend on the mode of attachment. The area is either nearly parallel to the attached surface or slopes gently from the hinge-line to the umbo, and consequently in the grypheate forms it eventually becomes more or less nearly perpendicular to the plane of the valves of the adult shell, but in completely attached forms the area and ligament-pit remain nearly parallel to the plane of the valves; between these two extremes every gradation can be traced. The ligament-pit and the umbo may curve forwards or backwards, or be perpendicular to the hinge-line. Small, irregular, rounded ridges or crenulations, more or less nearly at right angles to the margin of the valve, are seen on the inside of the shell on each side of the area, but are most developed on the posterior side. The adductor impression is rounded or slightly oval.

The *right* valve in the grypheate form with a very small attached surface is almost entirely concave or sometimes nearly flat. The part of the right valve which corresponds to the attached part of the left valve is more or less convex, and reproduces the detailed markings as well as the general form of the attached surface; when the latter is flat the corresponding part of the right valve is only slightly convex, and its convexity increases with that of the attached surface. As soon as the left valve grows free from the attached body the corresponding part of the right valve becomes concave and grows upwards at a considerable angle with the earlier convex part. When the entire left valve is attached the whole of the right valve is slightly convex and there is no upward growth of the marginal part. When the outer layer of the right valve is well preserved fine thread-like radial ribs are seen; they are widely separated and either straight or slightly irregular. The inner margin near the area has small ridges like those of the left valve.

Affinities.—The study of a large series of specimens shows clearly that *Ostrea hippopodium*, Nilsson, is only a form of *O. vesicularis* in which the entire or almost the entire surface of the left valve is attached, and consequently that valve is



FIGS. 154–167.—*Ostrea vesicularis*, Lam. Zone of *Belemnitella mucronata*, Norwich. Sedgwick Museum, Cambridge; except 156, 157, in Dr. Rowe's collection. 154, 156, 159, 161, 163, 164, 166, left valves. 155, right valve of 154. 157, right valve of 156. 158, interior of a right valve similar to 157. 160, right valve of 159. 162, right valve of 161. 165, right valve of 164. 167, dorsal view of 166. 166 and 167, natural size. Other figures × $\frac{1}{6}$.

either nearly flat (fig. 151) or grows upward near the margin only (fig. 145), and the right valve is either slightly convex throughout (figs. 147, 150) or with a narrow marginal part growing upwards (fig. 155). Although this type differs greatly in appearance from the grypheate form (fig. 182), yet every stage between the two extremes can be seen since there is a complete gradation from forms in which the entire surface is attached to forms in which only a very small part of the umbo is fixed. But whatever the form of the shell the part, if any, which grows free shows similar characters. This view of the relationship of *O. hippopodium* and *O. vesicularis* has already been maintained by Peron (1890) and by Müller (1898).

In the Chalk of this country numerous examples of the left valve of an oyster attached completely to flat or convex objects are found and have been commonly referred to *O. Normaniana*, d'Orbigny[1] (fig. 146). The right valve is nearly always missing. The marginal part of the left valve thins away rapidly to a sharp edge and this part usually shows a porous structure, whilst on the inner part of the valve a few distinct concentric ridges are seen; some of these specimens are young individuals and many are probably immature; the concentric ridges probably indicate the beginning of an upward growth of the margin which was soon discontinued and the attached growth resumed. Similar concentric ridges are present in some undoubted examples of *O. vesicularis* (figs. 148, 149), and the identity of this form with *O. vesicularis* is proved by the occasional preservation in its original position of the right valve (Plate LV, fig. 4; text-fig. 147) showing the characteristic radial ornamentation of *O. vesicularis*. A left valve of this form is figured by Geinitz[2] as *O. hippopodium*.

Avicula filata, Etheridge, from the Totternhoe Stone (zone of *Holaster subglobosus*) of Burwell, is founded on a right valve of a small specimen of *O. vesicularis*, and shows clearly the fine radial ribs. It agrees with small specimens attached throughout or with only the margin free, found in the Upper and Lower Chalk as well as in the Gault[3] (Plate LV, figs. 4, 5, 7; text-fig. 147).

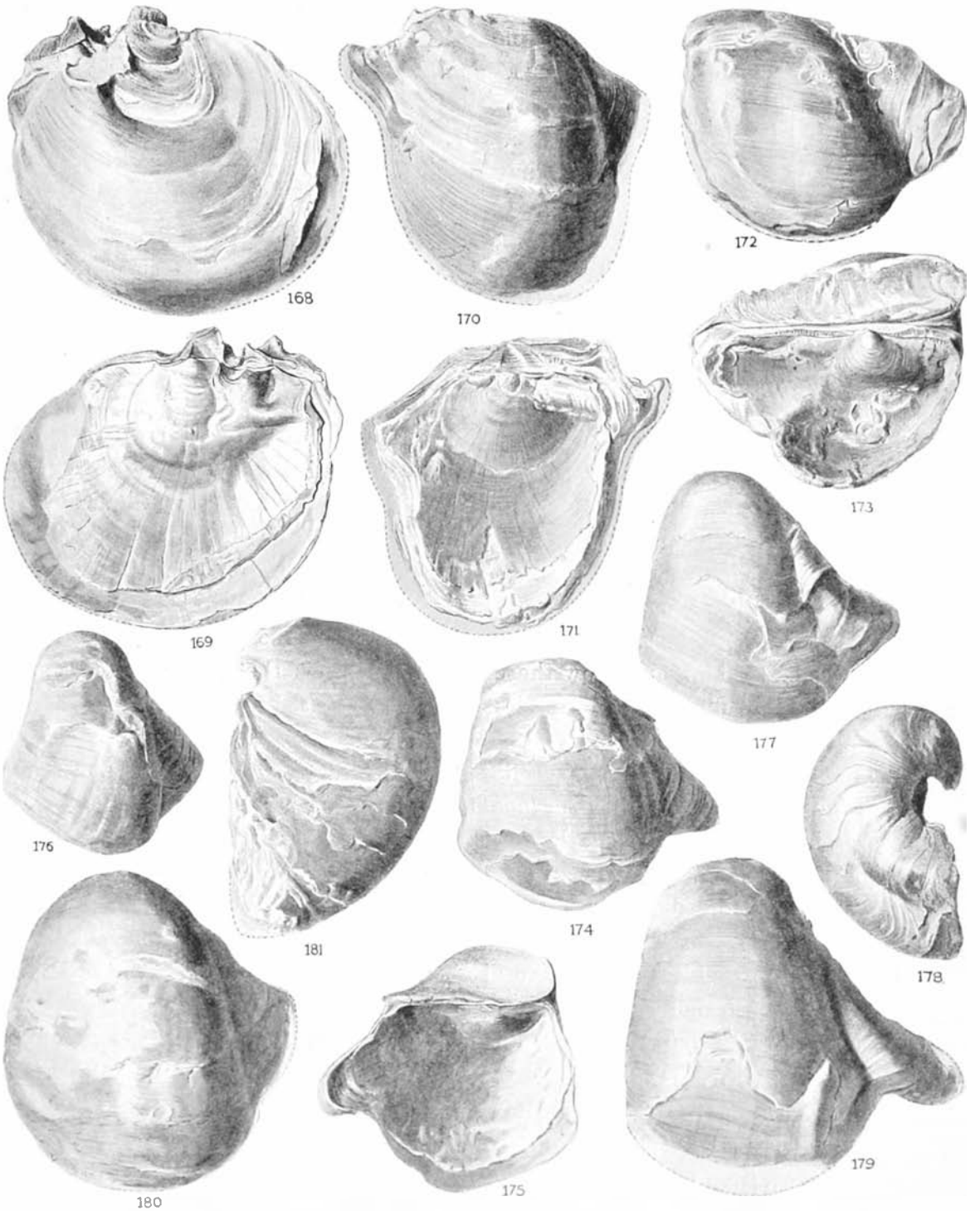
O. clavata, Nilsson, is a form in which the posterior part is more produced than usual owing to the position of the attached surface.

The *hippopodium* form of *O. vesicularis* found in the Cenomanian was named *O. Lesueuri* by d'Orbigny on account of its lower horizon. But Hennig, who has studied a series of Cenomanian specimens, sees no reason for separating it from the Senonian examples, and Müller (1898) likewise includes it in *O. vesicularis*.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 746, pl. cccclxxxviii, figs. 1—3.

[2] 'Palæontographica,' vol. xx, pt. 2, pl. viii, fig. 6.

[3] *Anomia subradiata*, Reuss, is probably a small example of *O. vesicularis* similar to *Avicula filata* of Etheridge. Reuss, 'Die Verstein. der böhm. Kreideformat.,' pt. 2 (1846), p. 45, pl. xxxi, fig. 19.



FIGS. 168–181.—*Ostrea vesicularis*, Lam. Zone of *Belemnitella mucronata*, Norwich. 168, 169, left and right valves. Norwich Museum, No. 2133. 170, 171, left and right valves. Dr. Rowe's Collection. 172, 173, left and right valves. Sedgwick Museum. 174, 175, left and right valves. Norwich Museum. 176–179, left valves. Sedgwick Museum. 178, posterior view of 177. 180, 181, left valve. Dr. Rowe's Collection. 181, anterior view of 180. All × $\frac{2}{3}$.

O. proboscidea, d'Archiac, is included by Zittel and by G. Müller in *O. vesicularis*, and the latter points out its probable close connection with *O. biauriculata*, Lamarck. The type of *O. proboscidea* from the Santonian of Saintes, Dordogne, is not quite satisfactory, but most of the specimens figured by Coquand seem to be inseparable from *O. vesicularis*.

The grypheate forms of *O. vesicularis* have been usually placed in the "genus" *Gryphæa*, and the *hippopodium* forms in *Ostrea*; in the case of this species, at any rate, "*Gryphæa*" cannot be accepted as a genus.[1]

In the Lower Chalk (Plate LV, figs. 8, 9) a small grypheate form[2] varying only to a small extent in dimensions is common and is not usually associated with larger forms; the uniformity in size and character of this form at first give the impression that it may be a distinct variety, but comparison with the small forms of *O. vesicularis* from the Upper Chalk (figs. 166, 167) shows that they cannot be separated; their small size was probably due to local conditions. Further, it may be noted that in earlier beds (the Upper Greensand) large forms of both the grypheate and *hippopodium* types occur (figs. 143—145), and are indistinguishable from those found in the Upper Chalk. Some rather small grypheate forms are also found in the Gault and Cambridge Greensand, and also forms with all or the larger part of the left valve attached, but they are not common in the Gault.

A few specimens of a small oyster have been found in the Lower Greensand of Atherfield and Shanklin, and show the fine radial ribs on the right valve[3]; some of these, and probably all, are examples of *O. vesicularis*, but the left valves are not, in all cases, well preserved.[4]

Remarks.—*O. vesicularis* attains its greatest development in the zones of *Belemnitella mucronata* and *Ostrea lunata* in this country, where the grypheate forms are abundant and reach a large size. The form with the posterior wing-like projection (figs. 174–179) occurs mainly in the zone of *B. mucronata*. *O. vesicularis* has been observed attached to sponges, corals, echinoids, oysters, *Inoceramus*, *Spondylus*, gasteropods, Ammonites, and *Belemnitella*. The long range in time and the wide geographical distribution of this species have already been noted by Hennig and other authors.

Types.—*O. vesicularis*, Lamarck, and *O. deltoidea*, Lamarck, from the Upper Chalk of Meudon. *Gryphæa globosa*, Sowerby, from the zone of *Belemnitella*

[1] This conclusion is in agreement with Peron's views on the "genera" of the Ostreidæ; see 'Descript. Brach., etc., Terr. Crét. Tunisie' (1890—91), pp. 107—109.

[2] A similar but rather larger form occurs in the Melbourn Rock and *plenus*-marls.

[3] Examples of this are figured in vol. i, pl. v, figs. 4, 5

[4] *Ostrea virgata*, Sowerby, possesses numerous fine radial ribs. The type is the only specimen known; it was found in the Lower Chalk (probably zone of *Holaster subglobosus*) of Sussex. The affinities of this form cannot be determined. Dixon, 'Geol. Sussex' (1850), p. 357, pl. xxvii, fig. 1.

macronata of Norwich, is in the British Museum. *O. hippopodium*, Nilsson, from the Upper Chalk of Kopinge, is in the Lund Museum. The specimens of *O. hippopodium* figured by Goldfuss from the Cenomanian of Essen, are in the Munich Museum. The examples of *O. vesicularis* figured by William Smith came from Norwich and are in the British Museum. The original of *Gryphæa globosa* var. *depressa*, Sowerby (in Dixon), cannot be found; the specimens of *Ostrea* figured by the same author (Dixon, pl. xxviii, figs. 22, 23), from the zone of *Holaster subglobosus* near Warminster, are in the British Museum. The specimen figured by S. P. Woodward as *O. vesiculosa* from the Upper Chalk of Sussex, is also in that Museum. *Aricula filata*, Etheridge, from the Totternhoe Stone of Burwell, is in the Sedgwick Museum.

Fig. 182.—*Ostrea vesicularis*, Lam. Zone of *Ostrea lunata*, Trimingham. Dr. Rowe's Collection. Left valve. × ⅓.

Distribution.—Lower Greensand (Ferruginous Sands) of Shanklin. Gault of Folkestone. Cambridge Greensand. Upper Greensand (zone of *Schlænbachia rostrata*) of the Isle of Wight. Upper Greensand (zone of *Pecten asper*) of Warminster.

Chalk Marl (zone of *Schlænbachia varians*) of Folkestone, Offham, and Burwell. Cenomanian (Meÿer's bed 11) of Beer Head. Cenomanian Sandstone of Wilmington.

Zone of *Holaster subglobosus* of Chilcomb (Hants), Glynde (Lewes), Burham, Arlesey, Ickleford (near Hitchin), Cherry Hinton, Burwell, and Isleham.

Zone of *Rhynchonella Cuvieri* of the South Devon coast and Dover. Melbourn Rock, Melbourn.

Zone of *Terebratulina lata* of the South Devon coast, Dover, Cuxton, Charing, and Beachy Head.

Zone of *Holaster planus* of Mupe Bay, Borstal, West Wratting, Cheveley, and Swaffham (Norfolk).

Zone of *Micraster cor-testudinarium* of Borstal Manor, Chatham, and Stevenage.

Zone of *Micraster cor-anguinum* of Witherington, Quidhampton, Camp Hill (near Salisbury), Northfleet, Gravesend, and the Thanet coast.

Zone of *Marsupites testudinarius* of the Thanet coast. *Uintacrinus* band of Devizes Road (Salisbury).

Zone of *Actinocamax quadratus* of Whaddon, East and West Harnham, Fareham, Shawford, and Bishops Waltham.

Zone of *Belemnitella mucronata* of the Dorset coast and Norwich.

Zone of *Ostrea lunata* of Trimingham.

OSTREA VESICULOSA (*Sowerby*), 1822. Plate LV, figs. 10—14; Plate LVI, fig. 1.

1822. GRYPHÆA VESICULOSA, *J. Sowerby*. Min. Conch., vol. iv, p. 93, pl. cccl xix.

? 1847. OSTREA VASCULUM, *A. d'Archiac*. Mém. Soc. géol. de France, ser. 2, vol. ii, p. 312, pl. xvi, figs. 5, 6.

1849. GRYPHÆA VESICULOSA, *T. Brown*. Illustr. Foss. Conch. Gt. Brit. and Ireland, p. 149, pl. lxi, figs. 8, 9.

1850. OSTREA VESICULOSA, *E. Guéranger*. Bull. Soc. géol. de France, ser. 2, vol. vii, p. 802.

1854. GRYPHÆA VESICULOSA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 168.

? 1868. OSTREA COLUMBA, *A. Briart and F. L. Cornet*. Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 46, pl. iv, figs. 13—15.

1869. — VESICULOSA, *H. Coquand*. Mon. Ostrea, Terr. Crét., p. 152, pl. lix, figs. 4—7.

1871. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 311, pl. cxciv, figs. 1—6.

— GRYPHÆA VESICULOSA, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 466, pl. xxxix, figs. 1, 2.

1882. — — *G. Sequenza*. Atti R. Accad. Lincei, ser. 3, Cl. Sci. Fis. Math., vol. xii, p. 182, pl. xix, fig. 2.

1890–91. OSTREA VESICULOSA, *A. Peron*. Descript. Brach., etc., Terr. Crét. Tunisie, p. 126.

1903. — — *R. Fortau*. Bull. Inst. Égyptien, ser. 4, vol. iv, p. 290.

? 1908. GRYPHÆA *aff.* VESICULOSA, *F. Favre*. Neues Jahrb. für Min., etc., Beil.-Bd. xxv, p. 609.

Non 1864. OSTREA VESICULOSA, *S. P. Woodward*. Geol. Mag., vol. i, p. 112, pl. v, fig. 6.

Description.—Left valve usually thick, very convex, grypheate, more or less oval, height usually considerably greater than the length; slightly or moderately inequilateral, sometimes with a rounded ridge extending from the umbo to the postero-ventral extremity. Posterior part often convex and separated from the remainder of the valve by a furrow. Umbo sharp, prominent, more or less incurved, and usually with a small posterior curvature; surface of attachment generally small. Area and ligament-pit high, straight or with a small backward curvature. Adductor impression oval or rounded. Right valve thin, concave. Surface of both valves smooth, except for growth-lines.

Affinities.—This species is closely allied to *O. vesicularis*, but the umbo is more pointed, usually less incurved and with a smaller attached surface; the area is higher, and usually the height of the shell is relatively greater in proportion to its length. Most of these differences are probably to be accounted for by the small size of the attached surface.

Type.—From the Upper Greensand of Warminster, in the British Museum.

Distribution.—Upper Greensand: common in the zone of *Schlænbachia rostrata* of Ventnor, Warminster, Dinton and Potterne; rare in the zone of *Pecten asper* of Ventnor, Warminster, and Ballard Down (Swanage). Chloritic Marl of Compton Bay, Isle of Wight.

OSTREA CANALICULATA (*Sowerby*), 1813. Plate LVI, figs. 2–16.

1813. CHAMA CANALICULATA, *J. Sowerby*. Min. Conch., vol. i, p. 68, pl. xxvi, fig. 1 (non *Ostrea canaliculata*, Sowerby.)
1821. OSTREA CANALICULATA, *M. J. L. Defrance*. Dict. Sci. nat., vol. xxii, p. 26.
1827. OSTREA LATERALIS, *S. Nilsson*. Petrific. Suecana, p. 29, pl. vii, figs. 7—10.
— CHAMA CONICA, *Nilsson*. Ibid., p. 28, pl. viii, fig. 4.
1829. GRYPHÆA CANALICULATA, *J. de C. Sowerby*. Min. Conch., vol. vi, p. 218.
— EXOGYRA UNDATA, *Sowerby*. Ibid., vol. vi, p. 220, pl. dcv, figs. 5—7.
1833. OSTREA LATERALIS, *A. Goldfuss*. Petref. Germ., vol. ii, p. 24, pl. lxxxii, fig. 1.
1834. GRYPHÆA VOMER, *S. G. Morton*. Synopsis Organic Remains Cret. U. States, p. 54, pl. ix, fig. 5.
1837. OSTREA LATERALIS, *W. Hisinger*. Lethæa Suecica, p. 46, pl. xiii, fig. 1.
— AMPHIDONTE UNDATA, *G. G. Pusch*. Polens Paläont., p. 39.
1842. EXOGYRA PARVULA, *A. Leymerie*. Mém. Soc. géol. de France, ser. 2, vol. v, p. 17, pl. xii, figs. 8, 9.
1845–6. OSTREA LATERALIS, *H. B. Geinitz*. Grundriss d. Versteiu., p. 480, pl. xx, fig. 22.
1846. EXOGYRA LATERALIS, *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 42, pl. xxvii, figs. 38—47.
1847. OSTREA CANALICULATA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 709, pl. cccclxxi, figs. 4—8.

1847. EXOGYRA LATERALIS, *J. Müller*. Petref. der Aachen. Kreidef., pt. 1, p. 49.
1849. GRYPHÆA UNDATA, *T. Brown*. Illustr. Foss. Conch., Gt. Britain and Ireland, p. 149, pl. lx, figs. 14, 15.
— — CANALICULATA, *Brown*. Ibid., p. 149, pl. lxi, fig. 18.
1850. OSTREA CANALICULATA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, pp. 139, 170, 255.
? 1852. — CYRTOMA, *R. Kner*. Denkschr. Akad. Wissensch. Wien., Math.-nat. Cl., vol. iii, p. 320, pl. xvii, fig. 11.
1853. — CANALICULATA, *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 522, pl. l, fig. 2.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 173.
— EXOGYRA LATERALIS, *Morris*. Ibid., p. 167.
1863. OSTREA LATERALIS, *A. v. Strombeck*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 110.
— EXOGYRA LATERALIS, *H. Drescher*. Ibid., vol. xv, p. 357.
1867. OSTREA LATERALIS, *B. Lundgren*. Palæont. Iakttag. Fäxekalk. Limhamn, p. 23.
1868. EXOGYRA LATERALIS, *E. Eichwald*. Lethæa Rossica, vol. ii, p. 398.
1869. OSTREA CANALICULATA, *H. Coquand*. Mon. Ostrea, Terr. Crét., p. 128, pl. xlv, figs. 13, 14; pl. xlvii, figs. 7—10; pl. lii, fig. 13; pl. lx, figs. 13—15.
— — LATERALIS, *Coquand*. Ibid., p. 96, pl. xviii, fig. 12; pl. xxx, figs. 10—14.
1870. EXOGYRA LATERALIS, *F. Römer*. Geol. v. Oberschles., p. 341, pl. xxix, figs. 4, 5.
? — OSTREA LATERALIS, *H. Credner*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xxii, p. 228.
1871. — CANALICULATA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 305, pl. cxciii, figs. 4—14.
— EXOGYRA CANALICULATA, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 463, pl. xlviii, figs. 6—8.
1872. OSTREA (EXOGYRA) LATERALIS, *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. i), p. 179, pl. xli, figs. 28—35; pt. ii, pl. viii, figs. 15—17.
1877. EXOGYRA LATERALIS, *A. Fritsch*. Stud. im Geb. böhmisch. Kreideformat., ii, Weissenberg. u. Malnitz. Schicht., p. 140, fig. 136.
1881. OSTREA LATERALIS, *J. Gosselet*. Esquisse géol. du Nord, pl. xvii, fig. 14.
1882. EXOGYRA LATERALIS, *H. Schröder*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 261.

1882. Exogyra canaliculata, *G. Seguenza*. Atti R. Accad. Lincei, ser. 3, Cl. Sci. Fis. Math., vol. xii, p. 176.

1883. — lateralis, *Fritsch*. Op. cit., iii, Iserschicht., p. 118.

? 1887. — *cf.* lateralis, *F. Frech*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxix, p. 153.

1888. Ostrea canaliculata, *A. Peron*. Hist. Terr. de Craie S.E. Bassin Anglo-Parisien, p. 175.

— Exogyra canaliculata, *G. Müller*. Jahrb. d. k. preuss. geol. Landesanst. für 1887, p. 401.

1889. Exogyra lateralis, *Fritsch*. Op. cit., iv, Teplitz. Schicht., p. 86.

— Ostrea (Exogyra) lateralis, *O. Griepenkerl*. Senon v. Königslutter (Palæont. Abhandl., vol. iv), p. 36.

— Exogyra lateralis, *E. Holzapfel*. Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p 256.

1890—91. Ostrea canaliculata, *A. Peron*. Descript. Brachiop., etc., Terr. Crét. Tunisie, p. 163.

1893. Exogyra lateralis, *Fritsch*. Op. cit., Priesen. Schicht., p. 102.

1894. Ostrea lateralis, *A. Hennig*. Geol. Fören. i Stockholm, Förhandl., vol. xvi, p. 513.

1895. — (Exogyra) lateralis, *F. Vogel*. Holländisch. Kreide, p. 13.

? — Exogyra *cf.* canaliculata, *E. Tiessen*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 465.

1896. Ostrea canaliculata, *A. J. Jukes-Browne and W. Hill*. Quart. Journ. Geol. Soc., vol. lii, p. 149.

1897. — lateralis, *A. Hennig*. Revision Lamellibr. i Nilsson's 'Petrif. Suecana,' p. 23.

— Exogyra lateralis, *Fritsch*. Op. cit., vi, Chlomek. Schicht., p. 68.

— — — *R. Leonhard*. Palæontographica, vol. xliv, p. 50.

— — — *A. Rutot*. Bull. Soc. Belge Géol. Pal. et Hydrol., vol. x, p. 27.

— — canaliculata, *R. B. Newton*. Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 91, pl. iii, figs. 7, 8.

1898. Ostrea canaliculata, *R. Fortau*. Bull. Inst. Egyptien, ser. 4, vol iv, p. 292.

— Exogyra lateralis, *G. Müller*. Mollusk. Untersen. v. Braunschweig u. Ilsede (Abhandl. d. k. preuss. geol. Landesanst., N.F., 25), p. 15, pl. iii, fig. 2.

— — — *O. M. Reis*. Geognost. Jahresh. (1897), p. 108.

1901. — — *A. Wollemann*. Jahrb. d. k. preuss. geol. Landesanst., vol. xxi, p. 14.

— — — *H. Imkeller*. Palæontographica, vol. xlviii, p. 38.

1902. — — *J P. J. Rørn*. Mollusk. i. Danmarks Kridtaflej. I. Lamellibr., p. 118.

1905. Exogyra lateralis, *T. Wegner*. Zeitschr. d. deutsch. geol. Gesellsch., vol. lvii, p. 184.

? 1907. Gryphæostrea vomer, *S. Weller*. Cret. Pal. New Jersey, p. 455, pl. xliv, figs. 6–11.

1909. Ostrea (Exogyra) lateralis, *W. Rogala*. Bull. Internat. Acad. Sci. Cracovie (1909), 2, p. 691.

1911. Exogyra lateralis, *Fritsch*. Op. cit., Korycan. Schicht., p. 46, fig. 210.

— — — *K. Vogel von Falckenstein*. Zeitschr. d. deutsch. geol. Gesellsch., vol. lxii, p. 561.

Description.—Shell generally rather small, usually higher than long, very inequivalve.

Left valve very convex or inflated; the greatest convexity is between the umbo and the postero-ventral extremity, and gives in some cases the appearance of a much rounded carina, behind which the valve is either flattened or slightly concave; sometimes there is a posterior wing-like expansion. The ventral margin is rounded; the lower part of the posterior margin is often slightly concave, ending above in a point. Umbo usually much incurved, and directed posteriorly. The ligament pit usually curves posteriorly. This valve is attached posteriorly to the umbo; the size, shape, and direction of the attached surface vary in different individuals, and affect the form of the shell in the usual way. The surface of the shell shows growth-lines, and in some specimens there are numerous, fine, somewhat irregular ridges running parallel to the margin of the valve. In the interior of the valve a few widely separated growth-ridges occur.

Right valve operculiform, nearly flat, or concave or undulating. Umbo very small, curving spirally forwards. Surface with widely separated ridges running parallel to the margin of the valve.

Affinities.—The Albian and Cenomanian examples of this species were regarded by Coquand as distinct from those found in the Upper Chalk and named *O. lateralis* by Nilsson; but d'Orbigny, Geinitz, Peron, Jukes-Browne, and Hennig have shown that the forms named *lateralis* cannot be separated from those which occur in earlier beds (*canaliculata*). Peron states that on the Continent this species ranges without interruption through all the stages of the Cretaceous, from the Aptian to the Danian; he also notes its wide geographical distribution. This species belongs to Conrad's "genus" *Gryphæostrea*; it has been referred to *Gryphæa* by some writers, but more usually to *Exogyra*; the left valve, except for the attached surface, is often grypheate in form, while the right valve shows some resemblance to *Exogyra*. Pictet and Campiche consider that *O. canaliculata* is closely related to *Exogyra conica*; but it seems more probable that it is allied to

O. vesicularis, the differences being accounted for by the attached surface in the former being on the posterior side of the shell.

The form with well-developed concentric ridges (Plate LVI, fig. 10), which is abundant in the zone of *Actinocamax quadratus*, but ranges from the zone of *Rhynchonella Cuvieri* to that of *Belemnitella mucronata*, has been named *O. canaliculata* var. *striata*.[1]

Types.—*Chama canaliculata*, Sowerby, from the Upper Greensand of Shute, near Warminster, is in the British Museum. *O. lateralis*, Nilsson, is from the Upper Chalk of Sweden. *Chama conica*, Nilsson, from the Upper Chalk of Kopinge, Sweden. *Exogyra undata*, Sowerby, from the Upper Greensand, Blackdown, cannot be found.

Distribution.—Hythe Beds (Bargate Stone) of Godalming. Lower Greensand of Faringdon and Brickhill.

Gault of Folkestone and Okeford Fitzpaine. Upper Greensand (zones of *Schlœnbachia rostrata* and *Pecten asper*) of the Isle of Wight (Ventnor, Niton, Compton Bay). Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown. Upper Greensand (Rye Hill Sands) of Warminster.

Chalk Marl (zone of *Schlœnbachia varians*) of Chiseldon. Cenomanian of Wilmington, Devon. Zone of *Holaster subglobosus* of Fulbourn and Burwell.

Zone of *Rhynchonella Cuvieri* of Harvet (Kent). Melbourn Rock of Hitchin.

Zone of *Terebratulina lata* of Hampshire, the South Devon coast, and Dover.

Zone of *Holaster planus* of Culver Cliff and Dover.

Zone of *Micraster cor-testudinarium* of Pinhay, Borstal, Seaford and Dover.

Zone of *Micraster cor-anguinum* of Quidhamptom and Northfield.

Zone of *Marsupites testudinarius* of Taplow. *Uintacrinus* band of Devizes Road (Salisbury), Holmwood Park (Keston), and the Thanet Coast.

Zone of *Actinocamax quadratus* of East and West Harnham, Whaddon, Marwell (Hants), Compton, Shawford, Fareham, West Meon, Mottisfont, Taplow and Brighton.

Zone of *Belemnitella mucronata* of the Dorset Coast, Rogers Whiting Pit (Fareham) and Alderbury well.

Zone of *Ostrea lunata* of Trimingham.

OSTREA SEMIPLANA, *J. de C. Sowerby*, 1825. Plate LVI, figs. 17—19. Plate LVII. Plate LVIII, figs. 1—5. Text-figures 183—193).

1803. OSTRACITES SULCATUS, *J. F. Blumenbach*. Specim. archæol. tell., p. 18, pl. i. fig. 3. (Non. *Ostrea sulcata*, Born, 1778.)

[1] Rowe, 'Zones of the White Chalk. I. Kent and Sussex' (1900), p. 345; Griffith and Brydone, 'Zones of the Chalk in Hants' (1911), p. 3.

1822. OSTREA, *G. Mantell.* Foss. S. Downs, p. 207, pl. xxv, fig. 4.
1825. — SEMIPLANA, *J. de C. Sowerby.* Min. Conch., vol. v, p. 144. pl. ccccl.xxxix, fig. 3.
1827. — FLABELLIFORMIS, *S. Nilsson.* Petrific. Suecana, p. 31, pl. vi, fig. 4.
— — ? PLICATA, *Nilsson.* Ibid., p. 31, pl. vii, fig. 12.
— — PUSILLA, *Nilsson.* Ibid., p. 32, pl. vii, fig. 11. (Non *pusilla*, Brocchi, 1814.)
1833. — ALÆFORMIS, *S. Woodward.* Geol. Norfolk, p. 48, pl. vi, figs. 1—3.
— — INEQUICOSTATA, *Woodward.* Ibid., p. 48, pl. vi, fig. 4.
— — FLABELLIFORMIS, *A. Goldfuss.* Petref. Germ., vol. ii, p. 12, pl. lxxvi, fig. 1.
— — SULCATA, *Goldfuss.* Ibid., p. 13, pl. lxxvi, fig. 2.
— — ARMATA, *Goldfuss.* Ibid., p. 13, pl. lxxvi, fig. 3.
1837. — FLABELLIFORMIS, *W. Hisinger.* Lethæa Suecica, p. 48, pl. xiv, fig. 1.
— — ? PLICATA, *Hisinger.* Ibid., p. 48, pl. xiv, fig. 2.
1837. — INCONSTANS, *F. Dujardin.* Mém. Soc. géol. de France, vol. ii, p. 229.
1839. — FLABELLIFORMIS, *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 19.
1841. — — *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 45.
— — SULCATA, *Römer.* Ibid., p. 46.
— — ARMATA, *Römer.* Ibid., p. 46.
? 1843. — MACROPTERA ? *H. B. Geinitz.* Die Verstein. von Kieslingswalda, p. 17, pl. iii, figs. 22—24.
— — SULCATA, *Geinitz.* Ibid., p. 17.
1846. — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 39, pl. xxviii, figs. 2—4, 8.
— — FLABELLIFORMIS, *Reuss.* Ibid., p. 39, pl. xxviii, figs. 5—7, 16, pl. xxix, figs. 19, 20.
1847. — SEMIPLANA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 747, pl. ccccl.xxxviii, figs. 4, 5.
— — FLABELLIFORMIS, *J. Müller.* Petref. der Aachen. Kreidef., pt. 1, p. 39.
— — ARMATA, *Müller.* Ibid., p. 39.
1849. — SEMIPLANA, *T. Brown.* Illustr. Foss. Conch. Gt. Britain and Ireland, p. 145, pl. lix, fig. 7.
— — INÆQUICOSTATA, *Brown.* Ibid., p. 147, pl. lxi,*, fig. 13.
1850. — SEMIPLANA, *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 198.
— — CARINATA, *J. de C. Sowerby*, in *F. Dixon.* Geol. Sussex, p. 357 (*O. frons*, p. 386, ed. 2), pl. xxvii, fig. 2.
— — SEMIPLANA, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 256.

? 1850. OSTREA SEMIPLANA, *A. Alth.* Geogn.-paläont. Beschreib. v. Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 254, pl. xiii, fig. 2.

1851. — BRONNI, *J. Müller.* Petref. der Aachen. Kreidef., pt. 2, p. 69, pl. vi, fig. 20.

1854. — SEMIPLANA, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 174.

— — INÆQUICOSTATA, *Morris.* Ibid., p. 173.

1859. — SEMIPLANA, *J. Müller.* Petref. der Aachen. Kreidef., Supplement, p. 7.

1863. — — *R. Drescher.* Zeitschr. der deutsch. geol. Gesellsch., vol. xv, p. 356.

— — SULCATA, *A. Kunth.* Ibid., vol. xv, p. 732.

1868. — FLABELLIFORMIS, *E. Eichwald.* Lethæa Rossica, vol. ii, p. 368.

1869. — SEMIPLANA, *H. Coquand.* Mon. Ostrea, Terr. Crét., p. 74, pl. xxviii, figs. 1—15; pl. xxxv, figs. 1, 2; pl. xxxviii, figs. 10—12.

— — CUCULUS, *Coquand.* Ibid., p. 52, pl. xvii, figs. 19—21.

— — LICHENIFORMIS, *Coquand.* Ibid., p. 91, pl. xxxvii, figs. 17—19.

— — MERCEYI, *Coquand.* Ibid., p. 93, pl. xxviii, fig. 22; pl. xxix, figs. 8—14.

— — PERONI, *Coquand.* Ibid., p. 95, pl. xxxv, figs. 3—5; pl. xxxviii, figs. 5—9.

— — ACANTHONOTA, *Coquand.* Ibid., p. 103, pl. xxxviii, figs. 1—4.

1870. — SULCATA, *F. Römer.* Geol. v. Oberschles., p. 343, pl. xxix, fig. 3.

— — CUCULUS, *C. Schlüter.* Neues Jahrb. für Min., etc., p. 951.

1871. — SEMIPLANA, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 321.

1872. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 29, pl. viii, figs. 8—11, 13.

1873. — FLABELLIFORMIS, *J. I. Lahusen.* Foss. White Chalk of Simbirsk (Imper. Russ. Min. Corps Instit.), pt. 2, p. 250, pl. v, fig. 3.

1876. — (ALECTRYONIA) SULCATA, *D. Brauns.* Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 393.

1877. — SEMIPLANA, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat. ii, Weissenberg. u. Malnitz. Schicht., p. 141, fig. 138.

1878. — SULCATA, *C. Barrois.* Ann. Soc. géol. Nord, vol. v, p. 408.

1882. ALECTRYONIA SULCATA, *H. Schröder.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 261.

? 1883. OSTREA SEMIPLANA, *Fritsch.* Op. cit., iii, Iserschicht., p. 121, fig. 97.

— — FRONS, *Fritsch.* Ibid., p. 121, fig. 96.

1885. ARMATA, *J. Böhm.* Verhandl. nat. Vereines preuss. Rheinl., vol. xlii, p. 76.

1885. Alectryonia crista ungulata, *Böhm*. Ibid., p. 75, pl. i, fig. 1.
1888. Ostrea semiplana, *A. Peron*. Hist. Terr. de Craie Bassin Anglo-Parisien, p. 179.
— — Peroni, *Peron*. Ibid., p. 180.
— — sulcata, *G. Müller*. Jahrb. d. k. preuss. geol. Landesanst. für 1887, p. 400.
1889. — semiplana, *E. Holzapfel*. Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 251, pl. xxviii, figs. 5, 6.
— — Goldfussi, *Holzapfel*. Ibid., p. 249, pl. xxviii, figs. 8—18.
— — Bronni, *Holzapfel*. Ibid., p. 250, pl. xxviii, figs. 3—7.
— — armata, *Holzapfel*. Ibid., p. 253, pl. xxviii, figs. 1, 2.
— — Merceyi, *Holzapfel*. Ibid., p. 251, pl. xxviii, fig. 4.
? 1889. — semiplana, *Fritsch*. Op. cit., iv, Teplitz. Schicht., p. 87.
1889. — (Alectryonia) sulcata, *O. Griepenkerl*. Senon v. Königslutter (Palæont. Abhandl., vol. iv), p. 33.
1890—91. — semiplana, *A. Peron*. Descript. Brachiop., etc., Terr. Crét. Hauts-Plateaux de la Tunisie, p. 154.
? 1893. — — *Fritsch*. Op. cit., v, Priesener Schicht., p. 102.
1894. — — *B. Lundgren*. Mollusk. i *Mammillatus* och *Mucronata* zonerna (K. Svenska Vet.-Akad. Handl., n.f., vol. xxvi, No. 6), p. 37.
— larva, *Lundgren*. Ibid., p. 37.
— — semiplana, *A. Hennig*. Geol. Fören. i Stockholm Förhandl., vol. xvi, p. 514.
— — cuculus, *Hennig*. Ibid., p. 516.
1895. — Bronni, *F. Vogel*. Holländisch. Kreide, p. 7.
1897. — semiplana, *R. Leonhard*. Palæontographica, vol. xliv, p. 51.
? — — — *Fritsch*. Op. cit., vi, Chlomek. Schicht., p. 68.
— — — *A. Rutot*. Bull. Soc. Belge Géol. Pal. et Hydrol., vol. x, p. 25.
— — (Alectryonia) armata, *Rutot*. Ibid., p. 23.
— semiplana, *A. Hennig*. Revision Lamellibr. i Nilsson's 'Petrific. Suecana,' p. 9, pl. i, figs. 7, 10—14, 16, 18, 19.
1898. — (Alectryonia) semiplana, *O. M. Reis*. Geognost. Jahresh. (1897), p. 107, pl. iv, fig. 18.
semiplana, *G. Müller*. Molluskenfauna Untersen. v. Braunschweig u. Ilsede, p. 8, pl. i, figs. 1—4; pl. iii, figs. 3, 4.
1901. — — *A. Wollemann*. Jahrb. d. k. preuss. geol. Landesanst., vol. xxi (1900), p. 13.
— — — var. armata, *H. Imkeller*. Palæontographica, vol. xlviii, p. 37, pl. i, figs. 3—6.
? 1902. — cf. semiplana, *A. Wollemann*. Lüneburg. Kreide (Abhandl. d. k. preuss. geol. Landesanst., n. f., 37), p. 49.

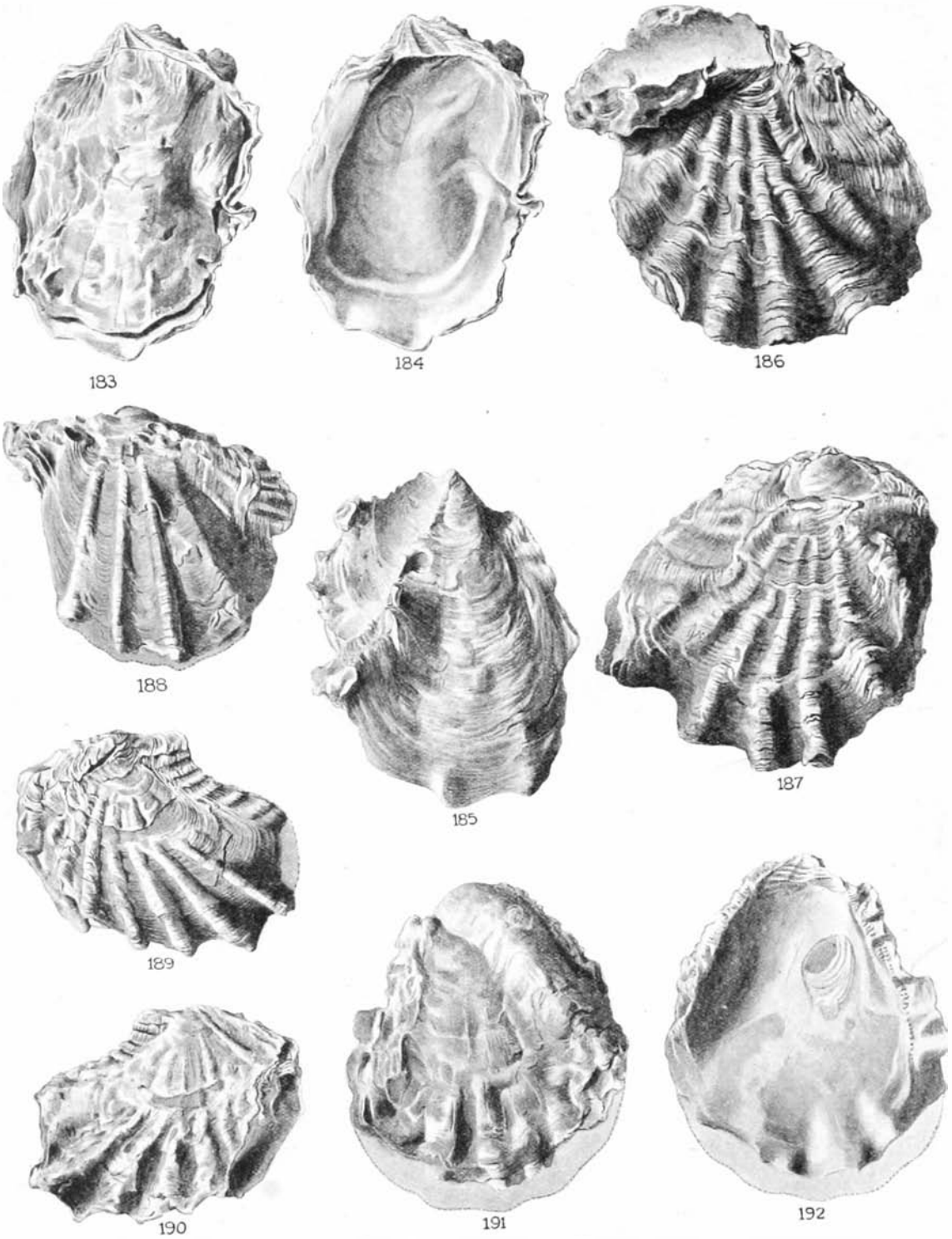
1902. Ostrea Merceyi, *Wollemann*. Ibid., p. 51, pl. iii, figs. 6, 7.
— — semiplana, *J. P. J. Ravn*. Mollusk. Danmarks Kridtafl. i, Lamellibr., p. 113, pl. iii, figs. 5, 7, 8.
1903. Alectryonia semiplana, *E. Dacqué*. Palæontographica, vol. xxx, 2, p. 366, pl. xxxiv, figs. 1—4.
1905. Ostrea semiplana, *T. Wegner*. Zeitschr. d. deutsch. geol. Gesellsch., vol. lvii, p. 177, fig. 10.
— — armata, *Wegner*. Ibid., p. 179, figs. 11—13.
? 1906. — — *L. Krumbeck*. Palæontographica, vol. liii, p. 93.
1908. — Peroni, *P. A. Peron*. Compte Rendu Assoc. Franç. Avanc. Sci., vol. xxxvi (1907), p. 307.
1909. — (Alectryonia) Peroni, *M. Leriche*. Ann. Soc. géol. Nord, vol. xxxviii, p. 67, pl. iii, figs. 20—27.
— — semiplana, *W. Rogala*. Bull. Internat. Acad. Sci. Cracóvie (1909), 2, p. 690.
1911. — — *Fritsch*. Op. cit., Korycaner Schicht., p. 47, fig. 214.
1911. Alectryonia semiplana, *K. Vogel v. Falckenstein*. Zeitschr. d. deutsch. geol. Gesellsch., vol. lxii, p. 559.

Description.—Form of shell extremely variable, depending on the shape, size and position of the surface to which the left valve is attached. In many specimens the shell was fixed to a cylindrical object (*Belemnitella*), but in other cases to a flat or slightly curved surface.

In the larger, fully grown specimens, in which the attached surface is relatively small and mainly in front of the umbones, being either parallel or oblique to the hinge, the shell is more or less triangular, or four-sided, or rounded, and its height is then often greater than its length (Plate LVII, fig. 7; Text-figs. 183—192).

When the shell is attached to a cylindrical body the length of which is at right angles to the hinge-line, the height of the shell is, at any rate during the attached stage, much greater than its length, and the front and back margins are more or less nearly parallel (Plate LVII, figs. 8, 12), but subsequently the postero-ventral part may grow in a posterior direction (Plate LVII, fig. 11). When the length of the attached body is parallel or nearly parallel with the hinge-line, and posterior to the umbo, the shell becomes much longer than high and extremely inequilateral (Plate LVII, figs. 1—3). If the attached surface is directed obliquely backwards from the umbo the shell becomes oblique and inequilateral. In small specimens having a very small attached surface the shell becomes sickle-shaped and the two valves similar in form (Plate LVI, fig. 18).

During the period in which the left valve is attached to a cylindrical object the corresponding part of the right valve takes a similarly convex form and remains without folds; when the left valve is attached to a flat or slightly curved surface



FIGS. 183—192.—*Ostrea semiplana*, Sowerby. 183—190, Zone of *Belemnitella mucronata*, Norwich. 183—185, right valve, and interior and exterior of left valve of one individual; Norwich Museum. 186, 187, left and right valves of one individual; Sedgwick Museum. 188, left valve (the right valve is concave); Sedgwick Museum. 189, 190, left and right valves of one individual; Norwich Museum, No. 2101. 191, 192. Zone of *Actinocamax quadratus*, East Harnham. Dr. Blackmore's Collection. Exterior and interior of a right valve. All × ⅔.

the corresponding part of the other valve is nearly flat and smooth (Plate LVIII, figs. 3—5). In the larger specimens with a relatively small attached surface the left valve (fig. 188) is more convex than the right, the latter becoming in some cases nearly flat or even concave. The free part of the shell develops folds. When the attached surface is relatively small the greater part of both valves possesses strong radial folds which interlock at the margin of the valves. The folds have more or less rounded summits, sometimes with small pointed projections, which occasionally develop into spines. The interspaces are usually broader than the folds. Well-marked growth-lines run parallel to the folded margin of the valves.

When only the margin of the shell is free no folds are developed, but the edge of the shell becomes toothed (Plate LVII, fig. 12); when a narrow strip is free numerous small folds appear on it (Plate LVII, fig. 13; Plate LVIII, figs. 1—4), forming a corrugated border to the smooth attached part of the shell. Occasionally, even when the greater part of the shell is free the folds are indistinct (figs. 183—185, 191). The direction of growth of the umbo, area, and ligament-pit vary according to the position of the attached surface; they may be in the plane of the valves, or curve inwards or outwards, sometimes becoming nearly perpendicular to the plane of the valves of the adult shell. The ligament-pit, area and umbones may be at right angles to the length of the shell, or may curve obliquely backwards or occasionally forwards. In some cases the area and ligament-pit are higher than long, in others longer than high.

The inner margin of the valves near the umbo often shows crenulations or minute irregular ridges. The form of the adductor impression varies with that of the shell; it is vertically elongated when the shell is high, and more rounded when the shell is longer.

Affinities.—A number of the different forms of this shell have been described as distinct species, since many writers have failed to recognise that the mode of growth of the shell is determined mainly by the character and position of the attached surface. The small sickle-shaped form (Plate LVI, fig. 18), with only a small surface of attachment and the two valves similar, was named *O. pusilla* by Nilsson (1827),[1] *O. alæformis* by Woodward (1833, pl. vi, fig. 1), and *O. Goldfussi* by Holzapfel (1889). Small forms which were attached for a longer period to a cylindrical object directed more or less nearly perpendicularly to the hinge (Plate LVII, figs. 8—11, Plate LVIII, figs. 1, 2) and with the margin of the valve folded and sometimes extended postero-ventrally were named *O. alæformis* by Woodward (1833, pl. vi, fig. 2), *O. Bronni* by Müller (1851),[2] *O. Peroni* by Coquand (1869). A form in which the shell was attached to a cylindrical object throughout except

[1] Hennig (1897), pl. i, figs. 14, 24.

[2] See also Hennig (1897), pl. i, figs. 7, 11, 12.

at the actual edge, which is toothed (Plate LVII, fig. 12), was named *O. Merceyi* by Coquand (1869).[1] Specimens which were attached to a flat object for a long period (Plate LVIII, figs. 3—5) were figured as *O. alæformis* by Woodward (1833, pl. vi, fig. 3) and *O. semiplana* by Sowerby (1825, the smaller figure). Larger forms with a relatively small portion of the anterior part of the shell attached to a cylindrical object and with well-developed folds, were named *O. inæquicostata* by Woodward (1833, pl. vi, fig. 4), *O. sulcata* by Nilsson (1827),[2] *O. flabelliformis* by Nilsson (1833),[3] and *O. semiplana* by Sowerby (1825, the larger figure) (Plate LVII, fig. 7; Text-figs. 186, 187, 193). The forms like *O. alæformis* and *O. Merceyi* are common in the upper zones. *O. carinata*, Sowerby (in Dixon, 1850), is a young form of *O. semiplana*. *O. armata*, Goldfuss, is recognised by Coquand and by Müller as a form of *O. semiplana* in which the ribs have become spiny. *O. licheniformis*, Coquand, is a form in which the valves have a rounded outline.

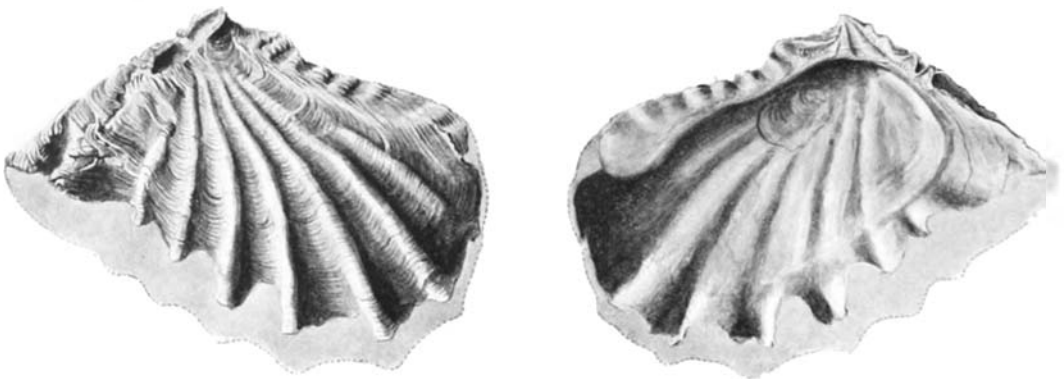


Fig. 193.—*Ostrea semiplana*, Sowerby. Zone of *Belemnitella mucronata*, Hartford Bridge, Norwich. Dr. Rowe's Collection. Exterior and interior of a left valve. × $\frac{1}{2}$.

O. acanthonota, Coquand, is a large form in which the ribs tend to become spiny. *O. arcolina*, Stoliczka, is closely allied to, and may be, as maintained by Peron, identical with *O. semiplana*. *O. Reboudi*, Coquand (= *O. plicatuloides*, Coq.) and *O. Janus*, Coquand, are regarded by Peron as forms of *O. semiplana*.

The close resemblance between the crenulations on the inner margin of the dorsal part of the valves in *O. semiplana* and in *O. vesicularis*, and the occasional presence of fine radial ribs on the right valve of *O. semiplana*, suggest that these two species are rather closely related.

Remarks.—The radial folds are usually stronger in examples from the zone of *Belemnitella mucronata* than in those from the lower zones. Occasionally the left umbo is exogyriform (Plate LVII, fig. 1 *b*), but this depends merely on the position of the attached surface.

[1] See also Holzapfel (1889) and Wollemann (1902).

[2] Hennig (1897), pl. i, fig. 18.

[3] Hennig (1897), pl. i, fig. 16.

Types.—*Ostracites sulcatus*, Blumenbach, from the Senonian of Salzberg near Quedlinburg, is stated by Hennig to be in the Natural History Museum, Berlin. *Ostrea* sp. Mantell, from the zone of *Micraster cor-anguinum* of Southerham near Lewes, and *O. semiplana*, Sowerby, from the zone of *Belemnitella mucronata* of Norwich, are in the British Museum. *O. alæformis*, Woodward, and *O. inequicostata*, Woodward, are from the zone of *B. mucronata* of Norwich; the original of fig. 3 of the former is in the Norwich Museum, but the other specimens cannot be found. *O. carinata*, Sowerby (in Dixon), cannot be found.

Distribution.—Probably zone of *Terebratulina lata* of the South Devon coast.

Zone of *Holaster planus* of the South Devon coast, Froxfield (Hants.), White Hill near Goring, and Hart's Lock Wood.

Zone of *Micraster cor-testudinarium* of Stevenage, Strood, and Chatham.

Zone of *Micraster cor-anguinum* of Micheldever, Witherington, Quidhampton, Foot's Cray, Southerham (Lewes), Northfleet, New Brompton, Gravesend, and Litcham, Norfolk.

Zone of *Marsupites testudinarius* of Ovingdean (Sussex). *Uintacrinus* band of Taplow and the Thanet coast.

Zone of *Actinocamax quadratus* of East Harnham.

Zone of *Belemnitella mucronata* of Ballard Head, Fareham, Clarendon and Norwich.

Zone of *Ostrea lunata* of Trimingham.

OSTREA SARUMENSIS, *sp. nov.* Plate LVIII, figs. 6—9.

Description.—Shell thick, higher than long; slightly, moderately, or considerable inequilateral.

Left valve very convex, with the attached surface of variable size. Area large, high, curved slightly or considerably backwards. Free part of valve with small radial folds, and growth-lamellæ. Inner margin with a row of small pits. Right valve slightly convex, with a large area; surface (except of the earlier part) ornamented with numerous small radial ribs separated by linear furrows, and crossed by growth-lamellæ.

Affinities.—The high area and the radial folds of the left valve suggest that this species may be related to *O. semiplana*; it also resembles some forms of *O. Boucheroni*. More specimens are needed in order to determine satisfactorily the affinities of this form.

Type.—In Dr. Blackmore's collection.

Distribution.—Zone of *Actinocamax quadratus* of East Harnham, near Salisbury.

OSTREA INCURVA, *Nilsson*, 1827. Plate LVIII, figs. 10—13. Plate LIX.

1827. OSTREA INCURVA, *S. Nilsson*. Petrif. Suecana, p. 30, pl. vii, fig. 6.
— — CURVIROSTRIS, *Nilsson*. Ibid., p. 30, pl. vi, fig. 5.
— — ACUTIROSTRIS, *Nilsson*. Ibid., p. 31, pl. vi, fig. 6.
1833. — CURVIROSTRIS, *A. Goldfuss*. Petref. Germ., vol. ii, p. 24, pl. lxxxii, fig. 2.
— — ACUTIROSTIS, *Goldfuss*. Ibid., p. 25, pl. lxxxii, fig. 3.
— — TRIANGULARIS, *S. Woodward*. Geol. Norfolk, p. 48, pl. vi, figs. 6, 7.
1837. — ACUTIROSTRIS, *W. Hisinger*. Lethæa Suecica, p 47, pl. xiii, fig. 6.
— — CURVIROSTRIS, *Hisinger*. Ibid., p. 48, pl. xiii, fig. 7.
— — INCURVA, *Hisinger*. Ibid., p. 47, pl. xiii, fig. 5.
1847. — ACUTIROSTRIS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 730, pl. cccclxxxi, figs. 1—3.
1849. — TRIANGULARIS, *T. Brown*. Illust. Foss. Conch. Gt. Britain and Ireland, p. 148, pl. lxi*, figs. 9, 10.
1850. — CURVIROSTRIS, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 255.
— — ACUTIROSTRIS, *d'Orbigny*. Ibid., p. 256.
— — CURVIROSTRIS, *A. Alth*. Geogn.-pal. Beschreib. v. Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 254, pl. xii, fig. 38.
— — ACUTIROSTRIS, *Alth*. Ibid., p. 254.
— — — , O. CURVIROSTRIS, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 173.
1859. — CURVIROSTRIS, *J. Müller*. Petref. Aachen. Kreideformat., Supplement, p. 7.
1868. — — *E. Eichwald*. Lethæa Rossica, vol. ii, p. 384.
1869. — — *H. Coquand*. Mon. Ostrea, Terr. Crét., p. 67, pl. xxxv, figs. 16—22.
— — ACUTIROSTRIS, *Coquand*. Ibid., p. 75, pl. xxxv, figs. 8—15, pl. xxxvi, figs. 1—5.
— — TRINACRIA, *Coquand*. Ibid., p. 64, pl. xxxv, figs. 23, 24.
? 1870. — ACUTIROSTRIS, *H. Credner*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xxii, p. 227.
1869. — CURVIROSTRIS, *E. Favre*. Moll. Craie de Lemberg., p. 162.
? 1871. — ACUTIROSTRIS, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 471, pl. xlv, figs. 1—6.
1878. — CURVIROSTRIS, *G. Behrens*. Zeitschr. deutsch. geol. Gesellsch., vol. xxx, p. 260.
1881. — ACUTIROSTRIS, *R. Etheridge*. In Penning and Jukes-Browne, Geol. Cambridge, p. 146, pl. iii, figs. 5, 6.

1881. OSTREA ACUTIROSTRIS var. INFLEXA, *Etheridge*. Ibid., p. 146, pl. iii, figs. 7, 8.
1888. — CURVIROSTRIS, *A. Peron*. Hist. Terr. de Craie S.E. Bassin Anglo-Parisien, p. 173 (*partim*).
1889. — — *O. Griepenkerl*. Senon. v. Königslutter (Palæont. Abhandl., vol. iv), p. 34, pl. ii, fig. 1.
1891. — — *J. Böhm*. Palæontographica, vol. xxxviii, p. 92, pl. iv, fig. 5.
— — ACUTIROSTRIS, *Böhm*. Ibid., p. 92, pl. iv, fig. 11.
1894. — — *B. Lundgren*. Mollusk. i *mammillatus* och *mucronata* zonerna, p. 39.
— — CURVIROSTRIS, *Lundgren*. Ibid., p. 40.
— — SCANIENSIS, *Lundgren*. Ibid., p. 40.
— — CURVIROSTRIS, *A. Hennig*. Geol. Fören. i Stockholm Förhandl., vol. xvi, p. 514.
— — ACUTIROSTRIS, *Hennig*. Ibid., p. 514.
1895. — CURVIROSTRIS, *F. Vogel*. Holländisch. Kreide, p. 5.
— — ACUTIROSTRIS, *Vogel*. Ibid., p. 5.
— — SCANIENSIS, *Vogel*. Ibid., p. 6.
1897. — INCURVA, *A. Hennig*. Revis. Lamellibr. i Nilsson's "Petrif. Suecana," p. 11, pl. i, figs. 15, 17, 21—23, 25—28.
— — ACUTIROSTRIS, *F. Nötling*. U. Cret. (Maestrichtian) Mari Hills (Palæont. Indica, ser. xvi, vol. i), p. 37, pl. ix, figs. 1, 9.
1899. — — *G. de Alessandri*. Palæont. Italica, vol. iv, p. 198.
1901. — CURVIROSTRIS, *H. Imkeller*. Palæontographica, vol. xlviii, p. 37.
— — ACUTIROSTRIS, *Imkeller*. Ibid., p. 37.
? 1902. — — *A. Quaas*. Palæontographica, vol. xxx, 2, p. 184, pl. xxi, fig. 11.
— — — *E. Dacqué*. Ibid., p. 363.
— — INCURVA, *J. P. J. Ravn*. Mollusk. i Danmarks Kridtafl., I, Lamellibr. p. 112, pl. iii, fig. 4.
1906. — — *E. Böse*. Senon. Cárdenas (Bol. Inst. geol. México, No. 24), p. 42, pl. i, fig. 5.
1908. — CURVIROSTRIS, *A. Peron*. Compte Rendu Assoc. Franç. Avanc. Sciences, vol. xxxvi (1907), p. 306.
— — — *M. Leriche*. Ibid., p. 338 (*partim*).
1909. — INCURVA, *W. Rogala*. Bull. Internat. Acad. Sci. Cracovie (1909), 2, p. 691.

Description.—Shell thin, usually higher than long; its form very variable, depending on the character and size of the attached surface.

The left valve is flat when attached throughout to a flat surface; concave when attached to a convex surface; convex when attached to a concave surface or when attached to only a small object near the umbo; irregular when attached to an

irregular surface. When the marginal part is free it grows more or less nearly vertically upwards from the attached surface. When entirely fixed the valve may be nearly symmetrical, but has usually a posterior curvature; when attached by a small area it usually grows backwards and becomes more or less sickle-shaped. The ligament-pit and umbo are straight in the nearly symmetrical forms; in the curved forms they are bent or arched more or less considerably backwards, but occasionally forwards.

The right valve is slightly convex when the entire left valve is attached to a flat object; more convex when it is attached to a convex object; nearly flat when it is attached to a concave object or when attached near the umbo only; irregular and undulating when the attached surface is irregular. The outline of the valve and the curvature of the ligament-pit and umbo vary according to those of the left valve. The surface of the right valve sometimes shows concentric ridges, especially near the umbo, and when well preserved there are numerous, small, irregular, radiating ridges. The inner margin of the valve on each side of the umbo has small, transverse, somewhat irregular rounded ridges. The form of the adductor impression varies with the shape of the shell.

Affinities.—Hennig (1897) has shown clearly that the differences between Nilsson's *O. incurva*, *O. curvirostris* and *O. acutirostris* are due to the mode of growth, which is determined by the character and size of the attached surface; and for this species Hennig selects the name *O. incurva*.

O. triangularis, Woodward, which was named *O. trinacria* by Coquand, is a form in which the entire left valve is attached to a flat surface; in the type this valve is fixed to a small portion of a large *Inoceramus* (Plate LIX, fig. 14). *O. drepanon*, Wollemann,[1] closely resembles the forms like *O. triangularis*, and should probably be regarded as a synonym of *O. incurva*. *Gryphæa globosa*, Woodward,[2] is included in this species by Coquand, but in the absence of the type it is difficult to give a definite opinion. D'Orbigny and Peron also include *O. conirostris*, Goldfuss. Peron (1888, 1908) regards *O. Wegmanniana*, d'Orbigny, as a form of *O. incurva*. *O. subuncinella*, Böhm,[3] appears to be closely allied to *O. incurva*. *O. Rabelaisi*, Coquand,[4] from Meudon, resembles closely some forms of *O. incurva* (Plate LIX, figs. 12—14), and should probably be included in that species.

Some specimens of *O. incurva* resemble the early parts of *O. semiplana* before the development of the radial folds.

Types.—Nilsson's types came from the Upper Chalk of Sweden. *O. triangularis*,

[1] 'Lüneberger Kreide' (1902), p. 49, pl. vii, figs. 6, 7. Rogala, 'Bull. Internat. Acad. Sci. Cracovie' (1909), 2, p. 691, pl. xxviii, fig. 16.

[2] 'Geol. Norfolk' (1833), p. 52, pl. vi, fig. 8 (from Marham).

[3] 'Palæontographica,' vol. xxxviii (1891), p. 93, pl. iv, figs. 9, 10.

[4] 'Mon. Ostrea, Terr. Crét.' (1869), p. 66, pl. xxxvii, figs. 26, 27.

Woodward, from the zone of *Belemnitella mucronata* of Norwich, is in the Norwich Museum (Plate LIX, fig. 14).

Distribution.—Chalk Marl (zone of *Schlænbachia varians*) of Burham and Dover.[1]

Totternhoe Stone (zone of *Holaster subglobosus*) of Burwell.

Zone of *Rhynchonella Cuvieri* of White Nothe (Dorset), Peter's Pit (Burham) and Dover.

Zone of *Terebratulina lata* of Branscombe, Warnford (Hants) and Beachy Head.

Zone of *Micraster cor-anguinum* of Quidhampton, New Brompton, and Grays.

Zone of *Marsupites testudinarius* of Devizes Road (Salisbury), Taplow and West Wickham. *Uintacrinus* band of the Thanet coast.

Zone of *Actinocamax quadratus* of East and West Harnham, West Meon, Mottisfont, Soberton and Winterbourne (Berks).

Zone of *Belemnitella mucronata* of Alderbury, Clarendon and Norwich.

OSTREA BOUCHERONI, *Coquand*, 1859. Plate LX, figs. 1—15.

1859.	OSTREA	BOUCHERONI,	*H. Coquand.*	Bull. Soc. géol. de France, ser. 2, vol. xvi, p. 1007.
1862.	—	TEVESTHENSIS,	*Coquand.*	Géol. Pal. reg. sud. Province Constantine, p. 227, pl. xix, figs. 7—13.
1869.	—	BOUCHERONI,	*Coquand.*	Mon. Ostrea, Terr. Crét., p. 85, pl. xxxi, figs. 1—3; pl. xxxvii, figs. 1—16; pl. xxxviii, fig. 20.
1890-1.	—	—	*A. Peron.*	Descript. Brach., etc., Terr. Crét. Tunisie, p. 142.
1898.	—	—	*G. Müller.*	Mollusk. Untersen. v. Braunschweig u. Ilsede (Abhandl. d. k. preuss. geol. Landesanst., N.F., 25), p. 11, pl. iii, figs. 5—9.

Description.—Shell variable in form, usually considerably higher than long, with the anterior and posterior margins generally diverging gradually from the umbo. Often the shell is more or less nearly symmetrical, but may be irregular, and with the ventral part expanded.

Left valve very convex, with the anterior and posterior parts sloping rapidly from the flank to the margin. The flank is flattened or moderately convex. Umbonal region usually narrow and pointed. The attached surface is at the umbo and is usually rather small but sometimes large; when large the height of the shell may be relatively small, and the form of the left valve more or less semi-cylindrical. In

[1] Specimens of *Ostrea* found in the Upper Greensand of Haldon resemble closely *O. incurva*.

the larger specimens a posterior wing-like part is developed, and may be separated from the remainder of the valve by a furrow. The surface is marked with growth-rings.

Right valve thin, slightly convex or nearly flat; umbo small, with the marginal part sometimes growing upwards at a considerable angle with the earlier part. Surface nearly smooth.

Affinities.—The English specimens agree closely with the figures given by Müller, and fairly well with some of the smaller examples figured by Coquand; but the larger forms, in which the height of the shell is relatively less, have not been found in this country.

Specimens in which the attached surface is larger than usual and the height of the shell relatively less (Plate LX, figs. 14, 15) resemble some forms of *O. vesicularis*, and there seems to be almost a complete passage between these two species; this resemblance has already been noticed by Peron in specimens found in the Lower Senonian of Tunis.

The right valve of small specimens is similar to that of the forms of *O. incurva* in which the posterior curvature of the umbo is slight.

The form from Tebessa (Constantine), named *O. teresthensis* by Coquand, was subsequently identified by that author with *O. Boucheroni*, and that identification has been supported by Peron. *O. Rouvillei*, Coquand,[1] from Algeria, resembles the forms of *O. Boucheroni* which have a short and high shell.

Remarks.—In England the specimens now referred to *O. Boucheroni* have been hitherto identified as *O. Wegmanniana*, d'Orbigny,[2] but the latter species is regarded by Peron[3] and by Leriche,[4] as a synonym of *O. incurva* (p. 388). So far as I have been able to make out the characters of *O. Wegmanniana* from the figures of d'Orbigny and Coquand and from the examination of a single right valve, I am inclined to accept the view of Peron and Leriche.

This species is often gregarious; most of the English examples are of rather small size, and the left valve is much more frequently found than the right valve.

Type.—From the Lower Senonian of Lavalette (Charente), said to be in the École des Mines, Paris.

Distribution.—Zone of *Holaster planus* of Hitchin. Recorded by Rowe from the Isle of Wight.

Zone of *Micraster cor-anguinum* of Whitway (Hants), Farningham Road, Preston near Faversham, Gravesend, Charlton, and Loam Pit Hill (Lewisham).

[1] 'Geol. Pal. reg. sud. Province Constantine' (1862), p. 232, pl. xxii, figs. 9—10; and 'Mon. Ostrea, Terr. Crét.' (1869), p. 89, pl. xxi, figs. 3—6, pl. xxiv, figs. 7—11.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 749, pl. cccclxxxviii, figs. 6—8. Coquand, op. cit. (1869), p. 53, pl. iv, figs. 9—11, pl. xxiii, figs. 11—14. Alessandri, 'Pal. Italica,' vol. iv (1899), p. 198.

[3] 'Hist. Terr. Craie, S.E. Bassin Anglo-Parisien' (1888), p. 173.

[4] 'Compte Rendu Assoc. Franç. Av. Sci.,' 1907, pt. 2 (1908), p. 338.

Zone of *Marsupites testudinarius* of Farnborough, Ropley, Taplow, and Brighton. Recorded by Rowe from the Sussex and Thanet coasts.

Uintacrinus band of Devizes Road (Salisbury); Odeham, Alresford, and Itchen Abbas (Hants); Margate.

Zone of *Actinocamax quadratus* of Bullington, Ropley, Wield, Andover, and Rottingdean.

OSTREA LUNATA, *Nilsson*, 1827. Plate LX, figs. 16—19. Plate LXI, figs. 1—6.

1816. OSTREA CANALICULATA, *J. Sowerby*. Min. Conch., vol. ii, p. 81, pl. cxxxv, fig. 1. (Non *canaliculata*, Sowerby, 1813).
1827. — LUNATA, *S. Nilsson*. Petrif. Suecana, p. 31, pl. vi, fig. 3.
1833. — — *A. Goldfuss*. Petref. Germ., vol. ii, p. 11, pl. lxxv, fig. 2.
1834. — NASUTA, *S. G. Morton*. Synop. Org. Remains Cret. U. States, p. 51, pl. ix, fig. 6.
? — — MESENTERICA, *Morton*. Ibid., p. 51, pl. ix, fig. 7.
1837. — LUNATA, *W. Hisinger*. Lethæa Suecica, p. 49, pl. xiv, fig. 4.
1849. — — *T. Brown*. Illustr. Foss. Conch. Gt. Britain and Ireland, p. 147, pl. lxi*, figs. 20, 21.
1854. — LARVA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 173.
1869. — UNGULATA, *H. Coquand*. Mon. Ostrea, Terr. Crét., p. 58 (*partim*), pl. xxxi, figs. 6—8 (? 9, 10).
? 1870. — LUNATA, *H. Credner*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xxii, p. 227.
1884. — (ALECTRYONIA) LARVA, *C. A. White*. Ostreidæ of N. America (4th Ann. Rep. U.S. Geol. Survey), p. 296, pl. xlii, figs. 2—5, ? 6 (not 7—9).
1885. — LARVA var. NASUTA, *R. P. Whitfield*. Brach. and Lamellibr. Raritan Clays (Mon. U.S. Geol. Surv., vol. ix), p. 34, pl. iii, figs. 3, 4.
1894. — LUNATA, *A. Hennig*. Geol. Fören. i Stockholm Förhandl., vol. xvi, p. 515.
1895. — (ALECTRYONIA) LUNATA, *F. Vogel*. Holländisch. Kreide, p. 10.
1897. — LUNATA, *A. Hennig*. Revis. Lamellibr. i Nilsson's "Petrific. Suecana," p. 14.
1907. — NASUTA, *S. Weller*. Cret. Pal. New Jersey, p. 447, pl. xliii, figs. 7, 8.
? — — MESENTERICA, *Weller*. Ibid., p. 446, pl. xliii, figs. 9—14.

Description.—Shell inequivalve, elongated between the umbo and the posterior extremity, curved regularly, usually sickle-shaped.

Left valve moderately or slightly convex, the part near the umbo being more convex than the later part. Umbo small, usually curved posteriorly, with, in nearly

all cases, a very minute surface of attachment; on each side of the umbo is a wing-like or ear-like extension. The early part of the shell is smooth except for concentric lines or ridges and occasionally fine radial furrows; in the adult the anterior and ventral marginal parts develop broad rounded folds. The stage at which the folding begins and the size and number of the folds, vary in different individuals. Small folds sometimes occur on the posterior wing-like part. The ligament-pit is sometimes straight but usually curves posteriorly.

Right valve at first smooth and nearly flat, occasionally slightly concave, but afterwards becoming folded like the left valve. Umbo very small.

Affinities.—Most writers, following the example of Coquand, have united *O. lunata*, Nilsson, with *O. ungulata* (Schlotheim),[1] regarding the former as a young stage of the latter. Hennig (1894, 1897) and Vogel (1895), however, do not

[1] Knorr, 'Recueil. Monum. Castast. Pétrificat.,' vol. ii (1768), p. 130, P. II, pl. Dvii, figs. 5, 6. Bruguière, 'Hist. nat. Vers et Mollusques (Encycl. méthod.), Planches,' vol. iv (1827), pl. clxxxviii, figs. 4, 5. Faujas-St.-Fond, 'Hist. nat. Mte. Ste. Pierre' (1799), p. 150, pl. xxiii, fig. 6. *Ostracites ungulatus*, v. Schlotheim, in Leonhard's 'Taschenb. für Min.,' vol. vii, pt. 1 (1813), p. 112; *O. crista meleagris*, Schlothem, ibid., p. 112. *O. larva*, Lamarck, 'Animaux sans Vert.,' vol. vi (1819), p. 216; *O. doridella*, Lamarck, ibid., p. 210. ? *O. falcata*, Morton, 'Amer. Journ. Sci.,' vol. xvii (1830), p. 284; vol. xviii (1830), pl. iii, figs. 19, 20. *O. larva*, Goldfuss, 'Petref. Germ.,' vol. ii (1833), p. 10, pl. lxxv, fig. 1. ? *O. falcata*, Morton, 'Synop. Org. Rem. Cret. U. States' (1834), p. 50, pl. iii, fig. 5 *Alectryonia acrodonte*, Fischer de Waldheim, 'Bull. Soc. Imp. Nat. Moscou,' vol. viii (1834—5), p. 116, pl. v, fig. 2. *O. larva*, d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 740, pl. cccclxxxvi, figs. 4, 5, 8 (? 6, 7). *O. larva*, Müller, 'Petref. der Aachen. Kreidef,' pt. 1 (1847), p. 39. *O. tegulanea*, Forbes, 'Trans. Geol. Soc.,' ser. 2, vol. vii (1846), p. 156, pl. xviii, fig. 6. *O. ponticeriana*, d'Orbigny, 'Voy. Pol. Sud et l'Océanie. Atlas Géol.' (1847), pl. viii, figs. 45, 46. ? *O. larva* ?, Kner, 'Kreidemerg. v. Lemberg' (1850), p. 30, pl. v, fig. 4. *O. urogalli*, Quenstedt, 'Handb. d. Petrefactenkunde' (1852), p. 499, pl. xl, fig. 24. *O. larva*, Beyrich, 'Zeitschr. deutsch. geol. Gesellsch.,' vol. iv (1852), p. 153, pl. iv, fig. 3. ? *O. frons*, Kner, 'Denkschr. Akad. Wiss. Wien, Math.-nat. Cl.,' vol. iii (1852), p. 319, pl. xvii, fig. 10. ? *O. larva*, Favre, 'Moll. Foss. de la Craie de Lemberg' (1869), p. 160. *O. ungulata*, Coquand, 'Mon. Ostrea, Terr. Crét.' (1869), p. 58 (*partim*), pl. xxxi, figs. 4, 5, 12—15. *O.* (*Alectryonia*) *ungulata*, Stoliczka, 'Cret. Fauna S. India,' vol. iii (1871), p. 470, pl. xlvii, figs. 3, 4. *O. larva*, Lartet, 'Ann. Sci. géol.,' vol. iii (1873), p. 59. *Alectryonia larva*, Schröder, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xxxiv (1882), p. 262. *O.* (*Alectryonia*) *larva*, White, 'Ostreidæ of N. America' (1884), p. 296, pl. xlii, figs. 7—9. *O. ungulata*, Peron, 'Hist. Terr. de Craie S.E. Bassin Anglo-Parisien' (1888), p. 178. *O.* (*Alectryonia*) *larva*, Griepenkerl, 'Senon. v. Königslutter' ('Palæont. Abhandl.,' vol. iv, 1889), p. 33. *O. ungulata*, Holzapfel, 'Mollusk. Aachen. Kreide' ('Palæontographica,' vol. xxxv, 1889), p. 250. *Alectryonia ungulata*, Newton, 'Quart. Journ. Geol. Soc.,' vol. xlv (1889), p. 333, pl. xiv, fig. 12. *O. ungulata*, Peron, 'Descript. Brach., etc., Terr. Crét. Tunisie' (1890—91), p. 185. *O. ungulata*, Böhm, 'Palæontographica,' vol. xxxviii (1891), p. 91. *A. ungulata*, Newton, 'Journ. Conch.,' vol. viii (1896), p. 136. *O.* (*Alectryonia*) *ungulata*, Nötling, 'U. Cret. (Mæstrichtian) Mari Hills' ('Palæont. Indica,' ser. xvi, vol. i, 1897), p. 38, pl ix, figs. 4, 5. ? *O.* cf. *larva*, Quaas, 'Palæontographica,' vol. xxx, 2 (1902), p. 187, pl. xxi, fig. 12. *O.* (*Alectryonia*) *ungulata*, Boule and Thevenin, 'Annal. Paléont.,' vol. i (1906), p. 48 [6], pl. i, fig. 5. *A. larva*, Krumbeck, 'Palæontographica,' vol. liii (1906), p. 96, pl. vii, fig. 10. *O.* (*Alectryonia*) *ungulata*, Pethö, ibid., vol. lii (1906), p. 185, pl. xii, fig. 1.

accept this view, and consider that *O. lunata* is a distinct species. They have studied a large series of specimens agreeing with Nilsson's type, and do not find any transitions between *O. lunata* and *O. ungulata*. After examining a large number of specimens of *O. lunata* from Trimingham and comparing them with foreign examples and figures of *O. ungulata*, I am led to accept the conclusions of Hennig and Vogel. From the character of the margin of the shell these specimens appear to be fully grown individuals and they are not associated with any examples agreeing with Schlotheim's species. In *O. ungulata* the early part of the shell resembles the adult of *O. lunata*, but subsequently it becomes more elongate and develops much deeper folds on the posterior as well as on the anterior margin, consequently the valves become much deeper and more nearly equal than in *O. lunata*. Since the folding starts at a later stage in *O. lunata* than in *O. ungulata*, it is difficult to see how individuals of the former could ever develop into the latter as has been supposed by some writers.

Some of the small, sickle-shaped forms of *O. semiplana* show some resemblance to *O. lunata*, but their attached surface is usually larger and their folds are smaller and more numerous and occur on the posterior as well as the anterior margin.

Remarks.—Mr. Brydone has found a few examples of *O. lunata* in which the left valve is entirely attached to the surface of echinoids.

Types.—*O. canaliculata*, Sowerby, from Trimingham, is in the British Museum. *O. lunata*, Nilsson, is from the Ähus-sandstone. Hennig states that the figure given by Nilsson does not correctly represent the folds.

Distribution.—Upper Chalk (zone of *Ostrea lunata*) of Trimingham, Norfolk.

Genus—EXOGYRA, *T. Say*, 1820.
('Amer. Journ. Sci.,' vol. ii, p. 43).

EXOGYRA SINUATA (*Sowerby*), 1822. Plate LXI, fig. 13. Text-figs. 194—214.

1821.	GRYPHÆA COULONI, *M. J. L. Defrance.*	Dict. Sci. nat., vol. xix, p. 534.
—	— DUMERILII, *Defrance.*	Ibid., p. 535.
1822.	— SINUATA, *J. Sowerby.*	Min. Conch., vol. iv, p. 43, pl. ccexxxvi (non *Ostrea sinuata*, Lamarck, 1819).
—	— AQUILA, *A. Brongniart.*	In Cuvier's Ossem. Foss., vol. ii, pp. 332, 614, pl. ix, fig. 11.
1829.	— SINUATA, *J. Phillips.*	Geol. Yorks., p. 122, pl. ii, fig. 23.
—	EXOGYRA LÆVIGATA, *Sowerby.*	Min. Conch., vol. vi, p. 220, pl. dcv, fig. 4.
1833.	— AQUILA, *A. Goldfuss.*	Petref. Germ., vol. ii, p. 36, pl. lxxxvii, fig. 3.

1836. Ostrea falciformis, *F. A. Römer.* Die Verstein. nord-deutsch. Ool.-Geb., p. 59.
1837. Amphidonte aquila, *G. G. Pusch.* Polens Paläont., p. 38.
1840. Exogyra sinuata, *A. Leymerie.* Bull. Soc. géol. de France, vol. xi, p. 121 (vars. *subsinuata*, etc., p. 124).
1841. — — *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 47.
? — — undata, *Römer.* Ibid., p. 47.
1842. — sinuata et subsinuata *A. Leymerie.* Mém. Soc. géol. de France, vol. v, pp. 16, 17, 28, pl. xii.
1845. Gryphæa sinuata *vars.* lævigata, subsinuata, Couloni, *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 250.
1846. Exogyra sinuata, *A. Leymerie.* Statist. géol. et min. de l'Aube, pl. vi, fig. 1.
— — subsinuata, *Leymerie.* Ibid., pl. vii, fig. 3.
— — — *var.* aquilina, *Leymerie.* Ibid., pl. vii, fig. 4.
1847. Ostrea Couloni, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 698, pl. cccclxvi, figs. 1—4; pl. cccclxvii, figs. 1—3.
— — aquila, *A. d'Orbigny.* Ibid., p. 706, pl. cccclxx, figs. 1—4.
? — Exogyra sinuata, *A. d'Archiac.* Mém. Soc. géol. de France, ser. 2, vol. ii, p. 313.
1849. Gryphæa sinuata, *T. Brown.* Illustr. Foss. Conch. Gt. Brit. and Ireland, p. 149, pl. lx, fig. 5.
— — aquila, *Brown.* Ibid., p. 150, pl. lxi*, figs. 17—19.
— — lævigata, *Brown.* Ibid., p. 149, pl. lx, fig. 17.
1850. Exogyra aquila, *J. Ewald.* Zeitschr. d. deutsch. geol. Gesellsch., vol. ii, p. 470.
1853. Ostrea aquila, *F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, p. 520, pl. xlviii, figs. 1, 2.
1854. Exogyra sinuata, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 167.
1855. Ostrea Couloni, *G. Cotteau.* Moll. Foss. de l'Yonne, p. 122.
— — aquila, *Cotteau,* Ibid., p. 122.
1858. — Couloni, *F. J. Pictet and E. Renevier.* Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 138.
1859. — — *J. Vilanova-y-Piera.* Mem. geog.-agric. de Castellon, pl. iii, fig. 24.
1861. — — *P. de Loriol.* Anim. Invert. Foss. Mt. Salève, p. 110.
1868. — — *de Loriol.* Valangin. d'Arzier (Vaud). (Matér. Pal. Suisse, ser. 4), p. 51.
— Exogyra aquila, *E. Eichwald.* Lethæa Rossica, vol. ii, p. 399.
1869. Ostrea Couloni, *P. de Loriol and V. Gilliéron.* Urgon. infér. de Landeron, p. 24.
— — aquila, *H. Coquand.* Mon. Ostrea, Terr. Crét., p. 158, pl. lxi, figs. 4—9.

1869. Ostrea Couloni, *Coquand.* Ibid., p. 180, pl. lxv, fig. 10; pl. lxxi, figs. 8—10; pl. lxxiv, figs. 1—5; pl. lxxv, figs. 1—6, 22.

1870. — — *L. Dieulafait.* Bull. Soc. géol. France, ser. 2, vol. xxvii, p. 431.

1871. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 287, pls. clxxxvii, clxxxviii, cxcii, fig. 1.

1875. Exogyra sinuata, *J. Phillips.* Geol. Yorks., Part i, ed. 3, p. 244, pl. ii, fig. 23.

— — subsinuata, *Phillips.* Ibid., p. 244.

1877. Ostrea Couloni, *G. Böhm.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix, p. 231.

1878. Ætostreon latissimum, *E. Bayle.* Explic. Carte géol. France, vol. iv, pt. 2, Atlas, pl. cxxxix, figs. 1—3.

— — consobrinus, *Bayle.* Ibid., pl. cxxxix, fig. 4.

— — Couloni, *Bayle.* Ibid., pl. cxl, figs. 1, 2.

— — aquilinum, *Bayle.* Ibid., pl. cxl, figs. 3—5.

? 1883. Ostrea (Exogyra) Couloni, *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 100.

1884. — — — *O. Weerth.* Fauna d. Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 55.

1884. Exogyra aquila, *C. A. White.* Foss. Ostreidæ of N. America (4th Ann. Rep. U.S. Geol. Surv.), p. 304, pl. liii, figs. 1, 2.

1886. — Couloni, *H. Trautschold.* Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xv, p. 133.

1889. — sinuata, *G. W. Lamplugh.* Quart. Journ. Geol. Soc., vol. xlv, p. 615.

1891. — Couloni, *O. Behrendsen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xliii, p. 419.

1895. Ostrea (Exogyra) Couloni, *G. Maas.* Ibid., vol. xlvii, p. 270.

1896. Exogyra Couloni, *A. Wollemann.* Ibid., vol. xlviii, p. 831.

1897. — sinuata, *R. B. Newton.* Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 74, pl. ii, figs. 2, 3.

? 1897. — aquila, *K. Gerhardt.* Neues Jahrb. für Min., etc., Beil.-Bd. xi, p. 175, pl. iv, fig. 10.

1900. — Couloni, *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preus. geol. Landesanst. N.F., pt. 31), p. 8, pl. i, fig. 1.

? 1903. — *cf.* Couloni, *W. Paulcke.* Neues Jahrb. für Min., etc., Beil.-Bd. xvii, p. 291.

? 1904. — Couloni, *E. Dacqué.* Beitr. Paläont. u. Geol. Österr.-Ungarns u. d. Orients, vol. xvii, p. 14, pl. ii, figs. 6—8.

1905. Exogyra Couloni, *E. Harbort.* Fauna d. Schaumburg-Lippe'schen Kreidemulde (Abhandl. d. k. preuss. geol. Landesanst., N.F., 45), p. 30.

1907. -- *O. Haupt.* Neues Jahrb. für Min., etc., Beil.-Bd. xxiii, p. 211.

1908. -- -- *A. A. Stojanoff.* Ann. géol. et min. Russie, vol. x, p. 119.

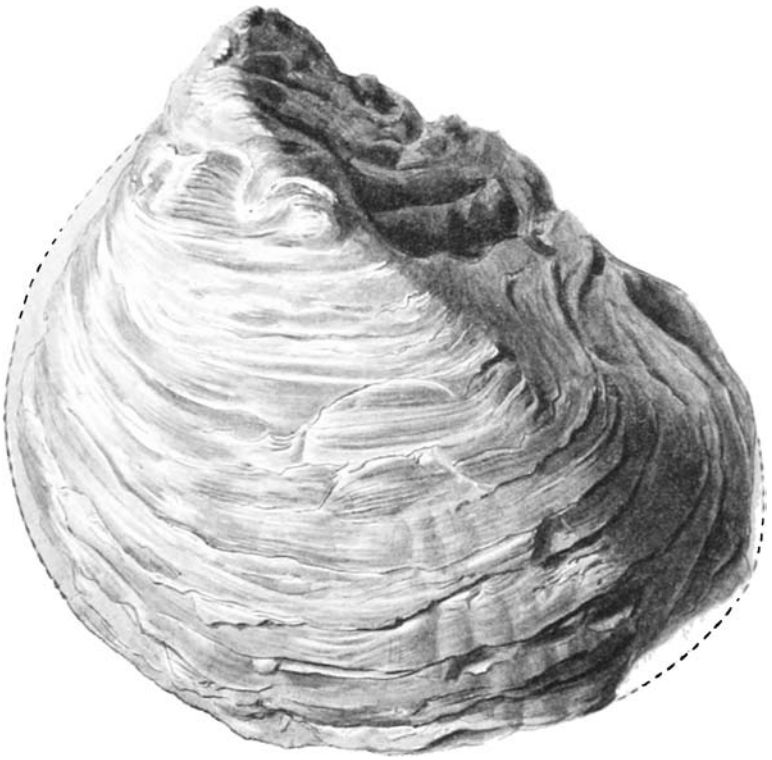
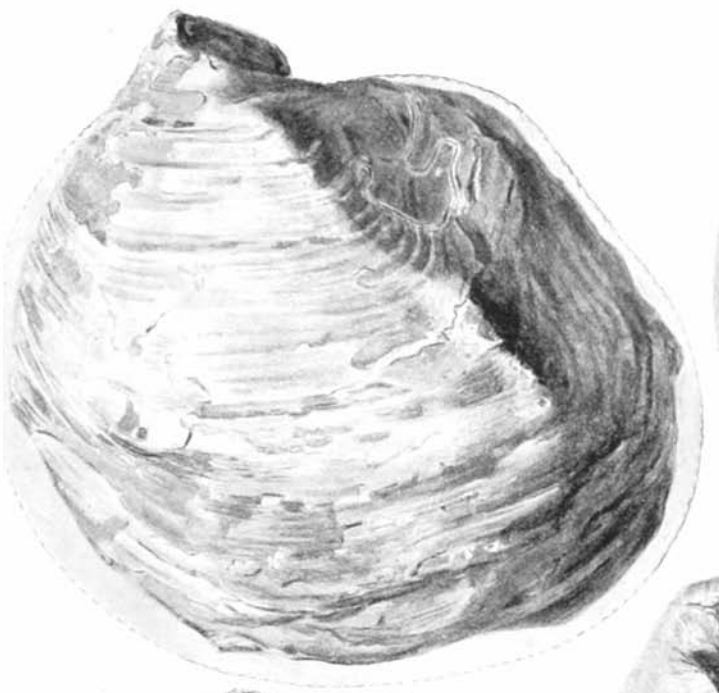


Fig. 194.—*Exogyra sinuata* (Sow.) Hythe Beds, Sevenoaks. Sedgwick Museum, Cambridge. Left valve. × ¾.

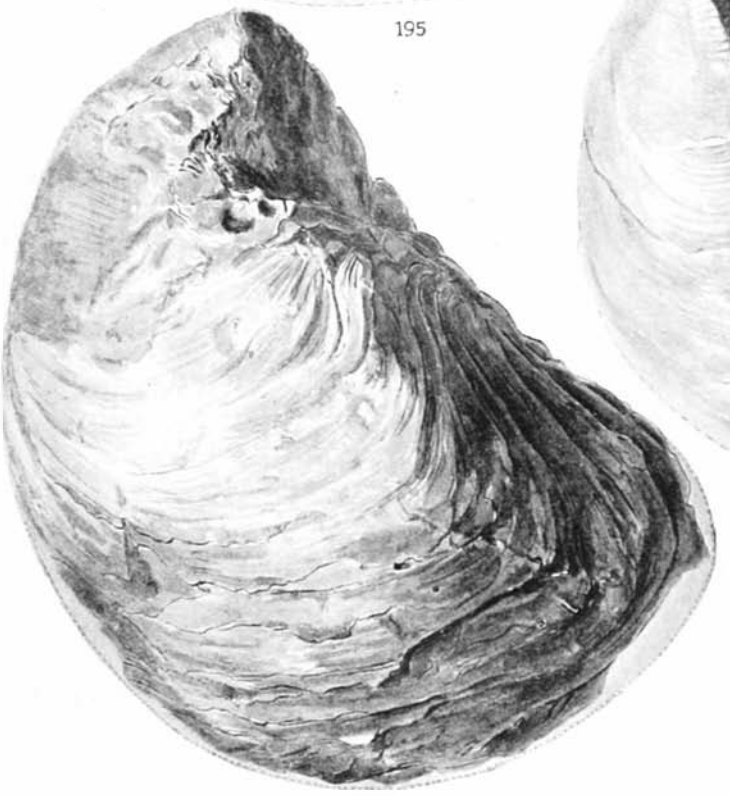
Description.—Shell with subtrigonal, subquadrate, oval or rounded outline; often large and massive. The posterior margin is truncated; in the early stages of growth it is either nearly straight or slightly concave; later it becomes more concave, with an angular projection at its dorsal and at its ventral end; in large specimens this margin usually becomes more rounded. The anterior and ventral margins usually form a convex curve. In large specimens the postero-dorsal margin is sometimes nearly straight. In many small, and in some large specimens, the height of the shell is distinctly greater than the length, but in others, particularly large forms, the height and length are nearly equal. In some of the high forms the shell is considerably arched, the posterior part being concave.

Left valve moderately or very convex. Umbo often relatively small, usually spiral, with a moderate or large backward curvature. The surface of attachment is



195

196



197

198

FIGS. 195—198.—*Exogyra sinuata* (Sow.). Left valves. 195, 197, 198, Sedgwick Museum. 196, Mr. Lamplugh's Collection. 195, Hythe Beds, Hythe. 196, Speeton Clay (zone of *Belemnites lateralis*), Speeton. 197, Tealby Limestone, Claxby. 198. Ferruginous Sands, Atherfield. All × 1.

199

201

200

202

203

Figs. 199—203.—*Exogyra sinuata* (Sow.). Sedgwick Museum. 199, 200, right and left valves of one specimen; Lower Greensand, Atherfield. 201—203, left valves. 201, 202, Tealby Limestone, Claxby. 203, Claxby Ironstone, Donnington. All × $\frac{3}{4}$.

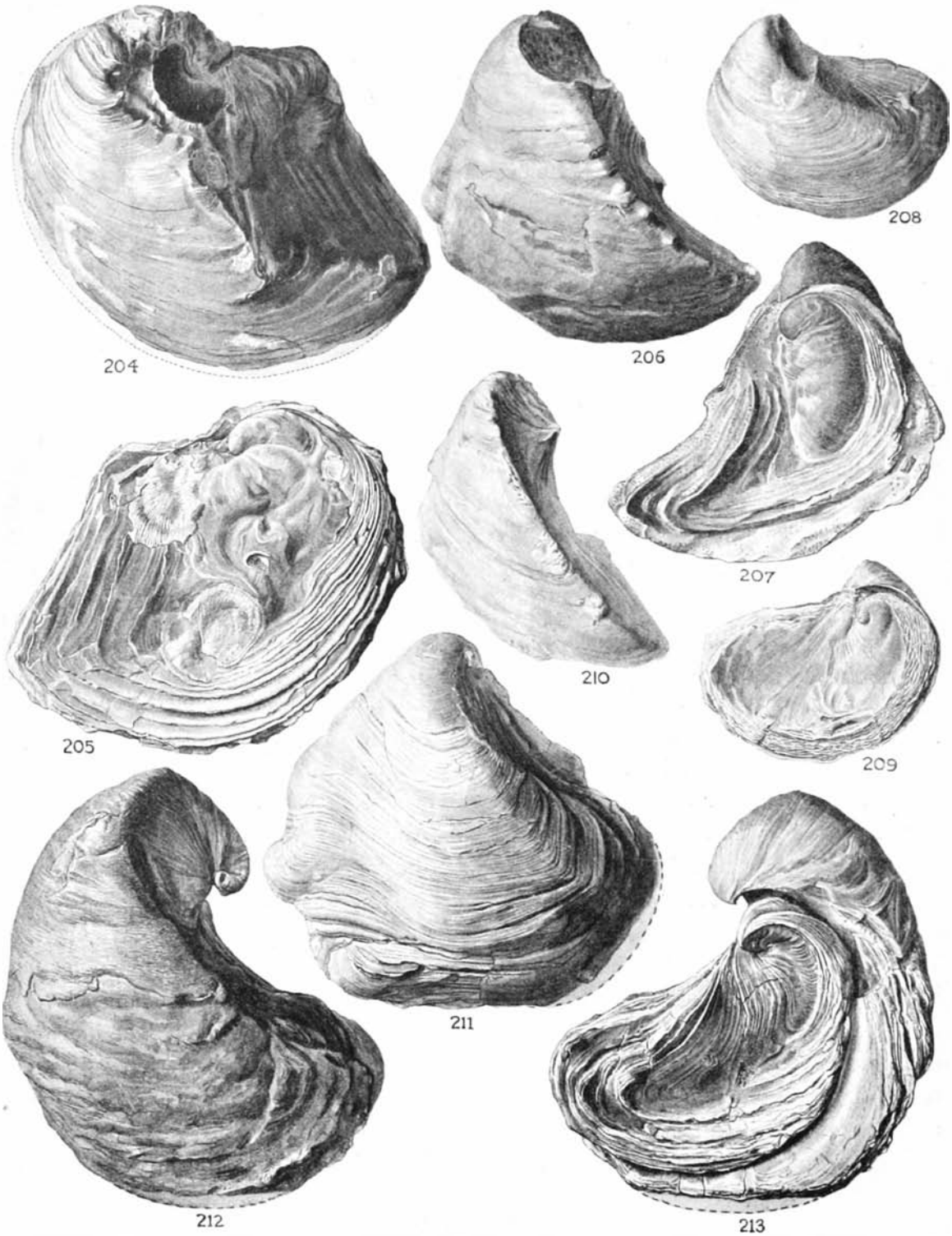
behind the umbo and is usually of small or moderate size. A carina extends in a curve from the umbo towards the postero-ventral extremity, and sometimes bears coarse tubercles or spiny projections; it is at first strong, and may be continued to the postero-ventral margin of the valve, which is then angular; but in large specimens it often becomes indistinct during the later stages of growth and may ultimately disappear. Usually the carina is angular at first and becomes rounded later, but it may be angular throughout or rounded throughout; sometimes it divides the valve into two nearly equal parts, but usually the anterior is larger than the posterior part. The former is convex; the latter is flattened or concave or undulating, and its slope to the posterior margin is often gradual, but may be steep or even perpendicular. The surface of the valve bears distinct growth-lines, and sometimes shows faint radial folds. The curvature of the ligament-pit varies with that of the umbo.

Right valve usually nearly flat or slightly concave or undulating, but sometimes very concave. Its outline varies as in the left valve. Umbo small, more or less considerably spiral. Surface with growth-lines and occasionally with faint radial ribs. Adductor impression large, oval, usually sub-median.

Affinities.—By some authors, especially Leymerie and Coquand, the forms similar to the types of *Gryphæa sinuata*, Sowerby, and *G. aquila*, Brongniart,[1] have been regarded as specifically distinct from those like *Exogyra subsinuata*, Leymerie[2]; but Pictet and Renevier (1858), after studying a large series of specimens from Switzerland, France, and England, came to the conclusion that it was impossible to separate these as two species; the same view was maintained by Pictet and Campiche in 1871, and has been supported more recently by Wollemann (1900), who has examined a large series of specimens from North Germany. Pictet, Renevier and Campiche showed that the two forms are not, as Leymerie maintained, characteristic of different horizons, but occur together, although varying in abundance at different levels. The study of numerous English and some foreign specimens leads me to endorse the view first expressed by Pictet and Renevier. The variation is found to be extremely great, and the different forms are connected by numerous gradations. It is also noticeable, as Pictet and Renevier pointed out, that the varieties of *subsinuata*, some of which were named *aquilina*, *dorsata*, and *falcifera* by Leymerie, may differ from one another more than they do from *sinuata*. The forms of the *sinuata* (*aquila*) type are common in the Atherfield and Hythe Beds, and those of the *subsinuata* type occur mainly in the zones of *Belemnites lateralis* and *B. jaculum*, but neither is confined to those horizons.

[1] See figs. 194, 195, 199, and the figures of Sowerby (1822), Brongniart (1822), Pictet and Roux (1853), Leymerie (1846), pl. vi, fig. 1.

[2] See figs. 202, 203, 206, 212, 214, and Leymerie (1842), pl. xii, figs. 3, 7; (1846), pl. vii, figs. 3, 4.



FIGS. 204—213.—*Exogyra sinuata* (Sow). 204, 205, left and right valves of one individual; Hythe Beds, Hythe; Sedgwick Museum. 206, 207, 210, Claxby Ironstone, Donnington; Sedgwick Museum; 206, 210, left valves; 207, right valve of 206. 208, 209, Hythe Beds, Hythe. Museum of Practical Geology, No. 20821. Left and right valves (*lævigata* form). 211, Speeton Clay, (zone of *B. lateralis*), Speeton. Mr. Lamplugh's Collection. Left valve. 212, 213. Speeton Clay, Speeton. Sedgwick Museum. Left and right valves of one individual. All × $\frac{2}{3}$.

Exogyra imbricata, Krauss,[1] from the Uitenhage Series, is closely allied to *E. Couloni*.

Remarks.—The proportion of the height to the length of the shell varies considerably. In some specimens the height is much greater than the length, but in others the two diameters are nearly equal. In the latter case the left valve is usually less convex relatively than in the higher and more strongly carinate forms. In the specimens in which the carina reaches the margin the postero-ventral extremity is more angular than in those in which it becomes indistinct. The slope of the posterior part of the left valve is gentle in the forms in which the height and length are nearly equal, but becomes steeper in the higher and more strongly carinate forms,

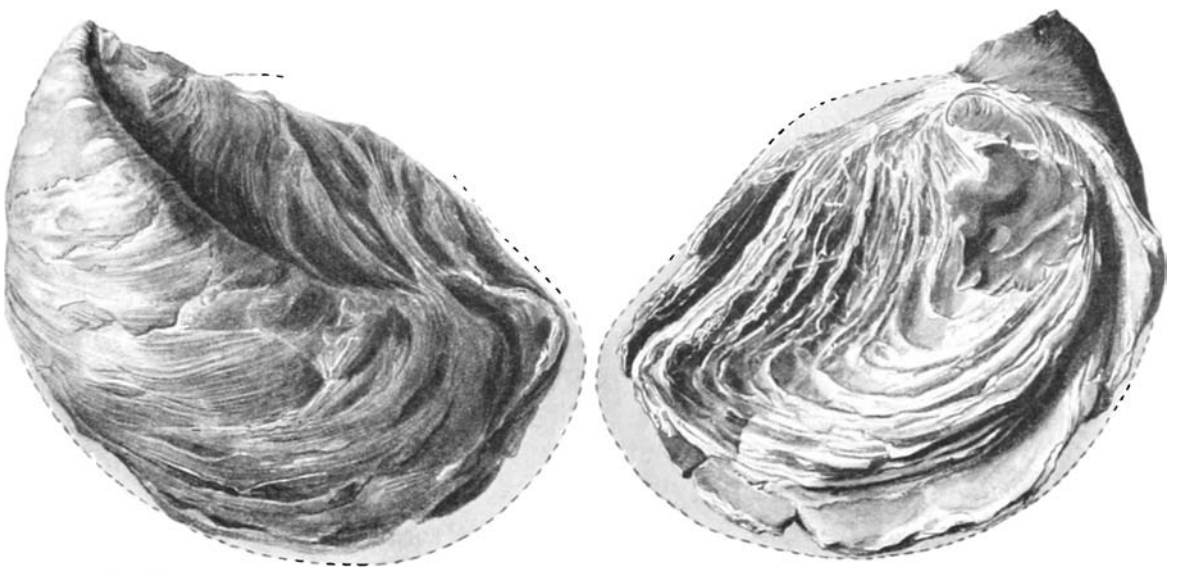


Fig. 214.—*Exogyra sinuata* (Sow). Speeton Clay (probably zone of *Belemnites lateralis*), Speeton. Sedgwick Museum. Left and right valves. × ¾.

and is sometimes, as in the example figured by Phillips (1822), perpendicular to the plane of the valves (fig. 211). In that type, which is an extreme example, the umbo is only slightly curved, but this form passes gradually into others with a strongly curved umbo. Indications of radial folds are seen in some specimens, but they are less distinct than in some foreign examples.

Some specimens show that the stage in which the posterior margin is sinuous is preceded by one in which it is only slightly concave (fig. 199). The type of *Gryphæa aquila*, Brongniart, is a small example of the *sinuata* form with the carina continued to the margin. The specimen figured by Pictet and Roux is similar, but larger, and with the carina becoming indistinct towards the margin; the large

[1] 'Nova Acta Acad. Cæs. Leop.-Carol. Nat. Cur.,' vol. xxii (1850), 2, p. 460, pl. 1, fig. 2. Sharpe. 'Trans. Geol. Soc.,' ser. 2, vol. vii (1856), p. 197, pl. xxiii, fig. 3. Kitchin, 'Ann. S. African Mus.,' vol. vii (1908), p. 77.

rounded forms (like Sowerby's *sinuata*) are older individuals of the same type, and sometimes attain a height of 8 or 9 inches.

A small, oval, very inequilateral form, with a rounded carina, was named *Exogyra lævigata* by Sowerby (1829), and was stated to have come from the Irish Greensand. An examination of the type shows clearly that it was not obtained from that deposit, but from the Hythe Beds; the form of the shell and the character of the matrix agree perfectly with other examples which have been found in the Hythe Beds (figs. 208, 209).

The examples from the Lower Greensand of Upware, which were referred by W. Keeping to *Exogyra Couloni*, probably belong to this species, but the specimens seem to me too few and not sufficiently perfect to enable the identification to be made with certainty.

In England Sowerby's name (*sinuata*) has been generally used for this species, but Defrance's name (*Couloni*) has been adopted by foreign writers; the former is used here since, although Defrance's name has priority, the description was scarcely sufficient for identification and was not accompanied by either a figure or a reference to a figure.

Types.—*Gryphæa Couloni*, Defrance, from the neighbourhood of Neuchâtel. *G. sinuata*, Sowerby, from the Hythe Beds of Ashford, and *E. lævigata* from the Hythe Beds, in the British Museum. *G. aquila*, Brongniart, from the Upper Aptian of the Perte du Rhône. *G. sinuata*, Phillips, from the Speeton Clay, in the York Museum. *Exogyra subsinuata*, Leymerie, from the Neocomian of the Aube.

Distribution.—Atherfield Beds of Atherfield, Compton Bay and Sevenoaks. Ferruginous Sands of Atherfield and Shanklin. Hythe Beds of Hythe, Lympne and Maidstone. Folkestone Beds of Folkestone. *Mammillatus* bed of Okeford Fitzpaine (Dorset). Speeton Clay (zones of *Belemnites lateralis*, *B. jaculum* and *B. brunsvicensis*) of Speeton. Claxby Ironstone (zone of *B. lateralis*) of Donnington. Tealby Limestone (zone of *B. brunsvicensis*) of Claxby.

EXOGYRA TUBERCULIFERA, *Koch and Dunker*, 1837. Plate LXI, figs. 7—11.

1835.	EXOGYRA SPIRALIS, *F. A. Römer.*	Verstein. nord-deutsch. Oolith.-geb. p. 65 (*partim*), (non *E. spiralis*, Goldfuss).
1837.	— TUBERCULIFERA, *F. C. L. Koch and W. Dunker.*	Nord-deutsch Oolith.-geb., p. 54, pl. vi, fig. 8.
? 1839.	— SUBPLICATA, *F. A. Römer.*	Verstein. nord-deutsch. Oolith.-geb., Nachtrag., p. 25, pl. xviii, fig. 17.
1841.	— — *Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 47.
—	- TUBERCULIFERA, *Römer.*	Ibid., p. 48.
1842.	— SUBPLICATA, *A. Leymerie.*	Mém. Soc. géol. de France, ser. 2, vol. v, p. 18, pl. xi. figs. 4—6.

1845. GRYPHÆA HARPA vars. SUBPLICATA et SEMIPLICATA, *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 250, pl. iii, fig. 12.

1847. OSTREA BOUSSINGAULTI, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 702, pl. cccclxviii, figs. 6—9 (non figs. 1—3 = *O. Minos*, Coquand).

1853. — HARPA, *F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, p. 526, pl. xlix, fig.2.

1854. EXOGYRA HARPA, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 166.

1855. OSTREA BOUSSINGAULTII, *G. Cotteau.* Moll. Foss. de l'Yonne, p. 121.

1858. — BOUSSINGAULTI, *F. J. Pictet and E. Renevier.* Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 140, pl. xix, fig. 5.

1868. — — *P. de Loriol.* Valangien d'Arzier (Matér. Pal. Suisse, ser. 4), p. 50, pl. iii, figs. 14—16.

1869. — — *P. de Loriol and V. Gilliéron.* Urgon. infér. Landeron, p. 26, pl. i, fig. 23, pl. ii, figs. 1—4.

— — — *H. Coquand.* Mon. Ostrea, Terr. Crét., p. 161 (*partim*), pl. lxiv, figs. 8—13.

— — TUBERCULIFERA, *Coquand.* Ibid., p. 189, pl. lxiii, figs. 8, 9; pl. lxvi, figs. 12, 13; pl. lxx, figs. 9—13.

1871. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 280, pl. clxxxvi, figs. 1—11.

? — — BOUSSINGAULTII, *W. A. Ooster.* Protozoe Helvetica, vol. ii, pp. 106, 127, 141, pl. xvi, figs. 5—7.

? 1884. — (EXOGYRA) SPIRALIS, *O. Weerth.* Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 56, pl. ix, figs. 13, 14 (? 12).

? 1892. EXOGYRA TUBERCULIFERA, *O. Behrendsen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xliv, p. 25.

? — — SUBPLICATA, *Behrendsen.* Ibid., p. 26.

1895. — — *G. Maas.* Ibid., vol. xlvii, p. 270.

— — SPIRALIS, *Maas.* Ibid., p. 270.

1896. — TUBERCULIFERA, *A. Wollemann.* Ibid., vol. xlviii, p. 832.

1897. — BOUSSINGAULTI, *K. Gerhardt.* Neues Jahrb. für Min., etc., Beil.-Bd. xi, p. 175, pl. i, fig. 6.

1900. — TUBERCULIFERA, *Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preuss. geol. Landesanst., N.F., pt. 31), p. 13.

1906. — — *Wollemann.* Jahrb. d. k. preuss. geol. Landesanst. u. Bergakad., vol. xxvii, p. 264.

Non 1842. Exogyra Boussingaultii, *A. d'Orbigny*. Voy. dans l'Amérique Mérid., vol. iii, pt. 4, pl. xviii, fig. 20; p. xxi, figs. 8, 9 (=*O. Minos*, Coquand).

Description.—Left valve very convex, elongated between the umbo and the postero-ventral extremity, more or less considerably arched, with a sharp carina curving from the umbo to the extremity and becoming less prominent on the later part of the valve. Behind the carina the valve is concave or flattened, in front of it regularly convex. Umbo more or less considerably spiral. From the carina a number of rounded radial ribs extend to the margin, but are indistinct or absent on the posterior part of the valve; these give a corrugated margin to the valve; the ribs are crossed by well-marked growth-ridges. Inside the valve, at a short distance from the margin, is a band of transverse crenulations. Adductor impression large, oval, submedian, or rather near the posterior margin. The attached surface may be small or large; when large, the marginal part (except the posterior) grows vertically upwards from the support and bears ribs. Right valve nearly flat, with growth-lines; umbo small, spiral.

Affinities.—This species is related to *E. Minos*, Coquand,[1] but in the latter radial ribs occur on the right valve. It seems probable that *E. tuberculifera* has been derived from a small form of *E. sinuata*. A small example (Plate LXI, fig. 13) which agrees with the *lævigata* type of *E. sinuata*, except for the presence of radial ribs, seems to connect that species with *E. tuberculifera*.[2]

Types.—The type of Koch and Dunker is a right valve from the Neocomian of the Elligser Brink; the surface of this specimen has a tuberculate appearance because it is encrusted by another organism.[3] Later authors have been able to identify it with the forms named *E. subplicata*, Römer, and *E. Boussingaultii*, d'Orbigny, of which good figures have been published. The specimens figured by Forbes, which have a large surface of attachment, are from Atherfield, and are now in the Museum of Practical Geology (No. 25984).

Distribution.—Lower Greensand:—*Perna*-bed of Atherfield, Redcliff (Sandown), and East Shalford; Crackers of Atherfield; Ferruginous Sands of Shanklin; Hythe Beds of Lympne.

[1] D'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1847), pl. cccclxviii, figs. 1—3; Coquand, 'Mon. Ostrea, Terr. Crét.' (1869), p. 183, pl. lxiv, figs. 1—3, pl. lxxiii, figs. 4—8, pl. lxxiv, figs. 14, 15; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' ('Mater. Pal. Suisse,' ser. 5, 1871), p. 278, pl. clxxxv; Wollemann, 'Bivalv. u. Gastrop. deutsch. u. holländ. Neocoms' (1900), p. 15; Müller, 'Deutsch.-Ost-Afrika,' vol. vii (1900), p. 548, pl. xxiii, fig. 1, text-figs. 46, 47.

[2] See also Leymerie (1842), pl. xi, fig. 4.

[3] The name *tuberculifera* is consequently inappropriate, but has been retained by several authors.

EXOGYRA CONICA (*Sowerby*), 1813. Text-figures 215—242.

1813. CHAMA CONICA, *J. Sowerby*. Min. Conch., vol. i. p. 69, pl. xxvi, fig. 3.
— — RECURVATA, *Sowerby*. Ibid., p. 69, pl. xxvi, fig. 2.
— — PLICATA, *Sowerby*. Ibid., p. 70, pl. xxvi, fig. 4.
— — HALIOTOIDEA, *Sowerby*. Ibid., p. 67, pl. xxv, figs. 1—5.
1829. EXOGYRA CONICA, *J. de C. Sowerby*. Ibid., vol. vi, p. 219, pl. dcv, figs. figs. 1—3.
? 1833. — CONICA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 36, pl. lxxxvii, fig. 1.
— — SUBCARINATA, *Goldfuss*. Ibid., p. 37, pl. lxxxvii, fig. 4.
— — UNDATA, *Goldfuss*. Ibid., p. 35, lxxxvi, fig. 10.
— — HALIOTOIDEA, *Goldfuss*. Ibid., p. 38, pl. lxxxviii, fig. 1.
1837. AMPHIDONTE CONICA, *G. G. Pusch*. Polens Paläont., p. 39.
— — HALIOTOIDEA, *Pusch*. Ibid., p. 38.
1839. EXOGYRA CORNU ARIETIS, E. HALIOTOIDEA et E. AQUILA, *H. B. Geinitz*. Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 20.
1840. — PLICATULA, *Geinitz*. Ibid., pt. 2, p. 84.
? 1846. — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 44, pl. xxxi, figs. 5—7.
1847. OSTREA CONICA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 726, pl. cccclxxviii, figs. 5—8; pl. cccclxxix, figs. 1—3.
— — RAULINIANA, *d'Orbigny*. Ibid., p. 708, pl. cccclxxi, figs. 1—3.
— — HALIOTIDEA, *d'Orbigny*. Ibid., p. 724, pl. cccclxxviii, figs. 1—4.
1849. GRYPHÆA CONICA, *T. Brown*. Illustr. Foss. Conch. Gt. Brit. and Ireland, p. 149, pl. lx, fig. 3.
— — HALIOTOIDEA, *Brown*. Ibid., p. 149, pl. lx, figs. 6—9.
1850. OSTREA CONICA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 171.
— — RAULINIANA, *d'Orbigny*. Ibid., p. 139.
— — HALIOTIDEA, *d'Orbigny*. Ibid., p. 171.
— EXOGYRA RAULINIANA, *J. de C. Sowerby*, in *F. Dixon*. Geol. Sussex, p. 357, (*E. haliotoidea*, p. 386, ed. 2), pl. xxvii, fig. 7.
— — CONICA, *H. B. Geinitz*. Das Quadersandst. oder Kreidegeb. in Deutschland, p. 202.
1853. OSTREA RAULINIANA, *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 521, pl. l, fig. 1.
1854. EXOGYRA CONICA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 166.
— — HALIOTOIDEA, *Morris*. Ibid., p. 166.
1859. — — *T. Wiltshire*. Red Chalk of England (Geol. Assoc.), p. 16, pl. ii, fig. 6.
— OSTREA VESICULARIS, *Wiltshire*. Ibid., p. 16, pl. ii, fig. 5.
1863. — CONICA, *A. v. Strombeck*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 109.

? 1868. OSTREA CONICA, *A. Briart and F. L. Cornet.* Meule de Bracquegnies (Mém. cour. et Mém. des. Sav. étrangers, vol. xxxiv), p. 45, pl. iv, figs. 3, 4.

— — HALIOTOIDEA, *Briart and Cornet.* Ibid., p. 45, pl. iv, figs. 5, 6, 8.

? 1868. EXOGYRA CONICA, *E. Eichwald.* Lethæa Rossica, vol. ii, p. 400.

1869. OSTREA CONICA, *H. Coquand.* Mon. Ostrea, Terr. Crét., p. 150, pl. liii, figs. 1—7.

— — HALIOTIDEA, *Coquand.* Ibid., p. 144, pl. l, figs. 8—10; pl. lii, figs. 11—17.

— — RAULINIANA, *Coquand.* Ibid., p. 157, pl. lxi, figs. 1—3.

? 1871. EXOGYRA HALIOTOIDEA, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 458, pl. xxxvi, fig. 7; pl. xxxvii, figs. 1—3.

1871. OSTREA RAULINIANA, *F. J. Pictet and G. Campiche.* Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 307, pl. cxciii, figs. 15, 16.

— — CONICA, *Pictet and Campiche.* Ibid., p. 302, pl. cxciii, figs. 1, 2.

1872. — (EXOGYRA) CONICA, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 183, pl. xl, figs. 8—13; pt. 2, pl. viii, fig. 14.

— — — HALIOTOIDEA, *Geinitz.* Ibid., p. 184, pl. xli, figs. 1—13.

1875. EXOGYRA HALIOTOIDEA, *A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. xxxi, p. 296.

? 1877. — CONICA, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat. ii. Weissenberg. u. Malnitz. Schicht., p. 139, fig. 134.

1878. RHYNCHOSTREON CONICUM, *E. Bayle.* Explicat. Carte géol. France, vol. iv, Atlas, pt. 1, pl. cxxxviii, figs. 6, 7.

1881. OSTREA CONICA, *J. Gosselet.* Esquisse géol. du Nord, iii, pl. xvii, fig. 11.

? 1882. EXOGYRA CONICA, *H. Schröder.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 259.

— — — *G. Seguenza.* Atti R. Accad. Lincei, ser. 3, Cl. Sci. Fis. Math., vol. xii, p. 176.

— — HALIOTIDEA, *Seguenza.* Ibid., p. 175.

1883. — CONICA, *vars., W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 101, pl. iv, fig. 3.

? 1885. — — *F. Nötling.* Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 14, pl. ii, figs. 1, 2.

1890-91. OSTREA CONICA, *A. Peron.* Brachiopodes etc., Terr. Crét. Hauts-Plateaux de la Tunisie, p. 113, pl. xxiii, figs. 8—10.

? 1893. OSTREA sp. *cf.* HALIOTOIDEA, *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 239.

1895. EXOGYRA CONICA, *E. Tiessen.* Ibid., vol. xlvii, p. 466.

? — — *cf.* HALIOTIDEA, *Tiessen.* Ibid., p. 465.

1909. — CONICA, *R. B. Newton.* Trans. Roy. Soc. S. Africa, vol. i, p. 51, pl. ii, figs. 8—10.

Non 1827. Chama conica, *S. Nilsson*. Petrific. Suecana, p. 28, pl. viii, fig. 4.
— 1837. — — *W. Hisinger*. Lethæa Suecica, p. 63, pl. xix, fig. 4.
? — 1841. Exogyra conica, *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 47.
? — 1883. — — *A. Fritsch*. Stud. im Gebiete d. böhm. Kreidef. iii Iserschicht., p. 117, fig. 92.

Description.—Left valve very convex, with a more or less subtriangular or semi-oval outline, very inequilateral. Anterior and ventral margins rounded; posterior margin oblique, either straight, slightly concave, convex or sinuous, often forming a rounded angle with the ventral margin. Umbo spiral, curved inwards, and considerably backwards; the attached surface usually behind the umbo. A carina, generally distinct but sometimes rounded, extends in a curve from the umbo towards the postero-ventral extremity. The part of the valve behind the carina is more or less flattened, and may be concave near the umbo; the part in front of the carina is regularly convex. In large specimens the postero-ventral part is more extended and the length of the shell in relation to the height becomes relatively greater, the postero-ventral extremity is more rounded, and the carina becomes less distinct. The surface of the valve is usually smooth, except for growth-lines, but in some specimens (*undata* form) numerous somewhat irregular radial ridges are present, either in the neighbourhood of the umbo or over the entire valve. On the inside of the valve, at a short distance from the margin, is a band of small transverse ridges and pits which broadens and becomes more irregular near the postero-dorsal margin. Adductor impression rather near the postero-dorsal margin, with its upper boundary straight or slightly convex.

Right valve thin, operculiform, often slightly concave, with a small spiral umbo; surface nearly smooth; outline varying with that of the left valve.

In the forms described above (*conica* type), the surface of attachment is small, but it may be very large so that all the left valve with the exception of a narrow marginal part is fixed (*haliotoidea* and *Raulíniana* types); between these extremes every gradation is found. The free marginal part, which seldom extends to the posterior border, usually grows nearly vertically upwards from the body to which the shell is attached. When the attached surface is mainly or entirely behind the position of the carina, then the free marginal part in front is larger, and usually the shell is relatively higher and the spire of the umbo less developed, and in such cases the marginal part sometimes forms an acute angle with the attached surface.[1] The character of the surface (flat, concave, convex or irregular) to which the left valve is attached also influences the form of the shell.

Affinities.—The forms of small or moderate size, which are abundant in the

[1] See d'Orbigny, pl. cccclxxviii, figs. 1—4.

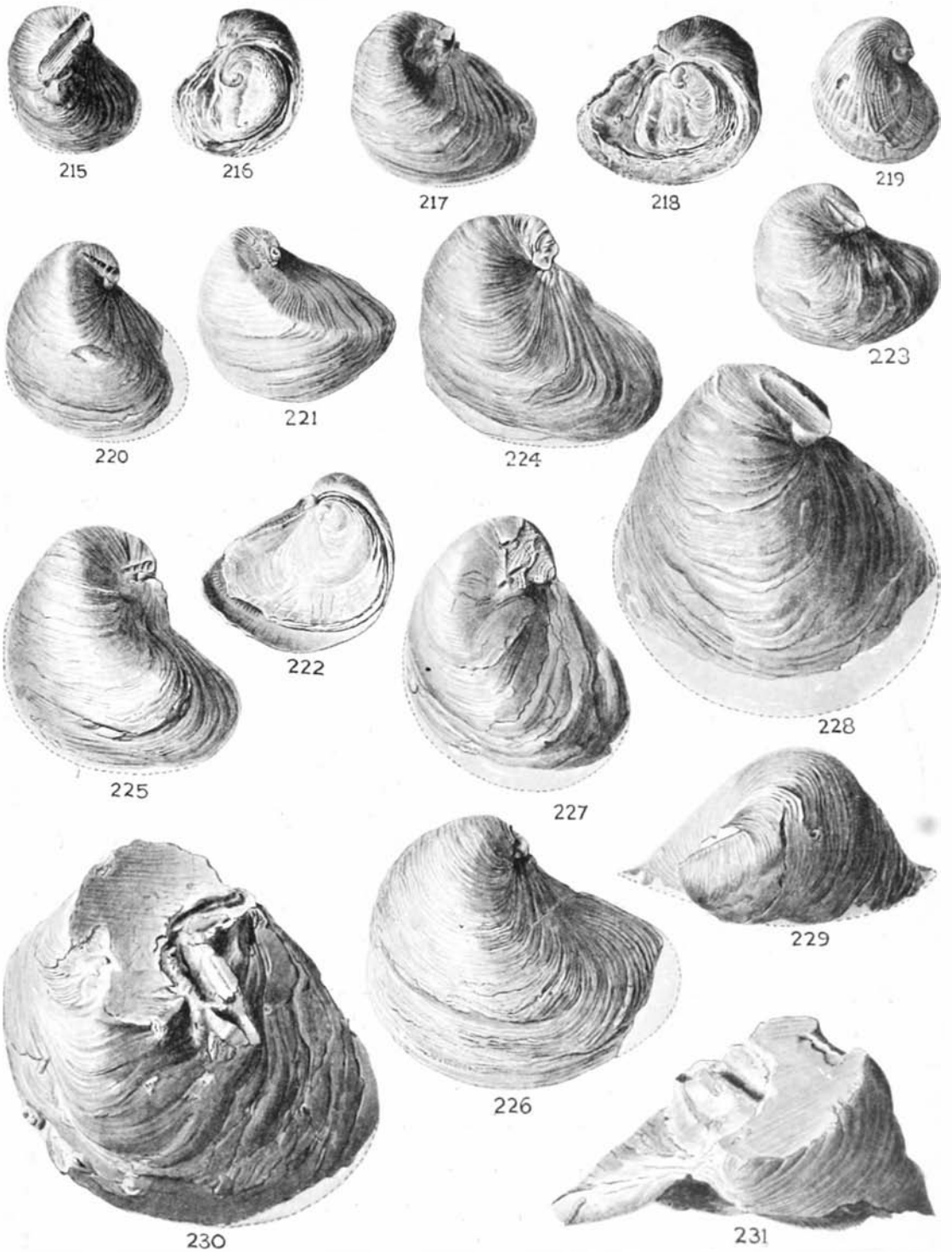
Upper Greensand, and of which typical examples were figured by Sowerby in 1829, have a small surface of attachment, and have been known in this country as *Exogyra conica* (figs. 220—225). A similar form, but of larger size, is common in the Chalk Marl (figs. 228, 229), and the Glauconitic Sandstone of Antrim; no line can be drawn between this and the smaller form of *E. conica*, with which it has been united by most authors (*e. g.* d'Orbigny, Morris, Coquand, Bayle, Peron); examples indistinguishable from *E. conica* of the Upper Greensand are associated with the larger form in Antrim, and on the other hand, some specimens found in the Upper Greensand of the south of England are of larger size than the majority of examples and cannot be separated from the larger form of *E. conica;* but nevertheless the larger form appears generally to mark a somewhat higher horizon than the smaller (*conica*, Sowerby) form.

E. haliotoidea, Sowerby, from the Upper Greensand (fig. 240), is a small form of *E. conica* with a large surface of attachment, and is connected by intermediate forms with examples having only a small attached surface. Similarly *E. Raulíniana*, d'Orbigny (fig. 236—239), from the Gault, Upper Greensand, and Lower Chalk, is a large form of *E. conica* with a large surface of attachment and is linked by a series of gradations (figs. 230—235) to the type with only a small attached surface. Peron[1] has already shown that the large specimens from the Cenomanian of France figured as *E. haliotoidea* by d'Orbigny and Coquand are only forms of *E. conica* modified by having a large surface of attachment; they occur in the same beds as undoubted examples of *E. conica*. In some specimens with a large attached surface the height of the shell is greater than usual, but this, as pointed out above, is due to the shell being fixed mainly or entirely by the posterior slope behind the carina; in such cases the free marginal part forms a sharp angle with the attached surface. Morris and Jukes-Browne united *E. haliotoidea* and *E. Raulíniana*, and Pictet and Campiche recognised the very close relationship of these two forms.

Examples from horizons above the Cenomanian have been referred to *E. haliotoidea* by some authors,[1] notably Hennig, who has compared the Senonian forms of Sweden with specimens from the Cenomanian and Gault. Without the opportunity of examining the Senonian forms I am unable to express any opinion as to

[1] 'Compte Rend. Assoc. franç. Avanc. Sci.,' xxxvi (1908), pt. 2, p. 312.

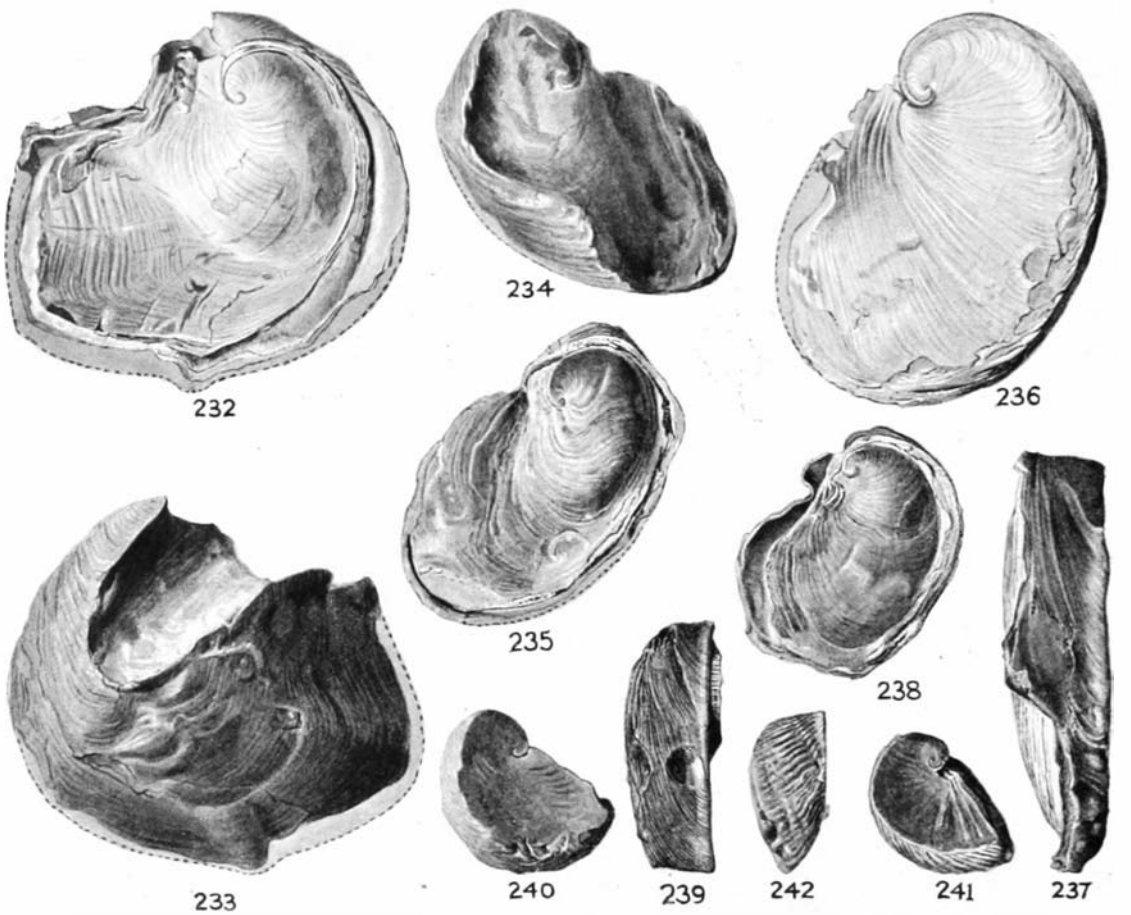
[2] *Chama haliotoidea*, Nilsson, Petrific. Suecana (1827), p. 28, pl. viii, fig. 3; Hisinger, 'Lethæa Suecica' (1837), p. 62, pl. xix, fig. 3. *Exogyra haliotoidea*, Reuss, 'Die Verstein. d. böhm. Kreideformat.,' pt. 2 (1846), p. 44, pl. xxvii, figs. 5, 9, 10, pl. xxxi, figs. 9—10; Müller, 'Petrefact. Aachen. Kreidef., pt. 1 (1847), p. 42; Schröder, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xxxiv (1882), p. 260, pl. xv, fig. 5; Griepenkerl, 'Palæont. Abhandl.,' vol. iv (1889), p. 36; Hennig, 'Revis. Lamellibr. i Nilsson's 'Petrific. Suecana' (1897), p. 19, pl. i, fig. 20, pl. ii, figs. 3, 4; Rutot, 'Bull. Soc. Belge Géol. Pal. et Hydrol.,' vol. x (1897), p. 27, fig. 11.



FIGS. 215—231.—*Exogyra conica* (Sow.). 215—226, Upper Greensand. 227—231, Chalk Marl. Sedgwick Museum except 219, 224, 228. 215, 216, Niton; left and right valves. 217, 218, Ventnor; left and right valves. 219, Haldon; British Museum, No. L. 16860; left valve of ribbed variety. 220—223, zone of *Schlœnbachia rostrata*, Blackdown; left valves. 222, right valve of 221. 224, zone of *Pecten asper*, Warminster; Bristol Museum; left valve. 225, zone of *P. asper*, Eversholt; left valve. 226, zone of *Schlœnbachia rostrata*, Dunscombe; left valve. 227, Folkestone; left valve. 228, 229, Blue Bell Hill, Burham; British Museum, No. L. 10382; left valve and dorsal view. 230, 231, Folkestone; left valve and dorsal view. All natural size.

their relationship. Hennig also includes *E. auricularis* (Wahlenberg)[1] in *E. haliotoidea*.

Pictet and Campiche figure and describe examples of *E. conica* from the Aptian. Specimens of *Exogyra* from the Lower Greensand of Upware, Brickhill, Faringdon and Shanklin have been referred to *E. conica*; in these the carina is more rounded



Figs. 232—242.—*Exogyra conica* (Sow.). Sedgwick Museum except 238—240. 232—235, Cambridge Greensand (base of Chalk Marl). 233, 234, left valves. 232, right valve of 233. 235, right valve of 234. 236, 237, zone of *Holaster subglobosus*, Burwell; 236, right valve; 237, anterior view of 236 showing the large size of the attached surface of the left valve. 238, 239, Gault, Folkestone; Museum of Practical Geology, No. 20873; 238, right valve; 239, anterior view showing left valve attached to a flat *Inoceramus*. 240, Upper Greensand, Devizes. Museum of Practical Geology, No. 20999. Left valve. 241, 242, Cambridge Greensand; ribbed form with a large surface of attachment; 241, left valve; 242, anterior view of 241. All natural size.

than in the common form of the species, but they agree closely with, and seem to be inseparable from some forms of *E. conica* from the Upper Greensand (figs. 215—218).

Small specimens with radial ribs (fig. 219), such as the one figured by Goldfuss

[1] 'Petrific. tell. Suec.' (1821), p. 58. See also Schröder, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xxxiv (1882), p. 260, pl. xv, fig. 4.

as *E. undata* and by d'Orbigny as *E. conica*, have not usually been regarded as distinct from *E. conica*.

Pictet and Campiche record *E. arduennensis* (d'Orbigny)[1] from the Upper Greensand of Blackdown, but they doubt whether that form is really distinct from *E. conica*; the chief difference is that in the former the left umbo is less prominent and less curved.

E. subconica, Vogel von Falckenstein,[2] from the Senonian is allied to *E. conica*.

Types.—The types from the Upper Greensand are in the British Museum. *Chama conica* from Chute (Warminster); *C. recurvata* and *C. plicata* from Haldon; *C. haliotoidea* (figs. 1, 3, 5 are missing) from St. Mary Donhead (Wiltshire). The specimens of *E. conica* figured by Sowerby in 1829 from the Upper Greensand of Blackdown, and the specimen figured in Dixon as *E. Rauliniana* from the Lower Chalk (probably zone of *Holaster subglobosus*) of Sussex, are in the same Museum. The specimens from the Lower Greensand of Upware, figured by Keeping, and those from the Red Limestone of Hunstanton figured by Wiltshire, are in the Sedgwick Museum.

Distribution.—Probably Lower Greensand of Upware and Faringdon. Lower and Upper Gault of Folkestone. Lower Gault of the Isle of Wight. Red Limestone of Hunstanton. Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown, Haldon, Dunscombe, Beer Head, Pinhay Cliffs, Niton, Ventnor, etc. Upper Greensand (zone of *Pecten asper*) of Evershot, Eggardon Hill, Warminster, the Dorset coast, and the Isle of Wight. Cambridge Greensand (indigenous and derived). Chloritic Marl of Compton Bay, Isle of Wight. Chalk Marl (zone of *Schlœnbachia varians*) of Folkestone, Blue Bell Hill (Burham), Reach and Stoke Ferry. Cenomanian of Wilmington, Devon, and the South Devon coast. Zone of *Holaster subglobosus* of Burham, Holborough, Dover, Arlesey, Burwell and Fulbourn.

EXOGYRA COLUMBA (*Lamarck*), 1819. Text-figs. 243—248.

1768. *G. W. Knorr and J. E. M. Walch.* Recueil Mon. Catastr. Pétrificat., vol. ii, p. 127, pl. D III, C, figs. 1—3.

1802. GRYPHÆA SUBORBICULATA, *Lamarck.* Système Anim. sans Vert., p. 398.

1813. GRYPHITES RATISBONENSIS, *E. T. v. Schlotheim.* In Leonhard's Taschenbuch für Min., vol. vii, p. 105.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 711, pl. cccclxii, figs. 1—4. Pictet and Campiche, 'Terr. Crét. Ste. Croix' (1871), pp. 304, 308, pl. cxciii, fig. 3.

[2] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. lxii (1911), p. 560, fig. 1.

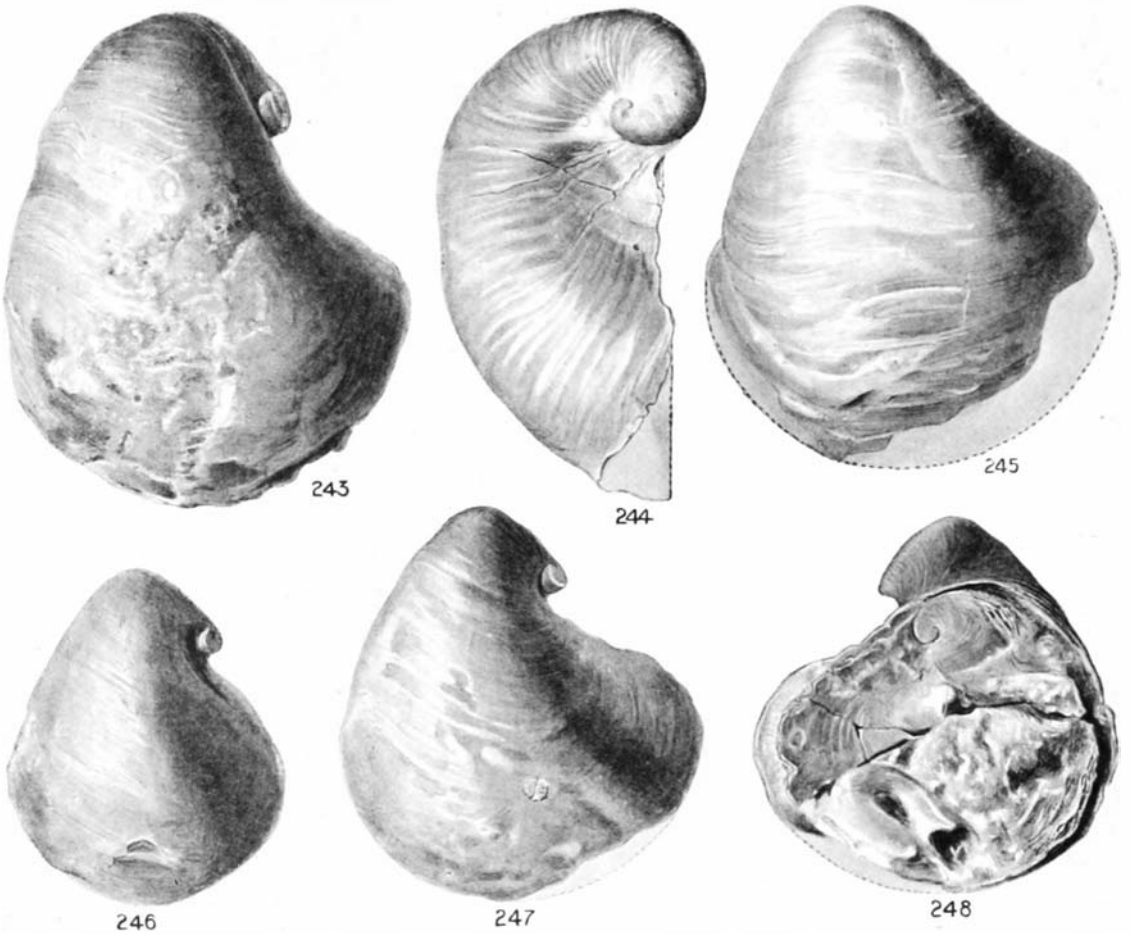
1819. GRYPHÆA COLUMBA, *Lamarck*. Anim. sans Vert., vol. vi, p. 198.
1820. GRYPHITES SPIRATUS, *E. T. v. Schlotheim*. Petrefactenk., p. 288 (*partim*).
1821. GRYPHÆA COLUMBA, *M. J. L. Defrance*. Dict. Sci. nat., vol. xix, p. 534.
1822. — — *J. de C. Sowerby*. Min. Conch., vol. iv, p. 113, pl. cccLxxxiii, figs. 1, 2.
— GRYPHEA COLUMBA, *A. Brongniart*. In Cuvier, Ossemens Fossiles, vol. ii, pp. 320, 608, pl. vi, fig. 8.
1832. OSTREA COLUMBA, *G. P. Deshayes*. Hist. nat. Vers et Mollusques (Encycl. méthod.), vol. ii, p. 302, Planches, vol. iv, pl. clxxxix, figs. 3, 4.
1833. EXOGYRA COLUMBA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 34, pl. lxxxvi, fig. 9.
1837. — — *A. d'Archiac*. Mém. Soc. géol. de France, vol. ii, p. 185.
— GRYPHÆA COLUMBA, *F. Dujardin*. Ibid., p. 228.
— AMPHIDONTE COLUMBA, *G. G. Pusch*. Polens Paläont., p. 37, pl. v, figs. 1, 2.
1839. EXOGYRA COLUMBA, *H. B. Geinitz*. Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 20.
1841. — (GRYPHÆA) COLUMBA, *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 46.
1846. — COLUMBA, *H. B. Geinitz*. Grundr. d. Verstein., p. 481, pl. xx, figs. 19, 20.
? — — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 43, pl. xxxi, figs. 1—4.
1847. OSTREA COLUMBA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 721, pl. cccclxxvii.
1850. — — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 171.
— EXOGYRA COLUMBA, *H. B. Geinitz*. Das Quadersandst. oder Kreidegeb. in Deutschland, p. 202.
1851-52. EXOGYRA COLUMBA, *H. G. Bronn*. Lethæa Geogn., vol. ii, pt. 5, p. 270, pl. xxxi, fig. 10.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 166.
1857. — — *J. Ewald*. Zeitschr. d. deutsch. geol. Gesellsch., vol. ix, p. 12.
1859. OSTREA REAUMURI, *H. Coquand*. Bull. Soc. géol. de France., ser. 2, vol. xvi, p. 960.
? 1866. OSTREA *cfr.* COLUMBA, *K. A. Zittel*. Bivalv. d. Gosaugeb. (Denkschr. d. k. Akad. d. Wissensch., Wien, Math.-nat. Classe, vol. xxv, pt. ii), p. 47 [123], pl. xix, fig. 2.
? 1868. OSTREA COLUMBA, *A. Briart and F. L. Cornet*. Meule de Bracquegnies (Mém. cour. et Mém. des. Sav. étrangers, vol. xxxiv), p. 46, pl. iv, figs. 13—15.
— EXOGYRA COLUMBA, *E. Eichwald*. Lethæa Rossica., vol. ii, p. 404.
1869. OSTREA RATISBONENSIS, *H. Coquand*. Mon. Ostrea, Terr. Crét., p. 121, pl. xlv, figs. 8—12.

? 1870. Ostrea columba, *W. A. Ooster.* Protozoe Helvet., vol. ii, p. 57, pl. x, fig. 18.
— Exogyra columba, *F. Römer.* Geol. v. Oberschles., p. 332, pl. xxvi, fig. 1.
1871. Ostrea columba, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 319.
— Exogyra suborbiculata, *F. Stoliczka.* Palæont. Indica, Cret. Foss. S. India, vol. iii, p. 462, pl. xxxv, figs. 1—4.
1872. Ostrea (Exogyra) columba, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 181, pl. xl, figs. 4—7.
1877. Exogyra columba, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat., ii. Weissenberg. u. Malnitz. Schicht., p. 139, fig. 135.
1878. Rhynchostreon Chaperi, *E. Bayle.* Explicat. Carte géol. France, vol. iv, Atlas, pt. 1, pl. cxxxviii, figs. 1—5.
1882. Exogyra ratisbonensis, *G. Seguenza.* Atti R. Accad. Lincei, ser. 3, Cl. Sci. Fis. Math., vol. xii, p. 181, pl. xix, fig. 1.
1890–91. Ostrea suborbiculata, *A. Peron.* Descript. Brach. etc., Terr. Crét. Tunisie, p. 119, pl. xxiii, figs. 11—13.
1893. Ostrea columba, *S. Meunier.* Le Naturaliste, p. 176, fig. 3.
— Exogyra columba, *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 238.
? — — suborbiculata, *T. W. Stanton.* Colorado Formation (Bull. U.S. Geol. Survey, No. 106), p. 62, pl. v, fig. 6; pl. vi, figs. 1, 2; pl. viii, fig. 1.
1897. — columba, *R. Leonhard.* Palæontographica, vol. xliv, p. 27.
— — — *U. Söhle.* Geogn. Jahresh. (1896), p. 41.
? 1900. — — *G. Müller.* Deutsch-Ost-Afrika, vol. vii, p. 566, pl. xxiv, fig. 2.
1902. — — *P. Oppenheim.* Centralbl. für Min., etc., p. 500.
1903. Ostrea suborbiculata, *R. Fortau.* Bull. Inst. Égyptien, ser. 4, vol. iv, p. 289.
1911. Exogyra columba, *O. Schlagintweit.* Neues Jahrb. für Min., etc., Beil.-Bd. xxxiii, p. 111.

Description.—Shell very inequivalve, moderately or rather considerably inequilateral, usually higher than long and more or less ovate in outline, with, in some cases, the postero-ventral margin somewhat produced.

Left valve inflated, usually with a very small surface of attachment. Umbo usually prominent, spiral, curved more or less considerably backwards. The flank of the valve may be regularly convex, or may show a rounded carina

extending from the umbo postero-ventrally, but this often becomes indistinct in the later stages of growth ; the posterior part of the valve (behind the carina) is convex, except the postero-dorsal part near the umbo, which is concave, and here the margin is more or less concave. The surface of the valve is smooth, except



FIGS. 243—248.—*Exogyra columba* (Lam.). Zone of *Pecten asper*. 243—245, Eversholt. 246—248, Eggardon Hill. 243—247, left valves. 244, posterior view of 243. 248, right valve and left umbo of 247. Sedgwick Museum, Cambridge. All × ⅔.

for growth-lines. Right valve flat, or slightly convex or concave, sometimes undulating. Umbo small, spiral.

Affinities.—This species is allied to *E. conica*, but the carina is less distinct and more rounded, the posterior part of the left valve is less flattened, and the spire of the left umbo is better developed.

Remarks.—Since the name given by Lamarck in 1819 (*columba*) has been used by the majority of later writers it seems better to retain that, rather than attempt to revive the little-known name given by the same author in 1802.

In the Cenomanian of France and other regions where this species is very abundant it is found to be much more variable than it is in the South of England. This variation is also seen in the specimens found in the Glauconitic Sandstone of Antrim. Variation is particularly noticeable in the size of the left umbo, in the extent of its curvature, the more or less inequilateral character of the shell and in the distinctness of the carina.[1]

In the Cenomanian of Algeria and Tunis, specimens, usually known as *Ostrea Mermeti*, Coquand,[2] are extremely abundant and very variable; but Peron, after comparison with numerous French specimens from the same horizon, refers these North African forms without doubt to *E. columba*.

Types.—From the Cenomanian of Le Mans. The specimens figured by Sowerby are in the British Museum; fig. 1 (upper figure) and fig. 2 are from the Cenomanian of Le Mans; fig. 1 (lower figure) is probably from the same locality although labelled "Northampton."

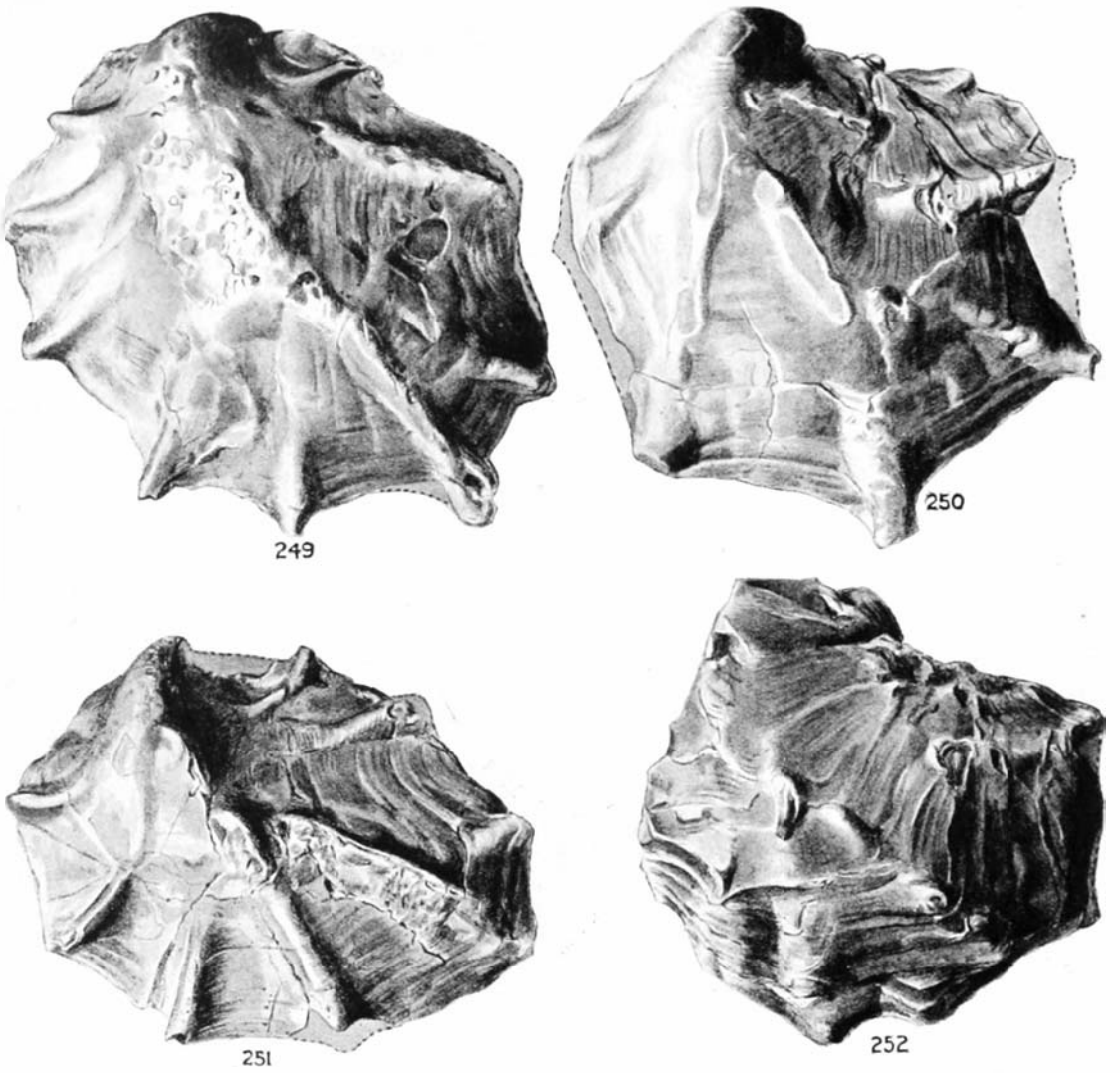
Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown, the South Devon and Dorset coasts. Upper Greensand (zone of *Pecten asper*) of the South Devon and Dorset coasts, Eversholt, Askerswell, Eggardon Hill, Littlebredy (Dorset) and Warminster. Chloritic Marl of Compton Bay, Isle of Wight. Cenomanian (Meÿer's beds 11, 12) of Beer Head.

EXOGYRA DIGITATA (*Sowerby*), 1817. Text-figs. 249—252.

1817. CHAMA DIGITATA, *J. Sowerby*. Min. Conch., vol. ii, p. 165, pl. clxxiv, figs. 1—4.
1840. EXOGYRA LACINIATA, *H. B. Geinitz*. Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 2, p. 58.
1849. GRYPHÆA DIGITATA, *T. Brown*. Illustr. Foss. Conch. Gt. Brit. and Ireland, p. 149, pl. lx, fig. 16.
1850. EXOGYRA DIGITATA. *H. B. Geinitz*. Das Quadersandst. oder Kreidegeb. in Deutschland, p. 204.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 166.
1862. OSTREA COQUANDI, *Julien*, in H. Coquand, Géo. et Pal. Constantine, pl. xxxiii, figs. 10—12.

[1] It should be noted that the apparently small size of the left umbo in the specimens figured by some authors (*e. g.* Geinitz) is due to the fact that the specimens are internal casts from which the thick shell has been removed.

[2] *O. Mermeti*, Coquand, 'Géol. et Pal. Reg. sud Prov. Constantine' (1862), p. 234, pl. xxiii, figs. 3—5; Coquand, 'Mon. Ostrea, Terr. Crét.' (1869), p. 131, pl. lii, figs. 10—12; Lartet, 'Annal Sci. géol., vol. iii (1873), p. 60, pl. x, figs. 8—16. *O. Larteti*, Coquand, *op. cit.* (1869), p. 153, pl. lxii, figs. 15, 16. *O. Luynesi*, Lartet, *op. cit.* (1873), p. 64, pl. x, figs. 17, 18; Coquand, *op. cit.* (1869), p. 153, pl. lxii, figs. 17, 18.



FIGS. 249—252.—*Exogyra digitata* (Sow.). Upper Greensand (zone of *Pecten asper*). Left valves. 249, near Lyme Regis; British Museum, No. 52. 250, White Nothe; British Museum, No. L. 4914. 251, Evershot; Museum of Practical Geology, No. 20956. 252, Weston, South Devon; Sedgwick Museum; convex variety. All × ⅔.

1868. OSTREA DIGITATA, *A. Briart and F. L. Cornet.* Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. XXXIV), p. 47, pl. iv, figs. 1, 2.

1869. — — *H. Coquand.* Mon. Ostrea, Terr. Crét., p. 142, pl. xli, figs. 6—8.

1871. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 317.

1872. Ostrea (Exogyra) digitata, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 184, pl. xl, fig. 14.

1882. Exogyra digitata, *G. Seguenza.* Atti R. Accad. Lincei, ser. 3, Cl. Sci. Fis. Math., vol. xii, p. 180.

Description.—Shell inequilateral, with rounded outline; height and length often nearly equal.

Left valve moderately, sometimes considerably convex. Umbo spiral, curved considerably backwards; the attached surface small, and posterior to the umbo. A carina, sometimes sharp, sometimes rounded, extends in a curve from the umbo towards the postero-ventral extremity, and becomes less distinct on the later part of the valve; behind the umbo the valve is concave or flattened. A few prominent, widely separated radial folds are present; some start from the carina, others begin later, and the ventral part of the carina sometimes becomes replaced by a fold. The dorsal folds are curved. On the folds strong spine-like projections are often developed, and form projections at the margin of the valve. Fine growth-lines occur, and bend over the folds. Right valve nearly flat.

Affinities.—*O. vultur*, Coquand,[1] resembles this species in its strong folds and spines, but the left valve is more inflated and the carina less distinct. *E. digitata* shows considerable resemblance to some forms of *E. cornu arietis* (Nilsson)[2] from the Senonian, in which is included *E. laciniata* (Nilsson).

Except for the strong radial folds *E. digitata* resembles some of the less convex forms of *E. sinuata*, from which it may have been derived.

Type.—The types, from the Upper Greensand (zone of *Pecten asper*) near Sidmouth, cannot be found.

Distribution.—Upper Greensand (zone of *Pecten asper*) of Beer, Weston (Devon), Evershot, and White Nothe (Dorset).

Exogyra sigmoidea, *Reuss*, 1844. Plate LXI, fig. 12.

1844. Exogyra sigmoidea, *A. E. Reuss.* Geognost. Skizz. Böhmen, vol. ii, p. 180.

1846. — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 44, pl. xxvii, figs. 1—4.

[1] 'Mon. Ostrea, Terr. Crét.' (1869), p. 118, pl. xxxix, figs. 1—4. *Rhynchostreon vultur*, Bayle, 'Explicat. Carte géol. France,' vol. iv (1878), Atlas, pl. cxli.

[2] Nilsson, 'Petrific. Suecana' (1827), p. 28, pl. viii, fig. 1. Griepenkerl, 'Palæont. Abhandl.,' vol iv (1889), p. 35, pls. v, vi, vii, figs. 6, 7. Hennig, 'Revis. Lamellibr. i Nilsson's Petrific. Suecana' (1897), p. 21. *Chama laciniata*, Nilsson, *op. cit.*, p. 28, pl. viii, fig. 2.

? 1866. Ostrea (Exogyra) sp. *cfr.* sigmoidea, *K. A. Zittel.* Bivalv. d. Gosaugeb. (Denkschr. d. k. Akad. Wissensch. Wien, Math.-nat. Cl., vol. xxxv, pt. 2), p. 123, pl. xix, fig. 5.

1869. — sigmoidea, *H. Coquand.* Mon. Ostrea, Terr. Crét., p. 93, pl. xxxiv, figs. 5—7 *bis*.

1872. — (Exogyra) sigmoidea, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 186, pl. xli, figs. 14—27.

? 1882. Exogyra *cfr.* sigmoidea, *R. Windmöller.* Jahrb. d. k. preuss. geol. Landesanst. für 1881, p. 30.

1888. — sigmoidea, *G. Müller.* Ibid. für 1887, p. 401.

1911. — — *A. Fritsch.* Stud. im Geb. d. böhmisch. Kreidef., Korycaner Schicht., p. 46, fig. 209.

Remarks.—The only English specimen I have seen is a right valve collected by Mr. Ll. Treacher. The strong carina, the concentric ribs on the anterior slope, the more sinuous and more oblique posterior margin and growth-lines distinguish this species from the *Rauliniana* form of *E. conica*. The inner margin of the valve is finely crenulate. The types came from the Lower Pläner-kalk of Schilling near Bilin.

Distribution.—Zone of *Micraster cor-anguinum* of Boxford, Berkshire.[1]

Family—RADIOLITIDÆ, *Gray.*

[Omitted from Vol. II, p. 210.]

Genus—Durania, *H. Douvillé*, 1908.

('Bull. Soc. géol. de France,' ser. 4, vol. viii, p. 309, and 'Mém. Soc. géol. de France, Paléont.,' vol. xviii, 1910, p. 23.)

Durania Mortoni (*Mantell*), 1833.

1833. Hippurites Mortoni, *G. Mantell.* Geol. S.E. England, p. 130.

1836. Conia, *R. Hudson.* Loudon's Mag. Nat. Hist., vol. ix, p. 104, fig. 19.

1838. Sphærulites Mortoni, *J. E. Gray.* Mag. Zool. Bot., vol. ii, p. 228.

1850. Hippurites Mortoni, *J. de C. Sowerby*, in *F. Dixon.* Geol. Sussex, p. 354 (p. 385, ed. 2), pl. xxvi, figs. 1, 2, 4.

[1] White and Treacher, 'Quart. Journ. Geol. Soc.,' vol. lxii (1906), p. 518.

1854.	Radiolites Mortoni, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 160.
? —	— sp., *Morris.*	Ibid., p. 160.
1900.	Biradiolites Mortoni, *H. Douvillé.*	Bull. Soc. géol. de France, ser. 3, vol. xxviii, p. 230.
1904.	— — *Douvillé.*	Ibid., ser. 4, vol. iv, p. 174.
1909.	Sauvagesia Mortoni, *A. Toucas.*	Classific. et Évolut. des Radiolitidés (Mém. Soc. géol. de France, Paléont., vol. xvii), p. 92, fig. 59.
1911.	Radiolites Mortoni, *F. Francke.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. lxiii, Monatsber., p. 357.
Non 1855.	— Mortoni, *S. P. Woodward.*	Quart. Journ. Geol. Soc., vol. xi, p. 59, pl. v, figs. 1, 2.
— 1866.	— — *K. A. Zittel.*	Bivalv. d. Gosaugeb. (Denkschr. d. k. Akad. Wissensch. Wien, Math.-nat. Cl., vol. xxv, pt. ii), p. 72, pl. xxv, figs. 1—3.
— 1903.	— — *V. Hilber.*	Jahrb. d. k. geol. Reichsanst., vol. lii, (1902), p. 282.

Description.—Lower valve at first conical, afterwards becoming elongate and cylindro-conical, nearly straight or slightly arched. Longitudinal ribs strong, angular, sometimes in groups of two or three, crossed by growth-lines. Bands concave, with fine ribs; the interband convex, usually with strong ribs. Radiating grooves bifurcate once, twice or more in passing from the inner to the outer margin. The cellular structure varies in coarseness in different specimens, and sometimes becomes rather finer towards the outer margin. Upper valve not known.

Affinities.—One of the specimens figured by Sowerby (Dixon, fig. 3) is distinguished from the others by its concave interband with fine ribs and by the narrower siphonal bands; it probably belongs to another species.

Remarks.—Fragments which probably belong to this species are moderately common in the Lower Chalk, and in the Cambridge Greensand,[1] but good specimens are rare. Some examples are of considerable size, the largest being a specimen from the Cambridge Greensand, in which the lower valve has a depth of 21 inches.

Types.—Mantell's specimens cannot be traced. The examples figured by Sowerby (in Dixon, figs. 1—4), from the zone of *Holaster subglobosus*, near Lewes (probably Glynde), and the specimen figured by Hudson from Lewes, are in the British Museum.

Distribution.—Cambridge Greensand (base of Chalk Marl). Probably Chalk

[1] Another species of *Durania* is represented in the Cambridge Greensand by a form with broad, slightly concave bands with fine ribs, and a narrow, strongly concave interband with coarse ribs. The bands and interband resemble those of some species of *Sauvagesia* (Toucas, 1909, pl. xvii, figs. 1, 3, 6).

Marl (zone of *Schlœnbachia varians*) of Ventnor and Folkestone. Zone of *Holaster subglobosus* of Burham and Lewes. Zone of *Rhynchonella Cuvieri* of Dover. Zone of *Terebratulina lata* of Wouldham. Zone of *Holaster planus* of Morgan's Hill, Wiltshire.

DURANIA sp. *cf.* AUSTINENSIS (*Römer*), 1852.

1855. RADIOLITES MORTONI, *S. P. Woodward*. Quart. Journ. Geol. Soc., vol. xi, p. 59, pl. v, figs. 1, 2.

1904. BIRADIOLITES AUSTINENSIS, *H. Douvillé*. Mission Scient. Perse. III, Études géol. iv, Paléont., p. 257.

1909. SAUVAGESIA AUSTINENSIS, *A. Toucas*. Classific. et Évolut. des Radiolitidés (Mém. Soc. géol. de France, Paléont., vol. xvii), p. 96, fig. 64.

1912. DURANIA AUSTINENSIS, *C. F. Parona*. Mem. R. Accad. Scienze di Torino, ser. 2, vol. lxii, p. 287, pl. ii, fig. 4.

Remarks.—In the specimen from the Upper Chalk figured by Woodward the siphonal bands are much broader than in *Durania Mortoni*, and the ribs on the convex interband are finer and more widely separated. The parts recognised by Toucas as siphonal bands were regarded by Woodward as the surfaces to which other individuals had been attached.

This species has been identified with Römer's *Hippurites austinensis* from Texas[1] by the authors quoted above, but, as Prof. Douvillé now points out, this identification must be regarded as uncertain since the essential characters of Römer's species are not yet known.[2] The finer structure of the outer layers of the shell cannot be taken as a distinguishing feature of Römer's species.

Type.—Woodward's specimens from Rosherville are in the British Museum.

Distribution.—Zone of *Micraster cor-anguinum* of Rosherville, near Gravesend.

[1] Römer, 'Kreidebild. v. Texas' (1852), p. 77, pl. vi, fig. 1.

[2] A few specimens show indications of the ligamental ridge and appear to belong to the genus *Sauvagesia*, *e. g.* British Museum No. 33957 from the zone of *Holaster subglobosus* of Sussex, and No. L. 4842 from the Turonian of Dover.

ADDITIONS AND CORRECTIONS.

ARCA, sp. [Vol. I, p. 35.]

Internal casts of a species of *Arca* have been found in the zone of *Belemnitella mucronata* of Norwich. Two examples are preserved in the Norwich Museum (Nos. 2121, 2122).

DICRANODONTA. [Vol. I, p. 53.]

Species of *Dicranodonta* have now been recognised by Borissjak [1] in the Jurassic deposits of Russia. In connection with this genus or subgenus the papers of Solger [2] and Schmidt [3] should be consulted.

CRENELLA ORBICULARIS (*Sowerby*), 1836. Plate LXI, figs. 14—17.

[Omitted from Vol. I, p. 105.]

1836.	LUCINA? ORBICULARIS,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 241, 341, pl. xvi, fig. 13.
1850.	LUCINA ORBICULARIS,	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 162 (*partim*).
1854.	— —	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 208.
1866.	— —	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 291.
1871.	LUCINA? ORBICULARIS,	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 252.

Description.—Shell thin, small, oval, higher than long, slightly inequilateral, regularly convex, with rounded margins. Umbones pointed, with a small anterior curvature. Lunule and escutcheon not defined. Ornamentation consists of numerous, equal, regular, radial ribs which curve outwards from the median line of the valve and are separated by narrow furrows. A few growth-rings occur at intervals.

[1] "Pelecypoden Jura-ablager. Europæisch. Russland. II Arcidæ," 'Mém. Com. géol.,' N.S., xix (1905), pp. 29—32, 58—60, pl. iv, figs. 5—13.

[2] "Ueber *Pseudocucullæa*, einen neuen Taxodontentypus," 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. lv (1903), Monatsber., p. 76.

[3] Ibid., vol. lvi (1904), Monatsber., p. 120.

Measurements:

	(1)	(2)	(3)	(4)	
Length	7	7	6·1	6	mm.
Height	8	7·6	7	6·75	,,

(1—4) Blackdown.

Affinities.—This species has been placed in the genus *Lucina* by previous writers, but Stoliczka suggests that it belongs to *Limopsis*. Although numerous specimens have been seen, none of them shows the character of the hinge and the adductor impressions satisfactorily, but I think that the species should be referred to the genus *Crenella*. *C. inflata* (Müller)[1] from the Senonian of Aachen is a much more inflated form.

Type.—From Blackdown; in the Bristol Museum.

Distribution.—Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown, Haldon, Sidmouth.

SEPTIFER LINEATUS (*Sowerby*). [Vol. I, pp. 107, 225.]

A specimen from the *Uintacrinus* band of Devizes Road, Salisbury, has been found by Dr. Blackmore. The type of *Modiola quadrata*, Sowerby (in Dixon) from Sussex is in the British Museum.

Vol. I, p. 117, footnote. The type of *Dianchora? guttata*, Sharpe (1853, pl. vi, fig. 4), is in the Museum of Practical Geology (Geological Society Collection).

DIMYODON BÖHMI, *Stolley*, 1892.

Grönwall[2] states that this, or a closely allied form, occurs in the Upper Chalk of Gravesend and Grays.

Vol. I, p. 152, footnote. *For* "Müller" *read* "Nilsson." *For* Ravn "p. 9," *read* "p. 91."

PECTEN (CHLAMYS) BRITTANNICUS, *Woods*. Plate LXI, fig. 18.
[Vol. I, p. 167, pl. xxi, figs. 1, 2.]

When this species was described only the left valve was known. A specimen from Bromley with the two valves united has since been found. The right valve

[1] Holzapfel, 'Palæontographica,' vol. xxxv (1889), p. 220, pl. xxv, figs. 17—19.

[2] 'Geol. Mag.' 1906, p. 203; Stolley, 'Die Kreide Schleswig-Holsteins' (1892), p. 243, pl. vii, fig. 8; Grönwall, 'Meddel. fra Dansk. geol. Foren.,' No. 6 (1900), p 78, pl. ii, fig. 8.

is nearly flat, and the broad radial ribs are much less distinct than on the left valve; numerous fine concentric ribs are present, and are widely spaced on the early part of the valve, but become closer together on the later part.

PECTEN (CHLAMYS) CRETOSUS, *Defrance*.

Vol. I, p. 179, line 17, delete "Clarendon and Alderbury (Salisbury)."

PECTEN (ÆQUIPECTEN) CAMPANIENSIS, *d'Orbigny*. [Vol. I, p. 192.]

A specimen of this species has been found by Dr. Rowe in the zone of *Micraster cor-testudinarium* of Dover.

LIMA (LIMEA?) sp. Plate LXI, fig. 19.

[Omitted from Vol. II, p. 52.]

A few examples of a species which resembles *Limea granulatissima*, Wollemann,[1] have been found in the Speeton Clay (zone of *Belemnites lateralis*) of Speeton. Only a young individual is figured by Wollemann, so that exact comparison cannot be made at present.

Sub-genus—PSEUDOPTERA, *Meek*.

When describing the species of *Pseudoptera* (pp. 63–69) I regarded it as a sub-genus of *Pteria*. Ligament-pits have not been seen in any English specimens, but their presence was noticed by Guéranger[2] and by Peron[3] and indicates that *Pseudoptera* cannot be associated with *Pteria*, but should probably be regarded as a sub-genus of *Gervillia*.

GERVILLIA FORBESIANA, *d'Orbigny*.

[Vol. II, p. 85, pl. xi, figs. 26, 27; pl. xii, figs. 1–5.]

This species belongs to the sub-genus *Ensigervilleia* of Dietrich.[4]

[1] 'Bivalv. u. Gastrop. d. deutsch. u. holländisch. Neocoms' (1900), p. 37, pl. ii, figs. 4, 5.

[2] 'Album Paléont. de la Sarthe' (1867), pp. 17, 20, pl. xxii, figs. 9, 10; pl. xxv, figs. 10, 11 Woods, 'Palæont. U. Cret. N. Nigeria' (1911), p. 278, footnote 1.

[3] "Descript. Brach. etc., Terr. Crét. Tunisie" (1890–91), p. 238.

[4] 'Centralbl. für Min., etc.' (1910), p. 235.

ASTARTE (ERIPHYLA) CONCINNA, *Sowerby*, 1836. Plate XVII, fig. 7 (see p. 116–118).

When describing the species of *Astarte* the only specimen of *A. concinna* known was the type, and I regarded it as probably only an individual variation of *A. striata*. Dr. Kitchin[1] has since found several specimens in the Sandgate Beds of a pit-sinking at Dover which agree with *A. concinna*, and he considers that this should be regarded as a distinct species. Dr. Kitchin also obtained *A.* (*Eriphyla*) *striata*, Sowerby, from the same place.

CRASSATELLITES, sp. [Omitted from Vol II, p. 130.]

Internal casts of a short subquadrate shell, probably belonging to the genus *Crassatellites*, occur in the Chloritic Marl of Maiden Bradley and Devizes.

CRASSATELLITES? EQUISULCATUS (*Woods*), 1897. Plate LXI, figs. 20, 21. Plate LXII, fig. 1.

[Omitted from Vol. II, p. 130.]

1897. ARCTICA? EQUISULCATA, *H. Woods*. Quart. Journ. Geol. Soc., vol liii, p. 391, pl. xxviii, figs. 6—8.

Description.—Shell convex, subquadrate, oblique, very inequilateral. Umbones anterior, pointed, with slight forward curvature. Greatest convexity between the umbones and the postero-ventral extremity; postero-dorsal part compressed. Adductor impressions distinct, the posterior one deep. Shell rather thick, ornamented with numerous concentric ribs, separated by narrow grooves.

Remarks.—The systematic position of this species is uncertain; it appears to be closely allied to the form from the Chloritic Marl mentioned above.

Type.—In the Sedgwick Museum.

Distribution.—Chalk Rock of Cuckhamsley, Berkshire.

ANTHONYA, sp. [Vol. II, p. 130.]

A portion of a left valve of *Anthonya* closely resembling *A. cantiana* has been found in the Upper Greensand (zone of *Pecten asper*) of Kingskerswell, Devon (Museum of Practical Geology, Jermyn Street, No. 997.)

[1] Lamplugh and Kitchin, 'Mesozoic Rocks in the Coal Explorations in Kent' (1911), p. 103.

CYPRINA MEYERI, *sp. nov.* Plate LXII, figs. 2, 3.

[Omitted from Vol. II, p. 141.]

Description.—Shell convex, oval, considerably inequilateral; anterior margin rounded, passing gradually into the slightly curved ventral margin; posterior margin truncated; postero-dorsal margin convex. Umbones prominent, curved inwards and forwards, with a rounded carina extending to the postero-ventral angle, and limiting a flattened postero-dorsal region. Lunular region depressed. Escutcheon long, deep, limited by a sharp carina. Ornamentation consists of concentric growth-rings. Length, 56 mm.; height, 42 mm.

Affinities.—This species shows some resemblance to *C. bernensis* (Leymerie),[1] but is less elongate and much less convex.

Type.—In the Sedgwick Museum, Cambridge (C. J. A. Meÿer collection).

Distribution.—Lower Greensand (*Perna*-bed), of Sandown.

CYPRINA? VECTIANA (*Forbes*), 1845. Plate LXII, fig. 4.

[Omitted from Vol. II, p. 141.]

1845. TELLINA? VECTIANA, *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 239, pl. ii, fig. 2.
1854. TELLINA VECTIANA, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 227.
1865. "TELLINA" VECTIANA, *F. J. Pictet and G. Campiche.* Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 141.
1871. TELLINA? VECTIANA (? HOMALINA), *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 123.

Description.—Shell triangular, moderately convex, with flattened sides, nearly equilateral. Anterior margin rounded; ventral margin slightly curved; postero-dorsal margin slightly convex, forming a rounded angle with the ventral margin. Umbones prominent, sharp, slightly curved. Lunular region depressed. Escutcheon long, limited by a rounded carina extending from the umbones to the postero-ventral extremity. Ornamentation consists of numerous strong concentric ribs, separated by narrow grooves. Length, 25 mm.; height, 17 mm.

Affinities.—This species shows some resemblance to *C. cuneata*, Sowerby, but the shell is much more compressed, and possesses distinct concentric ribs. I am not able to determine whether a postero-lateral tooth was present or not.

[1] 'Mem. Soc. géol. de France,' vol. v (1842), p. 5, pl. v, fig. 6. D'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii, pp. 98, 759, pl. cclxxi, and 'Prodr. de Pal.,' vol. ii (1850), p. 77. Pictet and Campiche, 'Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4, 1865), p. 212, pl. cxiii, figs. 1, 2.

Remarks.—The type cannot be found, but other specimens named by Forbes are in the Museum of Practical Geology (Geological Society Collection, No. 2217).

Distribution.—Lower Greensand (Crackers) of Atherfield.

UNICARDIUM ? COMPRESSUM, *sp. nov.* Plate LXII, figs. 5, 6.

[Omitted from Vol. II, p. 163.]

Description.—Shell convex, with flattened or slightly concave flanks, oval or subquadrate, moderately or slightly inequilateral. Anterior margin rounded; posterior margin subtruncate, slightly oblique, curved; ventral margin nearly straight and nearly parallel to the dorsal margin. Umbones broad, close together. A rounded carina extends from the umbo to the postero-ventral extremity, limiting the compressed postero-dorsal region. External ligament broad. Ornamentation consists of a few coarse somewhat irregular concentric ribs, which are sometimes rugose, with finer ribs in the interspaces.

Measurements:

	(1)	(2)
Length .	40	32 mm.
Height .	26	22 ,,
Thickness	17	— ,,

(1, 2) Crackers, Atherfield.

Affinities.—The hinge and interior of this species have not been seen, consequently its generic position cannot at present be definitely determined, but it is provisionally referred to *Unicardium* on account of its external resemblance to some Jurassic species of that genus. *U.? compressum* is similar to some forms of *Mya rugosa*, Römer,[1] which has been referred to the genus *Lucina* by de Loriol and Cotteau, to *Mactromya* by Agassiz, and to *Unicardium* by Zittel.

Type.—From Atherfield, in the Sedgwick Museum, Cambridge.

Distribution.—Lower Greensand (Crackers), of Atherfield. Atherfield Clay of Dover Colliery.

UNICARDIUM ? MAILLEANUM (*d'Orbigny*), 1844. Plate LXII, figs. 7—9.

[Omitted from Vol. II, p. 165].

1844. CARDIUM MAILLEANUM, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 40, pl. cclvi, figs. 7—12.

[1] See especially de Loriol and Cotteau, 'Mon. Paléont. Géol. Portlandien de l'Yonne' (1868), p. 135, pl. ix, figs. 10, 11.

1850. CARDIUM MAILLEANUM, *d'Orbigny*. Prodr. de Pal., vol. ii, p. 162.
1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 270.
1871. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 213 (*Læviicardium*).

Description.—Shell inflated, oval or subquadrate, longer than high, moderately inequilateral. Anterior margin rounded, passing gradually into the slightly convex ventral margin. Posterior margin high, subtruncate, forming an angle with the straight postero-dorsal margin. Postero-dorsal part of shell compressed. Umbones broad, curved forward. Ornamentation consists of concentric growth-lines and fine radial ribs.

Measurements:

	(1)	(2)	(3)	(4)	
Length . .	31	30	29	24	mm.
Height . .	27·5	27	26	21	,,
Thickness . .	22	23	20	16	,,

Base of Chalk of (1) Beaminster, (2) Maiden Newton, (3) Cerne, (4) Titherleigh.

Remarks.—This species was referred to *Cardium* by d'Orbigny, but the shell differs in form from that other Cretaceous species of that genus, and resembles more nearly *Unicardium*. The hinge is not known satisfactorily, but internal casts show indications of two cardinal teeth.

The ornamentation is often imperfectly preserved. I am indebted to M. de Grossouvre for the opportunity of examining specimens from the Cenomanian of Rouen.

Type.—From the Cenomanian of Rouen.

Distribution.—Base of the Chalk (zone of *Schlœnbachia varians*) of Beaminster, Cerne, Maiden Newton, Titherleigh and Chard.

TELLINA ? PHASEOLINA (*Phillips*), 1829. Plate LXII, fig. 10.

[Omitted from Vol. II, p. 177.]

1829. MYA PHASEOLINA, *J. Phillips*. Geol. Yorks., p. 121 (p. 254, ed. 3), pl. ii, fig. 13.
1850. LAVIGNON PHASEOLINA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 117.
1854. MYA PHASEOLINA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 212.
1870. LAVIGNON PHASEOLINA, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, p. 111.

Description.—Shell small, bean-shaped, convex, considerably inequilateral; posterior part higher than the anterior part. Anterior and posterior margins rounded. Postero-dorsal margin slightly convex. Ventral margin with a slight sinuosity. A rounded carina extends from the umbo towards the postero-ventral extremity, and limits a compressed postero-dorsal area. Umbones broad, close together.

Measurements :

Length . . . 8·5 mm. Height . . . 4·5 mm.

Affinities.—This species is more elongate and more convex than *T.? subphaseolina* (see below). No specimens having the shell preserved have been found.

Type.—A specimen which is believed to be the type is in the York Museum.

Distribution.—Speeton Clay (zones of *Belemnites jaculum* and *B. brunsvicensis*) of Speeton.

TELLINA ? SUBPHASEOLINA (*d'Orbigny*), 1850. Plate LXII, figs. 11, 12.

[Omitted from Vol. II, p. 177.]

1845. LAVIGNON PHASEOLINA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 407, pl. cclxxvii, figs. 8—10.

1850. — SUBPHASEOLINA, *d'Orbigny.* Prodr. de Pal., vol. ii, p. 136.

1865. TELLINA PHASEOLINA, *F. J. Pictet and G. Campiche.* Terr. Crét. Ste. Croix. (Matér. Pal. Suisse, ser. 4), p. 137, pl. cviii, fig. 10.

1870. LAVIGNON SUBPHASEOLINA, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 111.

— TELLINA PHASEOLINA, *Stoliczka.* Ibid., p. 123 (? *Peronæa*).

Description.—Shell oval or subquadrate, compressed, considerably inequilateral, posterior part higher than the anterior part. Postero-dorsal margin nearly straight; posterior margin curved; ventral margin with a shallow sinus due to a depression on the sides of the shell; anterior margin rounded. Umbones small, close together; between the umbones and the postero-ventral extremity is the greatest convexity of the shell.

Measurements :

	(1)	(2)	(3)
Length . . .	14	14	12 mm.
Height .	10	9·5	8·5 ,,
Thickness . . .	—	5	4· ,,

(1—3) Gault, Folkestone.

Affinities.—The hinge is not shown in any of the English specimens. Pictet and Campiche saw casts of the teeth, and they refer the species without doubt to

the genus *Tellina*. Externally, as was pointed out by Stoliczka, it resembles *Lepton*.

Type.—From the Gault of Gérodot (Aube).

Distribution.—Gault of Folkestone.

CYPRIMERIA (CYCLORISMA) SUBMERSA (*Sowerby*), 1836. Plate LXII, fig. 13.

[For references see Vol. II, p. 192, foot-note.]

Description.—Shell oval, inequilateral, convex, with the postero-dorsal part flattened and limited by a rounded carina passing from the umbo to the postero-ventral angle. Antero-dorsal margin nearly straight. Anterior margin rounded, passing gradually into the moderately convex ventral margin. Posterior margin truncated. Postero-dorsal margin slightly curved. Umbones of moderate size, with a slight forward curvature. Lunule limited by a faint groove. Escutcheon elongate, bordered by a carina. Ornamentation consists of small concentric ribs.

Affinities.—The left valve, which is described above, was found by Mr. Jukes-Browne in the Exeter Museum, and appears to be referable to Sowerby's *Venus submersa*, the only apparent difference being in the greater length of the shell.

The hinge agrees closely with that of *C.* (*Cyclorisma*) *parva* (Sowerby) (p. 185). Externally the shell is similar to *C.* (*Cyclorisma*) *rotomagensis* (d'Orbigny), but is less convex, more elongated, more inequilateral, with the forward curvature of the umbones more marked and the posterior margin more distinctly truncated.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown.

Genus—TAPES, *Megerle von Mühlfeld*, 1811.

[Omitted from Vol. II, p. 194.]

Sub-genus—ICANOTIA, *F. Stoliczka*, 1870.

(Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 145.)

TAPES (ICANOTIA) sp. Plate LXII, fig. 14.

Description.—Shell elongate-oval, very inequilateral, compressed, anterior and posterior ends rounded. Ventral margin convex; postero-dorsal margin nearly straight. Umbones inconspicuous. Ornamentation consists of numerous, close, radial ribs which are indistinct on the anterior part of the valve, and become stronger and more widely separated on the posterior part, where a small rib may occur between two larger ones. Length (approximate) 55 mm., height 26 mm.

Affinities.—Only two right valves of this species have been seen. They resemble closely *Capsa elegans*, d'Orbigny,[1] but the ribs on the posterior part of the shell are more numerous and less coarse.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown and Haldon.

LEPTOSOLEN? RECTANGULARIS (*Woods*), 1897. Plate LXII, figs. 15—17.

[Omitted from Vol. II, p. 221.]

1897. TRAPEZIUM RECTANGULARE, *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 392, pl. xxviii, figs. 11, 12.

Description.—Shell more or less oblong, very inequilateral, moderately convex, with flattened or slightly concave sides. Anterior part not so high as the posterior part. Postero-dorsal margin nearly straight and nearly parallel to the ventral margin; anterior margin rounded; posterior margin truncated, slightly convex or nearly straight, and almost at right angles to the postero-dorsal margin. Umbones inconspicuous, with a carina extending in a curve to the postero-ventral angle, and limiting a triangular postero-dorsal area. A strong internal ridge extends from the umbo towards the opposite ventral margin. Length 19 mm., height 11 mm.

Affinities.—A similar species has been referred doubtfully by Weller[2] to *Leptosolen*. *Modiola tetragona*, Reuss,[3] also shows some resemblance to the English species. The hinge is not shown in any of the specimens, and the generic position must be regarded as uncertain.

Type.—In the Sedgwick Museum, Cambridge.

Distribution.—Chalk Rock of Cuckhamsley, Berkshire.

Vol. II, page 230, line 5 from the bottom, for "*varians*" read "*rostrata*."

THRACIA? GRACILIS (*Sowerby*), 1836. Plate LXII, figs. 18, 19.

[Omitted from Vol. II, p. 244.]

1836. PSAMMOBIA? GRACILIS, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 242, 341, pl. xvi, fig. 12.
1850. TELLINA GRACILIS, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 159.
1854. PSAMMOBIA GRACILIS, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 222.

[1] 'Pal. Franç. Terr. Cret.,' vol. iii (1845), p. 423, pl. cccIxxxi, figs. 1, 2.
[2] 'Cret. Palæont. New Jersey' (1907), p. 626, pl. lxx, fig. 29.
[3] 'Die Verstein. der böhm. Kreideformat.,' pt. 2 (1846), p. 15, pl. xxxiii, fig. 6.

1865. TELLINA GRACILIS, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér Pal. Suisse, ser. 4), p. 138.

?1868. — — *A. Briart and F. L. Cornet.* Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 80, pl. vii, fig. 19, 20.

1870. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 123.

Description.—Shell elongate-oval, moderately convex, slightly inequivalve and inequilateral. Anterior margin rounded. Ventral margin slightly or moderately convex, and forming an acute angle with obliquely truncated posterior margin. Umbones incurved. A sharp carina extends in a curve from the umbo to the postero-ventral angle, and cuts off a flat or slightly concave postero-dorsal area. Ornamentation consists of concentric ribs, which are less numerous but stronger on the anterior part of the shell and the postero-dorsal area than elsewhere.

Measurements:

	(1)	(2)
Length . .	14	8 mm.
Height	6	4 „

(1, 2) Blackdown.

Affinities.—This species resembles *Thracia elegans* (d'Orbigny)[1] but possesses stronger concentric ribs. Its generic position cannot be determined definitely since only a few specimens have been seen, none of which shows the hinge or interior.

Type.—The type from Blackdown cannot be found.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown.

INOCERAMUS TUBERCULATUS, *Woods.* [See Vol. II, p. 302.]

An example of this species has been found in the zone of *Actinocamax quadratus* of East Harnham, Salisbury, by Dr. Blackmore.

INOCERAMUS INTERMEDIUS, *Sowerby.*

[Loudon's 'Mag. Nat. Hist.,' vol. ii (1829), p. 296, fig. 83.]

The figure given by Sowerby of a specimen from Norfolk appears to have been overlooked by previous writers; it probably represents a large form of *I. Lamarcki* var. *apicalis.*

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 386, pl. cccIxxiii, figs. 3–5.

I.—DISTRIBUTION OF THE LOWER CRETACEOUS SPECIES IN ENGLAND.

The genera are arranged in the order of the classification followed in this work. The species of each genus or subgenus are in alphabetical order. The stratigraphical divisions are those adopted in the 'Memoirs of the Geological Survey.'

Genus and Species.	Volume and Page.	Yorkshire, Lincolnshire, Norfolk.					Cambridgeshire to Wiltshire.		The Weald and Isle of Wight.		
		Speeton Series. Exact horizon not known.	Zone of *Belemnites lateralis*.	Zone of *Belemnites Jaculum*.	Zone of *Belemnites brunsvicensis*.	Lower Cretaceous, West Norfolk.	Lower Greensand of Upware, Potton, Brickhill.	Lower Greensand, Faringdon, Steend, Calne.	Atherfield Beds.	Hythe and Sandgate Beds. Ferruginous Sands.	Folkestone Beds. Sandrock Beds and Carstone.
NUCULANA											
scapha (*d'Orb.*)	I, 3			×		…			×		
Seeleyi (*Gard.*)	I, 5			×							
spathulata (*Forb.*)	I, 1	?							×	×	
speetonensis, *Woods*	I, 3	×									
subrecurva (*Phill.*)	I, 2		×								
NUCULA											
Lamplughi, *Woods*	I, 14		×								
Meÿeri, *Gard.*	I, 15		…			…			×		
planata, *Desh.*	I, 12		×	×		…	…		×	×	
sp. [Cornueliana, *Gard.* non *d'Orb.*]	I, 13		×			…	×				
sp. [simplex, *Gard.* non *Desh.*]	I, 14						…		…	×	
ANOMIA											
convexa, *Sow.*	I, 29					…				×	
lævigata, *Sow.*	I, 29	…				…			×	×	
pseudoradiata, *d'Orb.*	I, 27								×	×	
ARCA											
Carteroni, *d'Orb.*	I, 33					…	×		×		
Dupiniana, *d'Orb.*	I, 32						…		×	×	
Sanctæ-Crucis, *Pict. & Camp.*	I, 34	…				…	×		×		
BARBATIA											
aptiensis (*Pict. & Camp.*)	I, 35							…	×	×	
marullensis (*d'Orb.*)	I, 38						×	?			
(Scaphula ?) Austeni (*Forb.*)	I, 37								×	×	
GRAMMATODON											
securis (*Leym.*)	I, 44	…			×					?	
CUCULLÆA											
Cornueliana (*d'Orb.*)	I, 50					…	?		×	×	
Fittoni (*Pict. & Camp.*)	I, 52					…		…	×	×	
Forbesi (*Pict. & Camp.*)	I, 49		…			…	…		×	?	
vagans, *Keep.*	I, 52	…	?			…	×				

Genus and Species.	Volume and Page.	Yorkshire, Lincolnshire, Norfolk.					Cambridgeshire to Wiltshire.		The Weald and Isle of Wight.		
		Speeton Series. Exact horizon not known.	Zone of *Belemnites lateralis*.	Zone of *Belemnites Jaculum*.	Zone of *Belemnites brunsvicensis*.	Lower Cretaceous, West Norfolk.	Lower Greensand of Upware, Potton, Brickhill.	Lower Greensand, Faringdon, Seend, Calne.	Atherfield Beds.	Hythe and Sandgate Beds, Ferruginous Sands.	Folkestone Beds, Sandrock Beds and Carstone.
CUCULLÆA											
(Dicranodonta) donningtonensis, *Keep.*	I, 54		×			...	×				
obliqua (*Keep.*)	I, 55						×				
PECTUNCULUS											
marullensis, *Leym.*	I, 66	...				.		...		×	
TRIGONIA											
carinata, *Ag.*	I, 90	...	...			...			×	×	
caudata, *Ag.*	I, 81	...	...			...			...	×	
Etheridgei, *Lyc*	I, 81	...	...			...			×		
exaltata, *Lyc.*	I, 74	..	..			×					
ingens, *Lyc.*	I, 75	...	×			×					
nodosa, *Sow.*	I, 78	...				.			×	×	×
ornata, *d'Orb.*	I, 85	...			.				×	×	
Robinaldina ?, *d'Orb.*	I, 74	...			×						
scapha, *Ag.*	I, 73	...	..			×					
tealbyensis, *Lyc.*	I, 79		×								
upwarensis, *Lyc.*	I, 86					...	×				
vectiana, *Lyc.*	I, 84					...		×	×	×	
MYTILUS											
sp., *cf.* tornacensis, *d'Arch.*	I, 91	...				...	×				
MODIOLA											
æqualis, *Sow.*	I, 92					.	×		×	×	×
ligeriensis (*d'Orb.*)	I, 96								×		
rugosa, *Röm.*	I, 97					.			...	×	
subsimplex (*d'Orb.*)	I, 97								×	×	
undulata (*Forb.*)	I, 100					.			×		
(Brachydontes) vectiensis, *Woods*	I, 102							...	×	×	
CRENELLA											
bella (*Sow.*)	I, 104	...				.			×	×	
SEPTIFER											
lineatus (*Sow.*)	I, 106	...				.		×	...	×	
DREISSENSIA											
lanceolata (*Sow.*)	I, 110					..	..		×	×	
SPONDYLUS											
Roemeri, *Desh.*	I, 116					...	×	...	×		
striatus (*Sow.*)	I, 119					...		×			
PLICATULA											
æquicostata, *Keep.*	I, 136	...					×				

Genus and Species.	Volume and Page.	Yorkshire, Lincolnshire, Norfolk.					Cambridgeshire to Wiltshire.		The Weald and Isle of Wight.		
		Specton Series. Exact horizon not known.	Zone of *Belemnites lateralis.*	Zone of *Belemnites Jaculum.*	Zone of *Belemnites brunsvicensis.*	Lower Cretaceous, West Norfolk.	Lower Greensand of Upware, Potton, Brickhill.	Lower Greensand, Faringdon, Seend, Calne.	Atherfield Beds.	Hythe and Sandgate Beds. Ferruginous Sands.	Folkestone Beds. Sandrock Beds and Carstone.
PLICATULA											
Carteroniana, *d'Orb.*	I, 135	...				...	×	...	...	×	
placunea, *Lam.*	I, 134	?				...	...	...	?	×	
PECTEN											
(Syncyclonema) orbicularis, *Sow.* ..	I, 145		×	×	×	...	×	...	?	?	×
(Camptonectes) cinctus, *Sow.*	I, 152	...	×	×	×						
— Cottaldinus, *d'Orb.*	I, 156					...			×	×	
— striato-punctatus, *Röm.*	I, 157	...	×	×							
(Chlamys) Robinaldinus, *d'Orb.* ...	I, 181	...				...	?	×	×	×	
(Neithea) atavus, *Röm.*	I, 197					...	×	×	...	×	
— Morrisi (*Pict. & Ren.*)...	I, 201						...	...	×	×	
— quinquecostatus, *Sow.* ...	I, 202	...				...	×	×	...	...	×
HINNITES											
Favrinus, *Pict. & Roux* ...	I, 220					..			×	×	
OSTREA											
canaliculata, *Sow.*	II, 375					...	×	×	...	×	
diluviana (*L.*)	II, 342		×		×	...	×	×	×	×	?
Leymerii [*Desh.*] *Leym.*	II, 355					...	...	...	?	×	
vesicularis, *Sow.*	II, 360					...	...	...		×	
Walkeri, *Keep.*	II, 360					...	×				
EXOGYRA											
conica (*Sow.*)	II, 407	..			...	...	×	×	...	×	
sinuata (*Sow.*).....	II, 395	...	×	×	×	...	?		×	×	×
tuberculifera, *Koch & Dunk.*.....	II, 404	...				...			×	×	
LIMA											
(Plagiostoma) subrigida, *Röm.*...	II, 10	×	×								
— sp. *cf.* Orbignyana, *Math.*	II, 12	...							...	×	
— sp. *cf.* villersensis ?, *Pict. & Camp.* ..	II, 13	...			...	...	..	×			
(Acesta) longa, *Röm.*	II, 25	×			×	..	×				
(Mantellum) farringdonensis, *Sharpe*	II, 30	...				...	...	×			
— parallela (*Sow.*)	II, 28	×			.	...	×	×	×	×	×
(Limatula) Dupiniana, *d'Orb.*	II, 47	...			×	...	...	...	×	×	
— Tombeckiana, *d'Orb.* ...	II, 45	...			×	...	×			×	
(Limea ?) sp.	II, 425	...	×								
PTERIA											
(Oxytoma) Cornueliana (*d'Orb.*)	II, 57	...	×	×		...		×			
--- pectinata (*Sow.*)	II, 59	...		...		...				×	×
AUCELLA											
Keyserlingiana, *Trautsch.*	II, 70	...	×	×							
volgensis, *Lahus.*	II, 69	...	×								

Genus and Species.	Volume and Page.	Yorkshire, Lincolnshire, Norfolk.					Cambridgeshire and Wiltshire.		The Weald and Isle of Wight.			
		Speeton Series. Exact horizon not known.	Zone of *Belemnites lateralis.*	Zone of *Belemnites Jaculum.*	Zone of *Belemnites brunsvicensis.*	Lower Cretaceous, West Norfolk.	Lower Greensand of Upware, Potton, Brickhill.	Lower Greensand, Faringdon, Seend, Calne.	Atherfield Beds.	Hythe and Sandgate Beds. Ferruginous Sands.	Folkestone Beds. Sandrock Beds and Carstone.	
Gervillia												
alæformis (*Sow.*)	II, 79	...				...			×	×		
Forbesiana, *d'Orb.*	II, 85	...				...		...	×	×		
linguloides, *Forb.*	II, 78					...		...	×	×		
sublanceolata (*d'Orb.*)	II, 74	...				..			×	×		
(Pseudoptera) subdepressa (*d'Orb.*)	II, 63	...				...			×	×		
Perna												
Mulleti, *Desh.*	II, 87	×	...		×	...	×		×	×		
Ricordeana, *d'Orb.*	II, 90	...	...		×		...	...	×			
Inoceramus												
neocomiensis, *d'Orb.*	II, 262	...	...	...		...		...	...	×		
Salomoni, *d'Orb.*	II, 263	...	...						...	...	×	
sp.	II, 263	...	×									
Pinna												
Robinaldina, *d'Orb.*	II, 96	...	...		×	...	×	...	×	×		
Astarte												
cantabrigiensis, *Woods*	II, 107		...				×					
claxbiensis, *Woods*	II, 108	...	×									
elongata, *d'Orb.*	II, 102	...	...			...		×				
senecta, *Woods*	II, 106	...	×									
sinuata, *d'Orb.*	II, 104	.						...	...	×		
subacuta, *d'Orb.*	II, 103	...				...		...	×			
subcostata, *d'Orb.*	II, 109		...				...	...	×	×		
upwarensis, *Woods*	II, 105	...	...	...			×					
sp.	II, 107	×										
sp.	II, 111	...	...	...					...	...	×	
(Eriphyla) concinna, *Sow.*	II, 426	...	...	...		...		...	...	×		
— lævis (*Phill.*)	II, 115	×	×									
— obovata, *Sow.*	II, 113	...	...	...	...	...		...	×	×		
— striata, *Sow.*	II, 116, 426		...	...	...	...			...	×		
Opis												
neocomiensis, *d'Orb.*	II, 118	...				...	×	×				
Cardita ?												
fenestrata (*Forb.*)	II, 121	...				...			×			
Cardita												
upwarensis, *Woods*	II, 122	...					×					
sp.	II, 123	...							×			
sp.	II, 123	...	...	...					...	×		
Anthonya												
cantiana, *Woods*	II, 130					...			...	...	×	
sp.	II, 131	...				...			...	×		

Genus and Species.	Volume and Page.	Yorkshire, Lincolnshire, Norfolk.					Cambridgeshire and Wiltshire.		The Weald and Isle of Wight.		
		Speeton Series. Exact horizon not known.	Zone of *Belemnites lateralis.*	Zone of *Belemnites Jaculum.*	Zone of *Belemnites brunsvicensis.*	Lower Cretaceous, West Norfolk.	Lower Greensand of Upware, Potton, Brickhill.	Lower Greensand, Faringdon, Seend, Calne.	Atherfield Beds.	Hythe and Sandgate Beds. Ferruginous Sands.	Folkestone Beds. Sandrock Beds and Carstone.
CYPRINA											
anglica, *Woods*	II, 137	...		...	...	...		...	×	×	
claxbiensis, *Woods*	II, 135		×								
Meÿeri, *Woods*	II, 427					...	...		×		
obtusa, *Keep.*	II, 133					...	×				
(Venilicardia) protensa, *Woods*	II, 137					...		...	×	×	
Saussuri (*Brongn.*)	II, 131					...	...		×	×	
Sedgwicki (*Walk.*)	II, 133						×				
Sowerbyi, *d'Orb.*	II, 139		...		...	...		...		×	
tealbiensis, *Woods*	II, 136			...	×						
? vectiana (*Forbes*)	II, 427			...		...		...	...	×	
sp.	II, 136	...	...	...	×						
TRAPEZIUM ?											
arcadiforme (*Keep.*)	II, 148	...		...		...	×				
squamosum (*Keep.*)	II, 148	...	...	...		...	×				
sp. (*cf.* striata. *Gein.*)	II, 149	...			...	...	×				
LUCINA											
sp.	II, 152		×								
sp.	II, 152	...				...		...	...	×	
sp.	II, 153	...		...		...		...	...	×	
CORBICELLA											
claxbiensis, *Woods*	II, 157	...	×								
SPHÆRA											
corrugata, *Sow.*	II, 157	...		...	...	...		...	×	×	
UNICARDIUM											
claxbiense, *Woods*	II, 162		×								
? compressum, *Woods*	II, 428			...				...	...	×	
vectense, *Woods*	II, 163			...	...				×	×	
THETIRONIA											
minor (*Sow.*)	II, 167			...	...	...		...	×	×	×
TELLINA											
Carteroni, *d'Orb.*	II, 171	...		...	...	...		...	×	×	
(Linearia) sp.	II, 175	..		...	...	...		...	×	×	
TELLINA ?											
phascolina (*Phill.*)	II, 429	...	...	×	×						
MACTRA											
sp.	II, 177	...	...	...	...	...	...	...	...	×	
PTYCHOMYA											
Robinaldina (*d'Orb.*)	II, 179	...	...	...	...	...		...	×	×	

Genus and Species.	Volume and Page.	Yorkshire, Lincolnshire, Norfolk.					Cambridgeshire to Wiltshire.		The Weald and Isle of Wight.		
		Speeton Series. Exact horizon not known.	Zone of *Belemnites lateralis*.	Zone of *Belemnites Jaculum*.	Zone of *Belemnites brunsvicensis*.	Lower Cretaceous, West Norfolk.	Lower Greensand of Upware, Potton, Brickhill.	Lower Greensand, Faringdon, Seend, Calne.	Atherfield Beds.	Hythe and Sandgate Beds. Ferruginous Sands	Folkestone Beds. Sandrock Beds and Carstone.
CYPRIMERIA											
(Cyclorisma) parva (*Sow.*)	II, 184	...	...			...		...	×	×	
— vectensis (*Forb.*)	II, 183	...	...	...	...	...			×	×	
CLEMENTIA											
(Flaventia) Ricordeana (*d'Orb.*)	II, 189	...		...	...	...			×	×	
PROTOCARDIA											
anglica, *Woods*	II, 194	...	...	...	...	..				×	
sphæroidea (*Forb.*)	II, 195	...	...			...	...		×	×	
sp. (*cf.* peregrinorsa, *d'Orb.*)	II, 197		×								
CARDIUM											
Cottaldinum, *d'Orb.*	II, 203	...		...		...	×				
Ibbetsoni, *Forb.*	II, 201	...	...	...		...				×	
sp.	II, 204	...	...	...	...	...		×			
TOUCASIA											
Lonsdalei (*Sow.*)	II, 207	...	...	...	...	...		×			
CORBULA											
angulata (*Phill.*)	II, 210	...	...	×	×						
striatula, *Sow.*	II, 212	...	...	...	...	...			×	×	×
PHARUS											
Warburtoni (*Forb.*)	II, 217	...		...	...	...			×	×	
PANOPEA											
gurgitis (*Brongn.*)	II, 222	?			...	...	?		×	×	?
mandibula (*Sow.*)	II, 228	...	...	...		...			×	×	×
spilsbiensis, *Woods*	II, 222	...	×								
sp.	II, 221	...		...	×						
sp.	II, 230	...	...			...			...	×	
MARTESIA											
constricta (*Phill.*)	II, 231	×									
prisca (*Sow.*)	II, 232	...	...	...						×	
TURNUS											
Dallasi (*Walk.*)	II, 233	...				...	×				
PLECTOMYA											
anglica, *Woods*	II, 238	...	...			...		...		×	
ANATINA											
(Cercomya) gurgitis, *Pict. & Camp.*	II, 239	...				...	...		...	×	

Genus and Species.	Volume and Page.	Yorkshire, Lincolnshire, Norfolk.					Cambridgeshire to Wiltshire.		The Weald and Isle of Wight.		
		Speeton Series. Exact horizon not known.	Zone of *Belemnites lateralis.*	Zone of *Belemnites Jaculum.*	Zone of *Belemnites brunsvicensis.*	Lower Cretaceous, West Norfolk.	Lower Greensand of Upware, Potton, Brickhill.	Lower Greensand, Faringdon, Seend, Calne.	Atherfield Beds.	Hythe and Sandgate Beds. Ferruginous Sands.	Folkestone Beds. Sandrock Beds and Carstone.
THRACIA											
Phillipsi, *Röm.*	II, 240			×							
Robinaldina? (*d'Orb.*)	II, 242					...		...	×	×	
rotundata (*Sow.*)	II, 241					...		...	×	×	
PHOLADOMYA											
Cornueliana (*d'Orb.*)	II, 245				...	...			×	×	
gigantea (*Sow.*)	II, 246				...	...			×	×	
Martini, *Forb.*	II, 249			...	...			...	×	×	
speetonensis, *Woods*	II, 248		×	×	×						
MYOPHOLAS											
sp., *cf.* semicostatus (*Ag.*)	II, 253							×			
GONIOMYA											
Archiaci (*Pict. & Ren.*)	II, 254					...			...	×	
PLEUROMYA											
Orbigniana (*Rouill.*)	II, 256		×								

II.—DISTRIBUTION OF THE UPPER CRETACEOUS SPECIES IN ENGLAND.

Genus and Species.	Volume and Page.	Zone of *Dactiliceras mammillatum.*	Zone of *Hoplites interruptus* and *H. lautus.*	Zone of *Schlænbachia rostrata.*	Red Chalk.	Zone of *Pecten asper.*	Zone of *Schlænbachia varians.*	Zone of *Holaster subglobosus.*	Zone of *Rhynchonella Cuvieri.*	Zone of *Terebratulina lata.*	Zone of *Holaster planus.*	Zone of *Micraster cor-testudinarium.*	Zone of *Micraster cor-anguinum.*	Zone of *Marsupites testudinarius.*	Zone of *Actinocamax quadratus.*	Zone of *Belemnitella mucronata.*	Zone of *Ostrea lunata.*
NUCULANA																	
angulata (*Sow.*)	I, 8	...	...	×													
lineata (*Sow.*)	I, 7	...	...	×			?										
Mariæ (*d'Orb.*)	I, 6	...	×	?													
phaseolina (*Mich.*)	I, 9	...	×														
solea (*d'Orb.*)	I, 5	...	×	?													
Vibrayeana (*d'Orb.*)	I, 10	...	×	×													
sp., *cf.* siliqua (*Goldf.*)	I, 11	...	...	...							×						
NUCULA																	
albensis, *d'Orb.*	I, 24	...	×	×													
antiquata, *Sow.*	I, 26	...	...	×													
gaultina, *Gard.*	I, 25	...	×														
impressa, *Sow.*	I, 23	...	...	×													
obtusa, *Sow.*	I, 22	...	...	×													
ovata, *Mant.*	I, 21	...	×	×													
pectinata, *Sow.*	I, 16	...	×	×													
— *var.* cretæ, *Gardn.*	I, 18	...	...	×													
sp.	I, 27	...	...	...							×						
(Acila) bivirgata, *Sow.*	I, 19	...	×	×													
ANOMIA																	
papyracea, *d'Orb.*	I, 31		...				...	×									
? transversa, *Seel.*	I, 30		...				×										
sp., *cf.* pseudoradiata, *d'Orb.*	I, 30		×														
PLACUNOPSIS																	
undulata ? (*Müll.*)	I, 224	...	...					...	...						...	...	×
ARCA																	
pholadiformis, *d'Orb.*	I, 35	...	...	...	...	?											
BARBATIA																	
aptiensis (*d'Orb.*)	I, 224	...	×														
Gallienni (*d'Orb.*)	I, 41, 224	...	...	...	...	...	×										
Hugardiana ? (*d'Orb.*)	I, 40		...	×													
marullensis (*d'Orb.*)	I, 38		×	×													
rotundata (*Sow.*)	I, 40		...	×													
vendinnensis (*d'Orb.*)	I, 41		...	...			×										
sp. *cf.* Geinitzi (Reuss)	I, 42		...	...							×						
sp.	I, 42		...	...					...		×						
sp.	I, 43		...						...		×						
GRAMMATODON																	
carinatus (*Sow.*)	I, 45	×	×	×			×										
TRIGONOARCA																	
Passyana (*d'Orb.*)	I, 47		...	...		×	×										
CUCULLÆA																	
glabra, *Park.*	I, 57	...	...	×													
Mailleana (*d'Orb.*)	I, 63	...	...	...		×	×										
nana, *Leym.*	I, 62	...	×	×													

Genus and Species.	Volume and Page.	Zone of *Douvilleiceras mammillatum.*	Zone of *Hoplites interruptus* and *H. tardus.*	Zone of *Schlœnbachia rostrata.*	Red Chalk.	Zone of *Pecten asper.*	Zone of *Schlœnbachia varians.*	Zone of *Holaster subglobosus.*	Zone of *Rhynchonella Cuvieri.*	Zone of *Terebratulina lata.*	Zone of *Holaster planus.*	Zone of *Micraster cor-testudinarium*	Zone of *Micraster cor-anguinum.*	Zone of *Marsupites testudinarius.*	Zone of *Actinocamax quadratus.*	Zone of *Belemnitella mucronata.*	Zone of *Ostrea lunata.*
CUCULLÆA																	
obesa (*Pict. & Roux*)	I, 61	...		×			×										
venusta, *Nyst.*	I, 56	...	...	×													
sp.	I, 64	...	...				×										
ISOARCA																	
Agassizi, *Pict. & Roux*	I, 68	...		×													
obesa (*d'Orb.*)	I, 65	...		...			×										
PECTUNCULUS																	
euglyphus, *Woods*	I, 71	...	...	...	...	...	×										
sublævis, *Sow.*	I, 67	...	×	×													
umbonatus (*Sow.*)	I, 69	...	×	×													
Vaughani, *Woods*	I, 224	...	...	×													
LIMOPSIS																	
albensis, *Woods*	I, 71	...	×														
sp.	I, 72	...	...	...		...	...	...	...	...	×						
TRIGONIA																	
affinis, *Sow.*	I, 77	...	...	×	...	?	?										
aliformis, *Park.*	I, 83	...	×	×	...	×											
carinata, *Ag.*	I, 90	...	...	×	...	×											
costigera, *Lyc.*	I, 88	...	...	...	...	...	×										
crenulata, *Lam.*	I, 82	...	...	...	...	...	×										
crenulifera, *Lyc.*	I, 82	...	...	...	...	...	×										
Cunningtoni, *Lyc.*	I, 90	...	...	×													
dædalea, *Park.*	I, 80	...	...	×													
debilis, *Lyc.*	I, 78	..	...	...	...	...	×										
dunscombensis, *Lyc.*	I, 78	...	...	...	...	...	×										
eccentrica, *Park.*	I, 76	...	...	×													
Fittoni, *Desh.*	I, 88	...	×														
læviuscula, *Lyc.*	I, 77	...	...	×	...	...	?										
Meyeri, *Lyc.*	I, 84	...	...	...	...	...	×										
pennata, *Sow.*	I, 88	...	...	×	...	?	×										
scabricola, *Lyc.*	I, 82	...	...	×													
spectabilis, *Sow.*	I, 80	...	...	×													
spinosa, *Park.*	I, 86	...	...	×													
sulcataria, *Lam.*	I, 89	...	...	?	...	×	×										
Vicaryana, *Lyc.*	I, 87	...	...	×	...	?	×										
MYTILUS																	
inæquivalvis, *Sow.*	I, 91	...	...	×													
MODIOLA																	
flagellifera, *Forb.*	I, 99	...	...	×													
ligeriensis (*d'Orb.*)	I, 96	...	...	×	...	...	×										
reversa, *Sow.*	I, 94	...	...	×	...	×	×										
subsimplex (*d'Orb.*)	I, 97	...	×	×													
(Brachydontes) Guerangeri ? (*d'Orb.*)	I, 101	...	...	×	...	...	×										
— striato-costata (*d'Orb.*)	I, 103	...	...	×													
CRENELLA																	
orbicularis (*Sow.*)	II, 423	...	...	×													
LITHODOMUS																	
rugosus ? *d'Orb.*	I, 105	...	...	...	...	...	×										
SEPTIFER																	
lineatus (*Sow.*)	I, 106	...	...	×	...	×	×	×	...	...	×	...	×	×	×	×	

Genus and Species.	Volume and Page.	Zone of *Ammonites mammillatus*.	Zone of *Hoplites interruptus* and *H. laulus*.	Zone of *Schlænbachia rostrata*.	Red Chalk.	Zone of *Pecten asper*.	Zone of *Schlænbachia varians*.	Zone of *Holaster subglobosus*.	Zone of *Rhynchonella Cuvieri*.	Zone of *Terebratulina lata*.	Zone of *Holaster planus*.	Zone of *Micraster cor-testudinarium*.	Zone of *Micraster cor-anguinum*.	Zone of *Marsupites testudinarius*.	Zone of *Actinocamax quadratus*.	Zone of *Belemnitella mucronata*.	Zone of *Ostrea lunata*.
Dreissensia																	
lanceolata (*Sow.*)	I, 110			×													
Myoconcha																	
cretacea, *d'Orb.*	I, 114	...					×										
Spondylus																	
Dutempleanus, *d'Orb.*	I, 125	...		...	...		×	...	×	×	×	×	×	×	×	×	×
gibbosus, *d'Orb.*	I, 117	...		×	×												
latus (*Sow.*)	I, 121	...		...	...	...	...	×	×	×	×	×	×	×	×	×	
serratus, *Woods*	I, 124	...		...	...	..	...	...	...	...	...	...	...	×			
spinosus (*Sow.*)	I, 127	...		...	...	...	...	...	×	×	×	×	×	×	×	×	×
striatus (*Sow.*)	I, 119	...		...	...	×	×										
Plicatula																	
Barroisi, *Peron*	I, 141	...	...	...	...				×	×	×	×	×	×		×	
gurgitis, *Pict. & Roux*	I, 137	...	×	×	×												
inflata, *Sow.*	I, 139	...	...	?	..	×	×	×									
minuta, *Seel.*	I, 138	...	...	...	×	...	?										
Dimyodon																	
Nilssoni (*Hag.*)	I,143,225	...	...	×	...	...	×	...	×	×	×	×	×	×	×	×	
Pecten																	
(Syncyclonema) orbicularis, *Sow.*	I, 145		×	×	?	×	×	×									
— — *var.* haldonensis, *Woods*	I, 151			...		×											
(Camptonectes) curvatus, *Gein.*	I, 159			×		..	×										
— dubrisiensis, *Woods*	I, 162	...	...	...		...	×	×									
(Camptonectes ?) gaultinus, *Woods*	I, 163	..	×	?													
(Chlamys) britannicus, *Woods*	I, 167	...	...	...	...	...	...	...	...	...	...	...	×				
— cretosus, *Defr.*	I, 174	...	...	...	...	...	...	...	×	×	×	×	×	×	×	×	×
— elongatus, *Lam.*	I, 170	...	...	×	...	×	×	×									
— fissicosta, *Eth.*	I, 163	...	...	...	...		×	×									
— Mantellianus, *d'Orb.*	I, 179	...	...	...	...	...	...	...	...	...	...	...	×			×	
— Milleri, *Sow.*	I, 168	...	...	×		×											
— Puzosianus, *Math.*	I, 165		...	...		..	×										
— Robinaldinus, *d'Orb.*	I, 181	...	...	×		×	×										
— Stutchburianus, *Sow.*	I, 185	...		×													
— subacutus, *Lam.*	I, 169	...		...		?	×										
(Æquipecten) arlesiensis, *Woods*	I, 194					..	×	×									
— asper, *Lam.*	I, 186	...		...	...	×	×										
— Beaveri, *Sow.*	I, 188	...		×	?	..	×	×									
— campaniensis, *d'Orb.*	I, 192	...		...	...	...	...	...	...	...	...	×		×	×	×	×
— pulchellus, *Nilss.*	I, 194	...		...	...	...	...	...	...	...	...	...		...	...	..	×
— pexatus, *Woods*	I, 190	..		...	...		...	...	...	×	×	...		?	×	×	
— sarumensis, *Woods*	I, 192	...		...	...	...	...	...	...	...	...	...		...	×	×	
— sp.	I, 191	...		.	...	...	...	...	...	...	×	...		...	×		
Nilssoni, *Goldf.*	I,152,226	...		...	...	...	...	...	...	...	...	...		...	×		×
(Neithea) æquicostatus, *Lam.*	I, 208	...		...	...	×	×										
— cometa (*d'Orb.*)	I, 200	...		...	...	×	×										
— quadricostatus, *Sow.*	I, 210	...		×	...	×											
— quinquecostatus, *Sow.*	I, 202	.		×	...	×	×	...	...	×	×	×	×	×	×		
— sexcostatus, *Woodw.*	I, 214	..		...		...	×	×	...	...	...	...	...	?	×	×	
— striatocostatus, *Goldf.*	I, 217	...		...		...	...	...	...	...	...	...	...	...	...		×
Velopecten																	
pectinatus (*Seel.*)	I, 220		...	×													
Studeri (*Pict. & Roux*)	I, 218		...	×	×	?											
trilinearis (*Seel.*)	I, 219		...	×													

Genus and Species.	Volume and Page.	Zone of *Douvilleiceras mammillatum*.	Zone of *Hoplites interruptus* and *H. lautus*.	Zone of *Schlænbachia rostrata*.	Red Chalk.	Zone of *Pecten asper*.	Zone of *Schlænbachia varians*.	Zone of *Holaster subglobosus*.	Zone of *Rhynchonella Cuvieri*.	Zone of *Terebratulina lata*.	Zone of *Holaster planus*.	Zone of *Micraster cortestudinarium*.	Zone of *Micraster coranguinum*.	Zone of *Marsupites testudinarius*.	Zone of *Actinocamax quadratus*.	Zone of *Belemnitella mucronata*.	Zone of *Ostrea lunata*.
OSTREA																	
Boucheroni, *Coq.*	II, 391	...	...	...	...	...	...	...	...	...	×	...	×	×	×		
canaliculata (*Sow.*)	II, 375	...	×	×	...	×	×	×	×	×	×	×	×	×	×	×	×
cunabula, *Seel.*	II, 358	...	...	...	...	...	×										
diluviana (*L.*)	II, 342	...	...	×	...	×	×	×									
incurva, *Nilss.*	II, 388	...	...	...	...	...	×	×	×	×			×	×	×	×	
Leymerii [*Desh.*] *Leym.*	II, 355	×															
lunata, *Nilss.*	II, 393	...	...	...	...	...	...	...	...	...	...	...	...	...	...		×
sarumensis, *Woods*	II, 387	...	...	...	...	..	...	...	..	...	...	...	...	...	×		
semiplana, *Sow.*	II, 379	...	...	...	...	...	...	...	...	?	×	×	×	×	×	×	×
vesicularis, *Lam.*	II, 360	...	?	×	...	×	×	×	×	×	×	×	×	×	×	×	×
vesiculosa (*Sow.*)	II, 374	...	...	×	...	×	×										
EXOGYRA																	
columba (*Lam.*)	II, 413	...	...	×	...	×	×										
conica (*Sow.*)	II, 407	...	×	×	×	×	×	×									
digitata (*Sow.*)	II, 417	...	...	...	...	×											
sigmoidea, *Reuss*	II, 419	...	...	...	...	...	...	...	...	...	...		×				
LIMA																	
aspera (*Mant.*)	II, 8	...	...	...	...	...	×	×									
canalifera, *Goldf.*	II, 1	...	...	...	...	×											
Galliennei, *d'Orb.*	II, 3	...	...	×	...	...	×										
scabrissima, *Woods*	II, 7	...	...	...	...	×											
subovalis, *Sow.*	II, 5	...	...	×	...	×	×										
vectensis, *Woods*	II, 4	...	...	...	...	×											
(Plagiostoma) cretacea, *Woods*	II, 22	...	...	...	...	...	...	...	...	×	×	×	×	×	×	×	×
— globosa, *Sow.*	II, 16	...	×	...	×	×	×	×									
— Hoperi, *Mant.*	II, 17	...	...	...	...	...	...	...	...	×	×	×	×	×	×	×	×
— Marrotiana, *d'Orb.*	II, 24	...	...	...	...	...	...	...		...		...	...	...	...	×	...
— Meyeri, *Woods*	II, 15	...	...	...	...	×	×										
— semiornata, *d'Orb.*	II, 14	...	...	×	...	×	×										
(Acesta) clypeiformis, *d'Orb.*	II, 26	...	...	...	...	×											
(Mantellum) britannica, *Woods*	II, 38	...	...	...	...	...	...		...	..		...	×				
— cantabrigiensis, *Woods*	II, 37	...	...	...	...	...	×										
— elongata (*Sow.*)	II, 34	...	...	...	...	...	×	×									
— — *var.* echinata, *Eth.*	II, 36	...	...	...	...	...	?	×									
— gaultina, *Woods*	II, 31	...	×	×													
— interlineata, *Jukes-Browne*	II, 32	...	...	×													
— intermedia, *d'Orb.*	II, 33	...	...	...	...	×											
— Reichenbachi, *Gein.*	II, 39	...	...	...	...	×	×										
— sp.	II, 40	...	...	...	...	...	×										
(Ctenoides) divaricata, *Dujard.*	II, 44	...	...	...	...	...	...	...	...	×	×	...	×	×	×	×	
— rapa, *d'Orb.*	II, 40	...	...	...	...	×	×										
— tecta, *Goldf.*	II, 42	...	...	...	...	...	×										
(Limatula) decussata, *Goldf.*	II, 50	...	...	...	...	...	...	...	...			...	...	×	×	×	
— Fittoni, *d'Orb.*	II, 48	...	...	×	...		×										
— subæquilateralis, *d'Orb.*	II, 49	...	...	...	...	×											
— wintonensis, *Woods*	II, 51	...	...	...	...	...	...	...	...	...	...	...	?	...	×		
— sp.	II, 52	...	...	...	...	..	...	...	...	...	...	...	...	...	...	×	
(Limea ?) composita (*Sow.*)	II, 53	...	...	...	...	×											
— granulata (*Nilss.*)	II, 54	...	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×
PTERIA																	
(Oxytoma) dubia (*Eth.*)	II, 60	...	...	...	...	...	...	×									
— pectinata (*Sow.*)	II, 59	...	...	×													
— tenuicostata (*Röm.*)	II, 61	...	...	...	...	...	...	...	...	...	...	...	...	...	×		
— sp.	II, 60	...	...	...	...	...	...	×									

Genus and Species.	Volume and Page.	Zone of *Douvilleiceras mammillatum.*	Zone of *Hoplites interruptus* and *H. lautus.*	Zone of *Schlenbachia rostrata.*	Red Chalk.	Zone of *Pecten asper.*	Zone of *Schlenbachia varians.*	Zone of *Holaster subglobosus.*	Zone of *Rhynchonella Cuvieri.*	Zone of *Terebratulina lata.*	Zone of *Holaster planus.*	Zone of *Micraster cor-testudinarium.*	Zone of *Micraster cor-anguinum.*	Zone of *Marsupites testudinarius.*	Zone of *Actinocamax quadratus.*	Zone of *Belemnitella mucronata.*	Zone of *Ostrea lunata.*
AUCELLINA																	
gryphæoides (*Sow.*)	II, 72	...	...	×	×	×	×	×									
GERVILLIA																	
Forbesiana, *d'Orb.*	II, 85		×	×													
rostrata (*Sow.*)	II, 83		...	×													
sublanceolata (*d'Orb.*)	II, 74		...	×													
(Pseudoptera) anomala (*Sow.*)	II, 64		...	×													
— cœrulescens (*Nilss.*)	II, 67		...	...	...										×	×	×
— gaultina, *Woods*	II, 67		×														
— haldonensis, *Woods*	II, 66					×											
PERNA																	
oblonga, *Seel.*	II, 93	...	...	×													
Rauliniana, *d'Orb.*	II, 92	...	×	×													
semielliptica, *Seel.*	II, 94	...	..	×													
sp. (lanceolata, *Seel.*)	II, 95	...	...	×													
sp. (subspathulata, *Seel.*)	II, 95	...	...	×													
INOCERAMUS																	
anglicus, *Woods*	II, 264	...	?	×	×												
balticus, *Böhm*	II, 293	...	...	...	...	...	...							?	×	×	
cardissoides, *Goldf.*	II, 300	...	...	..	...	...	...							...	×		
concentricus, *Park.*	II, 265	...	×	×	×												
— *var.* subsulcatus, *Willsh.*	II, 268			×	×												
cordiformis, *Sow.*	II, 334			...	...	...	...	...			...	×	×	×			
corrugatus, *Woods*	II, 340			...	...	...	...	...			...	...	×				
costellatus, *Woods*	II, 336				...	...	...	...			×						
Crippsi, *Mant.*	II, 273				...	×	×	×									
— *var.* reachensis, *Eth.*	II, 278				...	...	×	×									
digitatus, *Sow.* (Chalk)	II, 337																
Etheridgei, *Woods*	II, 278					×	×	×									
inconstans, *Woods*	II, 285					...	...	...	...	?	×	×	×		×	×	
— *var.* sarumensis, *Woods*	II, 293					...	...	...	...	...	...	..	...		×		
— *var.* striatus, *Mant.*	II, 292					...	...	...	...	...	×	...	×				
involutus, *Sow.*	II, 327					...	...	...	...		...	×	×				
labiatus (*Schloth.*)	II, 281					...	...	...	×	×							
— *var.* latus, *Sow.*	II, 284					...	...	...	...	?	×						
Lamarcki, *Park.*	II, 307					...	...	...	×	×	×	×	×				
— *var.* apicalis, *Woods*	II, 319					...	...	...	×	×	×						
— *var.* Cuvieri, *Sow.*	II, 320					...	...	...	...	×	×	×	×				
— *var.* Websteri, *Mant.*	II, 319					...	...	..	...	...	×	×					
lingua, *Goldf.*	II, 299	...				...	...	...	...	...	...	...		?	...	×	
lobatus, *Goldf.*	II, 296	...				...	...	...	...	...	...	...			×		
pictus, *Sow.*	II, 279	...				...	×	×									
pinniformis, *Will.*	II, 338	...				...	...	...							×		
Salomoni, *d'Orb.*	II, 263	×															
sulcatus, *Park.*	II, 269			×	×												
tenuis, *Mant.*	II, 271			×	×	?	×										
tuberculatus, *Woods*	II, 302				...	...	...								×		
undulato-plicatus, *Röm.* (Senonian)	II, 304																
— *var.* digitatus, *Schlüt.*	II, 307												×		×		
sp.	II, 271			×													
PINNA																	
decussata, *Goldf.*	II, 99						×			×	×	?	×		?	×	×
Robinaldina, *d'Orb.*	II, 96		×	×													
tegulata, *Eth.*	II, 99		...	...				×									

Genus and Species.	Volume and Page.	Zone of *Douvilleiceras mammillatum.*	Zone of *Hoplites interruptus* and *H. lautus.*	Zone of *Sahlænbachia rostrata.*	Red Chalk.	Zone of *Pecten asper.*	Zone of *Schlænbachia varians.*	Zone of *Holaster subglobosus.*	Zone of *Rhynchonella Cuvieri.*	Zone of *Terebratulina lata.*	Zone of *Holaster planus.*	Zone of *Micraster cor-testudinarium.*	Zone of *Micraster cor-anguinum.*	Zone of *Marsupites testudinarius.*	Zone of *Actinocamax quadratus.*	Zone of *Belemnitella mucronata.*	Zone of *Ostrea lunata.*
ASTARTE																	
formosa, *Sow.*	II, 112	...	...	×													
impolita, *Sow.*	II, 113	...	...	×													
Omalioides, *Woods*	II, 111	...	...	×													
(Eriphyla) concinna (*Sow.*)	II, 426	...		×													
— obovata, *Sow.*	II, 113	...		×													
— striata, *Sow.*	II, 116	...	...	×													
OPIS																	
haldonensis, *Woods*	II, 119	...	...	×													
sp.	II, 120	...	...	×													
CARDITA																	
cancellata, *Woods*	II, 127	...	...	...		...	...				×						
Cottaldina, *d'Orb.*	II, 126	...	...	...		...	×										
tenuicosta (*Sow.*)	II, 124	...	×	×													
sp.	II, 127	...	...	...			×										
CRASSATELLITES																	
divisiensis, *Woods*	II, 128	...	...	×	...	?											
? equisulcatus (*Woods*)	II, 426	...	...	...	...	...	...	...	...	...	×						
vindinnensis (*d'Orb.*)	II, 129	...	...	...	...	...	×										
ANTHONYA																	
cantiana ? *Woods*	II, 426	...	...	...	...	×											
CYPRINA																	
cuneata, *Sow.*	II, 134	...	...	×													
ligeriensis, *d'Orb.*	II, 145	...	...	...		?	×										
(Venilicardia) angulata (*Sow.*)	II, 141	...	?	×													
— lineolata (*Sow.*)	II, 143	...	...	×													
— ?) quadrata (*d'Orb.*)	II, 146	...	...	×		×	×	...			×						
— truncata (*Sow.*)	II, 145	...	...	×													
TRAPEZIUM																	
trapezoidale (*Röm.*)	II, 149	...	...	...		...	...	...			×	...	...	...	...	×	
ISOCARDIA																	
similis, *Sow.*	II, 151	×															
LUCINA																	
Downesi, *Woods*	II, 155	...	...	×													
pisum, *Sow.*	II, 156	...	...	×													
? sculpta, *Phill.*	II, 153	...	×														
tenera, *Sow.*	II, 154	...	×	×													
SPHÆRA																	
sp.	II, 159	...	...	...			×										
MUTIELLA																	
? canaliculata (*Sow.*)	II, 160	...		×													
rotundata (*d'Orb.*)	II, 161					...	×										
UNICARDIUM																	
? gaultinum (*Pict. & Roux*)	II, 163	...		×													
? Mailleanum (*d'Orb.*)	II, 428	...		...		...											
ringmeriense (*Mant.*)	II, 164	...	...	×		...	×										
sp.	II, 163	...	...	×			×										
THETIRONIA																	
lævigata (*Sow.*)	II, 169	...	×	×													

Genus and Species.	Volume and Page.	Zone of *Douvilleiceras mammillatum.*	Zone of *Hoplites interruptus* and *H. lautus.*	Zone of *Schlœnbachia rostrata.*	Red Chalk.	Zone of *Pecten asper.*	Zone of *Schlœnbachia rarians.*	Zone of *Holaster subglobosus.*	Zone of *Rhynchonella Cuvieri.*	Zone of *Terebratulina lata.*	Zone of *Holaster planus.*	Zone of *Micraster cor-testudinarium.*	Zone of *Micraster cor-anguinum.*	Zone of *Marsupites testudinarius.*	Zone of *Actinocamax quadratus.*	Zone of *Belemnitella mucronata.*	Zone of *Ostrea lunata.*
Tellina																	
striatuloides, *Stol.*	II, 172	...	...	×	...	?											
subphaseolina, *d'Orb.*	II, 430	...	?	?													
(Palæomœra) inæqualis, *Sow.*	II, 173	...	...	×													
(Linearia) subtenuistriata, *d'Orb.*	II, 175	...	...	×													
— sp.	II, 177	...	...	×													
Mactra																	
angulata, *Sow.*	II, 177	...	...	×													
Dosiniopsis																	
caperata (*Sow.*)	II, 182			×													
subrotunda (*Sow.*)	II, 181			×													
Cyprimeria																	
(Cyclorisma) faba (*Sow.*)	II, 187	...	×	×													
— rotomagensis (*d'Orb.*)	II, 186	...	...	...			×										
— sublævis (*Sow.*)	II, 189	...	...	×													
— submersa (*Sow.*)	II, 431	...	...	×													
Clementia																	
(Flaventia) ovalis, *Sow.*	II, 191	...	...	×													
Callista																	
plana (*Sow.*)	II, 192	...	...	×													
Tapes																	
(Icanotia) sp.	II, 431	...	...	×													
Protocardia																	
Hillana (*Sow.*)	II, 197			×			×										
sp.	II, 196					×											
Cardium																	
turoniense, *Woods*	II, 204										×						
sp. (*cf.* cenomanense, *d'Orb.*)	II, 205										×						
sp.	II, 205			...							...					×	
(Granocardium) proboscideum, *Sow.*	II, 205			×													
Gyropleura																	
cornucopiæ (*d'Orb.*)	II, 208	...					×										
inequirostrata (*Woodw.*)	II, 209	...													...	×	
sp.	II, 210	...													×		
Durania																	
Mortoni (*Mant.*)	II, 420	...	...	...			×	×	×	×	×						
— sp. *cf.* austinensis (*Röm.*)	II, 422	...	...	...									×				
Corbula																	
elegans, *Sow.*	II, 216	...	...	×													
gaultina, *Pict. & Camp.*	II, 214	...	×														
truncata, *Sow.*	II, 215	...		×													
Solecurtus ?																	
(Azor ?) Actæon, *d'Orb.*	II, 219		...	×			×										
— Pelagi, *d'Orb.*	II, 218		...	×													
Leptosolen																	
Dupinianus (*d'Orb.*)	II, 219		×	×													
? rectangularis (*Woods*)	II, 432		...								×						
Panopea																	
gurgitis (*Brongn.*)	II, 222	×	×	×													

Genus and Species.	Volume and Page.	Zone of *Douvilleiceras mammillatum.*	Zone of *Hoplites interruptus* and *H. lautus.*	Zone of *Schlenbachia rostrata.*	Red Chalk.	Zone of *Pecten asper.*	Zone of *Schlenbachia varians.*	Zone of *Holaster subglobosus.*	Zone of *Rhynchonella Cuvieri.*	Zone of *Terebratulina lata.*	Zone of *Holaster planus.*	Zone of *Micraster cortestudinarium.*	Zone of *Micraster coranguinum.*	Zone of *Marsupites testudinarius.*	Zone of *Actinocamax quadratus.*	Zone of *Belemnitella mucronata.*	Zone of *Ostrea lunata.*
PANOPEA																	
mandibula (*Sow.*)	II, 228		×	×			×										
Meyeri, *Woods*	II, 229		...	×													
ovalis, *Sow.*	II, 229			×													
MARTESIA																	
constricta (*Phill.*)	II, 231		×	×													
? rotunda (*Sow.*)	II, 233				...						×						
TURNUS ?																	
amphisbæna (*Goldf.*)	II, 235		...				×	×	×	×	×	×	×	×	×		
sp. (*cf.* argonnensis, *Bur.*)	II, 234		×														
sp.	II, 235			×													
TEREDO																	
gaultina, *Woods*	II, 237		?	×													
ANATINA																	
(Cercomya), sp.	II, 239			×													
— sp.	II, 240			?		?	×										
THRACIA																	
carinifera (*Sow.*)	II, 244	...	...	...	...		×										
? gracilis (*Sow.*)	II, 432	...	...	×													
Sanctæ-Crucis, *Pict. & Camp.*	II, 243	...	×														
sp.	II, 244	...	×	×													
PHOLADOMYA																	
cordata, *Tate*	II, 253	...	...	...	...	...	...	...	...							×	
decussata (*Mant.*)	II, 250	...	...	×	...	...	×	×									
Fabrina, *d'Orb.*	II, 250	...	×	×													
GONIOMYA																	
Mailleana (*d'Orb.*)	II, 255	...		×			×										
LIOPISTHA																	
(Psilomya) gigantea (*Sow.*)	II, 257	...		×													
sp.	II, 258	...			×												
CUSPIDARIA																	
pulchra (*Sow.*)	II, 260	...	...					...	...		×	...				×	
Sabaudiana (*Pict. & Camp.*)	II, 259	...	×														
undulata (*Sow.*)	II, 260	...	×														

BIBLIOGRAPHY OF THE CRETACEOUS LAMELLIBRANCHIA.

[This includes works published since 1903, and some of earlier date which were omitted from the Bibliography given in Vol. I.]

AIRAGHI, C. *Inocerami* del Veneto. *Boll. Soc. geol. Ital.*, vol. xxiii (1904), p. 178.

ANDERSON, F. M. Cretaceous Deposits of the Pacific Coast. *Proc. Calif. Acad. Sci.*, ser. 3, vol. ii, No. 1, 1902. [Lamellibranchs, pp. 73—75.]

ANDERT, H. Die Inoceramen des Kreibitz-Zittauer Sandsteingebirges. (*Festschrift d. Humboldtvereins.*) Ebersbach, 1911.

ARKHANGELSKY, A. D. Sur quelques *Ostrea* du Paléocène et du Crétacé supérieur de la Russie. *Ann. géol. min. Russie*, vol. vii (1905), p. 189.

ARNAUD, H. Mémoire sur le Terrain Crétacé du sud-ouest de la France. *Mém. Soc. géol. de France*, ser. 2, vol. x (1877). [*Sphærulites*, p. 80.]

ARNOLD, R. Descriptions of New Cretaceous and Tertiary Fossils from the Santa Cruz Mountains, California. *Proc. U.S. Nat. Mus.*, vol. xxxiv (1908), p. 345. [Lamellibranch, p. 357.]

—— Palæontology of the Coalinga District, California. *Bull.* 396 *U.S. Geol. Survey*, 1909. [Lamellibranchs, p. 11, pl. i.]

ASCHER, E. Die Gastropoden, Bivalven und Brachiopoden der Grodischter Schichten. *Beitr. z. Pal. u. Geol. Österr.-Ungarns u. d. Orients*, vol. xix (1906), p. 135. [Lamellibranchs, pp. 153—166.]

BAYLE, E. Note sur le *Radiolites angulosus*, d'Orbigny. *Journ. de Conch.*, ser. 2, vol. i (1856), p. 370.

BEHRENDSEN, O. Zur Geologie des Ostabhanges der argentinischen Cordillere. II Theil. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xliv (1892), p. 1. [Lamellibranchs, pp. 19—29.]

BEYRICH, E. Bericht über die von Overweg auf der Reise von Tripoli nach Murzuk und von Murzuk nach Ghat gefundenen Versteinerungen. *Ibid.*, vol. iv (1852), p. 143. [Lamellibranchs, pp. 151—154, pls. iv, v.]

BÖHM, G. Ueber einige Fossilien aus Buchara. *Ibid.*, vol. li (1899), p. 465. [Lamellibranchs, pp. 466—469.]

BÖHM, J. Ueber *Inoceramus Cripsi*, Mant. *Ibid.*, vol. lix (1907), *Monatsb.*, p. 113.

Böhm, J. *Inoceramus problematicus*, v. Schloth. sp. *Ibid.*, vol. lxi (1909), *Monatsb.*, p. 117.

—— *Inoceramus Cripsi* auct. In Schröder und Böhm, Geologie und Paläontologie der subhercynen Kreidemulde. *Abhandl. d. k. preuss. geol. Landesanst.*, N.F. Heft 56 (1909), pp. 39—58, pls. ix—xiv.

—— Zur Verbreitung des *Inoceramus involutus*, Sow. *Centralbl. für Min.*, etc. (1910), p. 741.

—— and A. Heim. Neue Untersuchungen über die Senonbildungen der östlichen Schweizeralpen. II, Paläontologischer Teil, von J. Böhm. *Abhandl. d. schweiz. paläont. Gesellsch.*, vol. xxxvi (1909). [Lamellibranchs, pp. 26—31.]

—— Ueber *Inoceramus Cuvieri*, Sow. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. lxiii (1911), *Monatsber.*, p. 569.

Böse, E. La Fauna de Moluscos del Senoniano de Cárdensas, San Luis Potosí. *Bol. d. Inst. geol. de México*, No. 24, 1906. [Lamellibranchs, pp. 35—61.]

—— Monografía geológica y Paleontológica del Cerro de Muleros. *Ibid.*, No. 25, 1910. [Lamellibranchs, pp. 84—139.]

Boule, M., and A. Thevenin. Paléontologie de Madagascar. I, Fossiles de la Côte Orientale. *Annal. Paléont.*, vol. i (1906), p. 43. [Lamellibranchs, pp. 48—52 (= 6—10).]

Brandes, T. Gibt es Hippuritiden, welche durch Knospung Kolonien bilden? *Neues Jahrb. für Min.*, etc. (1909), vol. i, p. 93.

Brüggen, H. Die Fauna des unteren Senons von Nord-Perú. *Ibid.*, Beil.-Band xxx (1910), p. 717. [Lamellibranchs, pp. 742—762.]

Brugnière, J. G., etc. Encyclopédie méthodique [see Bibliography, vol. i, p. xiv]. Dates of publication are given by Sherborn and Woodward. *Ann. Mag. Nat. Hist.*, ser. 7, vol. xvii (1906), p. 577.

Burckhardt, C. Profils géologiques transversaux de la Cordillère argentino-Chilienne strat. et tect. *Anal. d. Mus. de La Plata*, Secc. Geol. y Min., vol. ii, 1900. [Cretaceous Lamellibranchs, pp. 49—51.]

—— Coupe géologique de la Cordillère entre las Lajas et Curacautin. *Ibid.*, Secc. Geol. y Min., vol. iii (1900). [Lamellibranchs, pp. 18—23, pls. xxi—xxvi.]

Choffat, P. Le Cretacique dans l'Arrabida et dans la Contrée d'Ericeira. *Commun. Comm. geol. Portugal*, vol. vi (1904), p. 1. [Lamellibranchs, pp. 47—51.]

—— Nouvelles données sur la zone littorale d'Angola. *Contrib. Conn. géol. des Colonies Portugaises d'Afrique*, 1905, p. 1. [Lamellibranchs, pp. 42—45.]

—— Espèces nouvelles ou peu connues du Mésozoique portugais. *Journ. Conch., Paris*, vol. liv (1906), p. 33. [Lamellibranchs, pp. 40—41.]

Clark, W. B., R. S. Lull, and E. W. Berry. Systematic Palæontology of the Lower Cretaceous Deposits of Maryland. (*Maryland Geol. Survey*, 1911.) Mollusca by W. B. Clark, p. 211. [Lamellibranchs, p. 213.]

Cossmann, M. Le Barrémien supérieur à facies urgonien de Brouzet-les-Alais (Gard). Déscription des Gastropodes et Pélécypodes. *Mém. Soc. géol. de France, Paléontologie*, vol. xv, 1907. [Lamellibranchs, pp. 28—41.]

Cragin, F. W. Descriptions of Invertebrate Fossils from the Comanche Series in Texas, Kansas and Indian Territory. *Colorado Coll. Studies*, 1894, p. 49. [Lamellibranchs, pp. 51—61.]

Dacqué, E. Mittheilungen über den Kreidecomplex von Abu Roash bei Kairo. *Palæontographica*, vol. xxx, 2 (1903), p. 337. [Lamellibranchs, pp. 361—378.]

—— Beiträge zur Geologie des Somalilandes. I. Untere Kreide. *Beitr. Paläont. u. Geol. Österr.-Ungarns u. d. Orients*, vol. xvii (1904), p. 7. [Lamellibranchs, pp. 12—17.]

Dainelli, G. *Vaccinites* (*Pironæa*) *polystylus* nel cretaceo del Capo di Leuca. *Boll. Soc. geol. Ital.*, vol. xxiv (1905), p. 119.

Décocq, C. Sur les Inocérames de la Craie du Nord. *Assoc. Franç. Avanc. Sci.*, 3me. Session. (Lille, 1874), 1875, p. 366.

Deshayes, G. P. Observations sur le *Sphærulites calceoides*. *Bull. Soc. géol. de France*, ser. 2, vol. viii (1850), p. 127.

Dietrich, W. O. *Ensigervilleia*, eine neue Gervilliengruppe aus dem oberen weissen Jura von Schwaben. *Centralbl. für Min.*, etc. (1910), p. 235.

Douvillé, H. Mission scientifique en Perse par J. de Morgan, vol. iii. Études géologiques. Partie iv. Paléontologie, Mollusques fossiles. Paris, 1904. [Lamellibranchs, pp. 244—251, 256—280.]

—— Études sur les Rudistes. Revision des principales espèces d' *Hippurites*. *Mém. Soc. géol. de France, Paléont.*, vol. i [1890] 1891, pp. 1—31 ; *ibid.*, vol. ii (1892), pp. 33—56 ; *ibid.*, vol. iii (1893), pp. 57—94 ; *ibid.*, vol. iv, (1894), pp. 95—135 ; Distribution régionale, *ibid.*, vol. v (1895), pp. 139—186 ; *ibid.*, vol. vii (1897), pp. 187—236.

—— Études sur les Rudistes. Rudistes de Sicile, d'Algérie, d'Égypte, du Liban et de la Perse. *Mém. Soc. géol. de France, Paléont.*, vol. xviii, 1910.

—— Sur les Biradiolitidés primitifs. *Bull. Soc. géol. de France*, ser. 4, vol. iv (1904), p. 174.

—— Sur quelques Rudistes à canaux. *Ibid.* (1904), p. 519.

— Étude sur les Vulsellidés. *Ibid.*, vol. vi (1906), p. 256.

— — Études sur les Lamellibranches. Vulsellidés. *Ann. de Paléont.*, vol. ii (1907), p. 97.

—— Les Lamellibranches cavicoles ou Desmodontes. *Bull. Soc. géol. de France*, ser. 4, vol. vii (1907), p. 96.

Douvillé, H. Sur le developpement des *Hippurites*. *Ibid.*, vol. viii (1908), p. 268.

—— Sur la classification des Radiolitidés. *Ibid.* (1908), p. 308.

—— Observations sur les Ostréidés, Origine et Classification. *Ibid.*, vol. x (1910), p. 634.

—— *Pseudotoucasia* et *Bayleia*. *Ibid.*, vol. xi (1911), p. 190.

Etheridge, R. fil. A Monograph of the Cretaceous Invertebrate Fauna of New South Wales. *Mem. Geol. Surv. N.S.W., Palæont.*, No. 11, 1902, 1903. [Lamellibranchs, pp. 14—39.]

—— Lower Cretaceous Fossils from the sources of the Barcoo, Ward and Nive Rivers, South Central Queensland. Part I, Annelida, Pelecypoda and Gasteropoda. *Rec. Australian Mus.*, vol. vi (1907), p. 317. [Lamellibranchs, pp. 319—327.]

—— Cretaceous Fossils of Natal. Part II, The Umsinene River Deposit (Zululand). *Third Rep. Geol. Surv. Natal and Zululand* (1907), p. 67. [Lamellibranchs, pp. 69—83.]

Fallot, E. Étude géologique sur les Étages moyens et supérieurs du Terrain Crétacé dans le S.E. de la France. *Ann. Sci. géol.*, vol. xviii (1885), p. 1. [Lamellibranchs, pp. 247—254.]

Favre, F. Die Ammoniten der unteren Kreide Patagoniens. *Neues Jahrb. für Min.*, etc., Beil.-Band xxv (1908), p. 601. [Lamellibranchs, pp. 608—612.]

Felix, J. Ueber Hippuritenhorizonte in den Gosauschichten der nord-östlichen Alpen. *Centralbl. für Min.*, etc. (1907), p. 417.

—— Studien über die Schichten der oberen Kreideformation in den Alpen und den Mediterrangebieten. II. Die Kreideschichten bei Gosau. *Palæontographica*, vol. liv (1908), p. 251. [Lamellibranchs, pp. 322—329.]

—— Ueber Hippuritenhorizonte in den Gosauschichten der nordöstlichen Alpen. *Centralbl. für Min.*, etc. (1910), p. 396. [Lamellibranchs, pp. 397—399.]

Fischer de Waldheim, G. Lettre à M. le Baron de Férussac sur quelques genres de coquilles du Muséum-Demidoff et en particulier sur quelques coquilles fossiles de la Crimée. *Bull. Soc. Impér. des Nat. de Moscou*, vol. viii (1835), p. 101. [Lamellibranchs, pp. 108—118.]

Flegel, K. Heuscheuer und Adersbach-Weckelsdorf. *Jahres-Bericht Schles. Ges. vaterländ. Cultur*, 1904 (1905), Abth. ii, p. 114. [Lamellibranchs, pp. 135–137.]

Fortau, R. Contribution à l'étude de la Faune Crétacique d'Égypte. *Bull. Inst. Égyptien*, ser. 4, vol. iv (1903), p. 231. [Lamellibranchs, pp. 279—344.]

Francke, F. Zusammenstellung der bisher in Nordeuropa bekannten Rudisten. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. lxiii (1911), *Monatsber.*, p. 356.

Frech, F. Geologische Beobachtungen im pontischen Gebirge. *Neues Jahrb. für Min.*, etc. (1910), vol. i, p. 1. [Lamellibranch, p. 6.]

FRIČ, A. Studien im Gebiete der böhmischen Kreideformation. Ergänzung zu Band I. Korycaner Schichten. *Archiv f. nat. Landesdurchforschung von Böhmen*, vol. xv, No. 1, 1911. [Lamellibranchs, pp. 30—55]

FRIEDBERGA, W. Drobny przyczynek do fauny warstw inoceramowych. *Sprav. Akad. Umiej. Krakow*, vol. xlii, pt. 3 (1908), p. 58.

FUTTERER, C. Ueber Hippuriten von Nabresina. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xlv (1893), p. 477.

GABB, W. M. Descriptions of some new species of Cretaceous Fossils from South America, in the Collection of the Academy. *Proc. Acad. Nat. Sci. Philad.*, 1860 (1861), p. 197, pl. iii. [Lamellibranchs, p. 198.]

GIEBEL, C. Repertorium zu Goldfuss' Petrefacten Deutschlands. Leipzig, 1866. [Lamellibranchs, pp. 40—84 and 87.]

GRÖNWALL, K. A. On the occurrence of the genus *Dimyodon*, Mun.-Chal., in the Mesozoic Rocks of Great Britain. *Geol. Mag.* (1906), p. 202.

HAENLEIN, C. v. *Inoceramen* aus der mittleren Kreide des nördlichen Harzrandes. *Zeitschr. für Nat. Halle*, ser. 4, vol. viii (1889), p. 465.

—— Ueber die Entwickelungsgeschichte des *Inoceramus Cripsi*, Mantell, und sein Vorkommen am Nordrande des Harzes. *Schrift. Nat. Ver. des Harzes* (Wernigerode), vol. vii (1892), p. 98.

HARBORT, E. Die Fauna der Schaumburg-Lippe'schen Kreidemulde. *Abhandl. d. k. preussisch. geol. Landesanst. u. Bergakad.*, N.F., 45, 1905. [Lamellibranchs, pp. 28–83.]

HARRIS, G. D. The Cretaceous and Lower Eocene Faunas of Louisiana. *Rep. Geol. Surv. Louisiana*, 1900, p. 289. [Lamellibranchs, pp. 292—296.]

HAUPT, O. Beiträge zur Geologie und Paläontologie von Südamerika, von *G. Steinmann*. xii, Beiträge zur Fauna des oberen Malm und der unteren Kreide in der argentinischen Cordillere. *Neues Jahrb. für Min.*, etc. Beil.-Bd. xxiii (1907), p. 187. [Lamellibranchs, pp. 207—222.]

HOLZAPFEL, E. Ueber einige wichtige Mollusken der Aachener Kreide. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xxxvi (1884), p. 454. [Lamellibranchs, pp. 456—472.]

IHERING, H. von. Notes sur quelques Mollusques fossiles du Chili. *Revista Chilena*, vol. vii (1902), p. 120. [*Hippurites, Radiolites.*]

—— Les Mollusques des terrains crétaciques supérieurs de l'Argentine orientale. *An. Mus. Nac. Buenos Aires*, vol. ix (1903), p. 193. [Lamellibranchs, pp. 198—206, 210—216.]

—— Nuevas Observaciones sobre moluscos cretáceos y terciarios de Patagonia. *Rev. d. Mus. de La Plata*, vol. xi (1904), p. 227. [Lamellibranchs, pp. 235, 236.]

—— Les Mollusques fossiles du Tertiare et du Crétacé supérieur de l'Argentine. *An. Mus. Nac. Buenos Aires*, ser. 3, vol. vii (1907), p. 1. [Lamellibranchs, pp. 3—27, 35—38, 42—48.]

IMKELLER, H. Einige Beobachtungen über die Kreideablagerungen im Leitzachtal, am Schlierund Tegernsee. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. lii (1900), p. 380. [Lamellibranchs, pp. 384—386.]

JOHNSON, D. W. Geology of the Cerillos Hills, New Mexico. Part ii. Palæontology. *School of Mines Quart.*, vol. xxiv (1903), No. 2. [Lamellibranchs, pp. 185—198.]

JUKES-BROWNE, A. J. On the genera of Veneridæ represented in the Cretaceous and older Tertiary Deposits. *Proc. Malacol. Soc.*, vol. viii (1908), p. 148.

KITCHIN, F. L. The Invertebrate Fauna and Palæontological Relations of the Uitenhage Series. *Ann. S. African Mus.*, vol. vii (1908), p. 21. [Lamellibranchs, pp. 65—162.]

KLER, M. O. *Neoceratites* du Boukhara de l'Orient. *Trav. Mus. géol. Pierre le Grand St. Pétersbourg*, vol. ii (1908), p. 157. [Lamellibranchs, pp. 168–173.]

KOSSMAT, F. Geologie der Inseln Sokótra, Sémha und Abd el Kûri. *Denkschr. d. k. Akad. Wissen. Wien.*, Math.-nat. Cl., vol. lxxi (1907), p. 1. [Lamellibranchs, pp. 48—51, 55—56.]

KRENKEL, E. Die Untere Kreide von Deutsch-Ostafrika. *Beitr. z. Paläont. u. Geol. Österreich-ungarns u. d. Orients*, vol. xxiii, 1910, p. 201. [Lamellibranchs, pp. 203—218.]

KRUMBECK, L. Beiträge zur Geologie und Palæontologie von Tripolis. *Palæontographica*, vol. liii (1906), p. 51. [Lamellibranchs, pp. 93—112.]

LANGENHAHN, W., and M. GRUNDEY. Das Kieslingswalder Gestein und seine Versteinerungen. Breslau, 1891. [Lamellibranchs, pp. 10—12.]

LARTET, L. Essai sur la Géologie de la Palestine et des contrées avoisinantes telles que l'Égypte et l'Arabie. Deuxième Partie. Paléontologie. *Annal. Sci. géol.*, vol. iii (1873). [Lamellibranchs, pp. 49—71.]

LEMOINE, P. Sur la présence des fossiles marins dans le Néocomien inférieur du Pays de Bray. *Bull. Soc. Sci. nat. Rouen*, vol. xliii, 1907 (1908), p. 129, pl. i.

LERICHE, M. Contribution à l'étude de la Faune de la Craie d'Épernay à *Magas pumilus*. *C. R. Assoc. Franç. Avanc. Sci.*, Reims, 1907, pt. 2 (1908), p. 334. [Lamellibranchs, pp. 336—338.]

—— Sur la limite entre le Turonien et la Sénonien dans le Cambrésis et sur quelques fossiles de la Craie grise. *Annal. Soc. géol. Nord*, vol. xxxviii (1909), p. 53. [Lamellibranchs, pp. 61—69.]

LEYMERIE, A. Synonymie de l'*Exogyra sinuata*. *Bull. Soc. géol. France*, vol. xi (1840), p. 121.

—— Thèse sur les caractères distinctifs des Huitres, des Gryphées et des Exogyres. Paris, 1840.

Longhi, P. Contribuzione alla conoscenza della Fauna del calcare cretaceo de Calloneghe presso il Lago di S. Croce nelle Alpi veneti, II. *Riv. ital. di Paleont.*, vol. ix (1903), p. 24. [Lamellibranchs, pp. 28—31.]

Meek, F. B. Palæontological Report. 6th Ann. Rep. U.S. Geol. Survey of the Territories, by F. V. Hayden, Washington (1873), p. 429. [Cretaceous Lamellibranchs, pp. 487—497.]

—— Report of the Geological Exploration of the 40th Parallel, vol. iv, Part I, Palæontology (1877). Cretaceous Fossils, p. 140. [Lamellibranchs, pp. 140—159.]

Meunier, S. Fossiles Malagaches. *Le Naturaliste* (August, 1893), pp. 175, 176.

Neumann, R. Beiträge zur Geologie und Paläontologie von Südamerika von G. Steinmann. XII. Beiträge zur Kenntniss der Kreideformation in Mittel-Perú. *Neues Jahrb. für Min.* etc., Beil.-Bd. xxiv (1907), p. 69. [Lamellibranchs, pp. 88—90, 101—118.]

Newton, R. B. On the occurrence of *Alectryonia ungulata* in S. E. Africa. *Journ. Conch.*, vol. viii (1896), p. 136.

—— Fossil Pearl-growths. *Proc. Malacol. Soc.*, vol. viii (1908), p. 128. [*Inoceramus*, etc.]

—— Cretaceous Gastropoda and Pelecypoda from Zululand. *Trans. Roy. Soc. S. Africa*, vol. i (1909), p. 1. [Lamellibranchs, pp. 31—86.]

Nowak, J. Gliederung der oberen Kreide in der Umgebung von Halicz. *Bull. Internat. Acad. Sci. Cracovie* (1909) 2, p. 871. [Lamellibranchs, pp. 874—876.]

Oppenheim, P. Neue Beiträge zur Geologie und Paläontologie der Balkanhalbinsel. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. lviii (1906), p. 109. [Lamellibranchs, pp. 126—128.]

Pálfy, M. von. Zwei neue *Inoceramus*-Riesen aus den oberen Kreideschichten der siebenbürgischen Landestheile. *Földtani Közlony*, vol. xxxiii (1903), pp. 445—451, 489—495.

Paquier, V. Les Rudistes urgoniens. *Mém. Soc. géol. de France, Paléontologie*, vol. xi (1903), pp. 1—46; vol. xiii (1905), pp. 48—102.

Parkinson, J. Remarks on the Fossils collected by Mr. Phillips near Dover and Folkestone. *Trans. Geol. Soc.*, ser. 1, vol. v (1819), p. 52.

Parona, C. F. Sopra alcune Rudiste de Cretaceo superiore del Cansiglio nelle Prealpi Veneto. *Mem. R. Accad. Sci. Torino* (2), vol. lix, 1909, pp. 139—156.

—— *Radiolites liratus* (Conr.) e *Apricardia Nöttlingi* (Blanck.) nel Cretaceo superiore della Siria. *Atti R. Accad. Sci. Torino*, vol. xliv (1909), p. 491.

—— Le Rudiste del Senoniano di Ruda. *Ibid.*, vol. xlvi (1911), p. 380.

Parona, C. F. Nuovi studii sulle Rudiste dell' Apennino (Radiolitidi). *Mem. R. Accad. Sci. Torino*, ser. 2, vol. lxii (1912), p. 273.

Pirona, G. A. L'Ippuritidi del colle Media nel Friuli. *Mem. Instit. veneto di Scienze*, vol. xiv (1869), p. 397.

Paulcke, W. Beiträge zur Geologie und Palæontologie von Südamerika von G. Steinmann. x, Ueber die Kreideformation in Südamerika und ihre Beziehungen zu anderen Gebieten. I Theil. *Neues Jahrb. für. Min.*, etc., Beil.-Bd. xvii (1903), p. 252. [Lamellibranchs, pp. 261—273, 288—297.]

Pavlow, A. P. Enchaînement des Aucelles et Aucellines du Crétacé russe. *Nouv. Mém. Soc. Imp. Nat. Moscou*, vol. xvii, p. 1, 1907.

Pellat, E. Sur l'âge des *Agria*. *Bull. Soc. géol. de France*, ser. 4, vol. vi (1906), p. 238.

Peron, P. A. Suppression d'un certain nombre d'Espèces dans la Nomenclature des *Ostrea* crétacés. *C. R. Assoc. franç. Av. Sci.*, vol. xxxvi, 1907 (1908), pt. 2, p. 305.

Pethö, J. Die Kreide-(Hypersenon-) Fauna des Peterwardeiner (Péterváradér) Gebirges (Fruska Gora). *Palæontographica*, vol. lii (1906), p. 57. [Lamellibranchs, pp. 184—316.]

Petraschecк, W. Über Inoceramen aus der Kreide Böhmens und Sachsens. *Jahrb. d. k. k. geol. Reichsanst.*, vol. liii (1903), p. 153.

—— Die Zone des *Actinocamax plenus* in der Kreide des östlichen Böhmen. *Ibid.*, vol. lv (1905), p. 399. [Lamellibranchs, pp. 429—434.]

—— Über Inoceramen aus der Gosau und dem Flysch der Nordalpen. *Ibid.*, vol. lvi (1906), p. 155.

Philippi, R. A. Die Tertiären und Quartären Versteinerungen Chiles. Leipzig, 1887. [Lamellibranchs, pp. 112—216.]

Ravn, J. P. J. On Jurassic and Cretaceous Fossils from North-East Greenland, *Meddelel. om Grönland*, vol. xlv (1911), p. 437. [Lamellibranchs, pp. 454—481.]

Repelin, J. Description des faunes et des gisements du Cénomanien saumâtre ou d'eau douce du Midi de la France. Marseille, 1902.

Richarz, P. S. Die geologische Bau von Kaiser Wilhelms-Land nach dem heutigen Stand unseres Wissens. *Neues Jahrb. für Min.*, etc., Beil.-Bd. xxix (1910), p. 406. [Lamellibranchs, pp. 476—487.]

Rogala, W. Über einige Lamellibranchen aus dem Lemberg-Nagorzanyer Senon. *Bull. Internat. Acad. Sci. Cracovie* (1909), 2, p. 689.

- — Die oberkretazischen Bildungen im galizischen Podolien. I. Teil, Turon. Weisse Kreide mit Feuersteinen. *Ibid.* (1911), p. 159. [Lamellibranchs, pp. 167—173.]

—— Ein Beitrag zur Kenntniss der Mukronatenkreide der Gegend von Lemberg. *Kosmos*, vol. xxxvi (1911), p. 467.

Rolland, G. Sur le Terrain crétacé du Sahara septentrional. *Bull. Soc. géol. de France*, ser. 3, vol. ix (1881), p. 508. [*Sphæculites*, p. 526.]

Römer, F. De Astartarum Genere et Speciebus, quæ esaxis jurassicis atque cretaceis proveniunt. Berlin, 1842.

Rouillier, C. Études progressives sur la géologie de Moscou. *Bull. Soc. Impér. Nat. Moscou*, vol. xxi (1848), pt. 1, p. 263; vol. xix, pt. 2 (1846), pl. D.

Rydzewski, B. Sur la faune crétacique de Mialy prés Grodno. *Bull. Internat. Acad. Sci. Cracovie*, 1909 (1910), p. 192. [Lamellibranchs, pp. 193—196.]

—— Przyczynek do znojomości fauny kredowej w Mialach pod Grodnem (na Litwei). *Sprav. Akad. Umiej. Krakow*, vol. xliv (1910), pt. 4, p. 77. [Lamellibranchs, pp. 80–85.]

Schafhäutl, K. E. Süd-Bayerns Lethæa Geognostica, 1863. [Lamellibranchs, pp. 135—179.]

Schlagintweit, O. Die Fauna des Vracon und Cenoman in Perú. Beitr. z. Geol. u. Paläont. v. Südamerika von G. Steinmann. *Neues Jahrb. für Min.*, etc., Beil.-Bd. xxxiii (1911), p. 43. [Lamellibranchs, pp. 90—96, 104—125.]

Schlüter, C. Einige Inoceramen und Cephalopoden der texanischen Kreide. *Verhandl. d. nat. Vereines d. preuss. Rheinl.*, vol. xliv (1887), Sitzungsber., p. 42.

Schmidt, F. Über die neue Gattung *Pseudoeucullæa*. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. lvi (1904), *Monatsb.*, p. 120.

Sharman, G., and E. T. Newton. Note on some Cretaceous Fossils from the Drift of Moreseat, Aberdeen. *Geol. Mag.* (1896), p. 247. [Lamellibranchs, pp. 251—253.]

Sharpe, D. On the Secondary District of Portugal which lies to the North of the Tagus. *Quart. Journ. Geol. Soc.*, vol. vi (1850), p. 135. [Lamellibranchs, pp. 176—191.]

Shattuck, G. B. The Mollusca of the Buda Limestone, with an appendix on the Corals, by T. W. Vaughan. *Bull. U.S. Geol. Survey*, No. 205, 1903. [Lamellibranchs, pp. 15—30.]

Simionescu, J. Studii geologice si Paleontologice din Carpatii Sudici. I. Studii geologice asupra Basenlui Dîmbovicióreĭ. II. Fauna Neocomiană din Basenul Dîmbovicióreĭ. *Acad. Romîna, Publicat. Fond. Vasil. Adamachi*, vol. i, No. 2. Bukarest, 1898. [Lamellibranchs, pp. 151—154.]

—— Fauna cretacica superióra de la Ürmös (Transilvania). *Ibid.*, No. 4. Bukarest, 1899. [Lamellibranchs, pp. 23—35.]

Smith, W. Strata identified by Organised Fossils. London, 1816–19. [Cretaceous Lamellibranchs, pls. iii, iv, v.]

Smoleński, G. Le Sénonien inférieur de Bonarka. I. Les Céphalopodes et les Inocéraminés. *Bull. Intern. Acad. Sci. Cracovie* (1906), p. 717.

Smoleński, G. Dolny Senon w Bonarce. I. Glowonogi i Inoceramy. *Abhandl. d. math.-nat. Klasse d. Akad. d. Wiss. in Krakau*, vol. xlvi (1906), p. 134. [*Inoceramus.*]

Snethlage, E. Ueber die Gattung *Joufia* G. Böhm. *Ber. naturf. Gesellsch., Freiburg-i-Br.*, vol. xvi (1906), pp. 1—9.

Sokolov, D. Aucelles et Aucellines provenant du Mangyslak. *Bull. Imp. Acad. Sci. St. Pétersb.*, ser. 6, vol. ii (1908), p. 635.

Sokolow, D. N. Ueber die ältesten Aucellen. *Bull. Com. géol. Russie*, vol. xxvii (1908), p. 383.

—— Aucellen von Timan und von Spitzbergen. *Mém. Com. géol. Russie*, n.s. No. 36, 1908.

—— Ueber Aucellen aus dem Norden und osten von Siberien. *Mém. Acad. Impér. Sci. St. Pétersbourg*, vol. xxi, No. 3, 1908.

—— Über Aucellinen aus Transkaspien. *Verhandl. d. kais.-russ. mineral. Gesellsch. Petersburg*, vol. xlvii (1909), p. 49.

Solger, F. Über *Pseudocucullæa*, einen neuen Taxodontentypus. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. lv (1903), *Monatsber.*, p. 76.

Sowerby, J. de C. *Inoceramus intermedius*, n. sp. *Mag. Nat. Hist.*, vol. ii (1829), p. 296, fig. 83.

—— In Sedgwick and Murchison. *Trans. Geol. Soc.*, ser. 2, vol. iii (1846), p. 301. [Gosau Fossils, pp. 417–419, pls. xxxviii, xxxix.]

Spulski, B. Beitrag zur Kenntniss der baltischen Cenoman-geschiebe Ostpreussens. *Schrift. phys.-ökon. Gesellsch. Königsberg*, vol. li (1910), p. 1. [Lamellibranchs, p. 2.]

Stanton, T. W. A new freshwater molluscan faunule from the Cretaceous of Montana. *Proc. Amer. Phil. Soc.*, vol. xlii (1903), p. 188. [Lamellibranchs, pp. 194—195.]

—— and J. B. Hatcher. Geology and Palæontology of the Judith River Beds. *Bull. U.S. Geol. Survey*, No. 257, 1905. [Lamellibranchs, pp. 104—113.]

Stefano, G. de. Fossili cretacei nel Bartoniano di Plati (Calabria). *Atti Soc. ital. Sci. nat. Milan*, vol. xliii (1904), p. 331. [Lamellibranchs, pp. 358—380.]

Steinmann, G., and O. Wilckens. Kreide- und Tertiärfossilien aus den Magellansländern, gesammelt von der Schwedischen Expedition, 1895—1897. *Arkiv für Zoologie*, vol. iv, No. 6 (1908).

Stojanoff, A. A. Zur Geologie des Bezirkes der Piatigorsk-Mineralquellen. Valanginien und Hauterivien der Kislowodsk-Umgegenden. *Ann. géol. et min. de la Russie*, vol. x (1908), p. 113. [Lamellibranchs, pp. 113—121.]

Stolley, E. Über die Kreideformation und ihre Fossilien auf Spitzbergen. *K. Svenska Vetenskapsakad. Handl.*, vol. xlvii, No. 11, 1912. [*Inoceramus*, pp. 20—22].

TAFF, J. A. The Chalk of South-Western Arkansas. *Twenty-Second Ann. Rep. U.S. Geol. Survey*, pt. 3 (1902), p. 687. [Figures of Lamellibranchs, pls. l—lii.]

TOUCAS, A. Sur un nouveau groupe d'*Hippurites*. *Bull. Soc. géol. de France*, ser. 4, vol. iii (1903), p. 137.

—— Études sur la Classification et l'Évolution des *Hippurites*. *Mém. Soc. géol. de France, Paléont.*, vol. xi (1903), pp. 1—60; vol. xii (1904), pp. 65—128; vol. xvii (1909), pp. 79—132.

—— Observations au sujet des critiques formulées par M. Henri Douvillé sur la Classification et l'Évolution des *Hippurites*. *Bull. Soc. géol. de France*, ser. 4, vol. iv (1904), p. 732.

—— Sur la Classification et l'Évolution des Radiolitidés. *Ibid.*, vol. v (1905), p. 523.

—— Relation des Radiolitidés avec les *Agria*. *Ibid.*, vol. vi (1906), p. 149.

—— Études sur la Classification et l'Évolution des Radiolitidés. *Mém. Soc. géol. de France, Paléont.*, vol. xiv (1907), pp. 1—46; vol. xvi (1908), pp. 47—80.

—— Sur la Classification des Hippurites. *Bull. Soc. géol. de France*, ser. 4, vol. x (1912), p. 723.

TOULA, F. Grundlinien der Geologie des Westlichen Balken. *Denkschr. d. k. Akad. d. Wissensch., Math.-nat. Classe, Wien*, vol. xliv (1882), Abth. ii, p. 1. [Lamellibranchs, pl. iv.]

—— Geologische Beobachtungen auf einer Reise in die Gegend von Silistria und die Dobrudscha, im Jahre, 1892. *Jahrb. d. k. k. geol. Reichsanst.*, vol. liv, 1904 (1905), p. 1. [Lamellibranchs, pp. 16—24, 35—40.]

TRAUTSCHOLD, H. Notes on Jurassic Fossils collected at Barbeau-le-Marni. *Verhandl. d. russisch-kaiserlich mineral. Gesellsch. in Petersburg.*, ser. 2, vol. iii (1868), p. 250. [*Aucella Keyserlingiana*.]

—— Le Néocomien de Sably en Crimée. *Nouv. Mém. Soc. Impér. Nat. Moscou*, vol. xv (1886). [Lamellibranchs, pp. 133—135.]

VADÁSZ, M. E. Paläontologische Studien aus Zentralasien. *Mitth. a. d. Jahrb. d. k. ungarisch. geol. Reichsanst.*, vol. xix, 1911. [Lamellibranchs, pp. 109—111.]

VIDAL, L. M. Nota acerca del Sistema cretáceo de los Pirineos de Cataluña. *Bolet. del Mapa geol. España*, vol. iv (1877), p. 257. [Lamellibranchs, pp. 348–368.]

VOGEL VON FALCKENSTEIN, K. Brachiopoden und Lamellibranchiaten der senonen Kreidegeschiebe aus Westpreussen. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. lxii (1911), p. 544. [Lamellibranchs, pp. 548–566.]

VREDENBURG, E. W. Note on a Hippurite-bearing Limestone in Seistan, and on the Geology of the adjoining region. *Rec. Geol. Surv. India*, vol. xxxviii (1909), p. 216. [Lamellibranchs, pp. 223—229.]

WANDERER, K. Die wichtigsten Tierversteinerungen aus der Kreide d. K. Sachsen. Jena, 1909.

WEGNER, T. Die Granulatenkreide des westlichen Münsterlandes. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. lvii (1905), p. 112. [Lamellibranchs, pp. 154—198.]

WELLER, S. The Fauna of the Cliffwood (N.J.) Clays. *Journ. Geol.*, vol. xii (1905), p. 324. Also *Ann. Rep. Geol. Survey New Jersey* for 1904 (1905), p. 133. [Notes on Lamellibranchs.]

—— A Report on the Cretaceous Palæontology of New Jersey, based upon the stratigraphic studies of G. N. Knapp. *Geol. Survey of New Jersey*, vol. iv, *Palæont. Series.* Trenton, 1907. [Lamellibranchs, pp. 369—661.]

WHITFIELD, R. P. Preliminary Report on the Palæontology of the Black Hills, 1877. (Powell's *Geol. and Geogr. Surv. Rocky Mountain Region*, 1877.)

—— Observations on some Cretaceous Fossils from the Beyrût District of Syria, in the Collection of the American Museum of Natural History, with descriptions of some new species. *Bull. Amer. Mus. Nat. Hist.*, vol. iii (1891), p. 381. [Lamellibranchs, pp. 390—413.]

WILCKENS, O. Die Anneliden, Bivalven und Gastropoden der Antarktischen Kreideformation. *Wissenschaft. Ergebn. schwedisch. Südpolar-exped.* 1901—3, vol. iii (1911), p. 97.

—— Beiträge zur Geologie und Palæontologie von Südamerika von *G. Steinmann.* XI, Revision der Fauna der Quiriquina-Schichten. *Neues Jahrb. für Min.*, etc., Beil.-Band xviii (1904), p. 181. [Lamellibranchs, pp. 224—265.]

—— Die Lamellibranchiaten, Gastropoden, etc., der oberen Kreide Südpatagoniens. *Ber. nat. Gesellsch. Freiburg-i.-Br.*, vol. xv (1905), p. 97 (91 of reprint). [Lamellibranchs, pp. 102—106, 132—148.]

WIŚNIOWSKI, T. Sur la Faune des Schistes de Spas et sur l'âge des grès massifs dans les Carpathes de la Galicie orientale. *Bull. Intern. Acad. Sci. Cracovie* (1906), p. 240. [Lamellibranchs, pp. 247—250.]

WOLLEMANN, A. Die Fauna des mittleren Gaults von Algermissen. *Jahrb. d. k. preuss. geol. Landesanst. u. Bergakad.* für 1903, vol. xxiv (1903), p. 22. [Lamellibranchs, pp. 25—26.]

—— Die Bivalven und Gastropoden des norddeutschen Gaults (Aptiens und Albiens). *Ibid.* für 1906, vol. xxvii (1906), p. 259. [Lamellibranchs, pp. 264—279.]

—— Nachtrag zu meinen Abhandlungen über die Bivalven und Gastropoden der unteren Kreide Norddeutschlands. *Ibid.* für 1908, vol. xxix (1908), p. 151. [Lamellibranchs, pp. 154—167.]

WOODS, H. The Cretaceous Fauna of Pondoland. *Ann. S. African Mus.*, vol. iv (1906), p. 275. [Lamellibranchs, pp. 287—310.]

—— Echinoidea, Brachiopoda, and Lamellibranchia from the Upper Cretaceous Limestone of Need's Camp, Buffalo River. *Ibid.*, vol. vii (1908), p. 13. [Lamellibranchs, pp. 16—18].

Woods, H. The Palæontology of the Upper Cretaceous Deposits of Northern Nigeria. (Appendix to *J. D. Falconer's* 'Geography and Geology of Northern Nigeria,' 1911, p. 273.) [Lamellibranchs, pp. 276—280.]

—— The Evolution of *Inoceramus* in the Cretaceous Period. *Quart. Journ. Geol. Soc.*, vol. lxviii (1912), pp. 1—19.

Woodward, H. A Fragment of a Fossil in a Chalk-Flint Pebble from the Sheringham Beach (Norfolk). *Geol. Mag.* (1910), p. 483. [Radiolite.]

Zekeli, L. F. Das Genus *Inoceramus* und seine Verbreitung in den Gosaugebilden den ostlichen Alpen. *Jahrb. Nat. Ver. Halle* (Berlin), vol. iv (1852), p. 79.

INDEX TO VOLUME II.

Synonyms are printed in italics. The Roman numerals refer to the plates. The numbers preceded by "f." refer to the text-figures.

ADLARD AND SON, IMPR., LONDON AND DORKING.

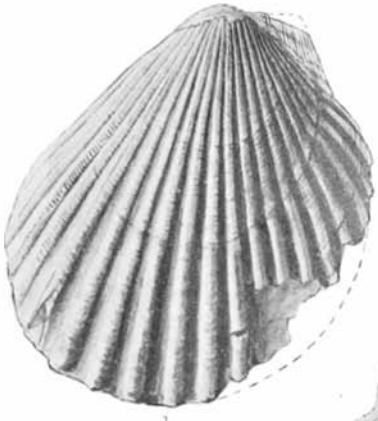
The figures are of natural size *unless the amount of enlargement or reduction is stated.*

PLATE I.

Genus—LIMA, *Bruguière.*

Lima canalifera, Goldfuss. Upper Greensand (zone of *Pecten asper*), Ventnor. Sedgwick Museum, Cambridge; except fig. 2, York Museum. (P. 1.)

1, 5, 6 *a*, 7 *a*, left valves; 6 *b*, antero-dorsal view; 7 *b*, portion × 2.
2, 3, 4, right valves.



1

2

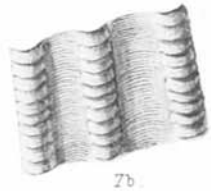
3

4

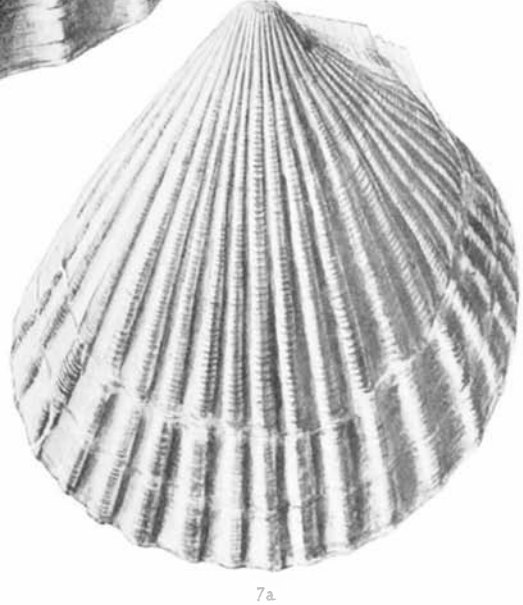
5

6b

6a



7b



7a

A Brock del

London Stereoscopic Co imp

PLATE II.

LIMA (*continued*).

FIGS.

1. *L. Galliennei*, d'Orb. Upper Greensand (zone of *Schlœnbachia rostrata*), Devizes. Museum of Practical Geology, No. 8798. *a*, right valve; *b*, antero-dorsal view; *c*, antero-ventral portion × 3. (P. 3.)

2. *L. vectensis*, Woods. Upper Greensand (zone of *Pecten asper*), Isle of Wight. Ventnor Institute. *a*, left valve; *b*, antero-dorsal view; *c*, portion × 3. (P. 4.)

3—7. *L. suboralis*, Sow. (P. 5.)

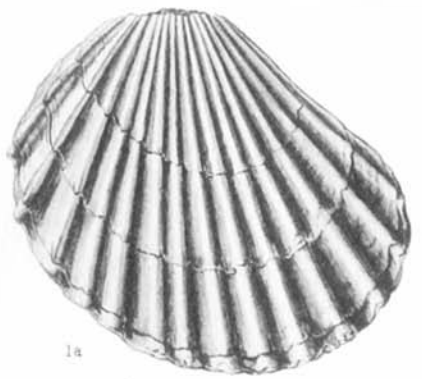
3. Upper Greensand, probably Warminster. Bristol Museum. Left valve × 1½.
4. Upper Greensand, Warminster. Museum of Practical Geology, No. 8805. *a*, right valve × 1½; *b*, antero-dorsal view × 1½.
5. Same horizon, etc. No. 8804. Left valve. *a*, median portion × 8; *b*, posterior portion × 8.
6. Greensand bed at the base of the Chalk, Folkestone. Sedgwick Museum. *a*, right valve; *b*, portion × 8.
7. Cambridge Greensand. Sedgwick Museum. *a*, right valve × 1½; *b*, antero-ventral portion × 8.

8, 9. *L. scabrissima*, Woods. Upper Greensand (zone of *P. asper*), Warminster. Museum of Practical Geology, Nos. 8815, 8816. (P. 7.)

8 *a*, left valve; *b*, antero-dorsal view.
9 *a*, right valve; *b*, portion × 4.

10, 11. *L. aspera* (Mant.). Lower Chalk (Totternhoe Stone). Sedgwick Museum. (P. 8.)

10. Cherry Hinton. Right valve.
11. Cherry Hinton. Left valve.

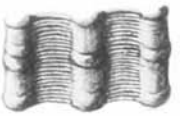

1a


1b


3


4a


4b


2c


1c


2a


2b

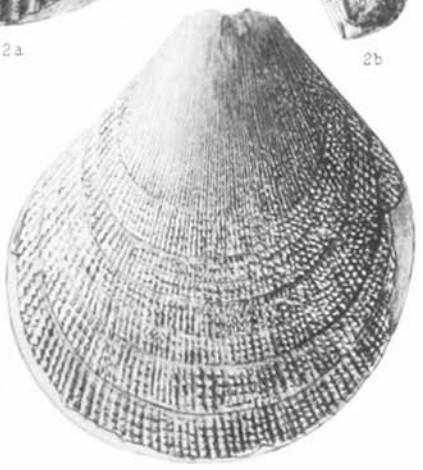

5a


5b


6a


7a


7b


8a


8b


6b


9a


9b


10


11

Brock del

London Stereoscopic Co imp

CRETACEOUS LAMELLIBRANCHIA

PLATE III.

LIMA (*continued*).

FIGS.

1—4. *L. aspera* (Mant.). Lower Chalk (Totternhoe Stone). 1—3. Sedgwick Museum. 4. York Museum. (P. 8.)

1. Burwell. *a*, right valve × 1½; *b*, median portion × 6.
2. Cherry Hinton. Left valve.
3. Burwell. Anterior area of right valve × 1½.
4. Burwell. Right valve.

5—9. *L.* (*Plagiostoma*) *subrigida*, Römer. Claxby Ironstone, Benniworth Haven. Sedgwick Museum (P. 10.)

5 *a*. Right valve; *b*, antero-dorsal view.
6. Left valve.
7. Antero-ventral part of right valve.
8. Portion of right valve × 6.
9. Left valve. Portion of a young individual × 8.

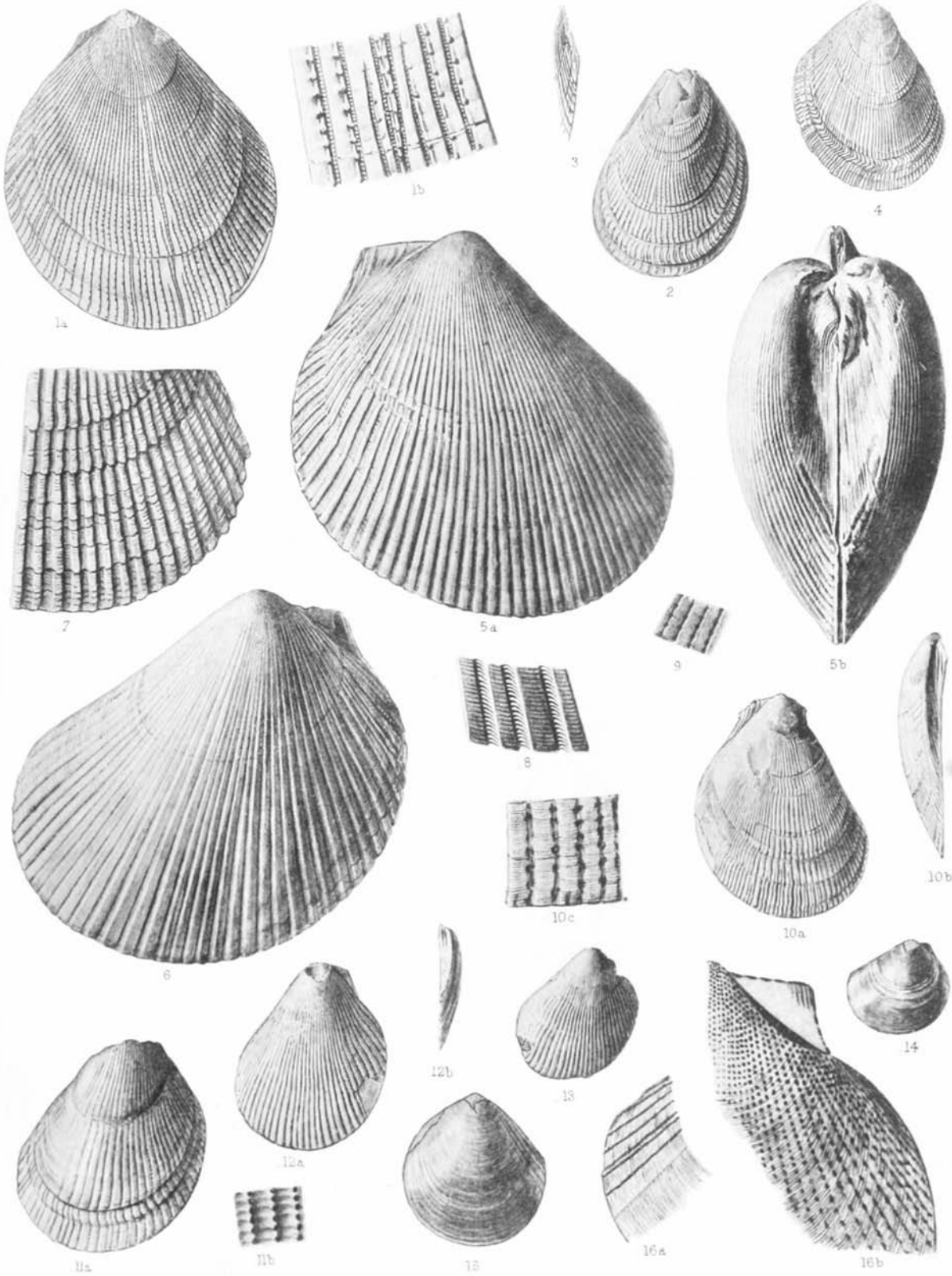
10. *L.* (*Plagiostoma*) sp., cf. *Orbignyana*, Matheron. Lower Greensand (Ferruginous Sands), Shanklin. British Museum, No. L 15754. *a*, right valve × 1½; *b*, anterior view of the same × 1½; *c*, portion × 6. (P. 12.)

11—13. *L.* (*Plagiostoma*) *villersensis?* Pict. and Camp. Lower Greensand, Faringdon. Sedgwick Museum. (P. 13.)

11 *a*, left valve × 1½; *b*, portion × 4.
12 *a*, left valve × 1½; *b*, anterior view, natural size.
13. Left valve.

14—16. *L.* (*Plagiostoma*) *semiornata*, d'Orb. Upper Greensand, Ventnor. (P. 14.)

14. York Museum. Left valve.
15. Sedgwick Museum. Right valve.
16. York Museum. Left valve. *a*, anterior part × 3; *b*, postero-dorsal part × 3.



T.A.Brock del.

London Stereoscopic Co. imp.

CRETACEOUS LAMELLIBRANCHIA.

PLATE IV.

LIMA (*continued*).

FIGS.

1. *L.* (*Plagiostoma*) *semiornata*, d'Orb. Upper Greensand, Ventnor. York Museum. Left valve. Portions of this specimen are enlarged on pl. iii, figs. 16 *a*, *b*. (P. 14.)

2, 3. *L.* (*Plagiostoma*) *Meyeri*, Woods. Upper Greensand, Warminster. (P. 15.)

2. Right valve. useum of Practical Geology, No. 8839.
3. Left valve. Sedgwick Museum, Cambridge.

4—6. *L.* (*Plagiostoma*) *globosa* (Sow). Lower Chalk. 4, 5. Totternhoe Stone, Burwell. 6. Zone of *Holaster subglobosus*, Fulbourn. Sedgwick Museum. (P. 16.)

4 *a*, left valve; *b*, dorsal view × 1½; *c*, portion × 12.
5 *a*, right valve; *b*, mid-ventral portion × 12.
6 *a*, right valve; *b*, dorsal view; *c*, median portion × 12.

7—12. *L.* (*Plagiostoma*) *Hoperi*, Mant. (P. 17.)

7—10. Zone of *Actinocamax quadratus*, East Harnham. Dr. Blackmore's collection 7. Left valve; 8 *a*, right valve; 8 *b*, anterior area of left valve; 9 *a*, left valve 9 *b*, dorsal view; 10, left valve.

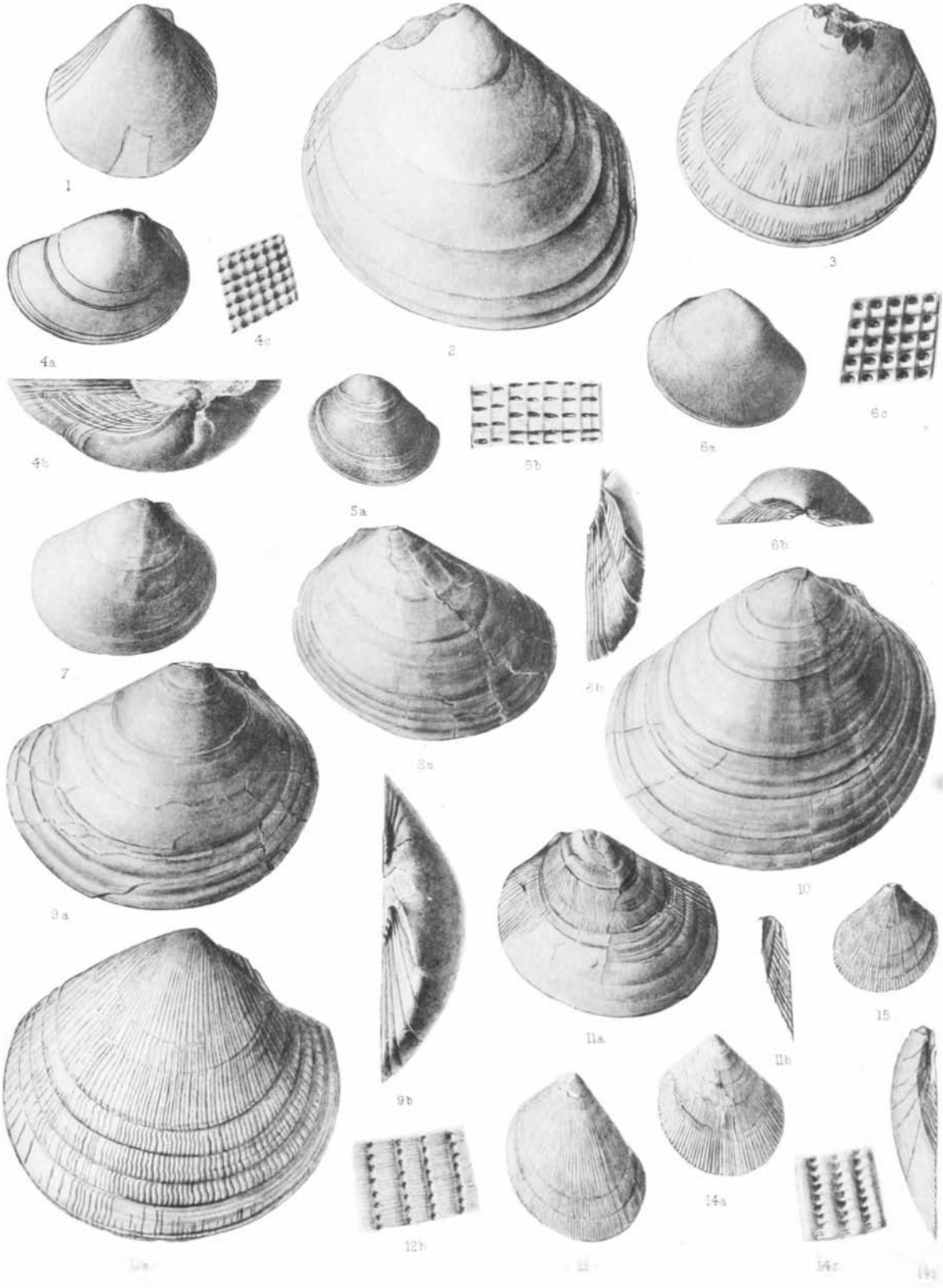
11. Zone of *Belemnitella mucronata*, Norwich. Norwich Museum. 11 *a*, right valve; 11 *b*, anterior area of the same.

12. Zone of *Micraster cor-anguinum*, Gravesend. Mr. Dibley's collection. 12 *a*, left valve; 12 *b*, portion × 6.

13—15. *L.* (*Plagiostoma*) *cretacea*, Woods. Dr. Blackmore's collection. (P. 22.)

13, 15. Zone of *Actinocamax quadratus*, East Harnham. 13. Right valve × 1½. 15. Left valve.

14. Upper part of zone of *A. quadratus*, Whaddon railway cutting. *a*, right valve: *b*, antero-dorsal view × 1½; *c*, portion × 6.



A Brock del

London Stereoscopic Co. imp.

PLATE V.

LIMA (*continued*).

FIGS.

1—4. *L.* (*Plagiostoma*) *cretacea*, Woods. (P. 22.)

1. Zone of *Actinocamax quadratus*, East Harnham. Dr. Blackmore's Collection. *a*, left valve; *b*, portion × 6.
2. Zone of *Micraster cor-testudinarium*, Borstal. Mr. Dibley's Collection. Left valve.
3. Zone of *Holaster planus*, Cheveley. Sedgwick Museum. Left valve.
4. Zone of *Micraster cor-testudinarium*, Cuxton. Mr. Dibley's Collection. *a*, left valve; *b*, postero-ventral portion × 4.

5. *L.* (*Plagiostoma*) sp. (? var. of *cretacea*). Chalk (? zone of *Holaster planus*), Burham. Sedgwick Museum. Left valve.

6, 7. *L.* (*Plagiostoma*) *Marrotiana*, d'Orb. Zone of *Belemnitella mucronata*, Norwich. Norwich Museum. (P. 24.)

6 *a*, left valve; *b*, mid-ventral portion × 3.
7 *a*, anterior area of right valve; *b*, median portion of left valve of same specimen.

8—12. *L.* (*Acesta*) *longa*, Römer. (P. 25.)

8. Lower Greensand, Upware. Mr. J. F. Walker's Collection. *a*, right valve; *b*, portion below the middle of the valve × 5.
9, 10. Lower Greensand, Brickhill. Right valves. Sedgwick Museum.
11. Tealby Limestone (zone of *Belemnites brunsvicensis*), North Willingham. Right valve. Sedgwick Museum.
12. Speeton Clay, Speeton. Museum of Practical Geology, No. 8781. *a*, right valve; *b*, portion × 4.

13. *L.* (*Acesta*) sp. Lower Greensand, West Dereham. Sedgwick Museum (collected by Mr. Jukes-Browne). *a*, right valve; *b*, antero-dorsal view; *c*, portion × 5. (P. 26.)

14, 15. *L.* (*Mantellum*) *parallela*, Sow. Lower Greensand (*Perna*-bed), Atherfield. (P. 28.)

14. Left valve. Sedgwick Museum.
15. British Museum, No. L 5066. *a*, left valve; *b*, dorsal view; *c*, portion at anterior end × 3; *d*, mid-ventral portion × 6.

16—20. *L.* (*Mantellum*) *gaultina*, Woods. Gault. 16—19, Black Ven. 20, Folkestone. Sedgwick Museum. (P. 31.)

16 *a*, left valve; *b*, antero-dorsal view.
17. Right valve.
18 *a*, ,, *b*, antero-dorsal view.
19. ,, median portion × 6.
20. Left valve

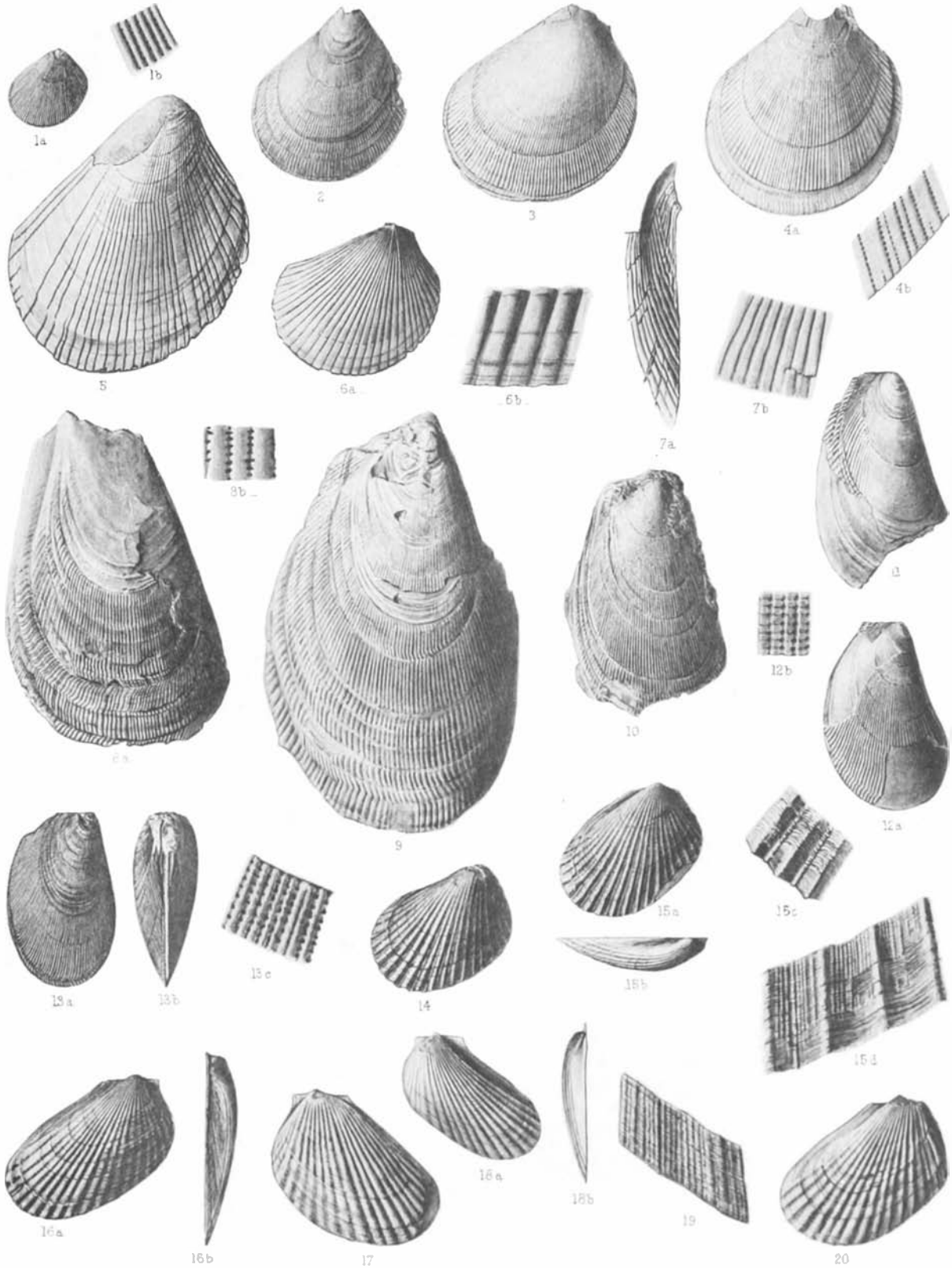


PLATE VI.

LIMA (*continued*).

FIGS.

1. *L.* (*Mantellum*) *interlineata*, Jukes-Browne. Cambridge Greensand, Cambridge. *a*, right valve; *b*, ventral part of left valve × 3. (P. 32.)

2—4. *L.* (*Mantellum*) *intermedia*, d'Orb. Rye Hill Sands, Warminster. (P. 33.)

2. York Museum. *a*, right valve; *b*, antero-ventral part × 4.
3. Brighton Museum. Left valve.
4. Sedgwick Museum. *a*, right valve; *b*, antero-dorsal view; *c*, posterior ear of right valve × 4.

5—7. *L.* (*Mantellum*) *elongata*, Sow. Chalk Marl, Folkestone. (P. 34.)

5. Mr. J. F. Walker's Collection. Right valve.
6. Sedgwick Museum. *a*, left valve; *b*, antero-dorsal view; *c*, mid-ventral portion × 3.
7. Sedgwick Museum. *a*, right valve; *b*, antero-ventral part × 8.

8, 9. *L.* (*Mantellum*) *elongata*, var. *echinata*, Eth. Sedgwick Museum. (P. 36.)

8. Totternhoe Stone, Burwell. Left valve. One of the types.
9. *H. subglobosus* zone, Burwell. *a*, left valve; *b*, antero-ventral portion × 4; *c*, posterior portion × 4.

10—12. *L.* (*Mantellum*) *cantabrigiensis*, Woods. Sedgwick Museum. (P. 37.)

10. The type. Cambridge Greensand. *a*, left valve; *b*, posterior portion × 6.
11. Antero-ventral portion of left valve × 6.
12. Lower Chalk, Burwell. Right valve × 1½.

13. *L.* (*Mantellum*) *britannica*, Woods. Zone of *Micraster cor-anguinum*, Seaford. Mr. R. M. Brydone's Collection. *a*, right valve; *b*, antero-dorsal view × 1½; *c*, portion at antero-ventral margin × 6; *d*, portion at postero-ventral margin × 6. (P. 38.)

14, 15. *L.* (*Mantellum*) *Reichenbachi*, Geinitz. Sedgwick Museum, Cambridge. (P. 39.)

14. Cenomanian Sandstone, Wilmington. *a*, left valve; *b*, antero-dorsal view.
15. Chloritic Marl, Chard. Right valve.

16. *L.* (*Mantellum*), sp. Chloritic Marl, Chardstock. Museum of Practical Geology, No. 7896. *a*, left valve; *b*, postero-ventral portion × 6. (P. 40.)

17. *L.* (*Ctenoides*) *rapa*, d'Orb. Upper Greensand, Haldon. British Museum, No. L 15612. *a*, right valve; *b*, median portion a short distance above the ventral margin × 3; *c*, portion near the anterior margin × 5. (P. 40.)

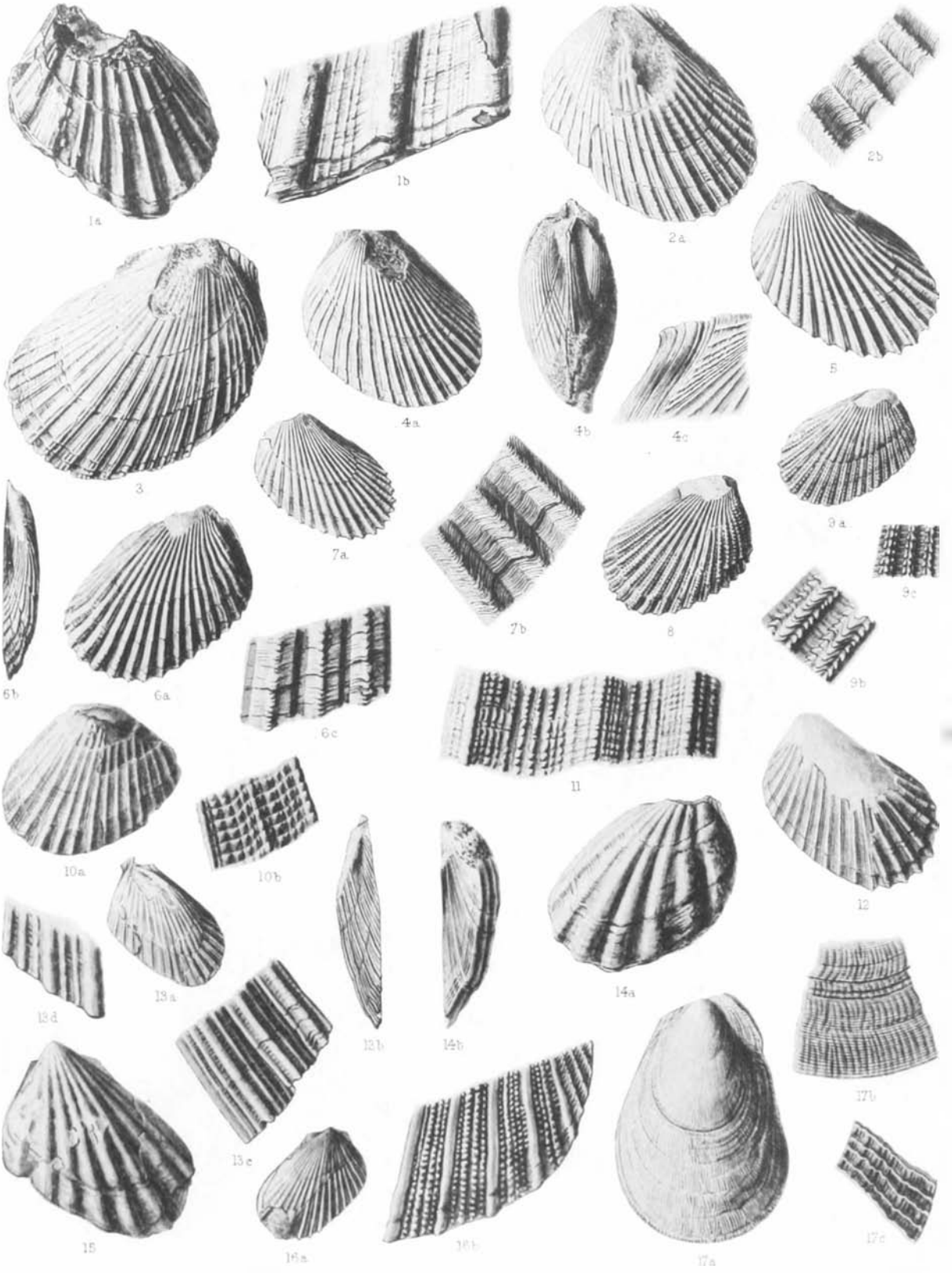

1a
1b
2a
2b
3
4a
4b
4c
5
6a
6b
6c
7a
7b
8
9a
9b
9c
10a
10b
11
12
13a
13d
13e
14a
14b
15
16a
16b
17a
17b
17c

PLATE VII.

LIMA (*continued*).

FIGS.

1. *L.* (*Ctenoides*) *rapa*, d'Orb. Upper Greensand, Haldon. British Museum, No. L 15613. Right valve. (P. 40.)

2, 3. *L.* (*Ctenoides*) *tecta*, Goldf. Chalk Marl (Bed 11), Dunscombe. Sedgwick Museum. 2, left valve. 3, mid-ventral portion of another specimen × 2. (P. 42.)

4—6. *L.* (*Ctenoides*) *divaricata*, Duj. (P. 44.)

4. Chalk, Newtimber. Brighton Museum. *a*, right valve; *b*, median portion above the middle of the valve × 4; *c*, postero-ventral portion × 4; *d*, median portion near the ventral margin × 4.
5. *Belemnitella mucronata* zone, Norwich. Sedgwick Museum. Left valve.
6. *Micraster cor-anguinum* zone, Micheldever. Winchester College. *a*, portion of left valve; *b*, portion of the same × 8.

7—9. *L.* (*Limatula*) *Tombeckiana*, d'Orb. Hythe Beds, Court-at-Street. Museum of Practical Geology. (P. 45.)

7. No. 8821. *a*, left valve × 1½; *b*, ventral portion × 5.
8. No. 8822. *a*, right valve × 1½; *b*, anterior view × 1½; *c*, ventral portion × 5.
9. No. 8824. *a*, right valve × 2; *b*, anterior view × 2.

10. *L.* (*Limatula*) *Tombeckiana ?*, d'Orb. Upper Greensand, Charmouth. Museum of Practical Geology, No. 8818. Right valve × 2. (P. 46.)

11. *L.* (*Limatula*) *Dupiniana*, d'Orb. Tealby Limestone, North Willingham. Sedgwick Museum. *a*, right valve; *b*, anterior view; *c*, ventral part of ribbed area × 8. (P. 47.)

12—15. *L.* (*Limatula*) *Fittoni*, d'Orb. Upper Greensand, Haldon. (P. 48.)

12. Sedgwick Museum. Left valve × 2.
13. Sedgwick Museum. Right valve × 1½.
14. British Museum, No. L 15615. Right valve × 1½.
15. British Museum, No. L 15615. *a*, left valve; *b*, posterior view; *c*, ventral portion × 3.

16, 17. *L.* (*Limatula*) *subæquilateralis*, d'Orb. Upper Greensand, Warminster. British Museum, No. 88928. (P. 49.)

16 *a*, left valve × 1½; 16 *b*, anterior view × 1½. 17, ventral portion × 6.

18—20. *L.* (*Limatula*) *decussata*, Goldf. *Actinocamax quadratus* zone, East Harnham. Dr. Blackmore's collection. (P. 50.)

18 *a*, right valve × 2; *b*, ventral portion × 6.
19. Median portion × 9.
20 *a*, right valve × 2; *b*, anterior view × 2.

21, 22. *L.* (*Limatula*) *wintonensis*, Woods. (P. 51.)

21. Chalk, Clayton. Brighton Museum. *a*, right valve × 2; *b*, median portion × 6.
22. *Actinocamax quadratus* zone, Winchester. Dr. Rowe's collection. *a*, right valve × 2; *b*, anterior view × 2; *c*, posterior view × 2; *d*, median portion × 8.

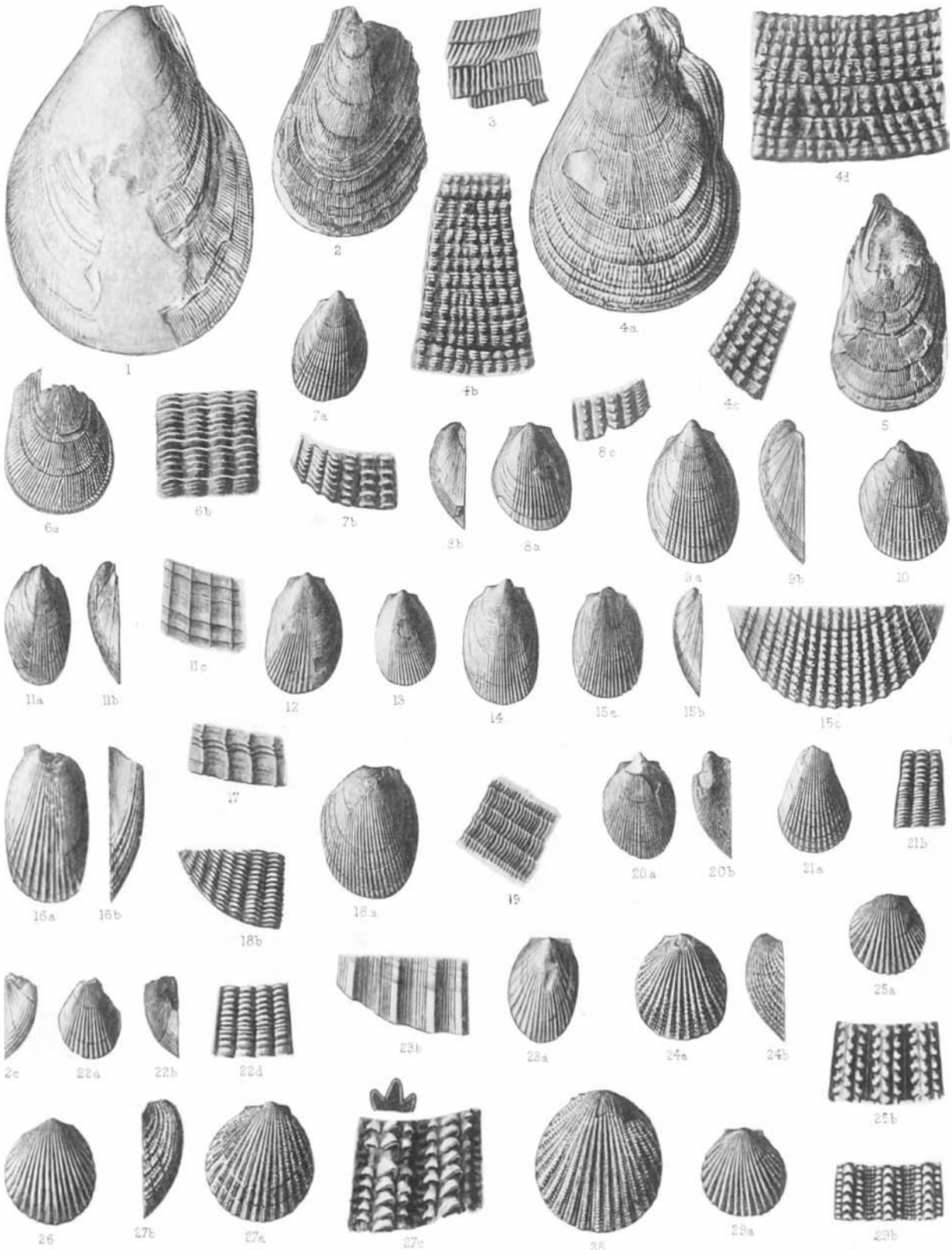
23. *L.* (*Limatula*) sp. *Belemnitella mucronata* zone, Clarendon. Dr. Blackmore's collection. *a*, right valve × 2; *b*, ventral portion × 9. (P. 52.)

24—26. *L.* (*Limea ?*) *composita* (Sow). Upper Greensand, Warminster. (P. 53.)

24. Museum of Practical Geology, No. 8786. *a*, right valve × 2; *b*, anterior view × 2.
25. Museum of Practical Geology, No. 8783. *a*, right valve; *b*, median part × 6.
26. Museum of Practical Geology, No. 8784. Left valve × 1½.

27—29. *L.* (*Limea ?*) *granulata*, (Nilss). *Belemnitella mucronata* zone. (P. 54.)

27. Norwich. Norwich Museum. *a*, left valve; *b*, anterior view; *c*, portion × 6, with section of a main rib.
28. Norwich. Sedgwick Museum. Left valve × 1½.
29. Alderbury. Dr. Blackmore's collection. *a*, right valve × 1½; *b*, median portion × 8.



CRETACEOUS LAMELLIBRANCHIA.

PLATE VIII.

Genus—PTERIA, *Scopoli.*

Sub-Genus—OXYTOMA, *Meek.*

FIGS.

1—7. *P.* (*Oxytoma*) *Cornueliana* (d'Orb.). 1—6. Speeton Series (D, 1), Speeton. 7. Claxby Ironstone, Claxby. (P. 57.)

1. Sedgwick Museum. Left valve.
2. York Museum. Left valve.
3. Sedgwick Museum. *a*, left valve; *b*, postero-ventral portion × 3.
4. Mr. Lamplugh's Collection. Left valve, portion near ventral margin × 3.
5. Mr. Lamplugh's Collection. Right valve.
6. York Museum. Right valve.
7. Sedgwick Museum. Right valve.

8—14. *P.* (*Oxytoma*) *pectinata* (Sow.). (P. 59.)

8—10. Folkestone Beds, Folkestone. Sedgwick Museum. Left valves, 8 *a*, × 1½; 8 *b*, portion of 8 *a* × 6. 10 *a*, × 2; 10 *b*, portion of 10 *a* × 8.

11, 12. Hythe Beds (Bargate Stone), Busbridge. Sedgwick Museum. Right valves. × 1½.

13, 14. Gault, Folkestone. British Museum, No. L, 4926. 13, left valve. 14 *a*, right valve; 14 *b*, portion of 14 *a* × 8.

15. *P.* (*Oxytoma*) sp. Totternhoe Stone, Hitchin. Left valve. Museum of Practical Geology, No. 2338. 15 *a* × 3; 15 *b*, portion × 9. (P. 60.)

16. *P.* (*Oxytoma*) *dubia* (Eth.). Totternhoe Stone, Burwell. Sedgwick Museum. One of the Types. Exterior (*a*) and interior (*b*) of right valve. × 2. (P. 60.)

17—23. *P.* (*Oxytoma*) *tenuicostata* (Römer). Upper Chalk. (P. 61.)

17, 18. *A. quadratus* zone, West Harnham. Dr. Blackmore's Collection. 17 *a*, left valve; *b*, portion near mid-ventral margin × 4; *c*, interior; *d*, hinge × 3. 18, left valve × 2.

19, 20. Coddenham. Museum of Practical Geology, Nos. 10788, 12620. 19 *a*, left valve; *b*, portion near the mid-ventral margin × 6. 20 *a*, left valve; *b*, posterior ear × 2.

21—23. Wells. Norwich Museum. Nos. 3249, 3250, 3251. 21 *a*, left valve; 21 *b*, portion near mid-ventral margin × 3. 22, left valve. 23, right valve and interior of the marginal part of the left valve.


1


2


3a


3b


4


5


6


7


8a


8b


9


10a


10b


11


12


13


14a


14b


15a


15b


16a


16b


17a


17b


17c


17d


18a


18


19b


20a


20b


21a


21b


22


23

T.A.Brock, del.

London Stereoscopic Co imp

CRETACEOUS LAMELLIBRANCHIA.

PLATE IX.

PTERIA (*continued*).

Sub-Genus—PSEUDOPTERA, *Meek.*

FIGS.

1. *P.* (*Pseudoptera*) *subdepressa* (d'Orb.). Lower Greensand (Crackers), Atherfield. The Type. Museum of the Geological Society, No. 2050. *a*, left valve; *b*, portion of posterior ear × 4. (P. 63.)

2—4. *P.* (*Pseudoptera*) *anomala* (Sow). Upper Greensand. 2, 3, Blackdown. 4, Haldon. (P. 64.)

2. The Type. Bristol Museum. *a*, left valve; *b*, postero-dorsal view; *c*, portion of ridge × 4; *d*, portion of posterior ear × 4.
3. British Museum, No. L, 16876. *a*, left valve; *b*, antero-ventral view.
4. British Museum, No. L, 16869. *a*, left valve × 2; *b*, portion near the middle of the valve × 8.

5—10. *P.* (*Pseudoptera*) *haldonensis*, Woods. Upper Greensand, Haldon. Left valves. (P. 66.)

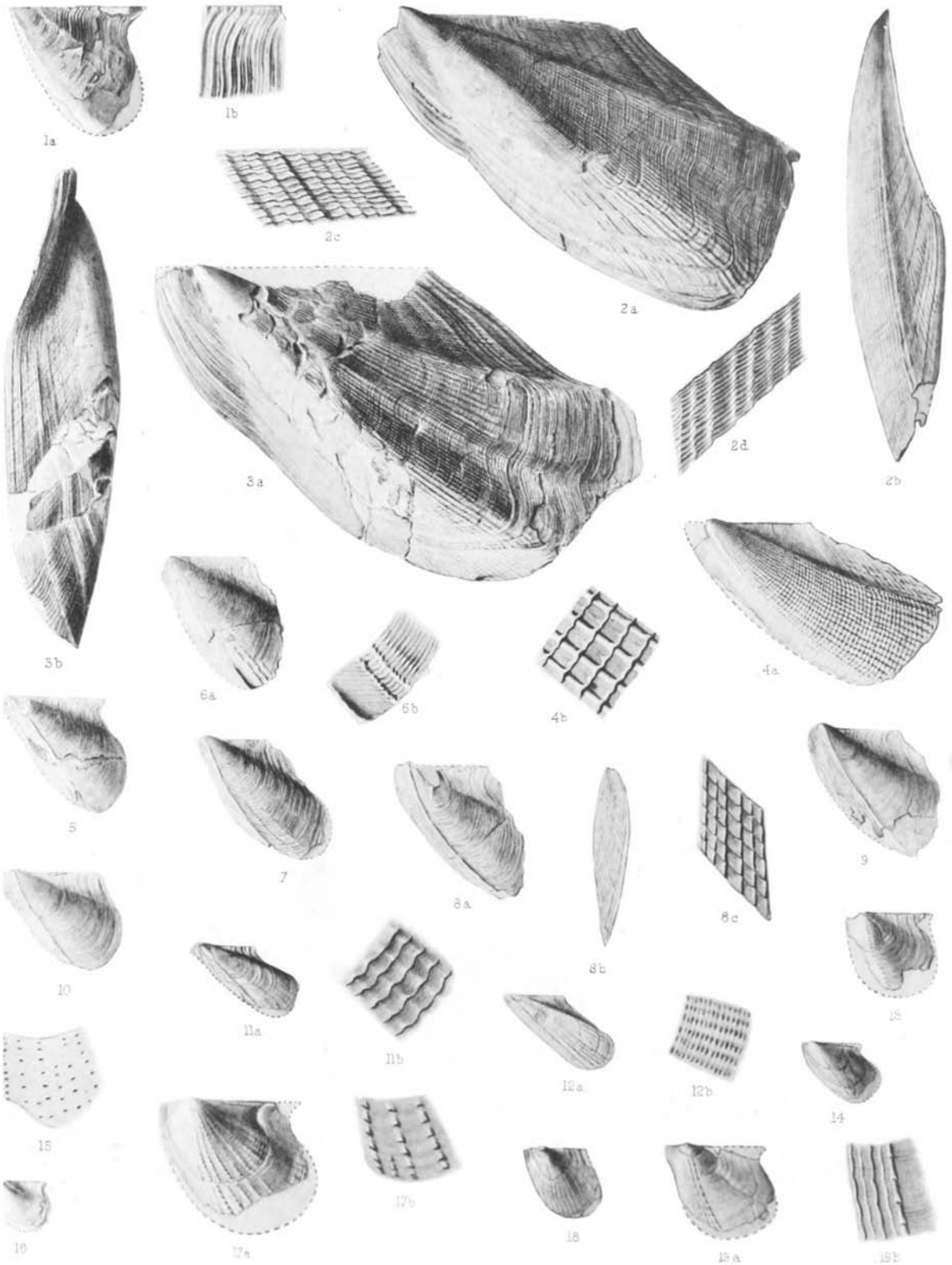
5. British Museum, No. L, 16800.
6 *a*. „ „ „ L, 16759; *b*, ventral portion × 3.
7. „ „ „ L, 16868.
8 *a*. „ „ „ L, 16868; *b*, antero-ventral view; *c*, middle part of antero-ventral side × 6.
9. Sedgwick Museum, Cambridge.
10. British Museum, No. L, 16805. × 2.

11, 12. *P.* (*Pseudoptera*) *gaultina*, Woods. Gault, Black Ven. Left valves. (P. 67.)

11 *a*. Museum of Practical Geology, No. 10780; 11 *b*, median portion × 6.
12 *a*. Sedgwick Museum; 12 *b*, median portion × 3.

13—19. *P.* (*Pseudoptera*) *caerulescens* (Nilsson). Upper Chalk. Left valves. (P. 67.)

13—15. Zone of *A. quadratus*, East Harnham. Dr. Blackmore's collection. 13 × 1½. 15, median part × 4.
16. Zone of *B. mucronata*, Clarendon. Dr. Blackmore's collection.
17—19. Zone of *B. mucronata*, Norwich. Norwich Museum. 17 *a* × 2; 17 *b*, median portion × 6. 19 *a*, × 1½; 19 *b*, portion with ribs × 4.



T. A. Brock, del

London Stereoscopic Co. imp

CRETACEOUS LAMELLIBRANCHIA

PLATE X.

Genus—AUCELLA, *Keyserling.*

FIGS.

1, 2. *A. volgensis*, Lahus. Spilsby Sandstone, Donnington. Sedgwick Museum. (The specimens figured by Pavlow.) 1 *a*, left valve; 1 *b*, anterior view; 1 *c*, right valve. 2 *a*, left valve; 2 *b*, right valve; 2 *c*, posterior view. (P. 69.)

3—5. *A. Keyserlingiana*, Trautsch. Claxby Ironstone, Claxby. Sedgwick Museum. 3 *a*, left valve; 3 *b*, right valve; 3 *c*, posterior view; 3 *d*, anterior ear and umbo of right valve × 3. 4 *a*, left valve; 4 *b*, right valve. 5, left valve. (P. 70.)

Genus—AUCELLINA, *Pompeckj.*

6—13. *A. gryphæoides* (Sow.). Cambridge Greensand, except figs. 11, 12, 13. Sedgwick Museum. (P 72.)

6. *a*, left valve; *b*, posterior view; *c*, right valve; *d*, part of right valve × 4.
7. *a*, left valve; *b*, right valve; *c*, dorsal view.
8. *a*, left valve; *b*, right valve.
9. *a*, umbo and anterior ear of left valve × 3; *b*, dorsal view showing areas, etc. × 3; *c*, area of right valve × 3.
10. Anterior ear of right valve × 3.
11. Lower Chalk, near Cambridge. Right valve × 1½.
12. Lower Chalk, Reach. Portion near the middle of the right valve × 6.
13. Red Limestone, Speeton. Left valve.

Genus—GERVILLIA, *Defrance.*

14—16. *G. sublanceolata* (d'Orb.). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. (P. 74.)

14. Right valve of a young individual.
15. Left valve of a young individual with only three ligament pits.
16. Left valve of an immature specimen.


1a
1b
1c
2c
2b
2a
3a
3b
3d
3c
6d
4a
4b
5
6a
6b
6c
7c
8a
8b
9a
9b
9c
7a
7b
12
13
10
11
14
15
16

PLATE XI.

GERVILLIA (*continued*).

FIGS.

1. *G. sublanceolata* (d'Orb). Upper Greensand, Blackdown. Sedgwick Museum. Interior of part of a right valve. (P. 74.)

2—8. *G. linguloides*, Forbes. Lower Greensand (Crackers), Atherfield. Figs. 2—4, 6—8, Sedgwick Museum; fig. 5, York Museum. (P.78.)

2. Left valve × 1½.
3. Hinge of left valve × 3.
4. Right valve × 1½.
5. Left valve × 1½.
6—8. Left valves.

9—11. *G. alæformis* (Sow.). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Figs. 9, 10, young specimens. (P. 79.)

9 *a*, left valve; *b*, portion near umbo × 3; *c*, right valve; *d*, dorsal view.
10 *a*, left valve × 1½; *b*, ribs near the middle of the left valve × 3; *c*, hinge of same valve × 3; *d*, area and ligament pits of right valve of the same specimen × 3.
11. Hinge of adult specimen. *Perna*-bed, Atherfield.

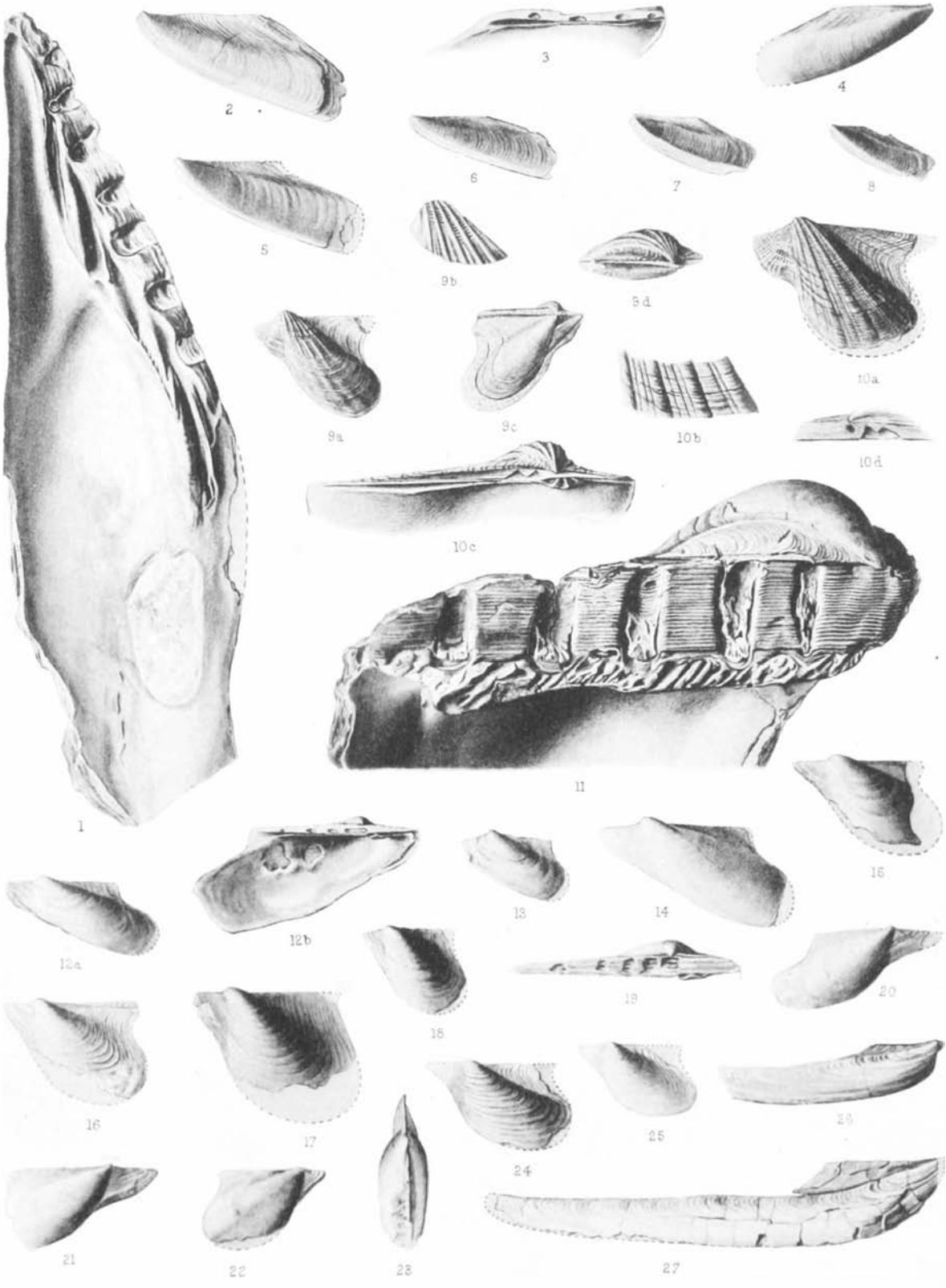
12—23. *G. rostrata* (Sow.). Upper Greensand, Blackdown. 12—19, left valves. 20—22, right valves. Sedgwick Museum, except figs. 13, 15, 22, 23. (P. 83.)

12 *b*, interior of 12 *a*, × 1½.
13. Museum of Practical Geology, No. 10784.
15. British Museum, No. L, 16872.
19. Hinge × 2.
22. Haldon. Museum of Practical Geology, No. 10783.
23. Dorsal view of the Type. Bristol Museum.

24, 25. *G.*, sp. Lower Greensand (Ferruginous Sands), Shanklin. Sedgwick Museum. Left valves. 24 × 1½. (P. 85.)

26, 27. *G. Forbesiana*, d'Orb. Right valves. Sedgwick Museum. (P. 85.)

26. Lower Greensand (Crackers), Atherfield.
27. Gault, Folkestone.



T A Brock. del

London Stereoscopic Co imp

CRETACEOUS LAMELLIBRANCHIA

PLATE XII.

GERVILLIA (*continued*).

FIGS.

1—5. *G. Forbesiana*, d'Orb. Gault, Folkestone. (P. 85.)

1. Sedgwick Museum. Left valve, × ⅔.
2. British Museum, No. L 4918. Left valve.
3. Sedgwick Museum. Right valve.
4. „ „ Left valve.
5. „ „ Hinge of right valve, × 1½.

Genus—PERNA, *Bruguière*.

6—9. *P. Rauliniana*, d'Orb. Gault, Folkestone. (P. 92.)

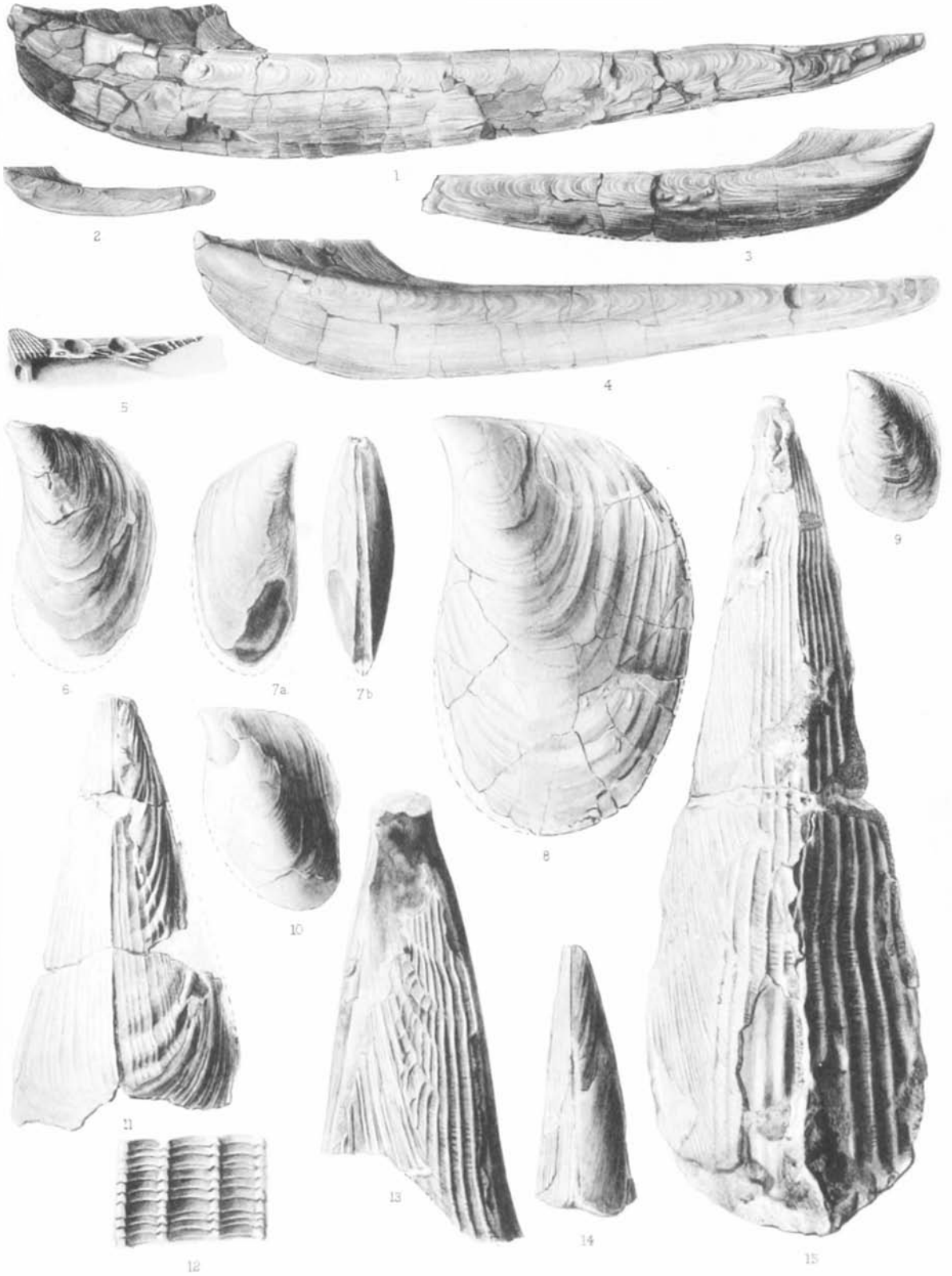
6. Sedgwick Museum. Left valve.
7. „ „ *a*, right valve; *b*, anterior view.
8. Museum of Practical Geology, No. 1605. Left valve.
9. „ „ „ No. 12638. Left valve.

10. *P.* sp. Gault, Folkestone. Sedgwick Museum. Left valve. (P. 94.)

Genus—PINNA, *Linnæus*.

11–15. *P. Robinaldina*, d'Orb. Lower Greensand. (P. 96.)

11. Isle of Wight. Bristol Museum. Right valve.
12. *Crioceras* Beds, Atherfield. British Museum, No. 48626. Portion of dorsal half of left valve. × 3.
13. *Perna*-bed, Atherfield. Sedgwick Museum. Ventral part of left valve.
14. Crackers, Atherfield. Museum of the Geological Society, No. 2100. Right valve.
15. *Perna*-bed, Atherfield. Sedgwick Museum. Left valve.



CRETACEOUS LAMELLIBRANCHIA

[A. Brock, del.

London Stereoscopic Co. imp.

PLATE XIII.

Pinna (*continued*).

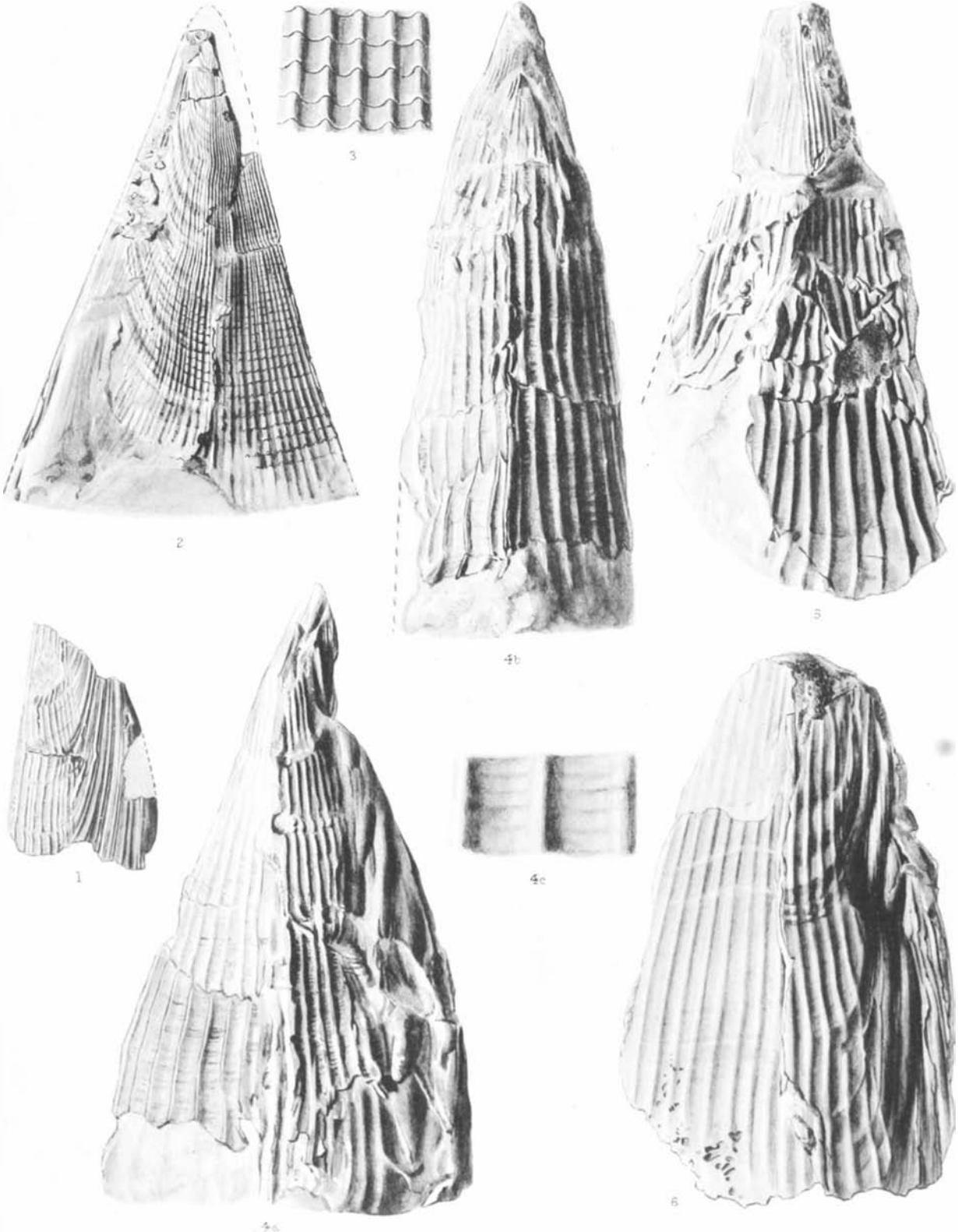
Figs.

1. *P. Robinaldina*, d'Orb. Lower Greensand, Isle of Wight. Museum of Practical Geology, No. 12636. Ventral part of right valve. (P. 96.)

2, 3. *P.* sp. Gault, Folkestone. 2. Sedgwick Museum; left valve. 3. Museum of Practical Geology, No. 12641; portion of dorsal part of left valve, × 6. (P. 99.)

4–6. *P. decussata*, Goldf. Chalk. (P. 99.)

4. Newtimber (Sussex). Brighton Museum. *a*, right valve; *b*, dorsal view of both valves; *c*, dorsal part of right valve, × 3.
5. *Holaster planus* zone, Balsham. Sedgwick Museum. Left valve.
6. Trimingham. Norwich Museum. Part of right valve.



CRETACEOUS LAMELLIBRANCHIA

PLATE XIV.

PINNA (*continued*).

FIGS.

1. *P. decussata*, Goldf. Right valve. Zone of *Belemnitella mucronata*, Norwich. Norwich Museum. This specimen is the type of *P. sulcata*, Woodw. (P. 101.)

Genus—ASTARTE, *Sowerby*.

2, 3. *A. elongata*, d'Orb. Lower Greensand. Seend. Museum of Practical Geology, Nos. 13176, 13181. (P. 102.)
2 *a*, right valve; 2 *b*, dorsal view.
3. Internal cast of right valve.

4–6. *A. subacuta*, d'Orb. Lower Greensand (*Perna*-bed), East Shalford. Sedgwick Museum. (P. 103.)
4. Right valve.
5. Internal mould of right valve, × 1½.
6. Portion of left valve.

7–9. *A. sinuata*, d'Orb. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. (P. 104.)
7. Left valve, × 1½.
8. Part of left valve.
9 *a*, right valve; *b*, dorsal view, × 1½.

10–12. *A. upwarensis*, Woods. Lower Greensand, Upware. (P. 105.)
10. Sedgwick Museum. Specimen figured by W. Keeping. *a*, right valve; *b*, anterior view; *c*, portion near the middle of the valve, × 3.
11. Sedgwick Museum. *a*, left valve; *b*, dorsal view.
12. Mr. J. F. Walker's Collection. Hinge of right valve, × 1½.

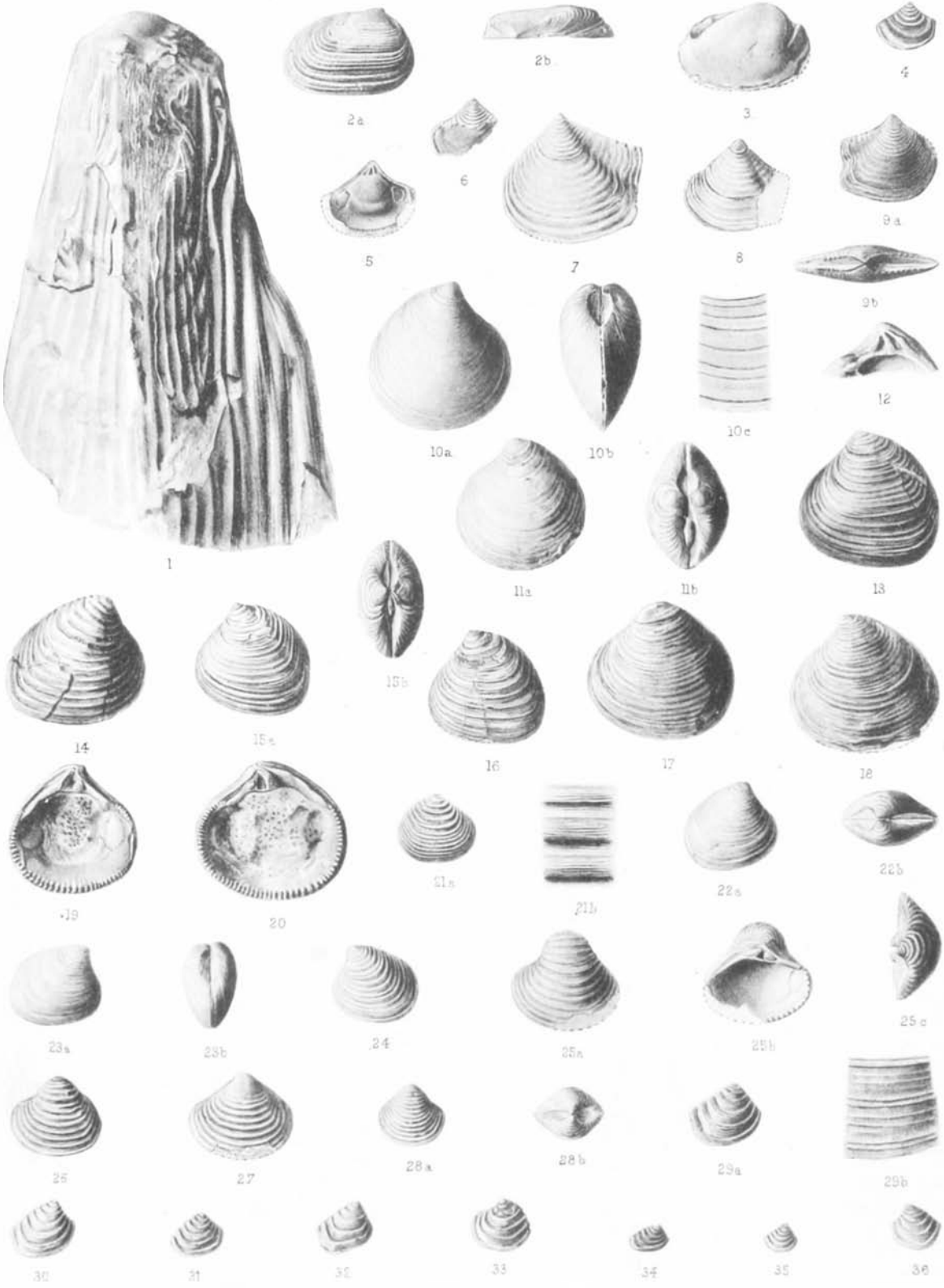
13–20. *A. senecta*, Woods. 13–16. Speeton Clay, Speeton. 17–20. Claxby Ironstone, Benniworth Haven. Sedgwick Museum, except fig. 16—York Museum. (P. 106.)
13. Left valve.
14. Right valve.
15 *a*, left valve; *b*, dorsal view.
16–18. Left valves.
19, 20. Interiors of left and right valves.

21. *A.* sp. Speeton Clay, Speeton. Sedgwick Museum. *a*, right valve; *b*, median part, × 5. (P. 107.)

22–24. *A. cantabrigiensis*, Woods. Lower Greensand, Upware. Sedgwick Museum. (P. 107.)
22 *a*, right valve; *b*, dorsal view.
23 *a*, right valve; *b*, anterior view.
24. Left valve.

25–28. *A. claxbiensis*, Woods. 25. Spilsby Sandstone, Spilsby. 26–28. Claxby Ironstone, Benniworth Haven. Sedgwick Museum, except fig. 27—York Museum. (P. 108.)
25 *a*, left valve; *b*, interior; *c*, dorsal view.
26, 27. Left valves, × 1½.
28 *a*, right valve; *b*, dorsal view.

29–36. *A. subcostata*, d'Orb. 29–35. Atherfield Beds. (P. 109.)
29. Peasmarsh. Museum of the Geological Society, No. 2181. *a*, right valve, × 2; *b*, part near the middle of the ventral margin, × 6.
30–35. Sevenoaks. British Museum, No. L 9284. 30, 31, 32, 35, right valves, × 2. 34, right valve, nat. size. 33, left valve, × 2.
36. *Perna*-bed, East Shalford. Sedgwick Museum. Left valve, × 1½.



CRETACEOUS LAMELLIBRANCHIA

T A Brock del

London Stereoscopic Co imt

PLATE XV.

ASTARTE (*continued*).

FIGS.

1, 2. *A. subcostata*, d'Orb., var. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. (P. 110.)

1 *a*, right valve, × 1½; *b*, anterior view, × 1½.
2 *a*, right valve, × 1½; *b*, dorsal view, × 1½.

3, 4. *A.*, sp. Folkestone Beds, Folkestone. 3, right valve; 4, left valve. Sedgwick Museum. (P. 111.)

5–7. *A. Omalioides*, Woods. Gault, Folkestone. British Museum, No. L 4958. 5, 7, left valves; 6, right valve. × 2. (P. 111.)

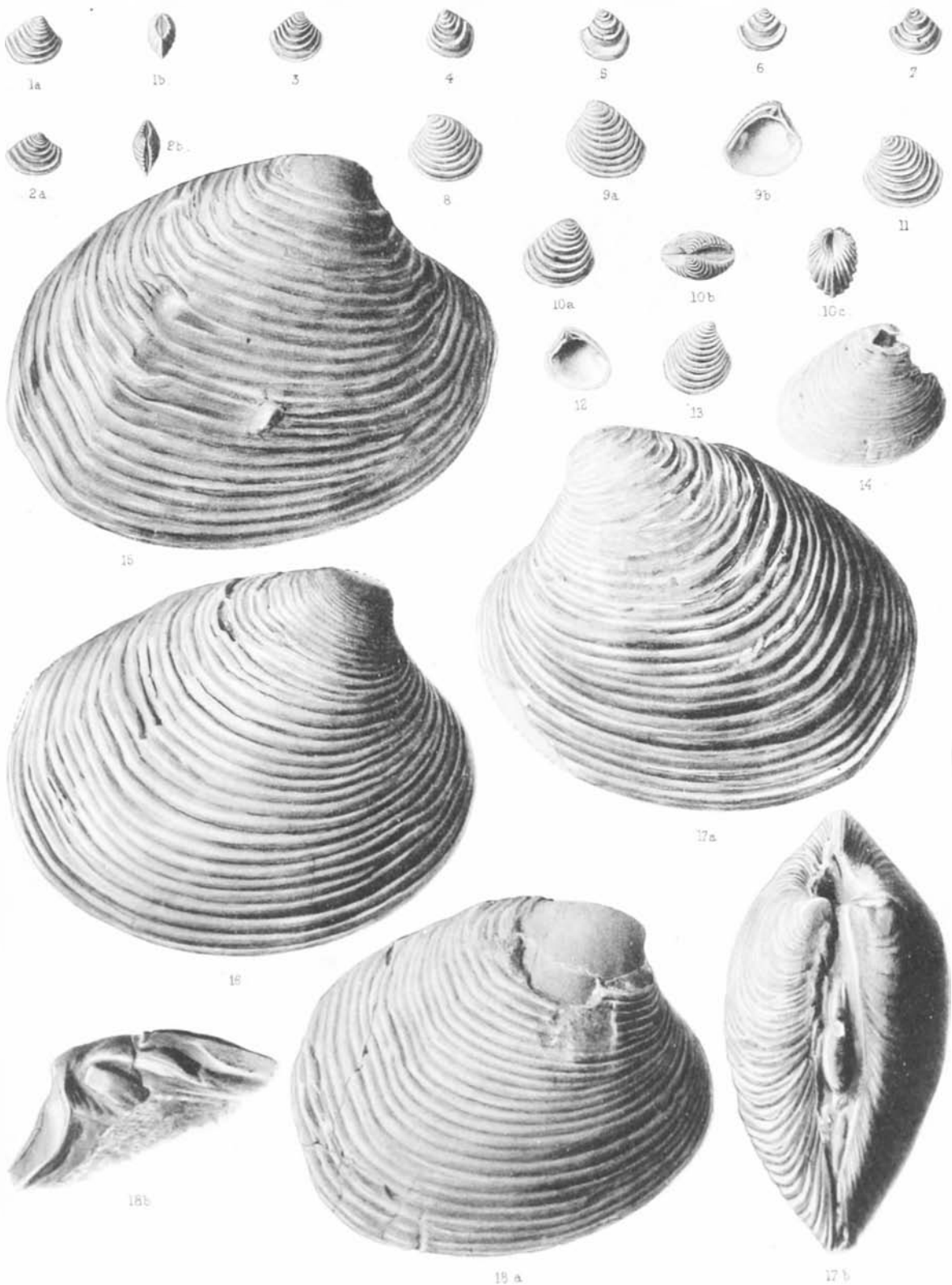
8–13. *A. formosa*, Sow. Upper Greensand, Blackdown. Sedgwick Museum. All × 3. (P. 112.)

8. Left valve.
9 *a*, left valve; *b*, interior.
10 *a*, right valve; *b*, dorsal view; *c*, anterior view.
11. Left valve.
12. Interior of right valve.
13. Right valve.

14. *A. impolita*, Sow. Upper Greensand, Blackdown. The Type. Bristol Museum. Right valve. (P. 113.)

15–18. *A.* (*Eriphyla*) *oborata*, Sow. Lower Greensand (*Perna*-bed). Sedgwick Museum. (P. 113.)

15. Atherfield. Right valve.
16. Sandown. Right valve.
17. Atherfield. *a*, left valve; *b*, dorsal view.
18. Sandown. *a*, right valve; *b*, hinge.



CRETACEOUS LAMELLIBRANCHIA

Brock, del

London Stereoscopic Co imp.

PLATE XVI.

ASTARTE (*continued*).

FIGS.

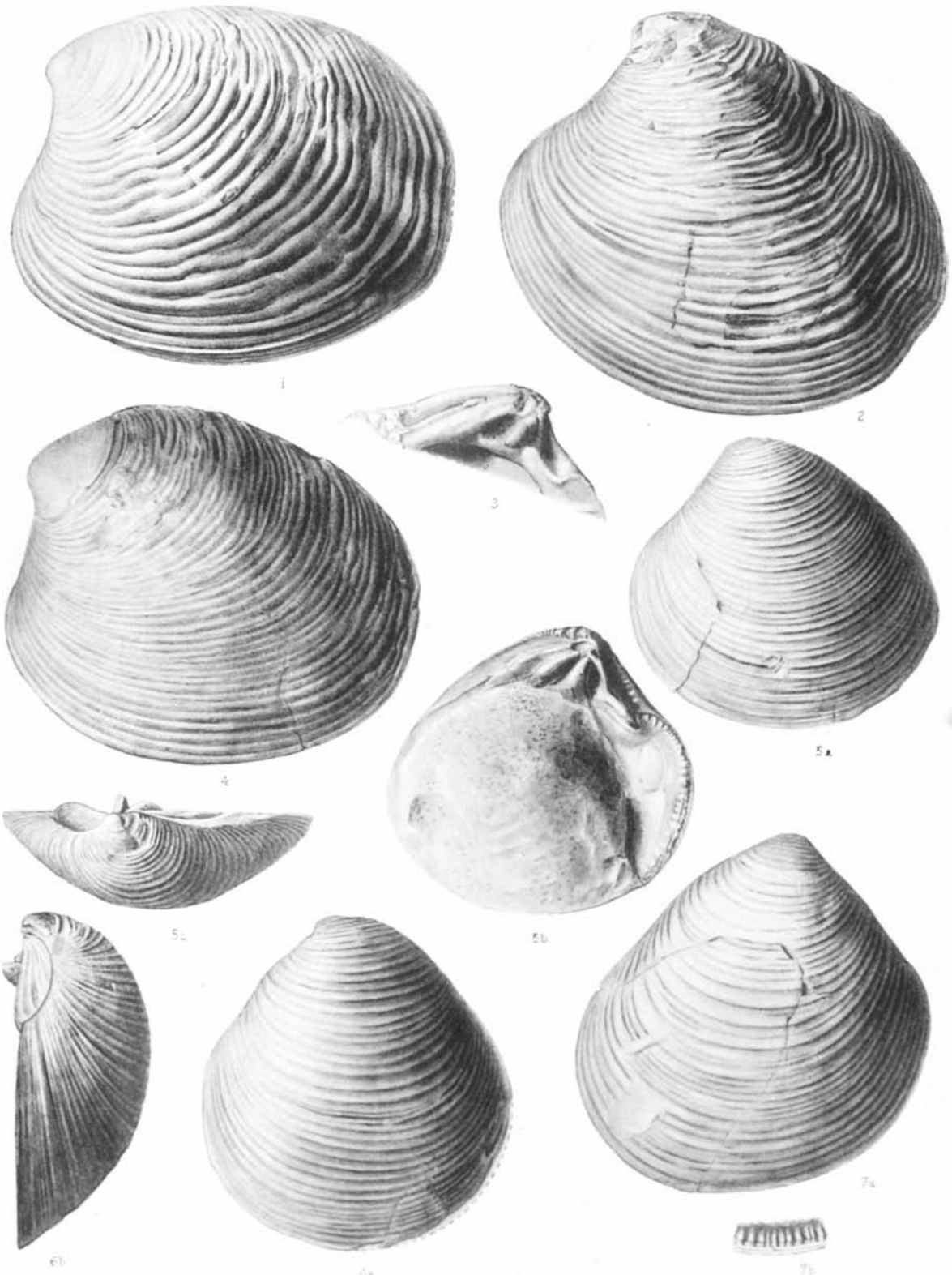
1–3. *A.* (*Eriphyla*) *obovata*, Sow. (P. 113.)

1. *Perna*-bed, Atherfield. Left valve. Sedgwick Museum.
2. *Perna*-bed, Sandown. Left valve. Sedgwick Museum.
3. Upper Greensand, Blackdown. Hinge of left valve. Museum of Practical Geology, No. 13184.

4. ? Variety of *A.* (*Eriphyla*) *obovata*, Sow. *Perna*-bed, Sandown. York Museum. Left valve.

5–7. *A.* (*Eriphyla*) *lævis* (Phill.). Claxby Ironstone, Benniworth Haven. Sedgwick Museum. (P. 115.)

5 *a*, left valve; *b*, interior; *c*, dorsal view.
6 *a*, left valve; *b*, anterior view.
7 *a*, right valve; *b*, part of inner margin



CRETACEOUS LAMELLIBRANCHIA

PLATE XVII.

ASTARTE (*continued*).

FIGS.

1. *A.* (*Eriphyla*) *lævis* (Phill.). Claxby Ironstone, Bennisworth Haven. Left valve. York Museum. (P. 115.)

2–7. *A.* (*Eriphyla*) *striata*, Sow. Upper Greensand, Blackdown. (P. 116.)

2. British Museum, No. L 587. *a*, right valve; *b*, interior of the same; *c*, dorsal view.
3. Sedgwick Museum. Interior of left valve (the teeth are drawn in part from a specimen in the Museum of Practical Geology, No. 13187).
4. British Museum, No. L 17076. Right valve.
5. Bristol Museum, No. 536. Right valve.
6. Museum of Practical Geology, No. 13188. Right valve.
7. Bristol Museum. The Type of *Astarte concinna*, Sow. Left valve.

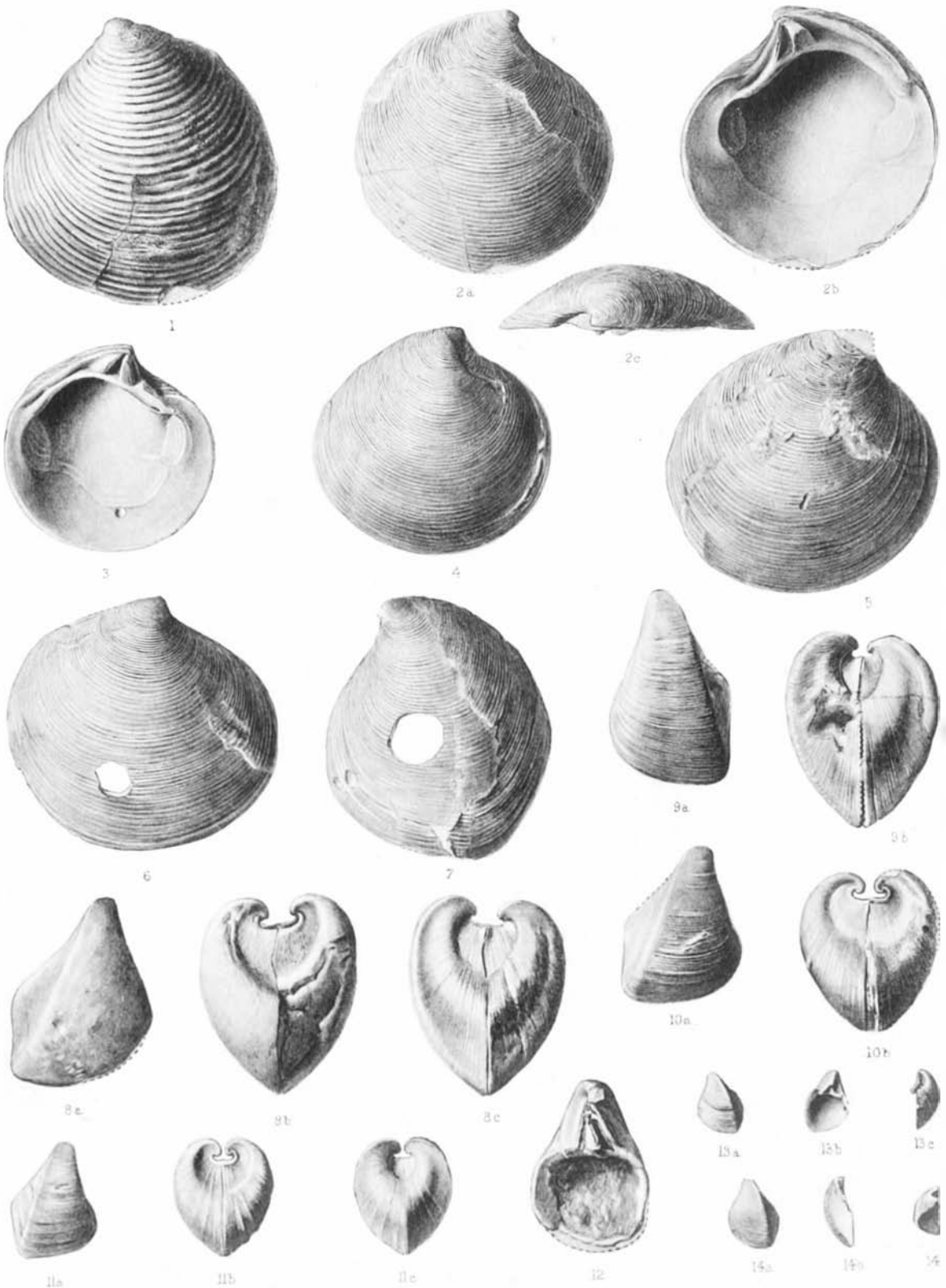
Genus—OPIS, *Defrance*.

8–12. *O. neocomiensis*, d'Orb. Lower Greensand, Upware. (P. 118.)

8. Sedgwick Museum. *a*, right valve; *b*, anterior view of both valves; *c*, posterior view.
9. Sedgwick Museum. *a*, left valve; *b*, posterior view.
10. Sedgwick Museum. *a*, right valve; *b*, anterior view.
11. Mr. J. F. Walker's Collection. *a*, right valve; *b*, anterior view; *c*, posterior view.
12. Mr. Walker's Collection. Interior of right valve.

13, 14. *O.* sp. Upper Greensand, Haldon. British Museum, No. L 17144. (P. 120.)

13 *a*, left valve; *b*, interior; *c*, anterior view.
14 *a*, left valve; *b*, posterior view; *c*, dorsal view.



CRETACEOUS LAMELLIBRANCHIA.

PLATE XVIII.

Opis (*continued*).

Figs.

1. *Opis haldonensis*, Woods. Upper Greensand, Haldon. British Museum, No. L 17143. *a*, exterior; *b*, interior of right valve; *c*, posterior view of the same; *d*, anterior view. (P. 119.)

Genus—Cardita, *Bruguière*.

2–4. *C.? fenestrata* (Forbes). Lower Greensand (*Perna*-bed), Atherfield. (P. 121.)

2. Museum of Practical Geology, No. 14360. *a*, left valve; *b*, dorsal view, × 1½; *c*, median part of left valve, × 4.
3. Sedgwick Museum. Right valve, × 1½.
4. Sedgwick Museum. *a*, left valve; *b*, anterior view.

5. *C. upwarensis*, Woods. Lower Greensand, Upware. Sedgwick Museum. *a*, right valve; *b*, dorsal view; *c*, anterior view; *d*, part near the middle of the right valve, × 4. (P. 122.)

6. *C.* sp. Lower Greensand (*Perna*-bed), Atherfield. Sedgwick Museum. *a*, left valve; *b*, dorsal view; *c*, part near the middle of left valve, × 5. (P. 123.)

7–14. *C. tenuicosta* (Sow.). Gault, Folkestone. 7–13. Sedgwick Museum. 14. British Museum, No. 48135. (P. 124.)

7. Left valve, × 1½.
8 *a*, left valve; *b*, anterior view.
9. Right valve.
10 *a*, left valve; *b*, dorsal view; *c*, part near the mid-ventral border, × 6.
11 *a*, right valve, × 1½; *b*, dorsal view, × 1½; *c*, part near the middle of the right valve, × 6.
12. Left valve. × 2.
13. Inflated variety. *a*, right valve; *b*, dorsal view.
14. Short and much inflated variety. *a*, right valve; *b*, dorsal view.

15, 16. *C. Coltaldina*, d'Orb. Chloritic Marl. (P. 126.)

15. Toller Fratrum. Museum of Practical Geology, No. 14348. Right valve.
16. Chard. Oxford Museum. *a*, left valve; *b*, dorsal view.

17, 18. *C. cancellata*, Woods. Chalk Rock, Cuckhamsley. Sedgwick Museum. (P. 127.)

17 *a*, wax cast of right valve, × 1½; *b*, ornamentation near the middle of the right valve, × 5.
18. Natural internal cast. *a*, left valve; *b*, anterior view.

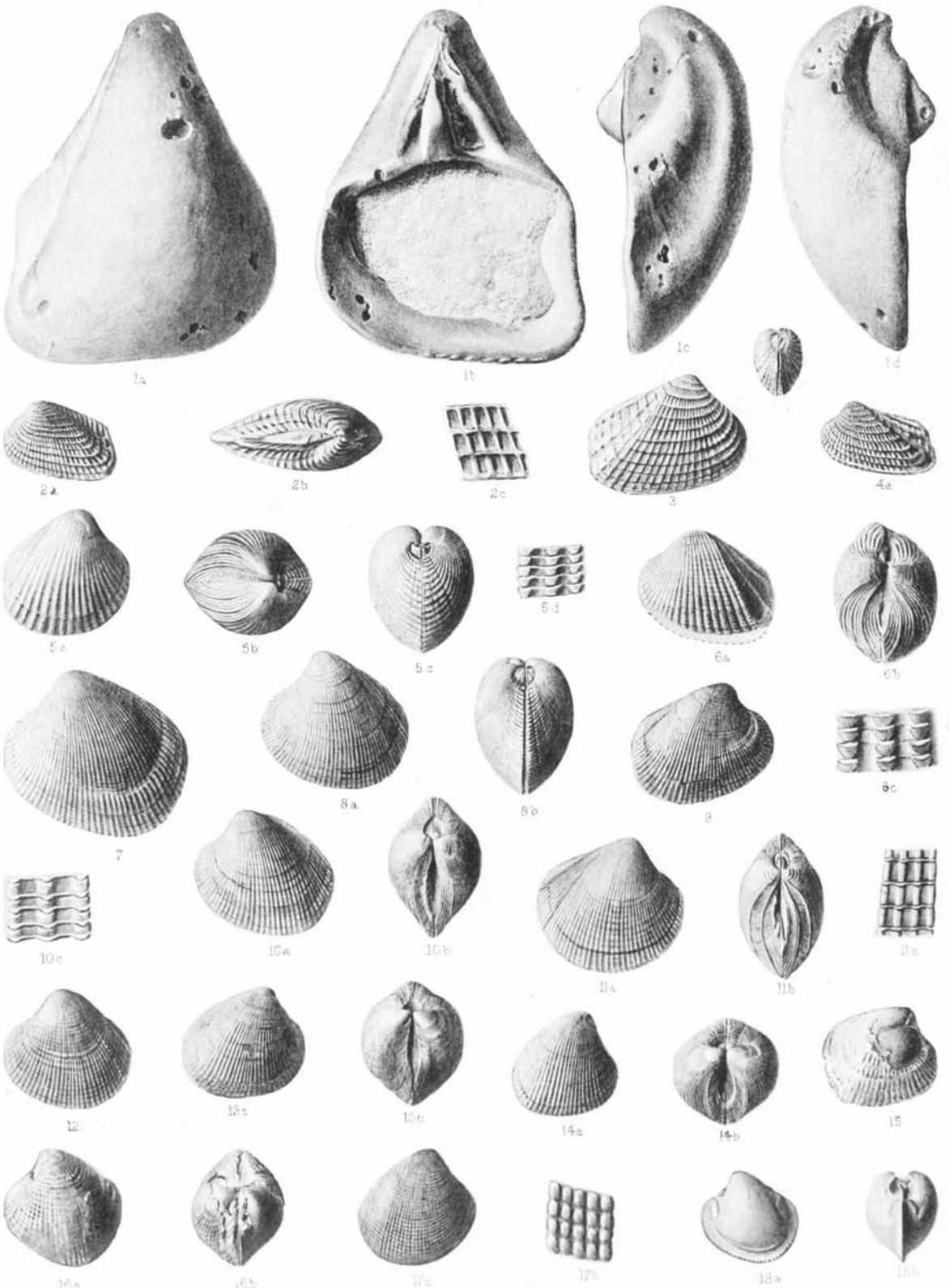

1a
1b
1c
1d
2a
2b
2c
3
4a
5a
5b
5c
5d
6a
6b
6c
7
8a
8b
8
9
10a
10b
10c
11a
11b
11c
12
13a
13b
14a
14b
15
16a
16b
17a
17b
18a
18b

PLATE XIX.

Genus—CRASSATELLITES, *Krüger*.

FIGS.

1. *C. divisiensis*, Woods. Upper Greensand, Devizes. Museum of Practical Geology, No. 16750. *a*, left valve; *b*, dorsal view. (P. 128.)

2, 3. *C. rudinnensis* (d'Orb.). Cenomanian (Meÿer's Bed, 10), Dunscombe. Sedgwick Museum. (P. 129.)

2 *a*, left valve; *b*, dorsal view; *c*, ornamentation near the middle of the valve, × 4; *d*, ornamentation on the posterior area, × 4.

3. Right valve.

Genus—ANTHONYA, *Gabb*.

4, 5. *A. cantiana*, Woods. Folkestone Beds, Folkestone. Sedgwick Museum. Right valves. 5 *b*, part near the mid-ventral border, × 5. (P. 130.)

6. *A.* sp. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Left valve. (P. 131.)

Genus—CYPRINA, *Lamarck*.

7–13. *C. Saussuri* (Brongn.). Lower Greensand (Crackers), Atherfield (except fig. 7, *Perna*-bed). Sedgwick Museum, except fig. 13. (P. 131.)

7. Left valve.

8 *a*, left valve; *b*, dorsal view.

9, 10. Left valves

11 *a*, right valve; *b*, dorsal view.

12. Left valve.

13. British Museum, No. L 564. Large form. *a*, left valve; *b*, dorsal view.

14. *C. Sedgwicki* (Walker). Lower Greensand, Upware. Sedgwick Museum. Left valve. (P. 133.)

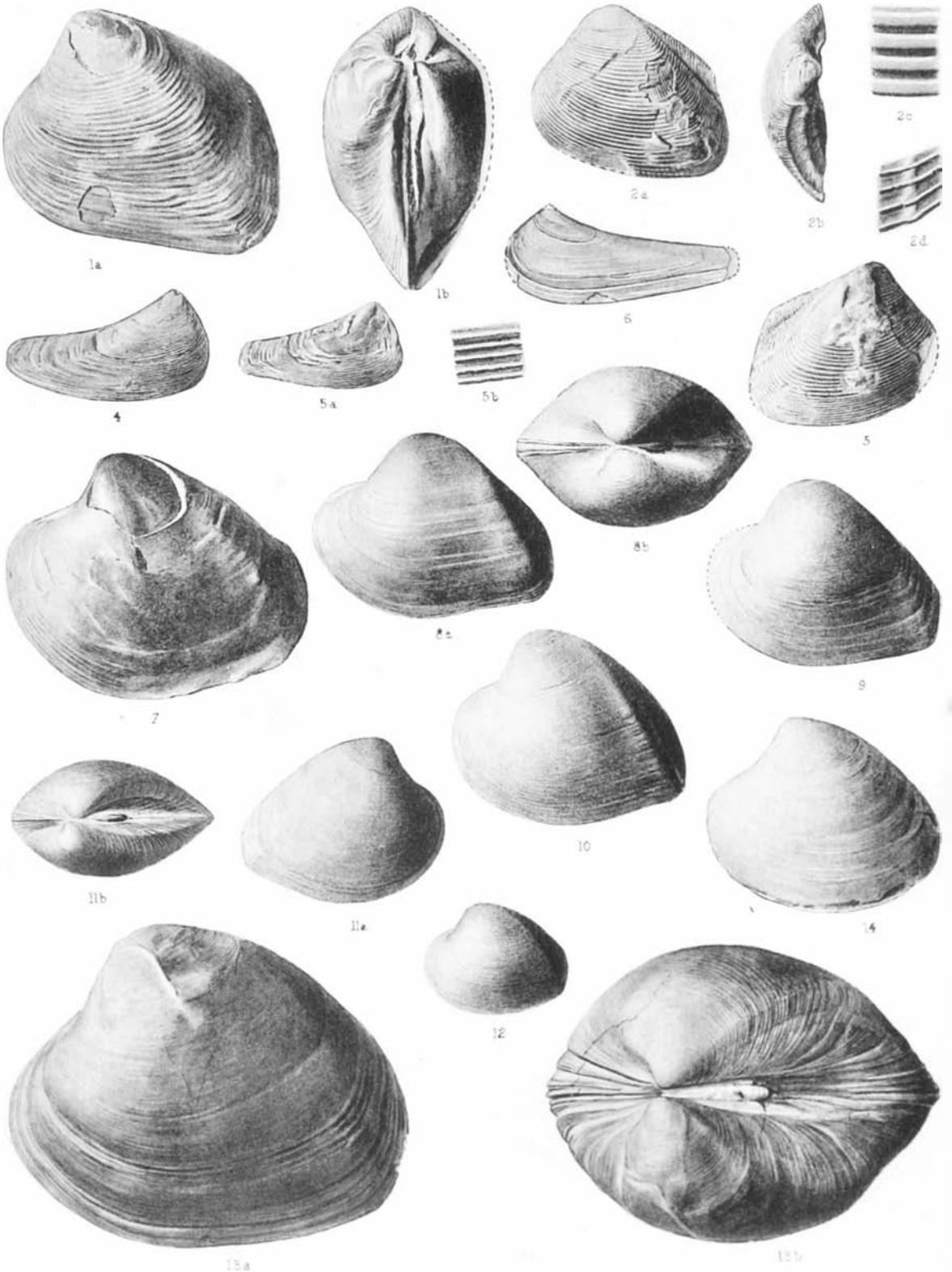

1a
1b
2a
2b
2c
2d
3
4
5a
5b
6
7
8a
8b
9
10
11a
11b
12
13a
13b
14

PLATE XX.

CYPRINA (*continued*).

FIGS.

1–5. *C. Sedgwicki* (Walker). Lower Greensand. (P. 133.)

1. Potton. The Type. Mr. Walker's Collection. *a*, right valve; *b*, dorsal view of both valves.

2–5. Upware. Sedgwick Museum. 2, 4, 5, left valves. 3 *a*, right valve; 3 *b*, anterior view of 3 *a*.

6. *C. obtusa*, Keeping. Lower Greensand, Upware. Sedgwick Museum. The Type. *a*, left valve; *b*, dorsal view. (P. 133.)

7–12. *C. cuneata*, Sow. Upper Greensand, Blackdown. (P. 134.)

7. British Museum, L 17066. Right valve.

8. British Museum, L 17066. Left valve.

9, 10. Sedgwick Museum. Left valves. 10 *b*, dorsal view of 10 *a*.

11. British Museum, L 17066. Left valve.

12 *a*. British Museum, L 17066. Right valve. 12 *b*, hinge, × 1½.

13. *C. tealbiensis*, Woods. Tealby Limestone, Claxby. British Museum, No. 49985. *a*, left valve, × ¾; *b*, dorsal view of both valves, × ¾. (P. 136).

14. *C.* sp. Speeton Clay, Speeton. Sedgwick Museum. Left valve. (P. 137.)

15, 16. *C. anglica*, Woods. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Left valves. (P. 137.)

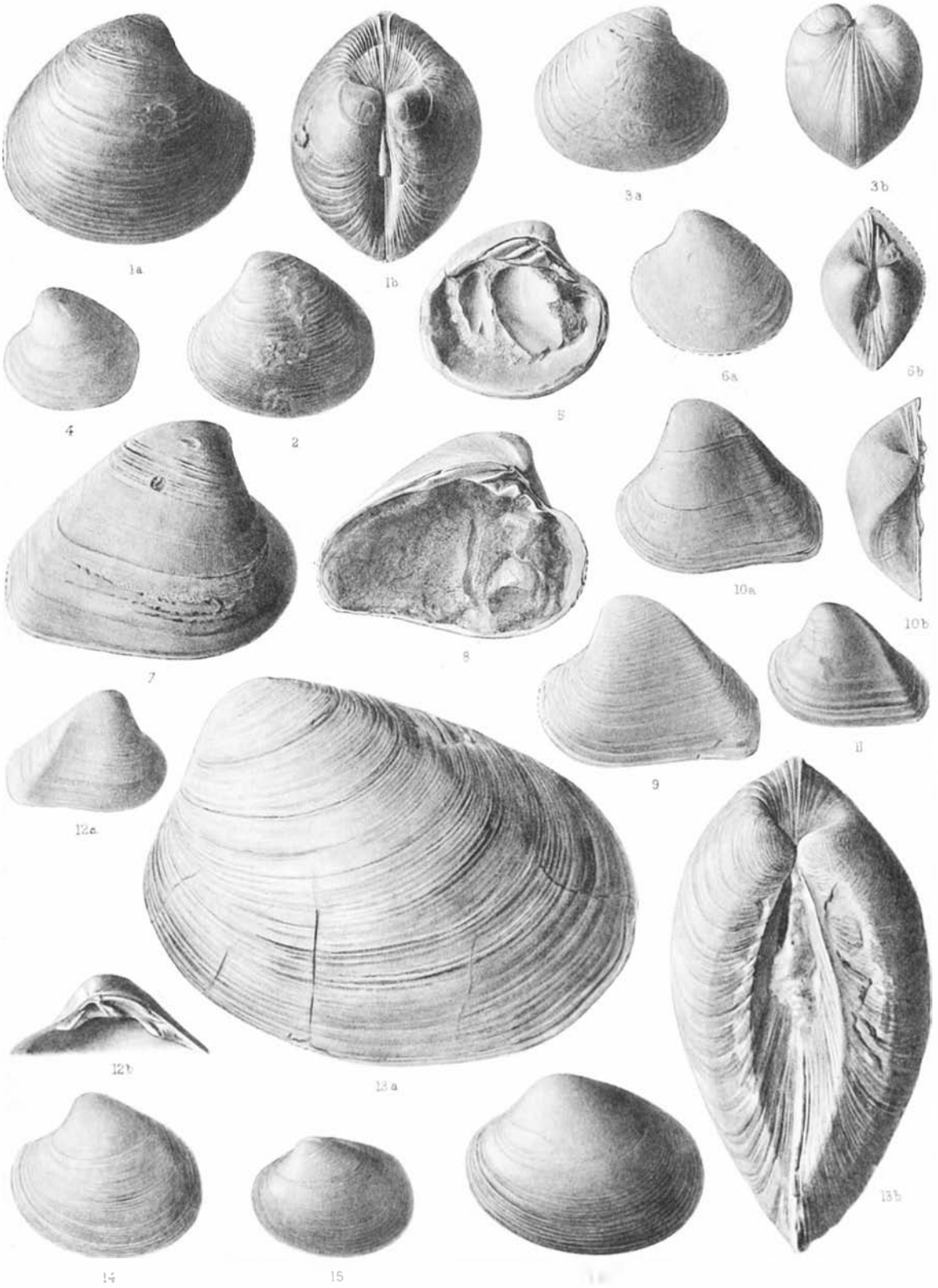

1a
1b
3a
3b
4
2
5
6a
6b
7
8
10a
10b
9
11
12a
13a
12b
13b
14
15

PLATE XXI.

Cyprina (*continued*).

Figs.

1. *C. anglica*, Woods. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. *a*, right valve; *b*, dorsal view. (P. 137).

2. *C. clarkiensis*, Woods. Claxby Ironstone, Benniworth Haven. Sedgwick Museum. Left valve. (P. 135.)

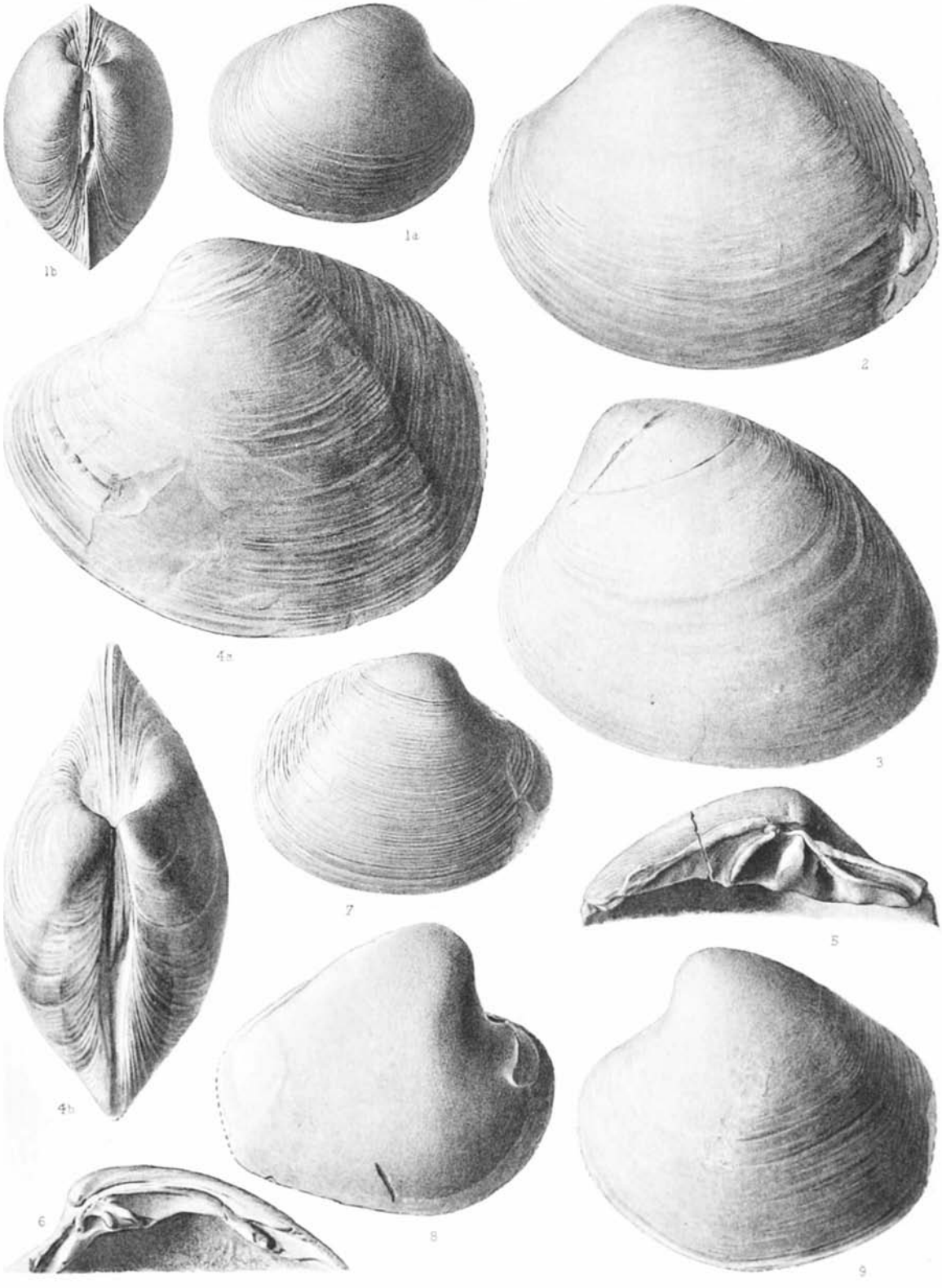
3. *C.* sp. Tealby Limestone, Claxby. Sedgwick Museum. Left valve, × $\frac{3}{4}$. (P. 136.)

4–7. *C.* (*Venilicardia*) *protensa*, Woods. Lower Greensand, Atherfield. See also Text-figures 20, 21. (P. 137.)

4. *Perna*-bed. Sedgwick Museum. *a*, left valve, × $\frac{3}{4}$; *b*, dorsal view, × $\frac{3}{4}$.
5. *Perna*-bed. Museum of Practical Geology, No. 16744. Hinge of left valve.
6. *Perna*-bed. British Museum, L 432. Hinge of right valve, × $\frac{3}{4}$.
7. Crackers. British Museum, L 6304. A small specimen. Right valve.

8, 9. *C. Sowerbyi*, d'Orb. See also Text-figure 22. (P. 139.)

8. Hythe Beds, Hythe. Sedgwick Museum. Internal cast of right valve.
9. Lower Greensand, between Atherfield and Blackgang. York Museum. Left valve.



CRETACEOUS LAMELLIBRANCHIA.

PLATE XXII.

Cyprina (*continued*).

Figs.

1–4. *C.* (*Venilicardia*) *angulata* (Sow.). Upper Greensand, Blackdown. See also Text-figures 23, 24. (P. 141.)

1. Sedgwick Museum. Left valve, × ¾.
2. Sedgwick Museum. Hinge of right valve, × ¾.
3. York Museum. Hinge of left valve.
4. Museum of the Geological Society. Hinge of right valve of a specimen with the umbones more anterior than usual. × ¾.

5–8. *C.* (*Venilicardia*) *lineolata* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum. (P. 143.)

5 *a*, left valve; 5 *b*, anterior view.
6 *a*, right valve; 6 *b*, hinge of the same.
7. Hinge of left valve.
8. Right valve.

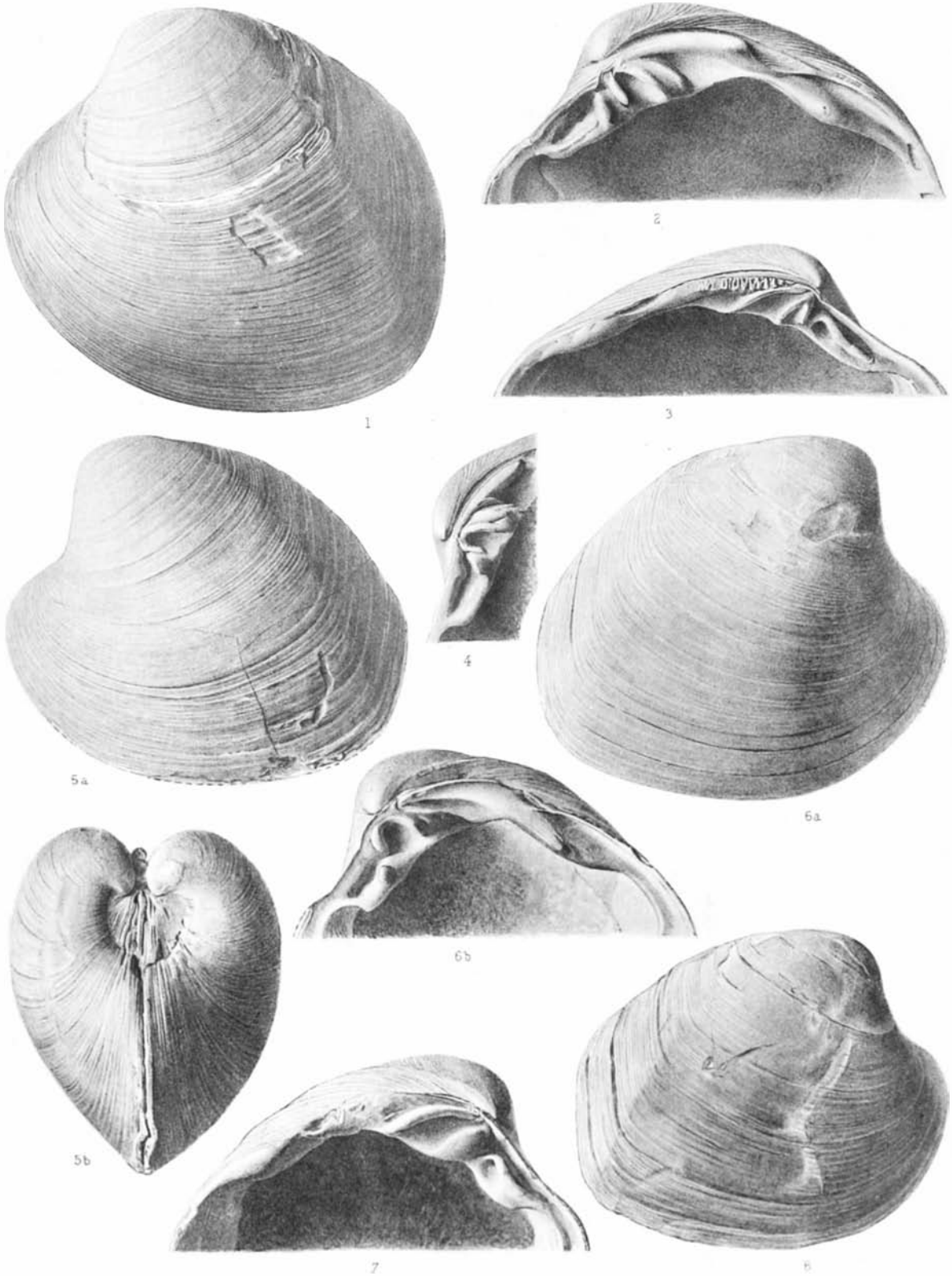

1
2
3
4
5a
5b
6a
6b
7
8

PLATE XXIII.

CYPRINA (*continued*).

FIGS.

1, 2. *C.* (*Venilicardia*) *lineolata* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum. Right valves. 2, a short form. (P. 143.)

3. *C.* (*Venilicardia*) *truncata* (Sow.). Upper Greensand, Blackdown. The Type. Bristol Museum. *a*, left valve; *b*, dorsal view of the same. (P. 145.)

4. *C.* (*Venilicardia*) *truncata ?* (Sow). Upper Greensand, Blackdown. Exeter Museum. Left valve. Probably an elongate variety of *C. truncata*. (P. 145.)

5. *C.* (*Venilicardia*) *truncata ?* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum. *a*, right valve; *b*, hinge. Probably a short variety of *C. truncata*. (P. 145.)

6–9. *C. quadrata*, d'Orb. Gault, Folkestone, except fig. 6. (P. 146.)

6. Upper Greensand, Warminster. Sedgwick Museum. Internal cast. Right valve.
7. Sedgwick Museum. *a*, left valve; *b*, dorsal view.
8. British Museum, L 9183. Right valve, decorticated.
9. Sedgwick Museum. *a*, left valve; *b*, dorsal view.

Genus—TRAPEZIUM, *v. Mühlfeldt.*

10, 11. *T. ? arcadiforme* (Keep.). Lower Greensand, Upware. (P. 148.)

10. The Type. Sedgwick Museum. *a*, right valve; *b*, dorsal view.
11. Mr. Walker's Collection. Anterior view.

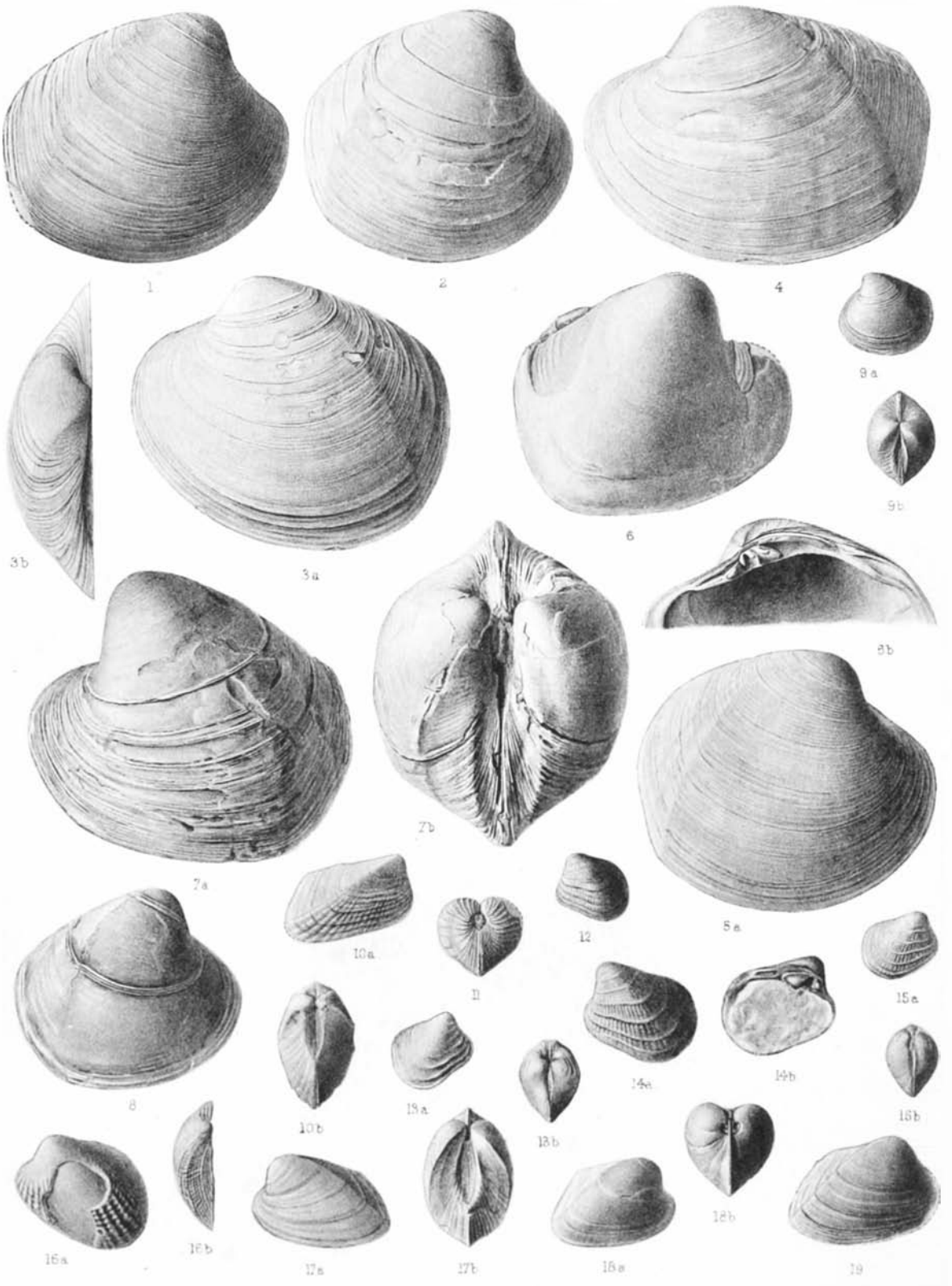
12–15. *T. ? squamosum* (Keep.). Lower Greensand, Upware. Sedgwick Museum, except fig. 14. (P. 148.)

12. Left valve.
13 *a*, right valve; *b*, dorsal view.
14. Mr. Walker's Collection. *a*, left valve, × 1½; *b*, interior of same, × 1½.
15 *a*, right valve; *b*, dorsal view.

16. *T. ?* sp. Lower Greensand, Upware. Sedgwick Museum. *a*, left valve; *b*, dorsal view. (P. 149.)

17–19. *T. trapezoidale* (Röm.). Chalk Rock, Cuckhamsley. Sedgwick Museum. (P. 149.)

17 *a*, left valve; *b*, dorsal view.
18 *a*, right valve; *b*, anterior view.
19. Right valve.



CRETACEOUS LAMELLIBRANCHIA.

PLATE XXIV.

FIGS.

1. *Cyprina claxbiensis*, Woods. Claxby Ironstone, Donnington. Sedgwick Museum. Hinge of right valve. (P. 135.)

Genus—LUCINA, *Bruguière*.

2, 3. *L.* sp. Spilsby Sandstone. 2, internal cast of right valve, Donnington. Sedgwick Museum. 3, right valve, Holton, Mr. Lamplugh's Collection. (P. 152.)

4, 5. *L.* sp. Lower Greensand. (P. 152.)

4. Near Atherfield. Museum of Practical Geology, No. 19719. Internal cast. *a*, right valve; *b*, dorsal view.
5. Sandgate Beds, Parham Park. Museum of the Geological Society, No. 2149. Internal cast of left valve.

6. *L.* sp. Lower Greensand (Ferruginous Sands), Shanklin. Sedgwick Museum, Cambridge. *a*, left valve; *b*, dorsal view. (P. 153.)

7–9. *L. ? sculpta*, Phill. Gault, Folkestone. (P. 153.)

7. Museum of Practical Geology, No. 19761. Right valve, × 1½.
8. British Museum, No. L 4990. *a*, part of right valve; *b*, dorsal view of both valves.
9. British Museum, No. L 4990. Left valve.

10–14. *L. tenera* (Sow.). Gault, Folkestone. (P. 154.)

10. Sedgwick Museum. *a*, left valve, × 1½; *b*, portion near middle of valve, × 8.
11. Sedgwick Museum. Right valve, × 1½.
12. British Museum, No. L 4977. *a*, left valve; *b*, dorsal view; *c*, portion near middle of valve, × 8.
13. British Museum, No. L 4977. *a*, left valve, × 1½; *b*, anterior view, × 1½.
14. British Museum, No. L 4977. Right valve, × 1½.

15. *L. Dournesi*, Woods. Upper Greensand, Blackdown. Museum of Practical Geology, No. 19771. *a*, left valve; *b*, dorsal view; *c*, portion near middle of valve, × 6. (P. 155.)

16–19. *L. pisum*, Sow. Upper Greensand, Blackdown. Sedgwick Museum, Cambridge. 16–18, right valves; 18 *b*, dorsal view; 19, left valve. All × 3. (P. 156.)

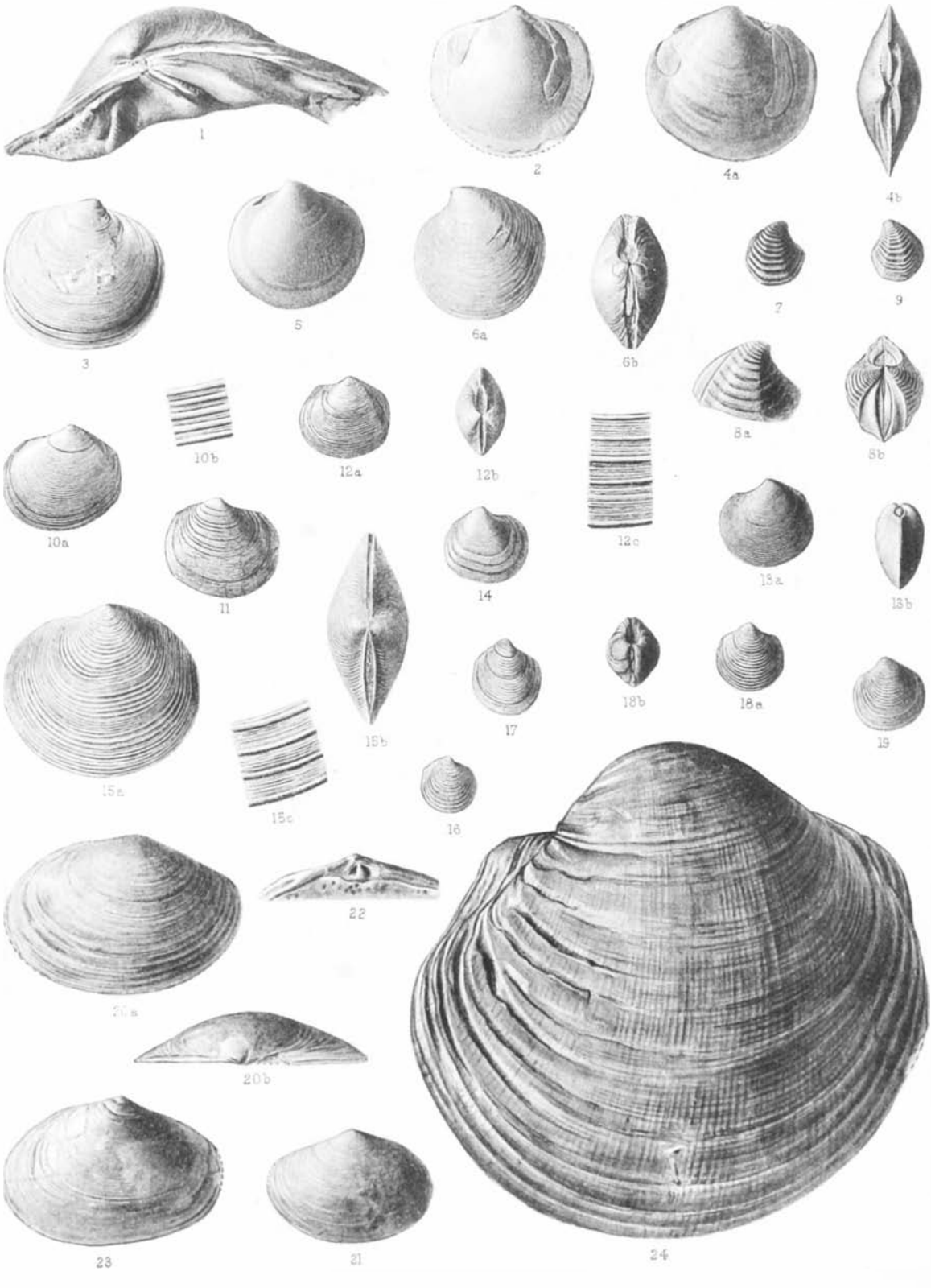
Genus—CORBICELLA, *Morris and Lycett*.

20–23. *C. claxbiensis*, Woods. Claxby Ironstone, Benniworth Haven. Sedgwick Museum, Cambridge. (P. 157.)

20 *a*, left valve; *b*, dorsal view of the same.
21. Right valve.
22. Hinge of right valve, × 1½.
23. Left valve.

Genus—SPHÆRA, *Sowerby*.

24. *S. corrugata*, Sow. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Left valve. See also text-figure 26. (P. 157.)



CRETACEOUS LAMELLIBRANCHIA

PLATE XXV.

Sphera (*continued*).

Figs.

1, 2. *S. corrugata*, Sow. Lower Greensand, Atherfield. (P. 157.)

1. Crackers, Atherfield. Sedgwick Museum. Right valve.
2. *Perna*-bed, Atherfield. British Museum, No. 50349. Hinge of right valve, × ¾.

3. *S.* sp. Base of Chalk Marl, Chard. Museum of Practical Geology, No. 7899. *a*, right valve; *b*, dorsal view. (P. 159.)

Genus—Mutiella, *Stoliczka*.

4–6. *M.? canaliculata* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum. (P. 160.)

4 *a*, left valve; *b*, interior of same; *c*, dorsal view; *d*, portion of anterior part, × 4.
5 *a*, left valve, × 1½; *b*, anterior view of same, × 1½; *c*, hinge, × 2.
6 *a*, right valve; *b*, anterior view of same; *c*, hinge, × 2.

Genus—Unicardium, *d'Orbigny*.

7. *U. claxbiense*, Woods. Claxby Ironstone, Benniworth Haven. Sedgwick Museum. *a*, left valve; *b*, dorsal view of the same. (P. 162.)

8–11. *U. rectense*, Woods. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. (P. 163.)

8 *a*, left valve; *b*, dorsal view; *c*, portion near the mid-ventral margin, × 3.
9. Left valve.
10. Hinge of right valve, × 1½.
11 *a*, right valve; *b*, anterior view.

12. *U.* sp. Upper Greensand, South Devon. Museum of the Geological Society, No. 1580. *a*, right valve; *b*, dorsal view; *c*, portion near the middle of the anterior half, × 8. (P. 163.)

13, 14. *U. ringmeriense* (Mant.). Base of Chalk Marl. (P. 164.)

13. Titherleigh. Sedgwick Museum. Left valve.
14. Chardstock. Museum of Practical Geology, No. 19803. *a*, right valve; *b*, dorsal view.

Genus—Thetironia, *Stoliczka*.

15. *T. minor* (Sow.). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. 15 *a*, right valve; *b*, portion near the mid-ventral margin, × 6; *c*, portion near the postero-dorsal margin, × 6. (P. 167.)

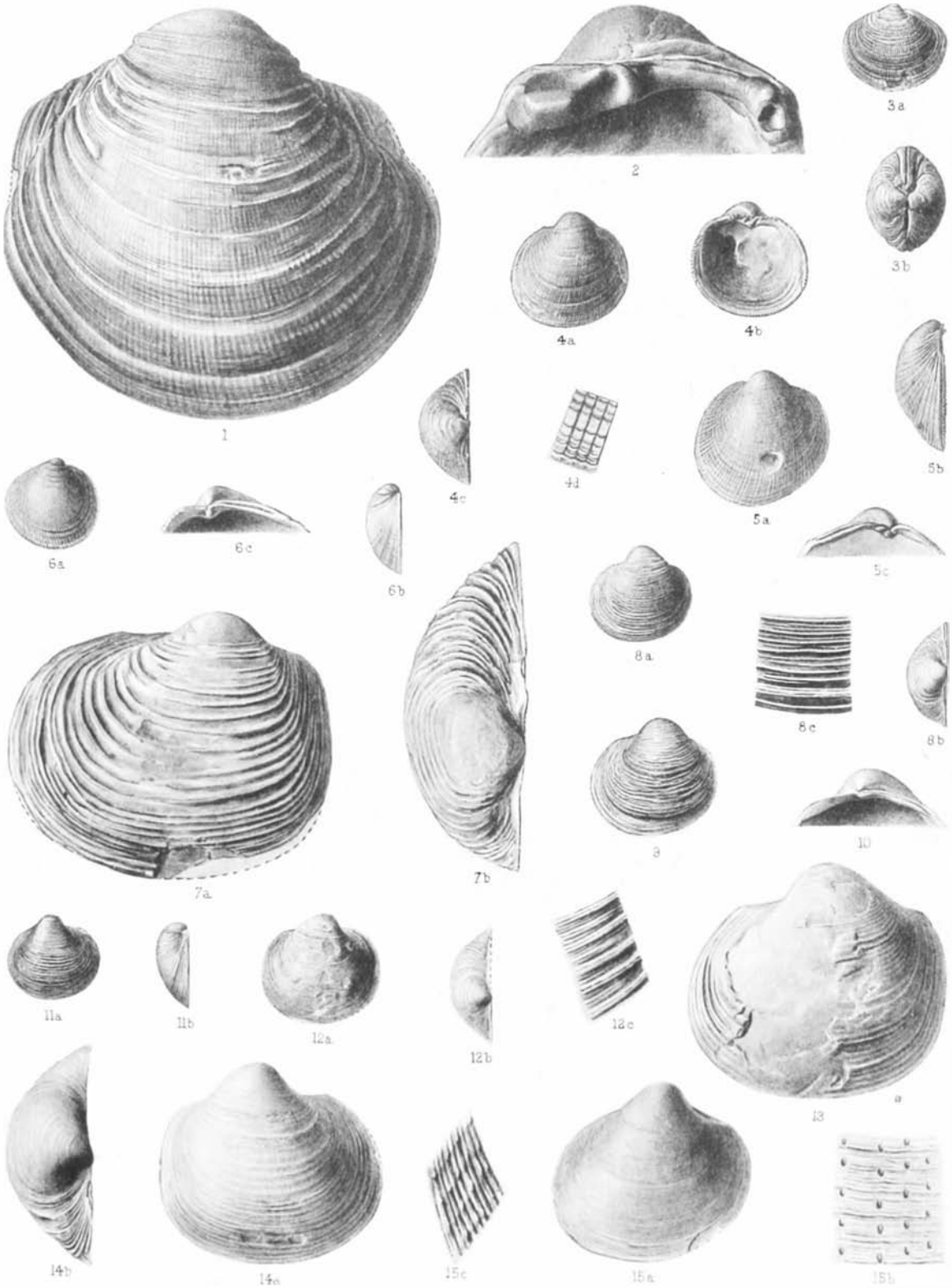

1
2
3a
3b
4a
4b
4c
4d
5a
5b
5c
6a
6b
6c
7a
7b
8a
8b
8c
9
10
11a
11b
12a
12b
12c
13
a
14a
14b
15a
15b
15c

PLATE XXVI.

THETIRONIA (*continued*).

FIGS.

1–8. *T. minor* (Sow.). Lower Greensand. Sedgwick Museum. 1–5, Crackers, Atherfield. 6, near Atherfield. 7, 8, Ferruginous rock, Shanklin. (P. 167.)

1. Right valve.
2 *a*, right valve; *b*, anterior view.
3. Right valve.
4 *a*, left valve; *b*, dorsal view.
5. Left valve.
6. Internal cast of right valve.
7. Internal cast. *a*, left valve; *b*, dorsal view.
8. Internal cast of right valve.

9–14. *T. lævigata* (Sow.). Upper Greensand, Blackdown. (P. 169.)

9. Sedgwick Museum. Left valve.
10. Sedgwick Museum. *a*, right valve; *b*, hinge of left valve of the same specimen, × 1½.
11. Museum of Practical Geology, No. 19783. Dorsal view.
12. Sedgwick Museum. Left valve.
13. Museum of Practical Geology, No. 19780. *a*, right valve; *b*, portion near the posterior margin, × 6.
14. Sedgwick Museum. Hinge of right valve, × 1½.

Genus—TELLINA, *Linnæus*.

15, 16. *T. Carteroni*, d'Orb. Lower Greensand (Crackers), Atherfield. Sedgwick Museum, Cambridge. (P. 171.)

15 *a*, right valve; *b*, portion near the anterior margin, × 3; *c*, portion near the posterior margin, × 3.
16 *a*, left valve; *b*, dorsal view of the same; *c*, hinge of the same, × 1½.

17. *T.* sp. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Right valve. (P. 172.)

18, 19. *T. striatuloides*, Stol. Upper Greensand, Blackdown. (P. 172.)

18. Sedgwick Museum. *a*, left valve; *b*, posterior part, × 3.
19. Sedgwick Museum. Interior of right valve.

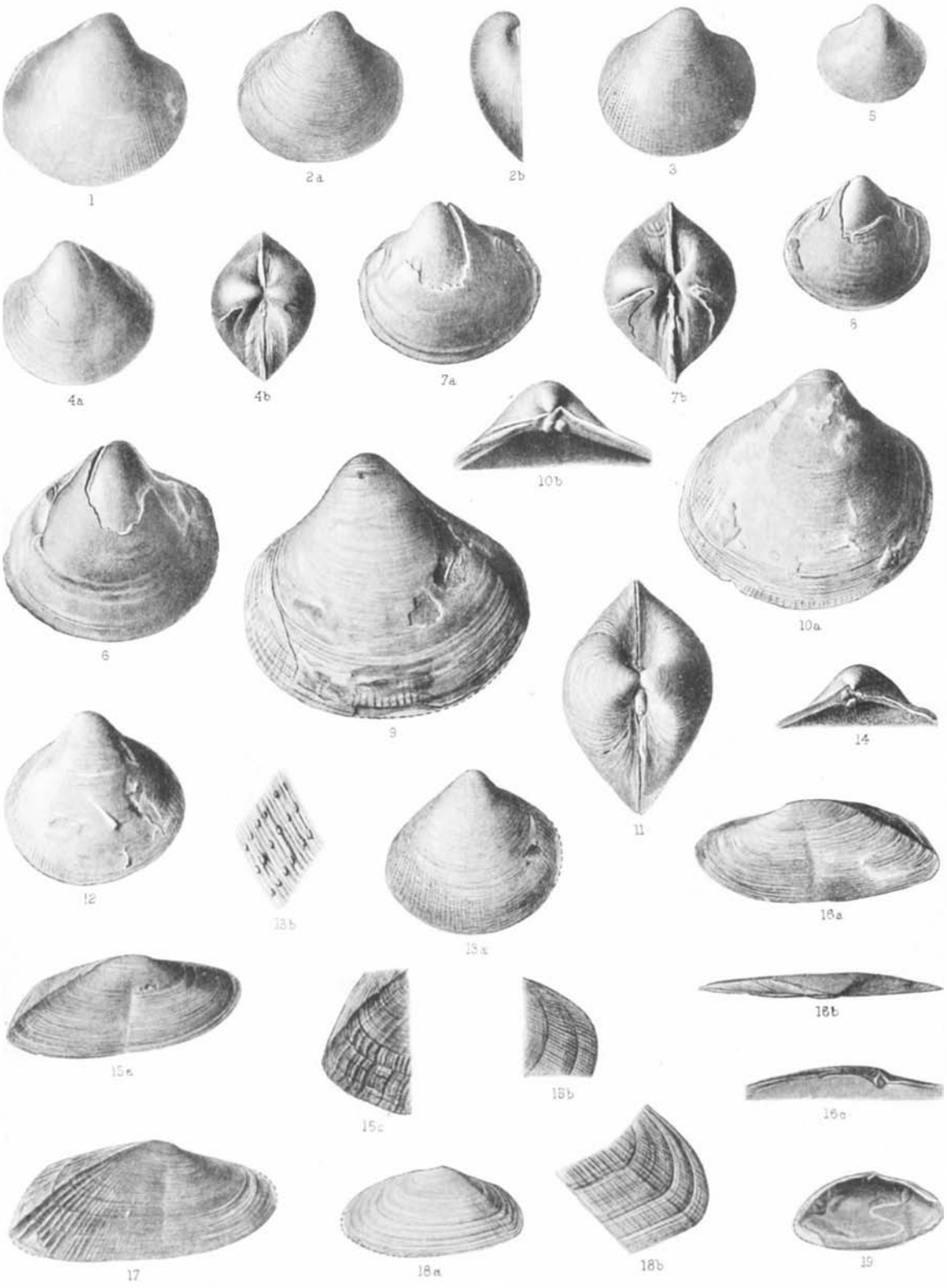

1
2a
2b
3
5
4a
4b
7a
7b
8
10b
6
9
10a
11
14
12
13b
13a
18a
15a
15c
15b
16b
16c
17
18a
18b
19

PLATE XXVII.

TELLINA (*continued*).

FIGS.

1. *T. striatuloides*, Stol. Upper Greensand, Blackdown. British Museum, No. L 16829. Hinge of right valve, × 2. (P. 172.)

2–8. *T.* (*Palæomæra*) *inæqualis*, Sow. Upper Greensand, Blackdown. Sedgwick Museum, except fig. 8. (P. 173.)

2. Right valve.
3 *a*, right valve; *b*, part of postero-dorsal area, × 4.
4, 5. Left valves.
6. Dorsal view.
7 *a*, interior of left valve; *b*, hinge of same, × 2.
8. British Museum, No. L 17129. Hinge of right valve, × 2.

9. *T.* (*Linearia*), sp. Lower Greensand (Crackers), Atherfield. British Museum, No. 48626. Left valve, × 1½. (P. 175.)

10–13. *T.* (*Linearia*) *subtenuistriata*, d'Orb. Upper Greensand, Blackdown. (P. 175.)

10. British Museum, No. L 7129. *a*, left valve, × 1½; *b*, dorsal view, × 1½.
11. Sedgwick Museum. Left valve, × 1½.
12. British Museum, No. L 17129. Right valve, × 1½.
13. British Museum, No. L 17129. Hinge of right valve, × 2.

14–16. *T.* (*Linearia*), sp. Upper Greensand, Blackdown. British Museum, No. L 17129. (P. 177.)

14. Right valve, × 1½.
15. Left valve.
16. Dorsal view, × 1½.

Genus—MACTRA, *Linnæus*.

17, 18. *M.* sp. Lower Greensand (Ferruginous Sands), Shanklin. Sedgwick Museum. 17 *a*, left valve; 17 *b*, dorsal view. 18, portion near the middle of valve, × 6. (P. 177.)

19–23. *M. angulata*, Sow. Upper Greensand, Blackdown. (P. 177.)

19. Museum of Practical Geology, No. 20714. *a*, right valve, × 1½; *b*, dorsal view, × 1½.
20. Sedgwick Museum. Left valve, × 1½.
21. Sedgwick Museum. *a*, left valve, × 1½; *b*, posterior view of same, × 1½.
22. Sedgwick Museum. Right valve.
23. Museum of Practical Geology, No. 20717. Hinge of left valve, × 3.

Genus—PTYCHOMYA, *Agassiz*.

24–26. *P. Robinaldina* (d'Orb.). Lower Greensand. Sedgwick Museum. (P. 179.)

24. *Perna*-bed, Atherfield. *a*, right valve; *b*, dorsal view.
25. *Perna*-bed, Atherfield. Left valve.
26. Ferruginous Sands, Shanklin. Hinge of right valve.

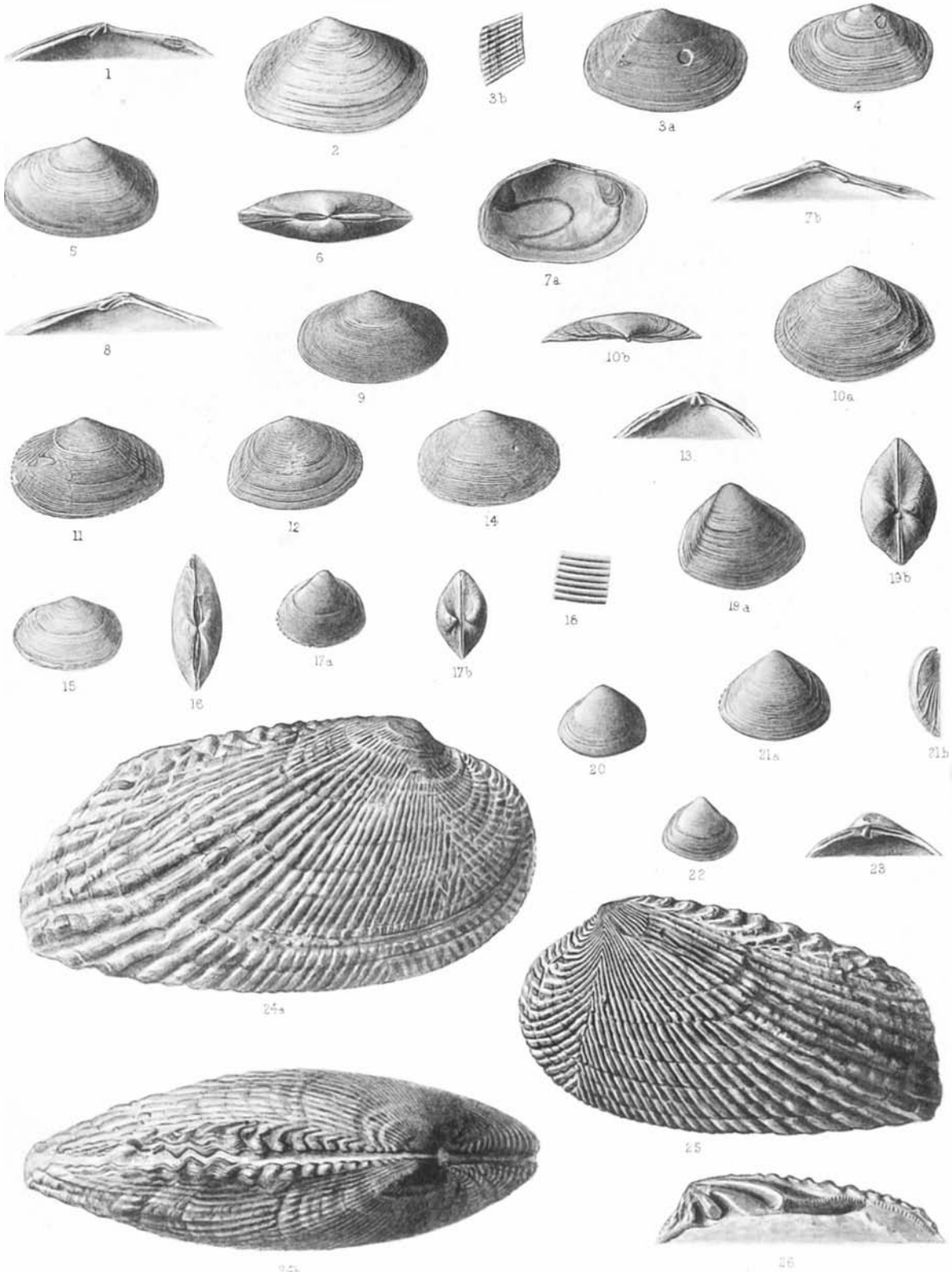

1
2
3b
3a
4
5
6
7a
7b
8
9
10b
10a
11
12
14
13
19b
19a
16
15
18
17a
17b
20
21a
21b
22
23
24a
25
24b
26

PLATE XXVIII.

Genus—DOSINIOPSIS, *Conrad.*

FIGS.

1—6. *D. subrotunda* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum, Cambridge; except fig. 2, British Museum, No. L17067. (P. 181).

1, 2, 6. Right valves.
3. Interior of right valve × 1½.
4, 5. Left valves. 5 *b*, interior of 5 *a*.

7—10. *D. caperata* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum. (P. 182).

7, 8. Right valves. 7 *b*, hinge × 1½.
9, 10. Left valves. 10 *b*, interior of 10 *a*; 10 *c*, dorsal view.

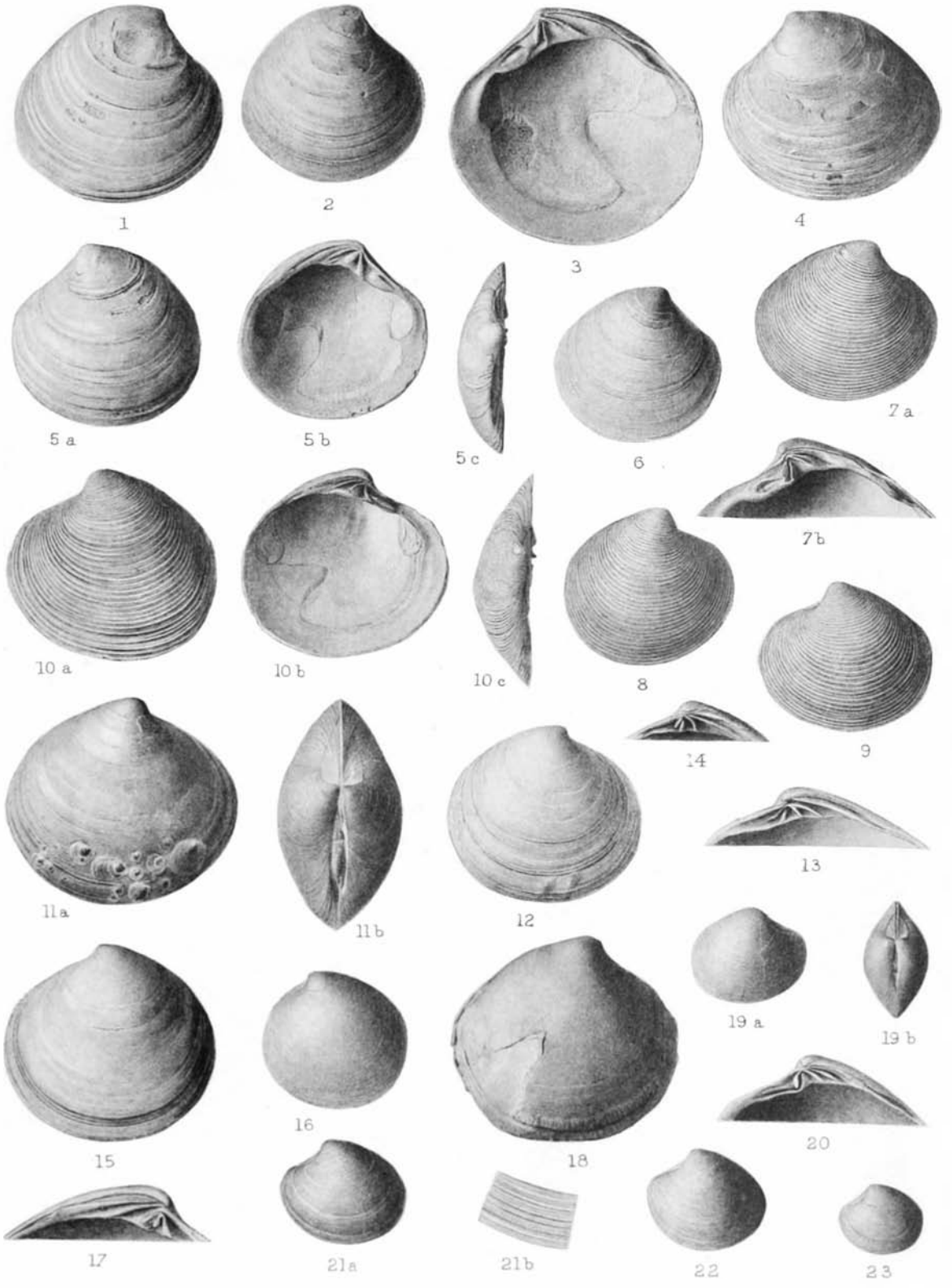
Genus—CYPRIMERIA, *Conrad.*

11—18. *C.* (*Cyclorisma*) *vectensis* (Forbes). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. (P. 183.)

11, 12. Right valves. 11 *b*, dorsal view of 11 *a*.
13, 14. Hinges of right valves. 13, a small specimen × 2.
15, 16. Left valves.
17. Hinge of left valve × 1½.
18. Internal cast of right valve. Exact horizon not known.

19—23. *C.* (*Cyclorisma*) *parca* (Sow.). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. (P. 184.)

19 *a*, right valve; *b*, dorsal view of both valves.
20. Hinge of right valve × 3.
21—23. Left valves. 21 *b*, part of 21 *a* near the ventral margin × 4.



CRETACEOUS LAMELLIBRANCHIA.

PLATE XXIX.

CYPRIMERIA (*continued*).

FIGS.

1—3. *C.* (*Cyclorisma*) *parca* (Sow.). Lower Greensand (Crackers), Atherfield, except fig. 3. Sedgwick Museum, Cambridge. (P. 184.)

1 *a*, left valve; *b*, anterior view of the same specimen.
2. Hinge of left valve × 3.
3. *Perna*-bed, East Shalford. Internal cast of left valve.

4—6. *C.* (*Cyclorisma*) *rotomagensis* (d'Orb.). 4, 5, Chloritic Marl. (P. 186.)

4. Woolcombe. Museum of Practical Geology, No. 18735. Right valve, with part of the shell preserved.
5. Maiden Bradley. Museum of Practical Geology, No. 18746. *a*, internal cast of right valve; *b*, dorsal view of the same specimen.
6. Cenomanian, Rouen. M. Fortin's Collection. Left valve with shell preserved.

7—15. *C.* (*Cyclorisma*) *faba* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum, except figs. 11, 14, 15. (P. 187.)

7—9. Right valves.
10. Hinge of right valve × 2.
11. Left valve. Museum of Practical Geology, No. 19774.
12. Dorsal view of both valves.
13. Hinge of left valve × 1½.
14. The Type of *Venus sublævis*, Sow. Bristol Museum. (P. 189.)
15. The Type of *Venus immersa*, Sow., somewhat crushed. Bristol Museum.

Genus—CLEMENTIA, *Gray*.

16—18. *C.* (*Flaventia*) *Ricordeana* (d'Orb.). Lower Greensand (*Perna*-bed), Atherfield. Sedgwick Museum. 16, 17, right valves; 18 *a*, left valve; *b*, dorsal view of the same specimen—the lunule is drawn from another specimen. (P. 189.)

19—26. *C.* (*Flaventia*) *oralis* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum, Cambridge, except figs. 20, 23, 26. (P. 191.)

19—22. Right valves. 20, Museum of Practical Geology, No. 19778.
23. British Museum, No. L19444. Interior of right valve.
24. Hinge of right valve × 1½.
25 *a*, left valve; *b*, dorsal view of the same specimen.
26. Museum of Practical Geology, No. 19814. Hinge of left valve × 1½.

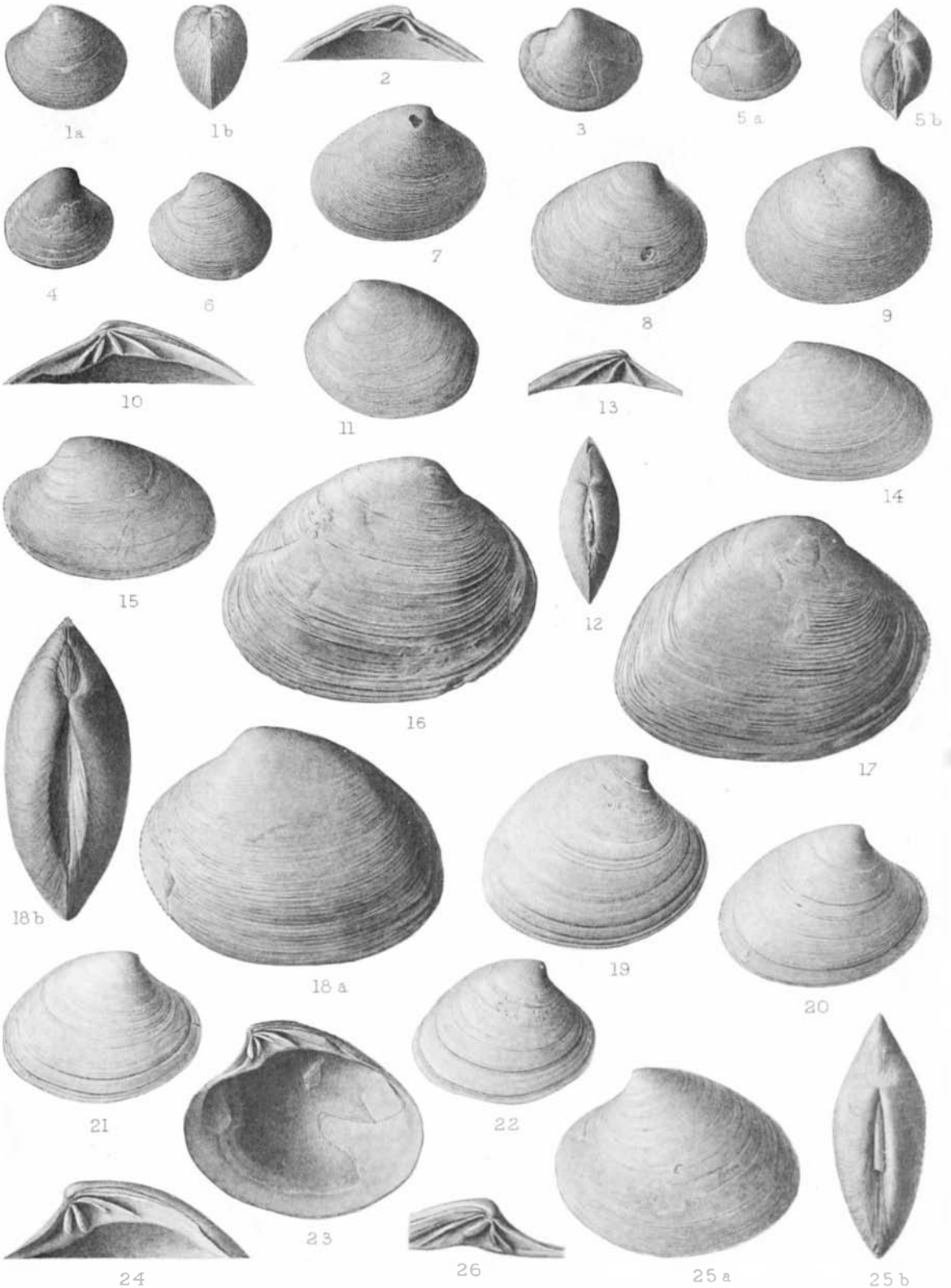

1a
1b
2
3
5a
5b
4
6
7
8
9
10
11
13
14
15
16
12
17
18b
18a
19
20
21
22
23
24
26
25a
25b

PLATE XXX.

Genus—CALLISTA, *Mörch*.

FIGS.

1—6. *C. plana* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum, Cambridge. (P. 192.)

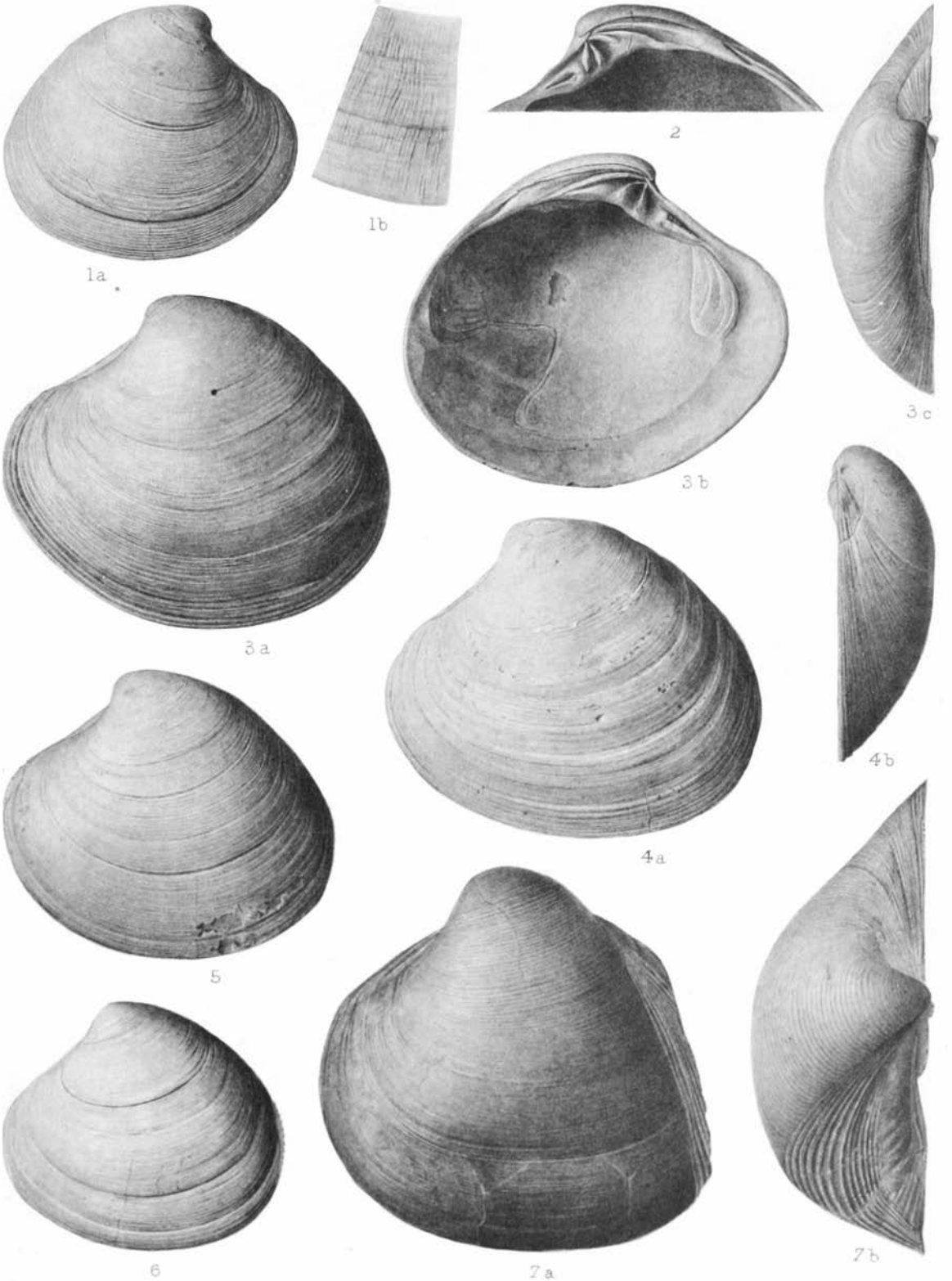
1 *a*, right valve; *b*, ornamentation on the postero-ventral part × 6.

2. Hinge of right valve. The part anterior to the middle of the anterior pit is drawn from another specimen.

3—6. Left valves. 3 *b*, interior of 3 *a*; 3 *c*, dorsal view of 3 *a*; 4 *b*, anterior view of 4 *a*.

Genus—PROTOCARDIA, *Beyrich*.

7. *P. anglica*, Woods. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. *a*, left valve × $\frac{2}{3}$; *b*, dorsal view × 1. (P. 194.)



CRETACEOUS LAMELLIBRANCHIA.

PLATE XXXI.

Protocardia (*continued*).

Figs.

1. *P. anglica*, Woods. Lower Greensand (Crackers), Atherfield. Sedgwick Museum, Cambridge. Right valve. (P. 194.)

2, 3. *P. sphæroidea* (Forbes). Lower Greensand (*Perna*-bed). (P. 195.)

2. Sandown. British Museum, No. L8247. *a*, left valve; *b*, dorsal view of the same specimen. × ⅔.

3. Atherfield. York Museum. *a*, left valve; *b*, posterior view of the same. × ⅔.

4. *P.* sp. Upper Greensand, Haldon. British Museum, No. L17041. Right valve. (P. 196.)

5. *P.* sp. Speeton Clay (zone of *Belemnites lateralis*), Speeton. Mr. Lamplugh's Collection. *a*, right valve × 2; *b*, dorsal view of both valves × 2. (P. 197.)

6. *P. Hillana* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum. *a*, left valve; *b*, posterior view of *a*; *c*, part of the posterior area × 4. (P. 197.)

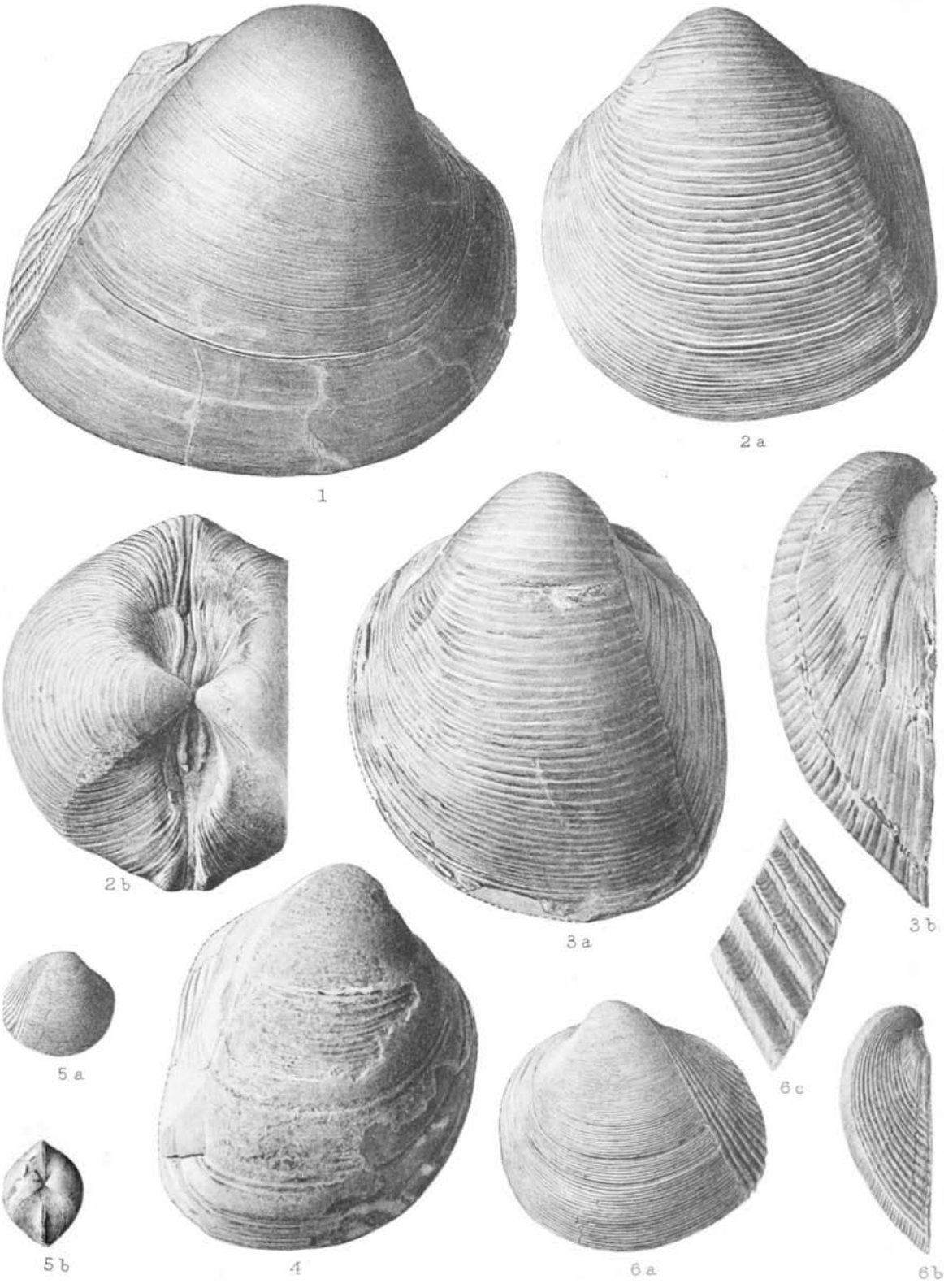

1
2a
2b
3a
3b
4
5a
5b
6a
6b
6c

PLATE XXXII.

PROTOCARDIA (*continued*).

FIGS.

1—6. *P. Hillana* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum, Cambridge. (P. 197.)

1. Left valve.
2, 3. Right valves.
4. Interior of left valve.
5. Hinge of right valve.
6. Dorsal view of both valves.

Genus—CARDIUM, *Linnæus*.

7—10. *C. Ibbetsoni*, Forbes. Lower Greensand (Crackers), Atherfield. Sedgwick Museum, Cambridge. (P. 201.)

7 *a*, right valve; *b*, dorsal view of both valves; *c*, posterior view; *d*, anterior view; *e*, portion of ornamentation of posterior area × 4; *f*, ornamentation near the middle of the ventral border × 4.
8, 9. Right valves.
10. Left valve.

11. *C. Coltaldinum*, d'Orb. Lower Greensand, Upware. Sedgwick Museum. *a*, right valve; *b*, dorsal view of both valves; *c*, posterior view; *d*, ornamentation of posterior area × 4; *e*, ornamentation near the mid-ventral border × 4. (P. 203.)

12. *C.* sp. Lower Greensand, Seend. Museum of Practical Geology, No. 21273. *a*, right valve; *b*, dorsal view. (P. 204.)

13—15. *C. turonicense*, Woods. Chalk Rock, Cuckhamsley. Sedgwick Museum. (P. 204.)

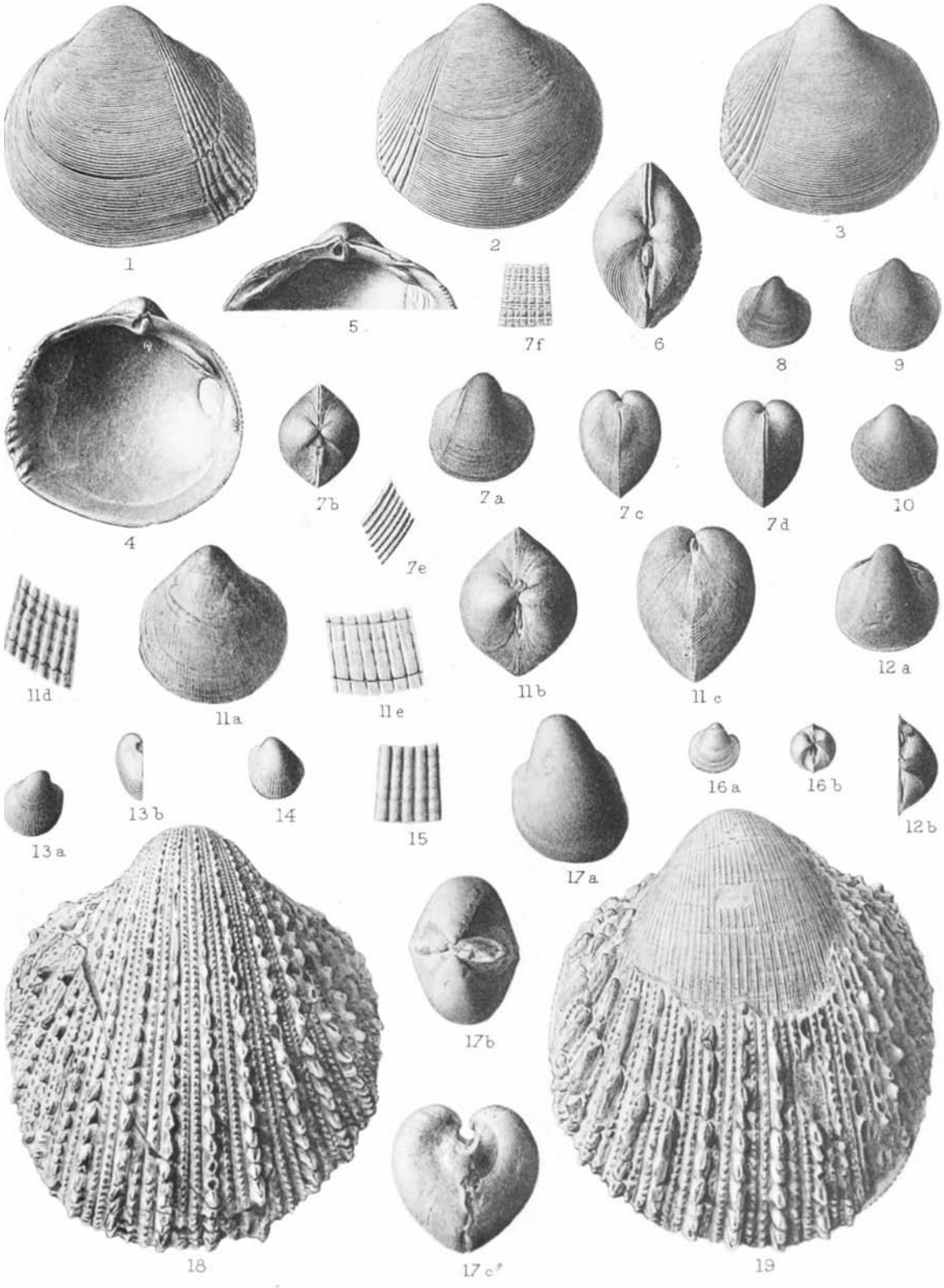
13 *a*, internal cast of right valve × 1½; *b*, anterior view of the same × 1½.
14. Internal cast of left valve × 1½.
15. Ornamentation drawn from a wax mould of an external cast × 6.

16. *C.* sp. Chalk Rock, Cuckhamsley. Sedgwick Museum. Internal cast. *a*, right valve; *b*, dorsal view of both valves. (P. 205.)

17. *C.* sp. Upper Chalk (zone of *Belemnitella mucronata*), Norwich. British Museum, No. L19443. Internal cast. *a*, left valve; *b*, dorsal view of both valves; *c*, posterior view. (P. 205.)

18, 19. *C.* (*Granocardium*) *proboscideum*, Sow. Upper Greensand, Blackdown. Sedgwick Museum. (P. 205.)

18. Right valve. The anterior marginal part is drawn from another specimen.
19. Left valve. Dorsal part decorticated.



CRETACEOUS LAMELLIBRANCHIA.

PLATE XXXIII.

CARDIUM (*continued*).

FIGS.

1—3. *C.* (*Granocardium*) *proboscideum*, Sow. Upper Greensand, Blackdown. Sedgwick Museum, Cambridge. (P. 205.)

1 *a*, right valve; *b*, anterior view of the same.
2 *a*, interior of left valve; *b*, dorsal view of the same.
3. Hinge of right valve.

Genus—TOUCASIA, *Munier-Chalmas.*

4—6. *T. Lonsdalei* (Sow.). Lower Greensand, Stock Orchard, near Calne. Internal casts. (P. 207.)

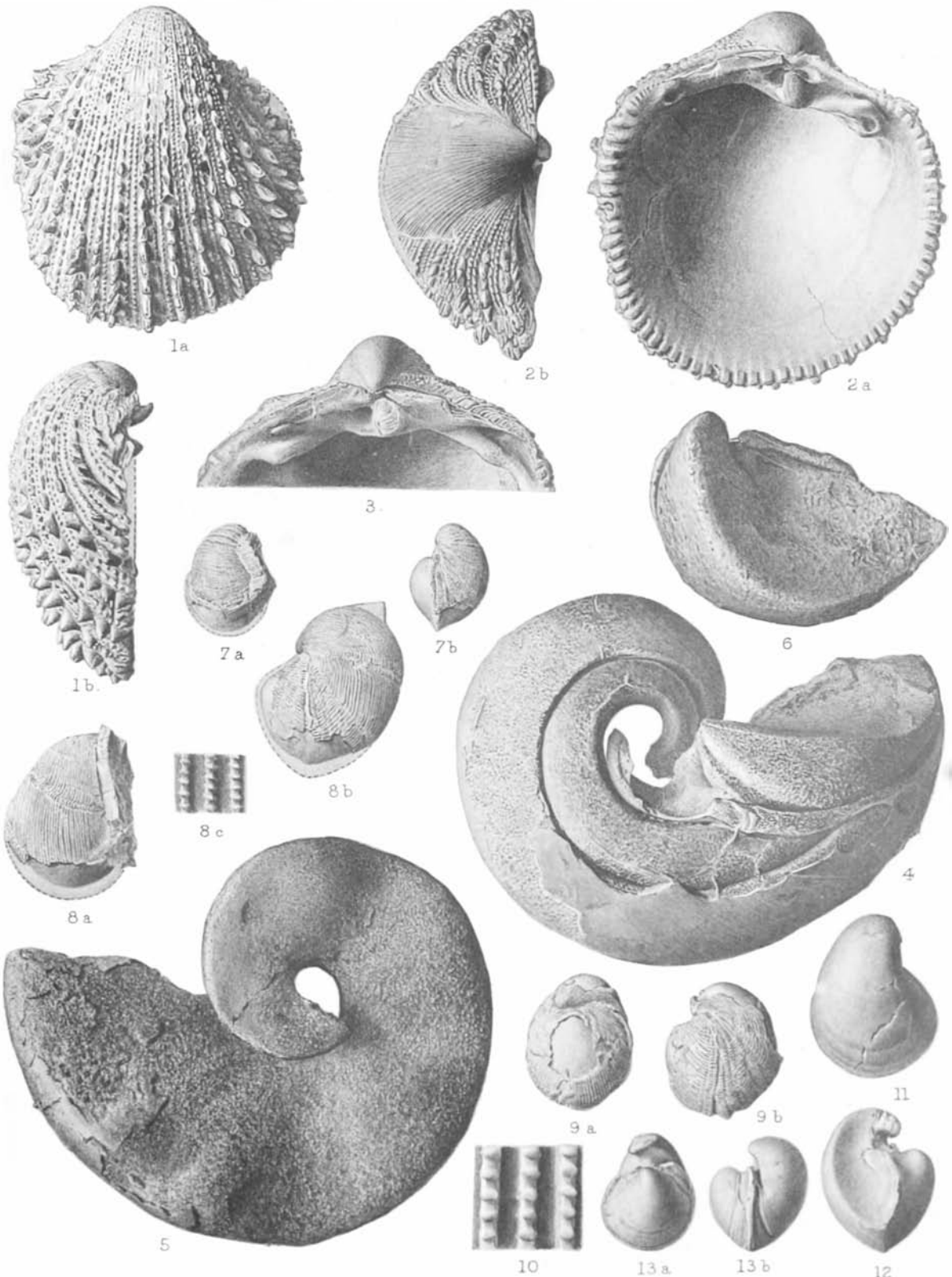
4. Both valves. Museum of Practical Geology, No. 22720.
5. Lower valve. Museum of Practical Geology, No. 22721. × ½.
6. Upper valve. British Museum, No. 88825.

Genus—GYROPLEURA, *Douvillé.*

7. *G. cornucopiæ* (d'Orb.). Chloritic Marl, Melbury Park. Museum of Practical Geology, No. 22140. *a*, right valve; *b*, posterior view of both valves. (P. 208.)

8—13. *G. inequirostrata* (Woodw.). Upper Chalk (zone of *Belemnitella mucronata*), Norwich. 8—10, British Museum, No. 21002. 11—13, Norwich Museum. (P. 209.)

8 *a*, right valve; *b*, posterior view of both valves; *c*, ornamentation of right valve × 8.
9 *a*, left valve and umbo of right valve; *b*, posterior view of both valves.
10. Ornamentation of right valve near the ventral margin × 12.
11. Right valve. Internal cast.
12. Anterior view of both valves. Internal cast.
13 *a*, left valve and umbo of right valve; *b*, posterior view of both valves Internal cast.



CRETACEOUS LAMELLIBRANCHIA

PLATE XXXIV.

GYROPLEURA (*continued*).

FIGS.

1. *G.* sp. Upper Chalk (zone of *Actinocamax plenus*), Seaford. Mr. F. R. B. Williams' Collection. *a*, left valve and umbonal part of right valve; *b*, posterior view of both valves; *c*, ornamentation of left valve × 3; *d*, ornamentation of right valve × 3. (P. 210.)

Genus—CORBULA, *Bruguière*.

2—5. *C. angulata* (Phill.). Speeton Clay, Speeton. 2, 5, Sedgwick Museum; 3, 4, Mr. Lamplugh's Collection. (P. 210.)

2 *a*, left valve; *b*, dorsal view of both valves; *c*, anterior view. × 5.
3, 4. Left valves × 5.
5. Right valve × 5.

6—12. *C. striatula*, Sow. Lower Greensand (Atherfield Beds), East Shalford; except 7 and 12, from the Crackers, Atherfield. Sedgwick Museum. × 5. (P. 212.)

6—10. Right valves. 9 *b*, dorsal view of 9 *a*.
11 *a*, left valve; *b*, dorsal view of both valves.
12. Anterior view of both valves.

13. *C.* sp. Lower Greensand, Punfield. Museum of Practical Geology, No. 22723. Right valve, the posterior part broken, × 5. (P. 213.)

14—16. *C. gaultina*, Pict. and Camp. Gault, Folkestone. × 5. (P. 214.)

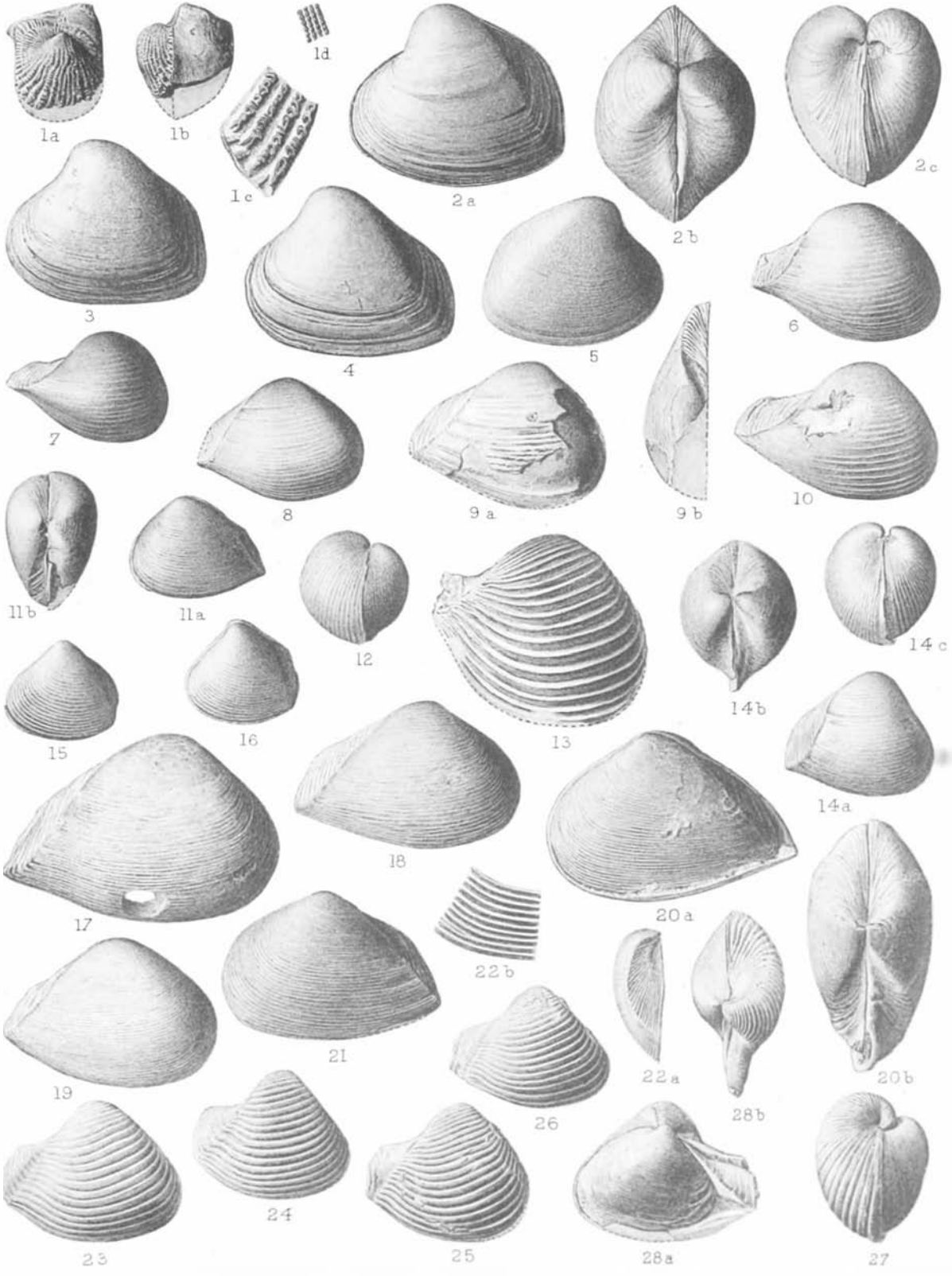
14. Sedgwick Museum. *a*, right valve; *b*, dorsal view of both valves; *c*, anterior view.
15, 16. Museum of Practical Geology, Nos. 22727, 22728. Left valves.

17—22. *C. truncata*, Sow. Upper Greensand, Blackdown. Sedgwick Museum. × 5. (P. 215.)

17—19. Right valves.
20, 21. Left valves. 20 *b*, dorsal view of 20 *a*.
22 *a*, posterior view of left valve × 5; *b*, ornamentation near the middle of the ventral margin × 10.

23—28. *C. elegans*, Sow. Upper Greensand, Blackdown. Sedgwick Museum. × 5. (P. 216.)

23—26. Right valves.
27. Anterior view of both valves.
28 *a*, left valve and umbo of right valve; *b*, dorsal view of *a*.



CRETACEOUS LAMELLIBRANCHIA.

PLATE XXXV.

Genus—PHARUS, *Leach.*

FIGS.

1—3. *P. Warburtoni* (Forbes). Lower Greensand (Crackers), Atherfield. Sedgwick Museum, Cambridge. 1, 3, right valves; 2 *a*, left valve; 2 *b*, dorsal view of 2 *a*; 2 *c*, portion of anterior part × 8. (P. 217.)

Genus—SOLECURTUS, *de Blainville.*

4. *S.* (*Azor?*) *Pelagi*, d'Orb. Upper Greensand, Blackdown. Sedgwick Museum. Right valve. (P. 218.)

5, 6. *S.?* (*Azor?*) *Acteon*, d'Orb. Left valves. 5, Upper Greensand, Haldon; British Museum, No. 34801. 6, Cenomanian, Dunscombe; Sedgwick Museum. (P. 219.)

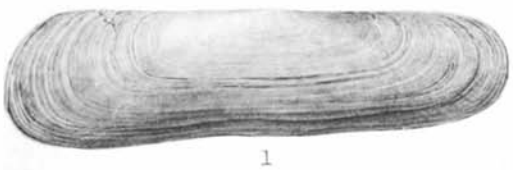
Genus—LEPTOSOLEN, *Conrad.*

7, 8. *L. Dupinianus* (d'Orb.). Gault, Black Ven. Sedgwick Museum. 7, right valve; 8, left valve. (P. 219.)

Genus—PANOPEA, *Ménard de la Groye.*

9—14. *P. gurgitis* (Brongn.). Lower Greensand (Crackers), Atherfield. Sedgwick Museum, Cambridge. (P. 222.)

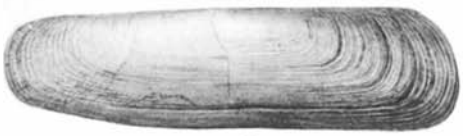
9. var. *neocomiensis*, Leym. *a*, left valve; *b*, dorsal view; *c*, ornamentation × 8.
10. var. *a*. Left valve.
11. var. *a*. *a*, right valve; *b*, dorsal view.
12. Right valve.
13. var. *neocomiensis*, Leym. *a*, left valve; *b*, ornamentation × 4.
14. *a*, right valve; *b*, dorsal view.



1

2 c

3



2 a

2 b

5

7

4

6

8

9 a

10

9 b

11 a

9 c

11 b

14 b

13 a

12

13 b

14 a

CRETACEOUS LAMELLIBRANCHIA.

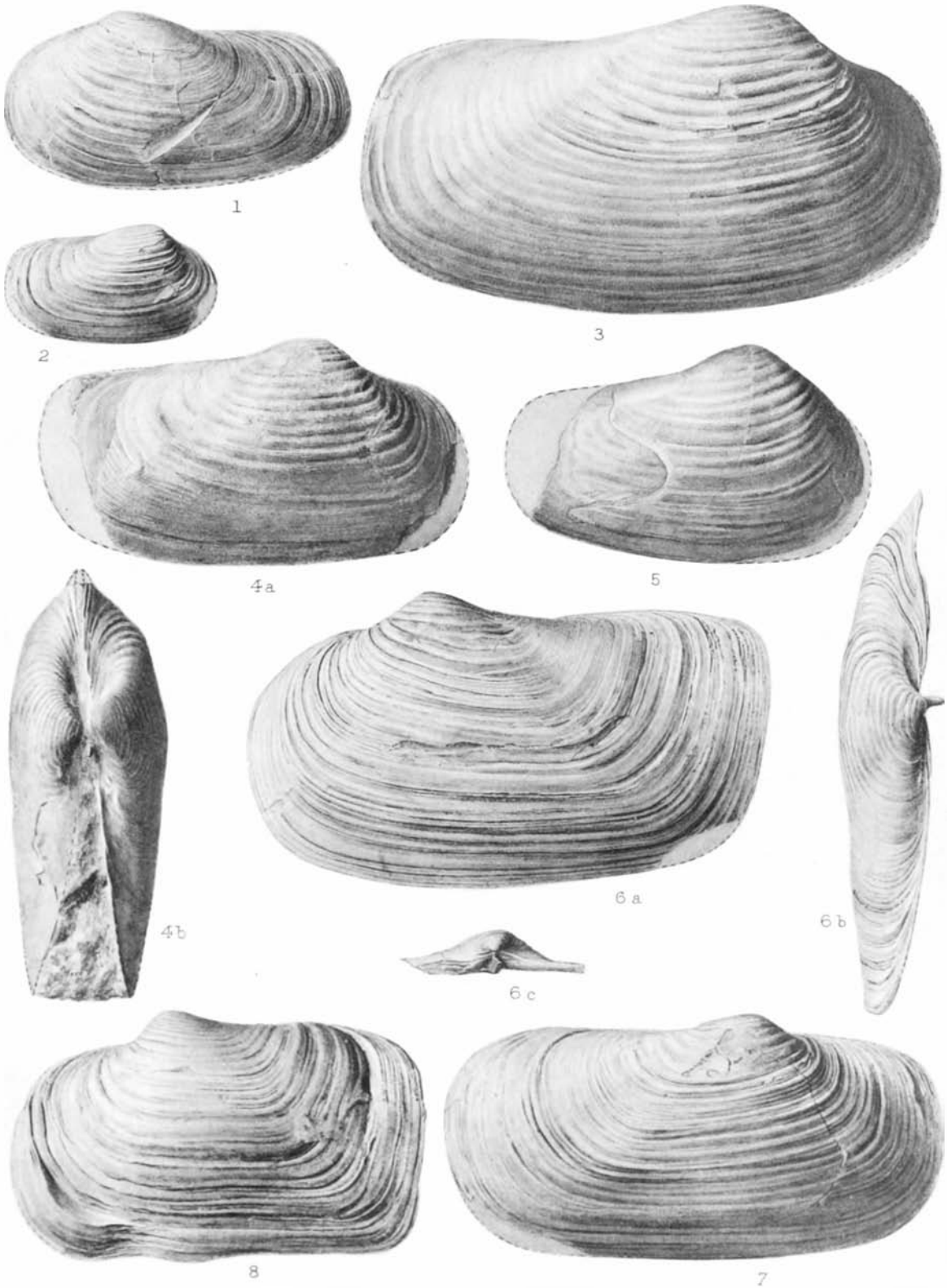
PLATE XXXVI.

PANOPEA (*continued*).

FIGS.

1—8. *P. gurgitis* (Brongn.). 1—5, Lower Greensand, Atherfield. 6—8, Upper Greensand, Blackdown. (P. 222.)

1. Crackers. Sedgwick Museum. Left valve.
2. Crackers. Sedgwick Museum. Right valve.
3. var. *plicata*, Sow. *Perna*-bed. Sedgwick Museum. Internal cast. Right valve.
4. var. *plicata*, Sow. Probably *Perna*-bed. York Museum. *a*, right valve; *b*, dorsal view.
5. Lobster clay. Sedgwick Museum. Internal cast. Right valve.
6. var. *plicata*, Sow. British Museum, No. L577. *a*, left valve; *b*, dorsal view; *c*, hinge of same.
7. var. *plicata*, Sow. British Museum, No. L17122. Right valve.
8. Short form of var. *plicata*, Sow. British Museum, No. L17120. Left valve.



CRETACEOUS LAMELLIBRANCHIA.

PLATE XXXVII.

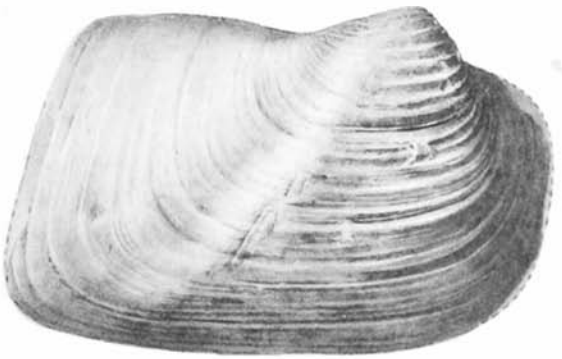
PANOPEA (*continued*).

FIGS.

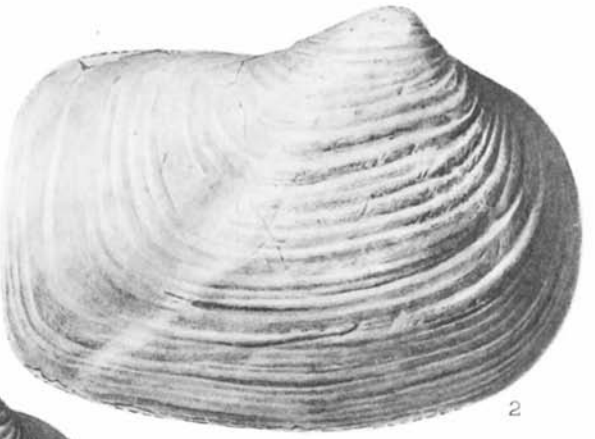
1—5. *P. mandibula* (Sow.). Upper Greensand. Sedgwick Museum, Cambridge. Internal casts. (P. 228.)

1. Ventnor. *a*, right valve; *b*, dorsal view.
2. Devizes. Right valve.
3. Ventnor. Left valve.
4. Devizes. *a*, right valve; *b*, anterior view.
5. Ventnor. Right valve.

6. *P. oralis*, Sow. Upper Greensand, Blackdown. The Type. Bristol Museum. *a*, portion of left valve; *b*, dorsal view. (P. 229.)



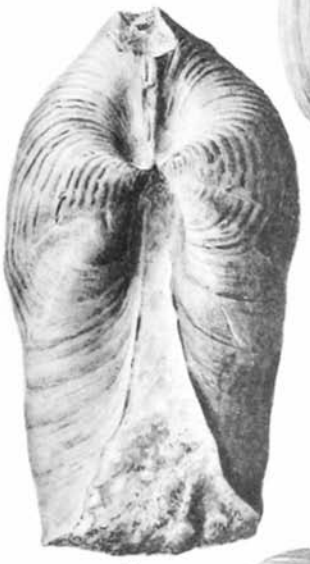
1a



2

4a

3



1b

4b

5

3a

6b

CRETACEOUS LAMELLIBRANCHIA.

PLATE XXXVIII.

PANOPEA (*continued*).

FIGS.

1. *P. Meyeri*, Woods. Upper Greensand, Blackdown. Sedgwick Museum, Cambridge. *a*, right valve; *b*, dorsal view. (P. 229.)

2. *P. spilsbiensis*, Woods. Spilsby Sandstone, Donnington. Sedgwick Museum. Internal cast. *a*, right valve; *b*, dorsal view. (P. 222.)

Genus—MARTESIA, *Leach.*

3—10. *M. constricta* (Phill.). 3—6, Speeton Clay, Speeton. 7—10, Gault, Folkestone. Mainly internal casts. (P. 231.)

3. York Museum. Right valve.
4. British Museum, No. L21607. Right valve. × 1½.
5. Sedgwick Museum. *a*, right valve; *b*, dorsal view of both valves. × 1½.
6. Sedgwick Museum. *a*, left valve, × 1½; *b*, anterior view, × 1½; *c*, portion of shell near the ventral margin × 10.
7. Museum of Practical Geology, No. 23487. Right valve. × 1½.
8. British Museum, No. L4997. Left valve with shell preserved. × 2.
9. British Museum, No. L4997. *a*, anterior view; *b*, dorsal view. Part of the shell is preserved. × 2.
10. Museum of Practical Geology, No. 23486. Right valve.

11. *M. prisca* (Sow.). Hythe Beds of Maidstone. Museum of Practical Geology, No. 23474. Internal cast of right valve. (P. 232.)

12, 13. *M.? rotunda* (Sow.). Chalk Rock, Cuckhamsley. Sedgwick Museum. 12, internal cast; *a*, left valve; *b*, dorsal view; *c*, anterior view. 13, right valve—drawn from a wax mould of the exterior, partly restored. × 2. (P. 233.)

Genus—TURNUS, *Gabb.*

14, 15. *T. Dallasi* (Walker). Lower Greensand, Potton. Sedgwick Museum. Internal casts. 14, the Type; *a*, right valve; *b*, dorsal view. 15, right valve. × 2. (P. 233.)

16, 17. *T.* sp. Gault, Folkestone. × 1½. (P. 234.)

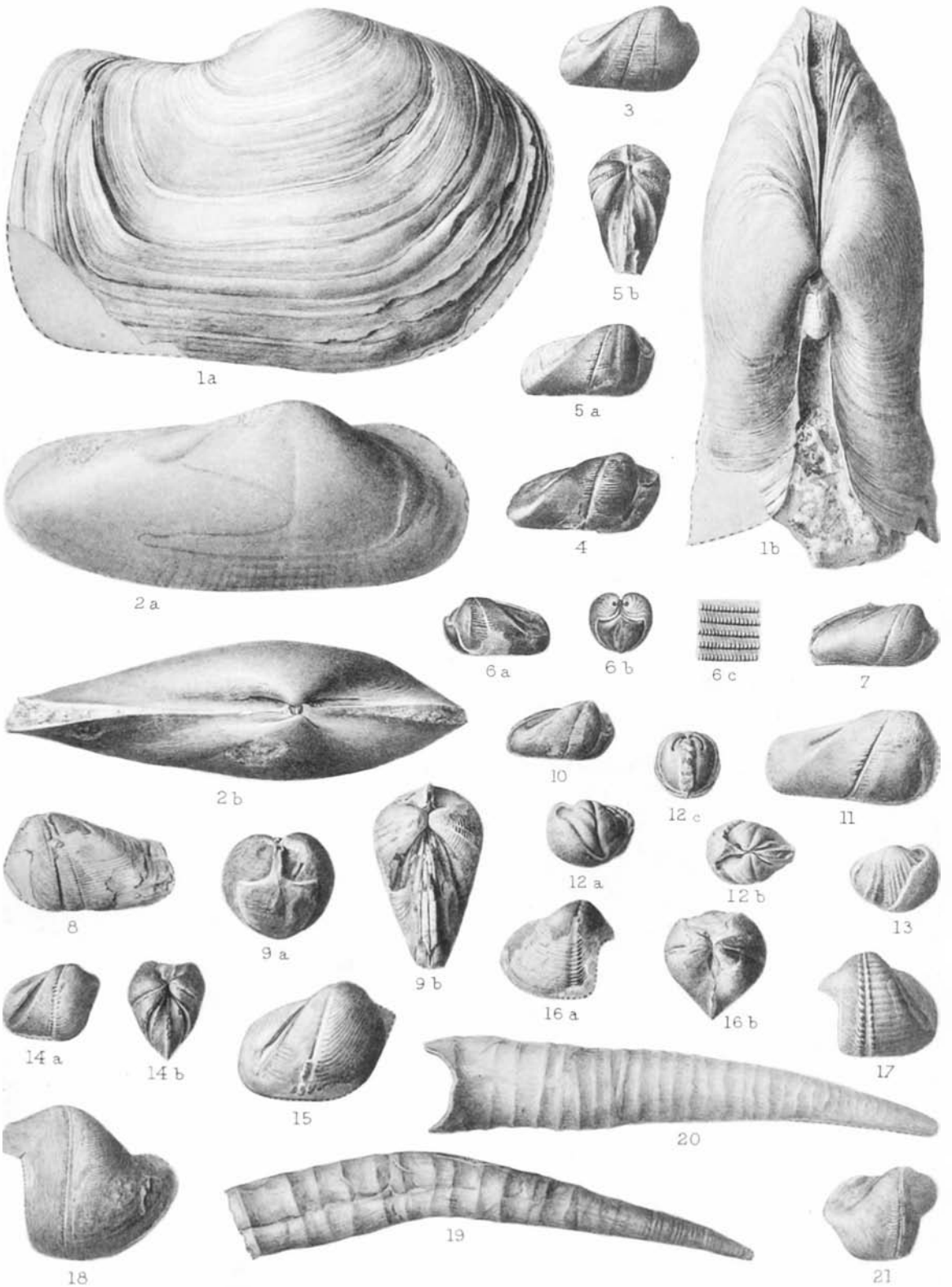
16. British Museum, No. L4996. *a*, right valve, with part of shell preserved; *b*, dorsal view.
17. Sedgwick Museum. Internal cast of left valve.

18. *T.* sp. Upper Greensand, Blackdown. British Museum, No. 24335. Left valve. × 1½. (P. 235.)

19, 20. *T.? amphisbæna* (Goldf.). Upper or Middle Chalk, Sussex. Sedgwick Museum. (P. 235.)

Genus—TEREDO, *Linnæus.*

21. *T. gaultina*, Woods. Gault, Folkestone. Museum of Practical Geology, No. 23485. Right valve. × 2. (P. 237.)



CRETACEOUS LAMELLIBRANCHIA.

PLATE XXXIX.

Genus—PLECTOMYA, *de Loriol.*

FIGS.

1. *P. anglica*, Woods. Lower Greensand (Crackers), Atherfield. Sedgwick Museum, Cambridge. *a*, right valve; *b*, ornamentation × 16. (P. 238.)

Genus—ANATINA, *Lamarck.*

2—4. *A.* (*Cercomya*) *gurgitis*, Pict. and Camp. Lower Greensand. (P. 239.)

2. *Perna*-bed, Isle of Wight. British Museum, No. L436. Right valve.
3. Crackers, Atherfield. Sedgwick Museum. *a*, part of left valve; *b*, dorsal view; *c*, ornamentation near the antero-ventral margin × 12.
4. Crackers, Atherfield. Sedgwick Museum. *a*, left valve; *b*, ornamentation near the antero-ventral margin × 10.

5. *A.* (*Cercomya*) sp. Upper Greensand, Isle of Wight. British Museum, No. 48626. Internal cast. *a*, right valve; *b*, dorsal view. (P. 239.)

6. *A.* (*Cercomya*) sp. Upper Greensand, Warminster. British Museum, No. 88926. Internal cast of part of right valve. (P. 240.)

Genus—THRACIA, *Leach.*

7—9. *T. Phillipsi*, Röm. Speeton Clay, Speeton. (P. 240.)

7. Mr. Stather's Collection. *a*, right valve; *b*, dorsal view.
8. Sedgwick Museum. Right valve.
9. Sedgwick Museum. Left valve.

10. *T. rotundata* (Sow.). Hythe Beds, Lympne. Museum of Practical Geology, No. 23470. *a*, right valve; *b*, dorsal view. (P. 241.)

1a

1b

2

3a

3c

3b

4b

4a

6

5b

5a

7a

7b

9

8

10b

10a

CRETACEOUS LAMELLIBRANCHIA.

PLATE XL.

THRACIA (*continued*).

FIGS.

1—3. *T. Robinaldina ?* (d'Orb.). Lower Greensand, Atherfield. Sedgwick Museum. (P. 242.)

1. *Perna*-bed. *a*, left valve; *b*, dorsal view.
2. Crackers. Left valve.
3. Crackers. Right valve.

4—6. *T. Sanctæ-Crucis*, Pict. and Camp. Gault. Left valves. 4, Folkestone; Sedgwick Museum. 5, Black Ven; Museum of Practical Geology, No. 23484. 6, Folkestone; Museum of Practical Geology, No. 1662. (P. 243.)

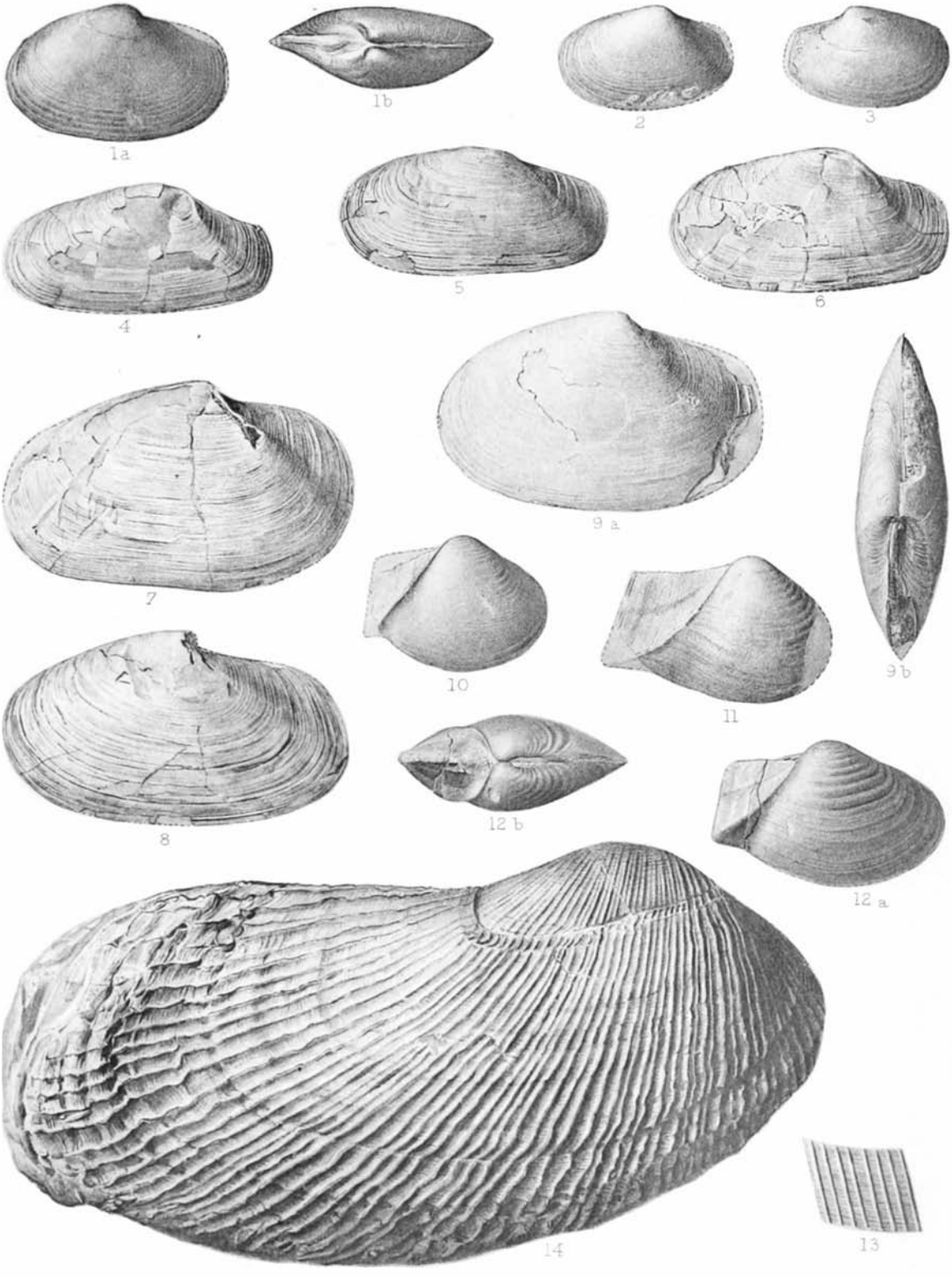
7—9. *T.* sp. 7, 8, Gault, Black Ven; Museum of Practical Geology, Nos. 23482, 23483, left valves. 9, Upper Greensand, Blackdown; Museum of Practical Geology, No. 19813; *a*, left valve; *b*, dorsal view. (P. 243.)

10—13. *T. carinifera* (Sow.). Chalk Marl. (P. 244.)

10, 11. Ventnor. Sedgwick Museum. Right valves.
12. Chard. Museum of Practical Geology, No. 23500, *a*, right valve; *b*, dorsal view.
13. Near Beaminster. Museum of Practical Geology, No. 23499. Ornamentation × 12.

Genus—PHOLADOMYA, *Sowerby*.

14. *P. gigantea* (Sow.). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Right valve. (P. 246.)



CRETACEOUS LAMELLIBRANCHIA.

PLATE XLI.

PHOLADOMYA (*continued*).

FIGS.

1. *P. gigantea* (Sow.). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Dorsal view of specimen figured on Plate XL. (P. 246.)

2, 3. *P. Cornueliana* (d'Orb.). Lower Greensand (Crackers), Atherfield. Sedgwick Museum, Cambridge. 2 *a*, right valve; *b*, dorsal view; 3, right valve. (P. 245.)

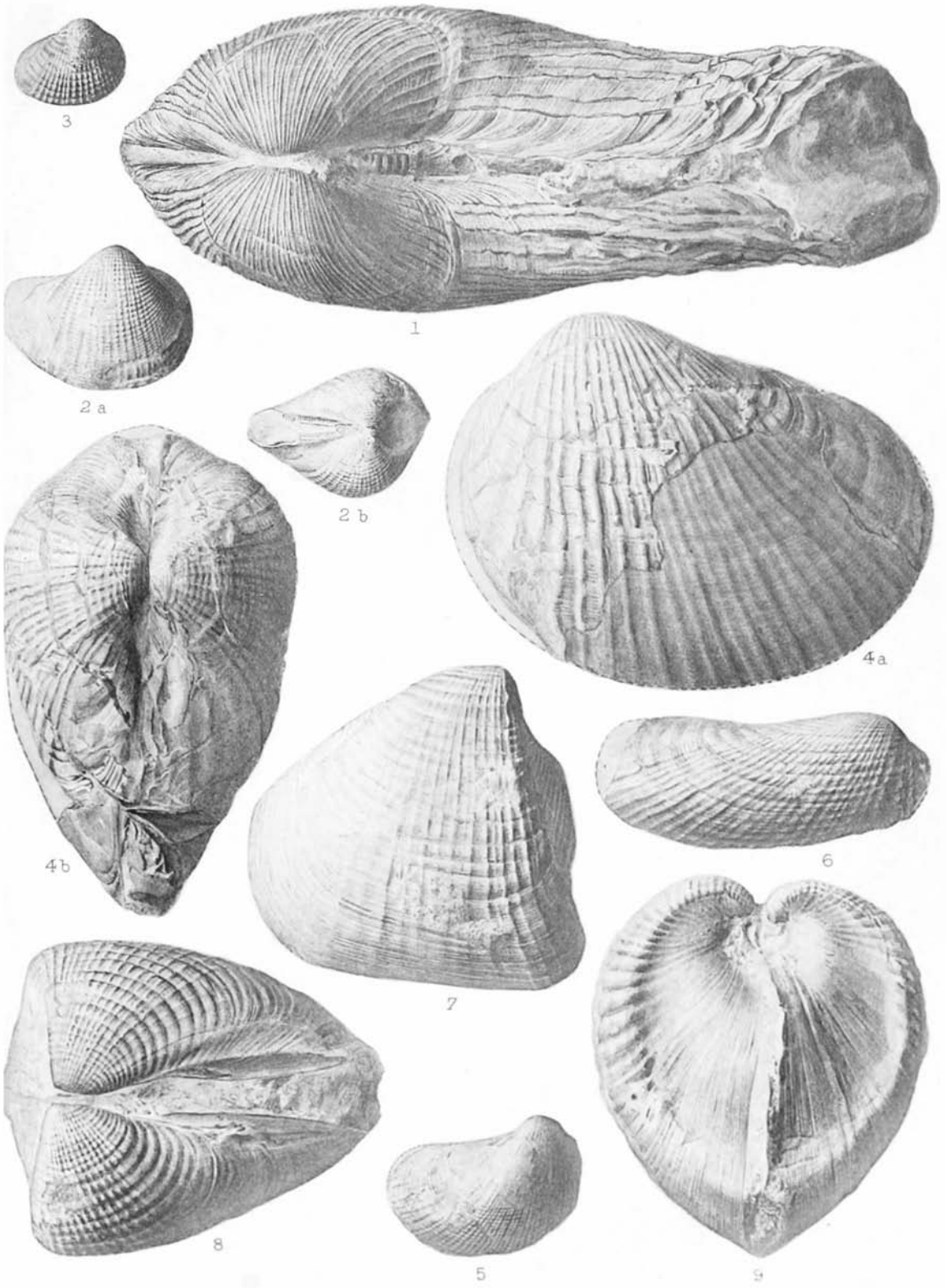
4. *P. speetonensis*, Woods. Speeton Clay, Speeton. Museum of Practical Geology, No. 23620. *a*, left valve; *b*, dorsal view. (P. 248.)

5. *P. Martini*, Forbes. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Right valve. (P. 249.)

6. *P. Fabrina*, d'Orb. Gault, Black Ven. Sedgwick Museum. Right valve, compressed dorso-ventrally. (P. 250.)

7—9. *P. decussata* (Mant.). Chalk Marl. (P. 250.)

7. Eastbourne. Sedgwick Museum. Right valve.
8. Ventnor. Sedgwick Museum. Dorsal view.
9. Ventnor. Sedgwick Museum. Anterior view.



CRETACEOUS LAMELLIBRANCHIA.

PLATE XLII.

PHOLADOMYA (*continued*).

FIGS.

1. *P. decussata* (Mant.). Chalk Marl, Chertsey. York Museum. Left valve. (P. 250.)

2. *P. cordata*, Tate. Upper Chalk (White Limestone, zone of *Belemnitella mucronata*), Tamlacht, co. Derry. Museum of Practical Geology, No. 23628. *a*, left valve; *b*, dorsal view; *c*, anterior view. (P. 253.)

Genus—MYOPHOLAS, *Douvillé*.

3. *M.* sp. *cf. semicostata* (Agassiz). Lower Greensand, Furze Hill, Faringdon. Sedgwick Museum. Internal cast. *a*, right valve; *b*, dorsal view. (P. 253.)

Genus—GONIOMYA, *Agassiz*.

4, 5. *G. Archiaci* (Pict. and Ren.) Lower Greensand (Crackers), Atherfield. Sedgwick Museum. Right valves. 4 *b*, dorsal view of 4 *a*. (P. 254.)

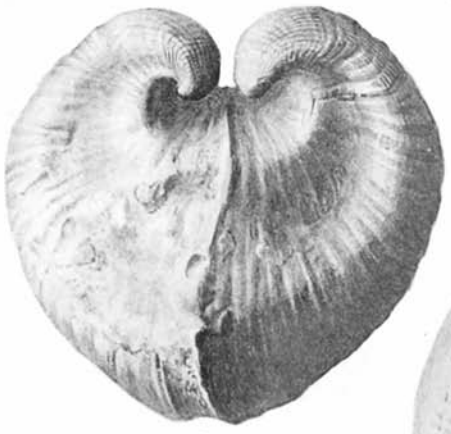
6, 7. *G. Mailleana* (d'Orb.). Sedgwick Museum. 6, Base of Chalk Marl, Chard; *a*, part of left valve; *b*, dorsal view. 7, Upper Greensand, near Maiden Bradley; right valve. (P. 255.)

1

3 b

3 a

2 a



2 c

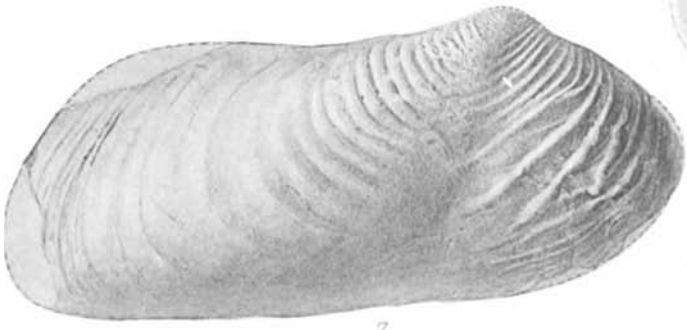
6 b

2 b

4 b

4 a

6 a



7

5

PLATE XLIII.

Genus—PLEUROMYA, *Agassiz*.

FIGS.

1, 2. *P. Orbigniana* (Rouillier). Spilsby Sandstone, Donnington. Sedgwick Museum, Cambridge. 1 *a*, right valve; 1 *b*, dorsal view. 2, ornamentation × 12; *a*, near middle of valve; *b*, near the ventral margin; *c*, between *a* and *b*. (P. 256.)

Genus—LIOPISTHA, *Meek*.

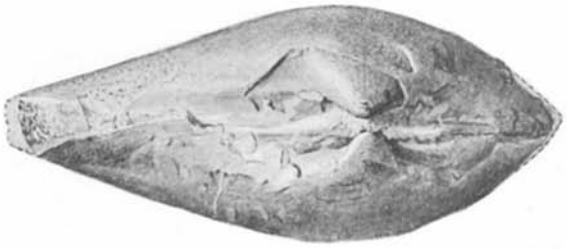
3, 4. *L.* (*Psilomya*) *gigantea* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum. 3 *a*, left valve; *b*, hinge of the same. 4, umbo of right valve × 6. (P. 257.)

5. *L.*, sp. Red Limestone, Hunstanton. British Museum, No. 83628. *a*, right valve; *b*, dorsal view; *c*, ornamentation × 6. (P. 258.)

Genus—CUSPIDARIA, *Nardo*.

6. *C. Sabaudiana* (Pict. and Camp.). Gault, Folkestone. Museum of Practical Geology, No. 23821. *a*, left valve × $1\frac{1}{2}$; *b*, dorsal view × $1\frac{1}{2}$. (P. 259.)

1a



1b

3b

2a

3a

2b

2c

4

6a

5a

5b

5c

6b

CRETACEOUS LAMELLIBRANCHIA.

PLATE XLIV.

Liopistha (*continued*).

Figs.

1, 2. *L.* (*Psilomya*) *gigantea* (Sow.). Upper Greensand, Blackdown. Sedgwick Museum, Cambridge. 1 *a*, right valve; 1 *b*, dorsal view of the same. 2, left valve. (P. 257.)

Cuspidaria (*continued*).

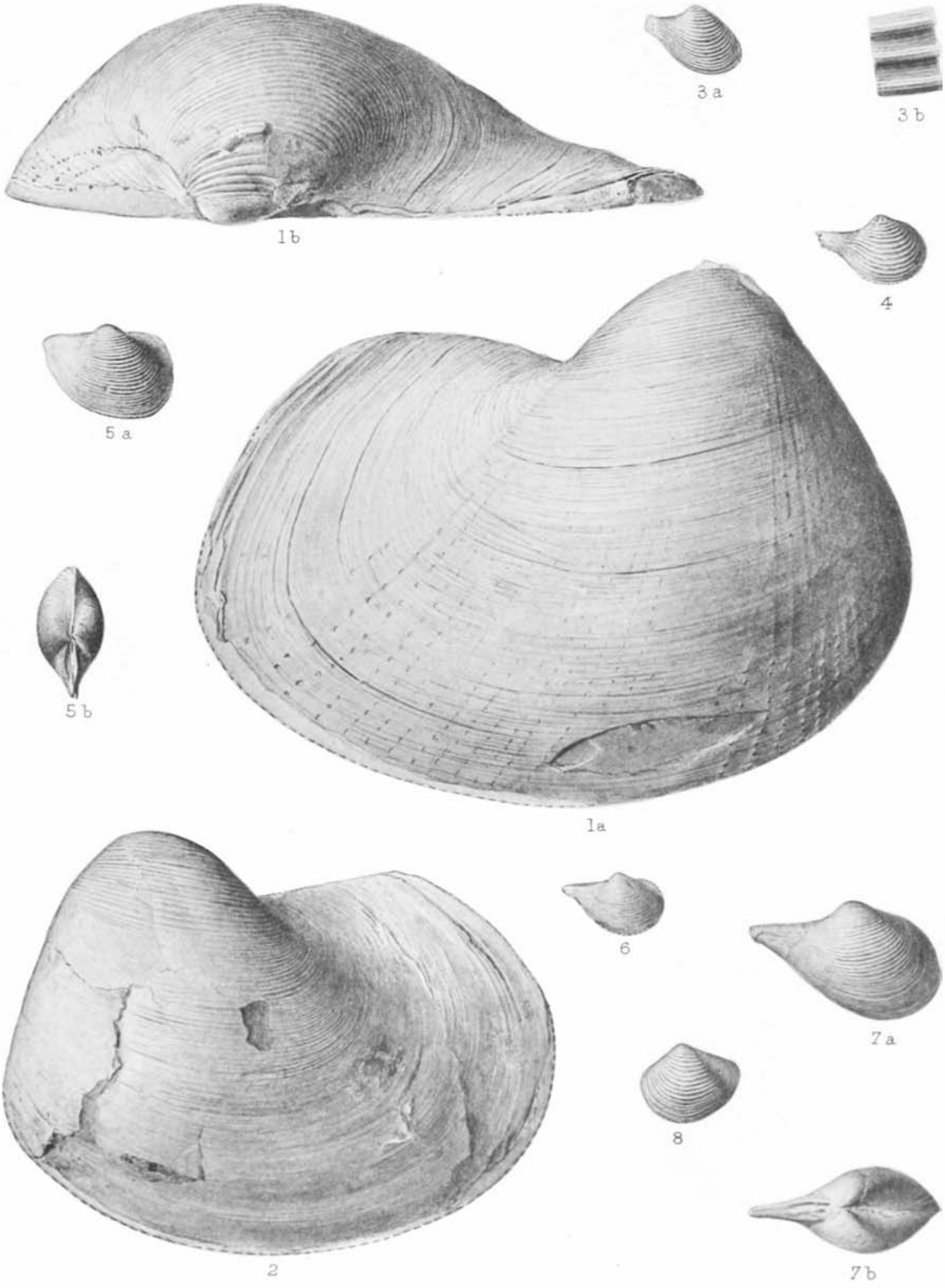
3. *C. Sabaudiana* (Pict. and Camp.). Gault, Folkestone. Sedgwick Museum. *a*, right valve; *b*, ornamentation × 5. (P. 259.)

4. *C. undulata* (Sow.). Gault, Folkestone. Sedgwick Museum. Right valve. (P. 260.)

5, 6. *C. pulchra* (Sow.). 5, Upper Chalk, Norwich. Norwich Museum. *a*, internal cast of right valve; *b*, dorsal view. 6, Chalk Rock, Henley Park; Sedgwick Museum, from Mr. L. Treacher's Collection; right valve. (P. 260.)

7. *C. pulchra ?* (Sow.). Upper Greensand, Devizes. British Museum, No. L21785. Internal cast, somewhat crushed. *a*, right valve; *b*, dorsal view. (P. 261.)

8. *C. ?* sp. Chalk Marl, Ventnor. British Museum, No. 38266. (P. 261.)



CRETACEOUS LAMELLIBRANCHIA

PLATE XLV.

Genus—INOCERAMUS, *Sowerby*.

FIGS.

1, 2. *I. neocomiensis*, d'Orb. 1, Hythe Beds, Lympne. Museum of Practical Geology, No. 21133. Left valve. 2, Lower Greensand, Atherfield. Sedgwick Museum, Cambridge. Right valve. (P. 262.)

3—7. *I. Salomoni*, d'Orb. *Mammillatus* bed, Copt Point, Folkestone. Sedgwick Museum. Internal casts of left valves. 4 *b*, dorsal view of 4 *a*. (P. 263.)

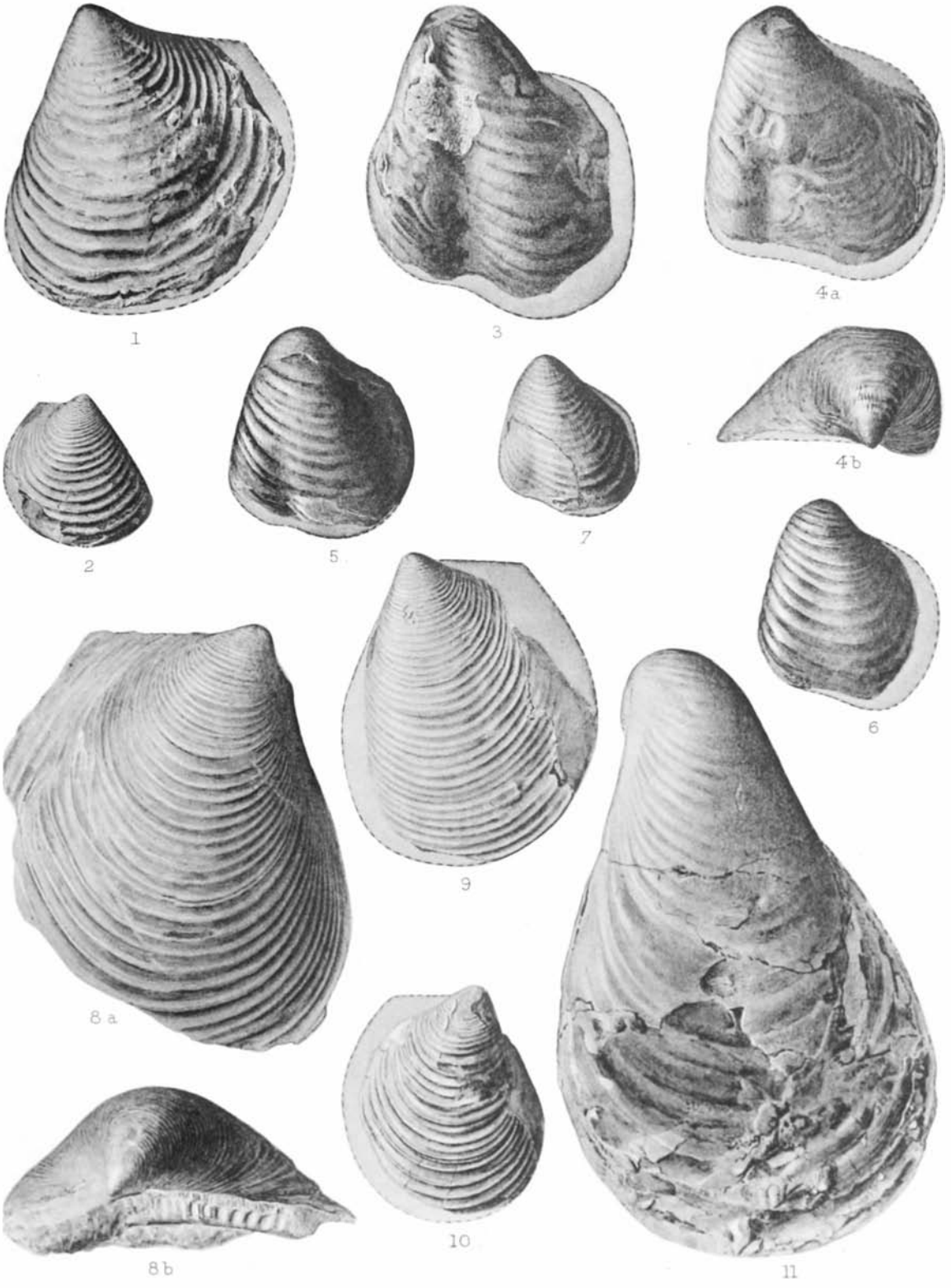
8—10. *I. anglicus*, Woods. (P. 264.)

8. Red Limestone, Hunstanton. Sedgwick Museum. *a*, part of right valve; *b*, dorsal view.

9. Gault, Folkestone. Sedgwick Museum. Left valve.

10. Gault, Folkestone. British Museum, No. L9665. Right valve.

11. *I. concentricus*, Park. Gault, Folkestone. British Museum, No. L5002. Left valve. (P. 265.)



CRETACEOUS LAMELLIBRANCHIA.

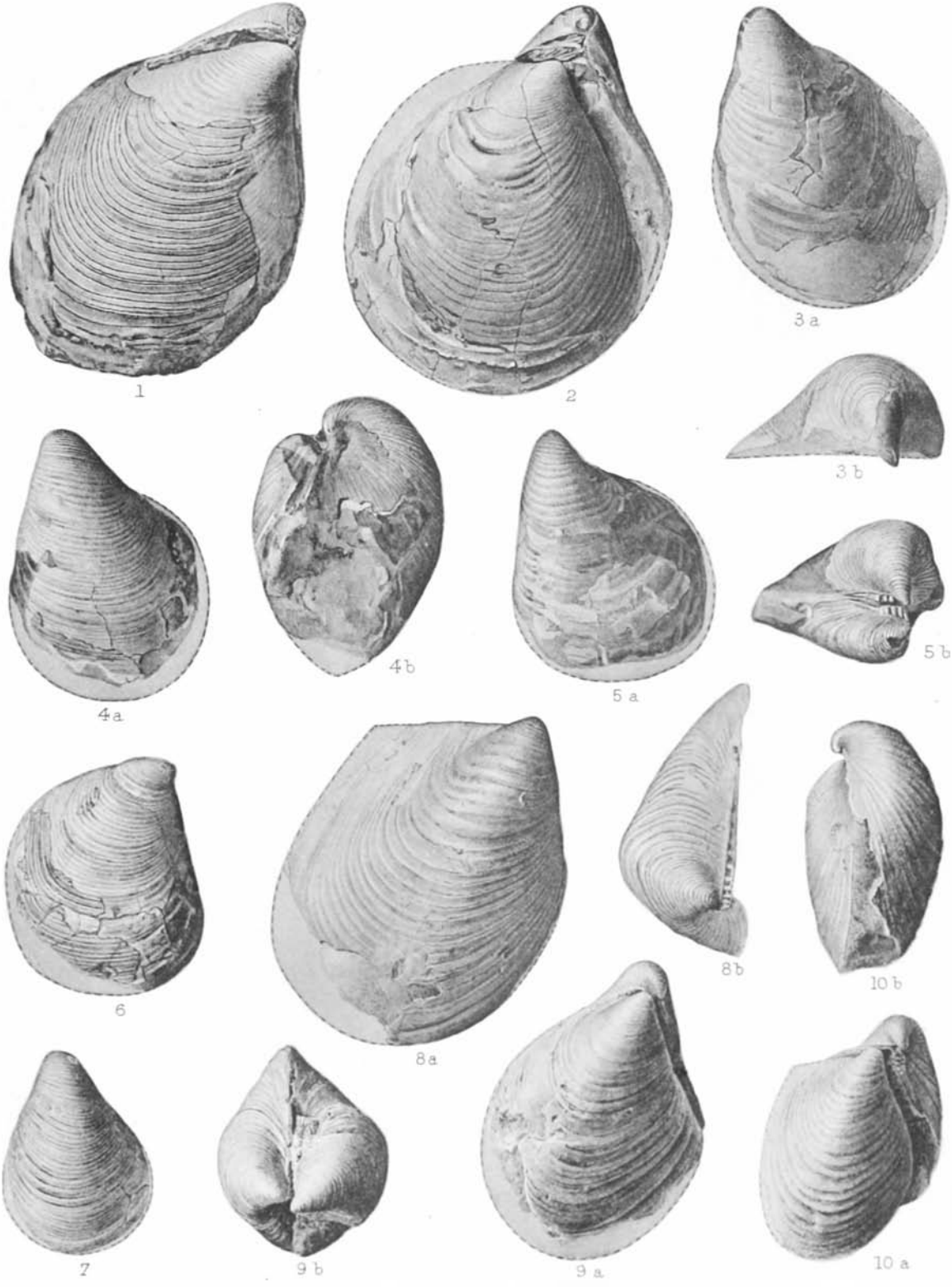
PLATE XLVI.

INOCERAMUS (*continued*).

FIGS.

1—10. *I. concentricus*, Park. 1—7, Gault, Folkestone. 8—10, Upper Greensand, Blackdown. (P. 265.)

1. British Museum, No. L5002. Right valve and umbo of left valve.
2. Sedgwick Museum, Cambridge. Right valve and umbo of left valve.
3. Sedgwick Museum. *a*, left valve; *b*, dorsal view of the same.
4. Sedgwick Museum. *a*, left valve; *b*, anterior view of both valves.
5. Sedgwick Museum. *a*, left valve, *b*, dorsal view of both valves.
6. Sedgwick Museum. Right valve.
7. Sedgwick Museum. Left valve.
8. Museum of Practical Geology, No. 21183. *a*, right valve; *b*, dorsal view of the same.
9. Sedgwick Museum. *a*, right valve and umbo of left valve; *b*, dorsal view of both valves.
10. Bristol Museum. *a*, right valve and part of displaced left valve; *b*, anterior view of both valves.



CRETACEOUS LAMELLIBRANCHIA.

PLATE XLVII.

INOCERAMUS (*continued.*)

FIGS.

1, 2. *I. concentricus*, Park. 1, Upper Greensand, Blackdown. Bristol Museum. Left valve. 2, Red Limestone, Hunstanton. Sedgwick Museum, Cambridge. Left valve. (P. 265.)

3—14. *I. concentricus* var. *subsulcatus*, Wiltsh. Gault, Folkestone. Left valves. (P. 268.)

3, 4. Sedgwick Museum, Cambridge.
5. Museum of Practical Geology, No. 21154.
6. British Museum, No. L5003.
7—9. Sedgwick Museum.
10. British Museum, No. L9664.
11—13. Sedgwick Museum.
14. Museum of Practical Geology, No. 21153.

15—20. *I. sulcatus*, Park. Gault, Folkestone. 15, British Museum, No. L11797; *a*, left valve; *b*, right valve; *c*, dorsal view. 16—20, Sedgwick Museum. 16, 18—20, left valves; 17, anterior view. (P. 269.)

CRETACEOUS LAMELLIBRANCHIA.

PLATE XLVIII.

INOCERAMUS (*continued*).

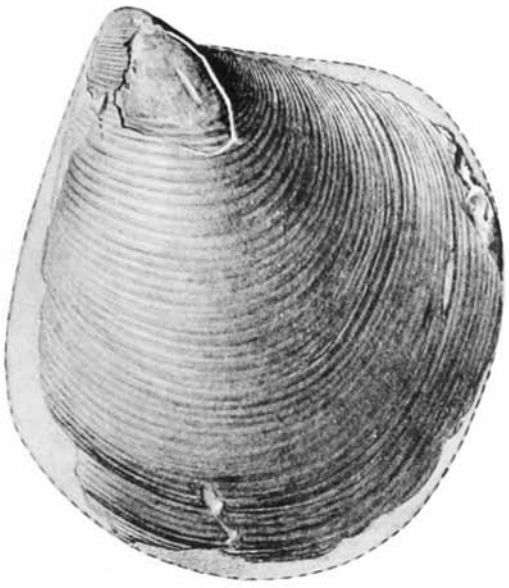
FIGS.

1. *I. tenuis*, Mant. Red Limestone, near Louth. Sedgwick Museum, Cambridge. *a*, left valve; *b*, dorsal view. (P. 271.)

2, 3. *I. Crippsi*, Mant. Upper Greensand (zone of *Pecten asper*), Warminster. (P. 273.)

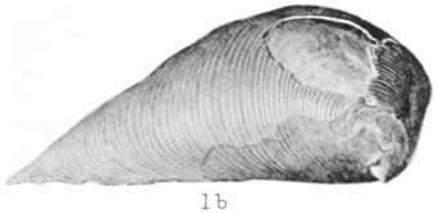
2. Museum of Practical Geology, No. 18898. *a*, right valve; *b*, dorsal view.
3. High variety. Sedgwick Museum. Right valve.

4, 5. *I. Crippsi* var. *reachensis*, Eth. Lower Chalk (zone of *Holaster subglobosus*), Blue Bell Hill, Burham. 4, British Museum, No. L10386. Left valve. 5, Mr. Dibley's Collection. Right valve. (P. 278.)



1a

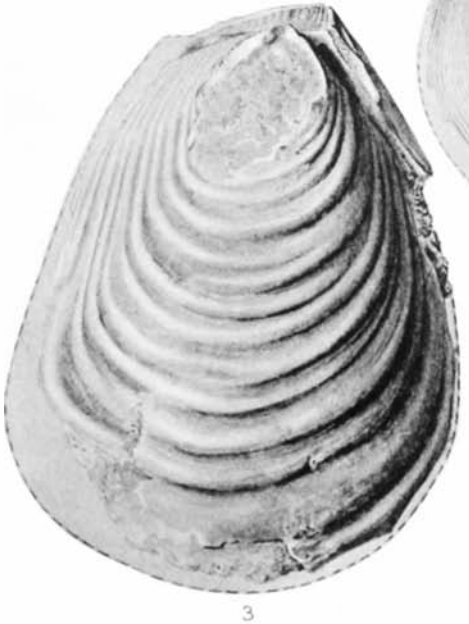
2a



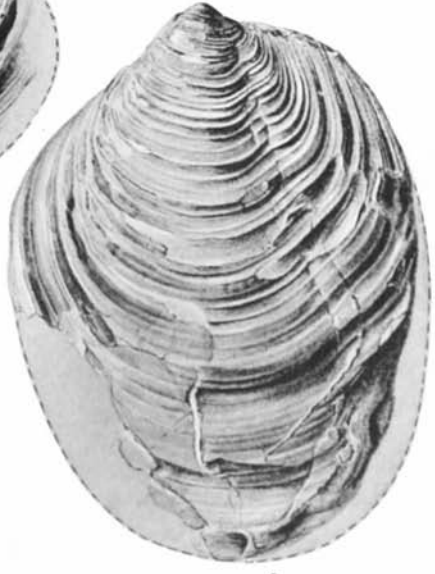
1b

2b

5



3



4

CRETACEOUS LAMELLIBRANCHIA.

PLATE XLIX.

INOCERAMUS (*continued*).

FIGS.

1. *I. Crippsi* var. *reachensis*, Eth. Lower Chalk (zone of *Holaster subglobosus*), Blue Bell Hill, Burham. British Museum, No. L10387. Right valve. (P. 278.)

2—4. *I. Etheridgei*, Woods. Lower Chalk. Sedgwick Museum, Cambridge. (P. 278.)

2. Chalk Marl, Hunstanton. *a*, left valve; *b*, hinge of the same.

3, 4. Totternhoe Stone (zone of *Holaster subglobosus*), Burwell. 3, one of the types; *a*, left valve; *b*, dorsal view of the same. 4, Right valve.

5, 6. *I. pictus*, Sow. Lower Chalk. (P. 279.)

5. Zone of *Holaster subglobosus*, Burham. British Museum, No. 44683. Right valve.

6. Locality unknown. British Museum, No. L22259. Left valve.

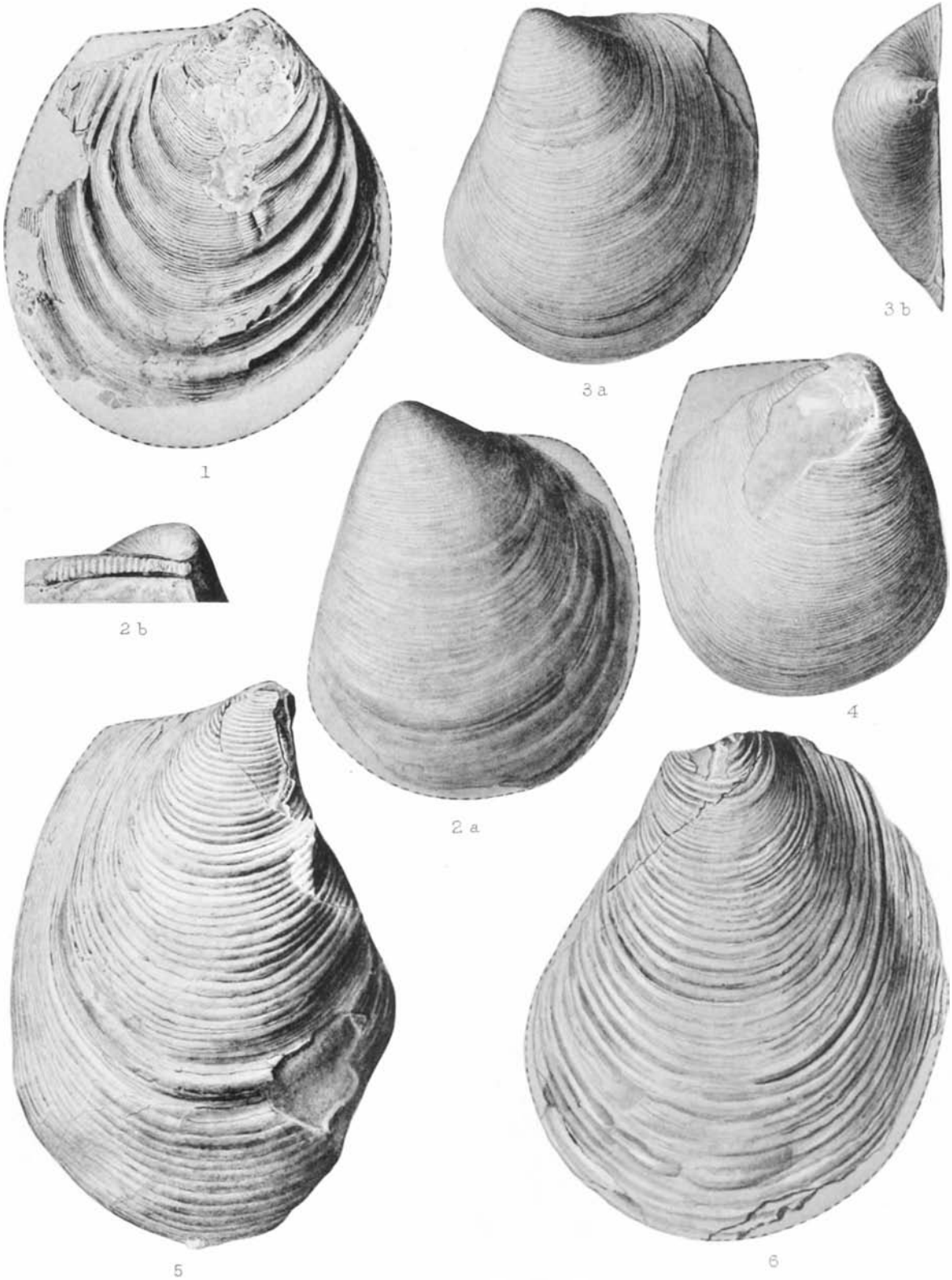

1
2 b
3 a
3 b
2 a
4
5
6

PLATE L.

Inoceramus (*continued*).

Figs.

1—6. *I. labiatus* (Schloth.). Middle Chalk. (P. 281.)

1. Locality unknown. British Museum, No. L20943. Left valve.

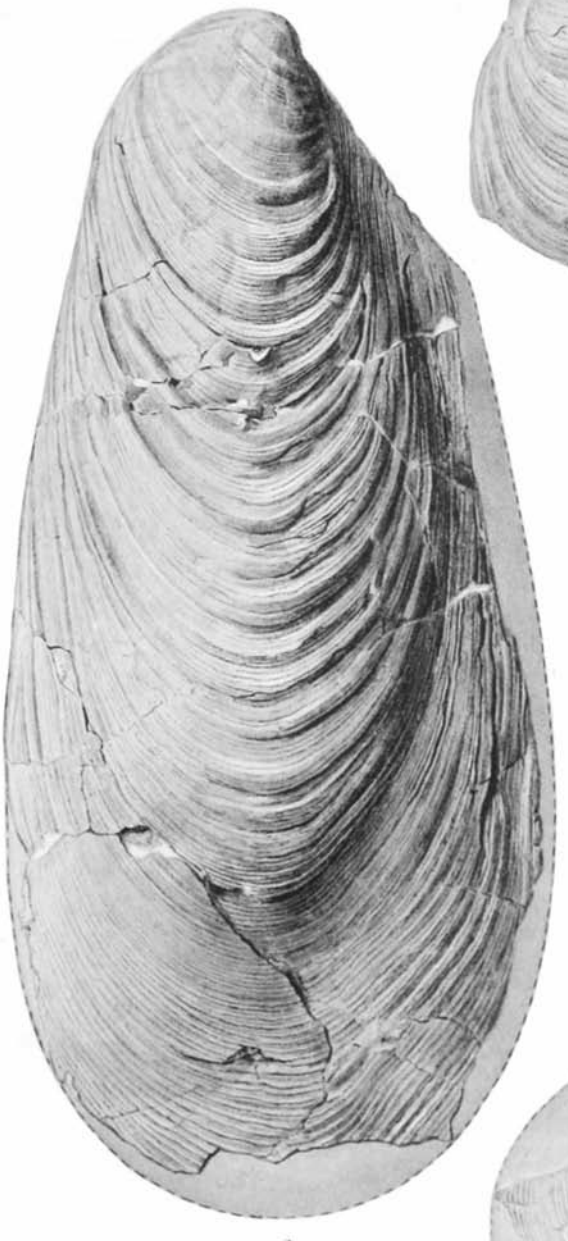
2, 3. Eastbourne. Sedgwick Museum. 2, Left valve. 3, Right valve.

4. Zone of *Rhynchonella Cuvieri*, Blanc Nez, Pas de Calais. Sedgwick Museum. Hinge and anterior margin of right valve.

5. Plumpton. British Museum, No. 5861. The specimen figured by Mantell, Foss. S. Downs, pl. xxvii, fig. 3, p. 216. Right valve.

6. Middle Chalk, near Warminster. Dr. Blackmore's Collection. Right valve.

2



1

5

4

3

6

PLATE LI.

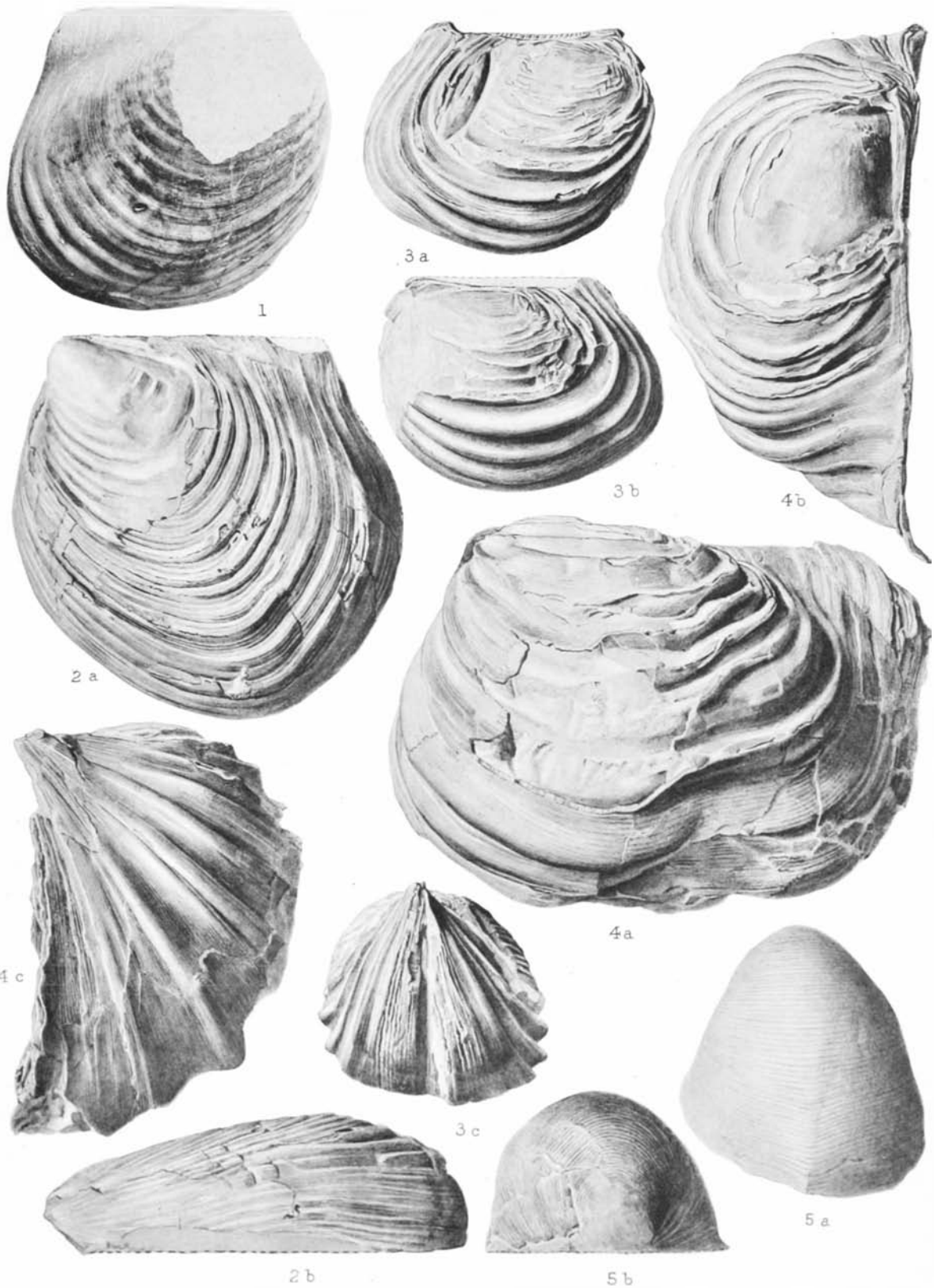
INOCERAMUS (*continued.*)

FIGS.

1—4. *I. inconstans*, Woods. Upper Chalk. (P. 285.)

1. Sussex (probably from the zone of *Terebratulina lata* of Malling). British Museum, No. L20955. The original of *I. Lamarcki*, Sowerby, in Dixon, 'Geol. Sussex,' pl. xxviii, fig. 29. Right valve.
2. Zone of *Holaster planus*, Swaffham, Norfolk. Norwich Museum. *a*, left valve; *b*, anterior view of the same.
3. Zone of *Actinocamax quadratus*, East Harnham, Salisbury. Dr. Blackmore's Collection. *a*, right valve; *b*, left valve; *c*, posterior view of both valves.
4. Same zone, etc. *a*, left valve; *b*, dorsal view; *c*, anterior view.

5. *I. inconstans* var. *striatus*, Mant. Zone of *Micraster cor-anguinum*, Southeram. British Museum, No. 4768. The Type of *I. striatus*, Mant. *a*, left valve; *b*, dorsal view of the same. (P. 292.)



CRETACEOUS LAMELLIBRANCHIA.

PLATE LII.

INOCERAMUS (*continued*).

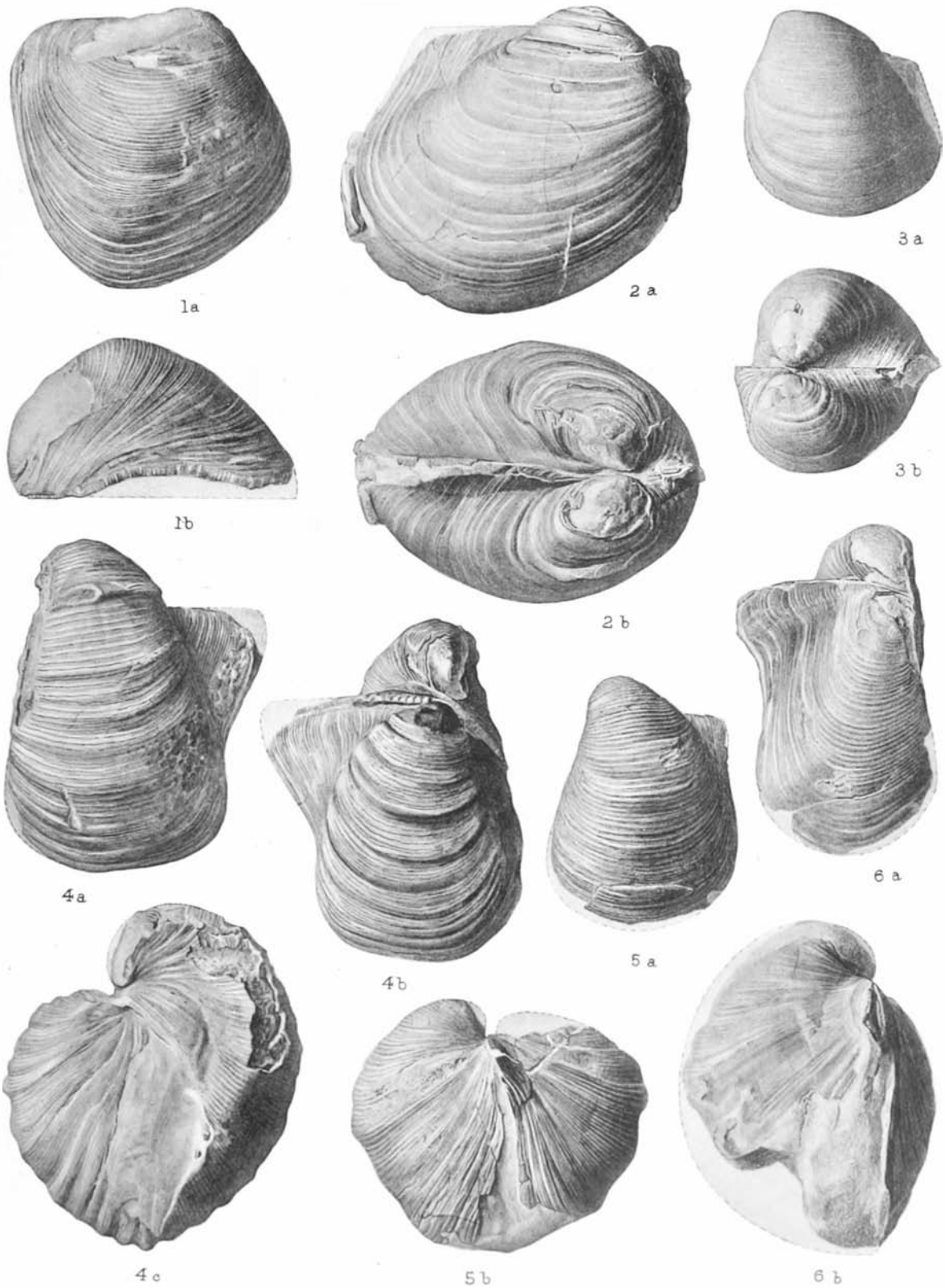
FIGS.

1. *I. inconstans* var. *striatus*, Mant. Upper Chalk, Norfolk (probably zone of *Holaster planus*, Swaffham). Norwich Museum. *a*, right valve; *b*, posterior view. (P. 292.)

2, 3. *I. inconstans* var. *sarumensis*, Woods. Zone of *Actinocamax quadratus*, East Harnham. Dr. Blackmore's Collection. 2*a*, right valve; 2*b*, dorsal view; 3*a*, left valve; 3*b*, dorsal view. (P. 293.)

4—6. *I. Lamarcki*, Park. Zone of *Holaster planus*. (P. 307.)

4. Newmarket. Sedgwick Museum, Cambridge. *a*, left valve; *b*, right valve with umbo of left valve; *c*, anterior view.
5. Stonehall pit, Dover. Collieries' Museum, Dover, No. 2134. *a*, left valve; *b*, posterior view.
6. Shakespeare's Cliff, Dover. Collieries' Museum, Dover, No. 2133. *a*, right valve with umbo of left valve; *b*, posterior view.



CRETACEOUS LAMELLIBRANCHIA

A. Brock. del.

London Stereoscopic Co. In

PLATE LIII.

INOCERAMUS (*continued*).

FIGS.

1, 2. *I. Lamarcki* var. *Websteri*, Mant. Upper Chalk. (P. 318.)

1. Upper part of zone of *Holaster planus*, Borstal pit. Mr. Dibley's Collection. Right valve.
2. Zone of *Micraster cor-testudinarium*, Chelsham, Surrey. British Museum, No. L2176. *a*, right valve (the anterior part concealed by flint); *b*, posterior view.

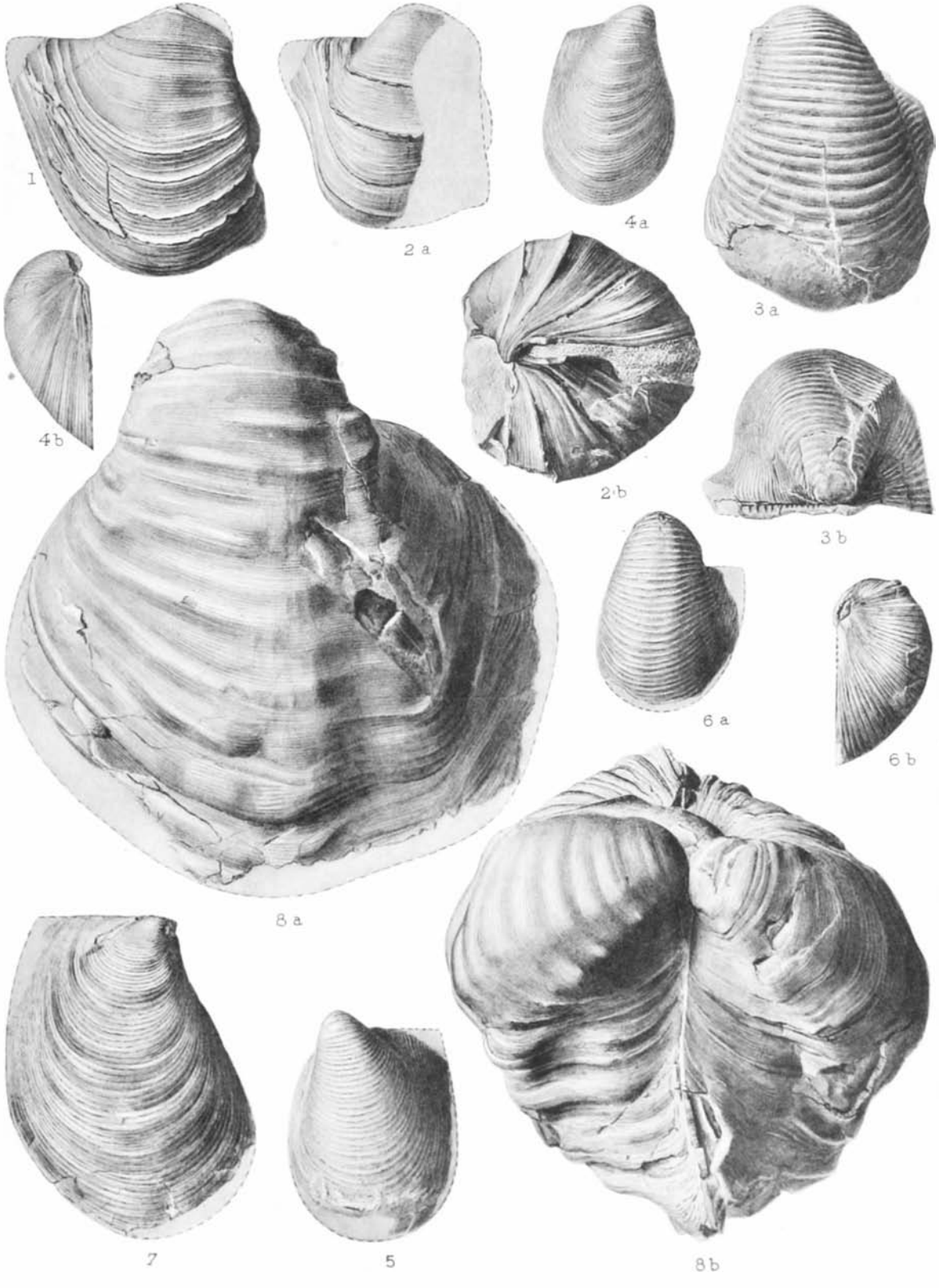
3. *I. Lamarcki*, Park. Southeram, Lewes (probably zone of *Holaster planus*). British Museum, No. 4767. The Type of *I. undulatus*, Mant. *a*, left valve; *b*, dorsal view. (P. 319.)

4—6. *I. Lamarcki* var. *apicalis*, Woods. (P. 319.)

4. Zone of *Rhynchonella Cuvieri*, Hitchin. Sedgwick Museum. *a*, right valve; *b*, anterior view.
5. Zone of *Rhynchonella Cuvieri*, Peter's pit, Burham. Mr. Dibley's Collection. Left valve.
6. Zone of *Holaster planus*, Newmarket. Sedgwick Museum. *a*, left valve; *b*, anterior view.

7. *I. Lamarcki* var. *Cuvieri*, Sow. Zone of *Terebratulina lata*, Royston. Sedgwick Museum. Right valve. (P. 320.)

8. *I. cordiformis*, Sow. Zone of *Micraster cor-anguinum*, Gravesend. British Museum, No. 43277. The Type. *a*, left valve; *b*, dorsal view of both valves. (P. 334.)



CRETACEOUS LAMELLIBRANCHIA

PLATE LIV.

INOCERAMUS (*continued*).

FIGS.

1. *I. Lamarcki*, Park., *var.* Swaffham, Norfolk (probably zone of *Holaster planus*). Variety connecting *I. Lamarcki* with *I. cordiformis*. Norwich Museum, No. 3298. *a*, right valve; *b*, anterior view. (P. 335.)

2—4. *I. cordiformis*, Sow. Upper Chalk. (P. 334.)

2. Zone of *Micraster cor-anguinum*, Gravesend. Sedgwick Museum. Right valve.

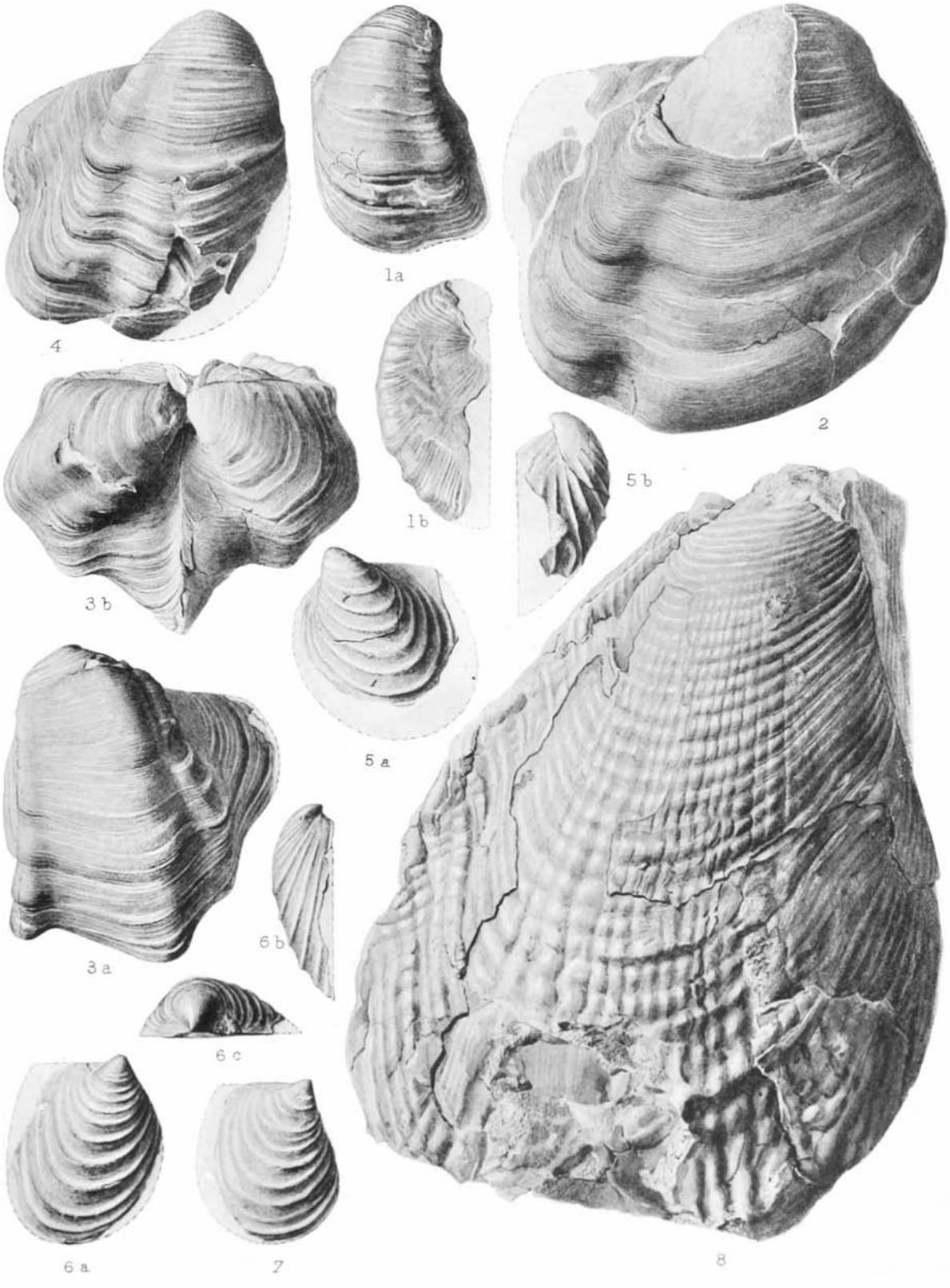
3, 4. Same zone, Micheldever. Dr. Blackmore's Collection. 3*a*, left valve; 3*b*, dorsal view of both valves; 4, right valve.

5—7. *I. costellatus*, Woods. Chalk Rock. (P. 336.)

5. Cuckhamsley. Sedgwick Museum. *a*, left valve; *b*, anterior view.

6, 7. Blount's Farm, Marlow. Museum of Practical Geology, Nos. 25510, 25511. 6*a*, right valve; 6*b*, anterior view; 6*c*, dorsal view; 7, right valve.

8. *I. tuberculatus*, Woods. Upper Chalk (zone of *Actinocamax quadratus*), Brighton. Brighton Museum. Part of right valve. (P. 302.)



CRETACEOUS LAMELLIBRANCHIA.

PLATE LV.

Genus—OSTREA, *Linnæus*.

FIGS.

1—3. *O. Walkeri*, Keep. Lower Greensand, Upware. Sedgwick Museum, Cambridge. (P. 360.)

1. The Type. *a*, right valve; *b*, left valve; *c*, anterior view.
2, 3. Interiors of left valves.

4—9. *O. vesicularis*, Lam. (P. 360.)

4. Probably zone of *Holaster planus*, Swaffham, Norfolk. Norwich Museum, No. 3290. Young individual attached to *Micraster*. Right valve and portion of left valve.
5. Gault, Folkestone. Sedgwick Museum. *a*, right valve; *b*, anterior view showing left valve almost entirely attached to a flat portion of *Inoceramus*.
6. Zone of *Belemnitella mucronata*, Norwich. Dr. Rowe's Collection. Attached obliquely to a *Belemnitella*. *a*, right valve; *b*, anterior view.
7. Zone of *Actinocamax quadratus*, East Harnham. Dr. Blackmore's Collection. *a*, right valve; *b*, anterior view showing the larger part of the left valve attached to a flat *Inoceramus*.
8, 9. Zone of *Holaster subglobosus*, Blue Bell Hill, Burham. British Museum, Nos. L 10408, L 10409. 8, 9*a*, left valves; 9*b*, dorsal view of 9*a*, showing the small surface of attachment.

10—14. *O. vesiculosa* (Sow.) Upper Greensand. Left valves. (P. 374.)

10. Zone of *Pecten asper*, Ballard Down. Sedgwick Museum. *b*, posterior view.
11. Zone of *Pecten asper*, Warminster. Museum of Practical Geology, No. 25942.
12. Zone of *Schlœnbachia rostrata*, Isle of Wight. Same museum, No. 25936. *b*, posterior view.
13. Zone of *Schlœnbachia rostrata*, Potterne. Same museum, No. 25932, *b*, posterior view.
14. Zone of *Schlœnbachia rostrata*, Dinton. Same museum, No. 25938. *b*, posterior; *c*, interior.


1a


1b.


1c


2


3


5a


5b


6a


6b


4


7a


7b


8


9a


9b


10a


10b


11


12a


12b


13a


13b


14a


14b


14c

PLATE LVI.

OSTREA (*continued*).

FIGS.

1. *O. vesiculosa* (Sow.). Upper Greensand (zone of *Schlœnbachia rostrata*), Dinton. Museum of Practical Geology, No. 25937. *a*, left valve; *b*, posterior view. (P. 374.)

2—16. *O. canaliculata* (Sow.). (P. 375.)

2. Gault, Folkestone. Museum of Practical Geology, No. 20819. *a*, left valve; *b*, right valve.

3—5. Gault, Folkestone. British Museum, Nos. L 4927, L 23044. 3*a*, left valve; 3*b*, dorsal view. 4, interior of left valve. 5, interior of right valve.

6. Upper Greensand (zone of *Pecten asper*), Warminster. Sedgwick Museum. *a*, left; *b*, right valve.

7. Zone of *Holaster subglobosus*, Burwell. Sedgwick Museum. Left valve.

8. Melbourn Rock, Hitchin. Sedgwick Museum. *a*, left valve; *b*, anterior view.

9. *Uintacrinus* band, Devizes Road, Salisbury. Dr. Blackmore's Collection. Left valve.

10, 11. Zone of *Actinocamax quadratus*, East Harnham. Dr. Blackmore's Collection. 10*a*, left valve; 10*b*, portion × 5. 11*a*, right valve and part of left valve; 11*b*, posterior view.

12. Same horizon and collection. West Harnham. *a*, left valve; *b*, posterior view.

13. Zone of *Actinocamax quadratus*, Marwell, Hants. Sedgwick Museum. Left valve.

14, 15. Zone of *Belemnitella mucronata*, Norwich. Dr. Rowe's Collection. 14*a*, 15*a*, left valves; 14*b*, 15*b*, right valves and parts of left valves.

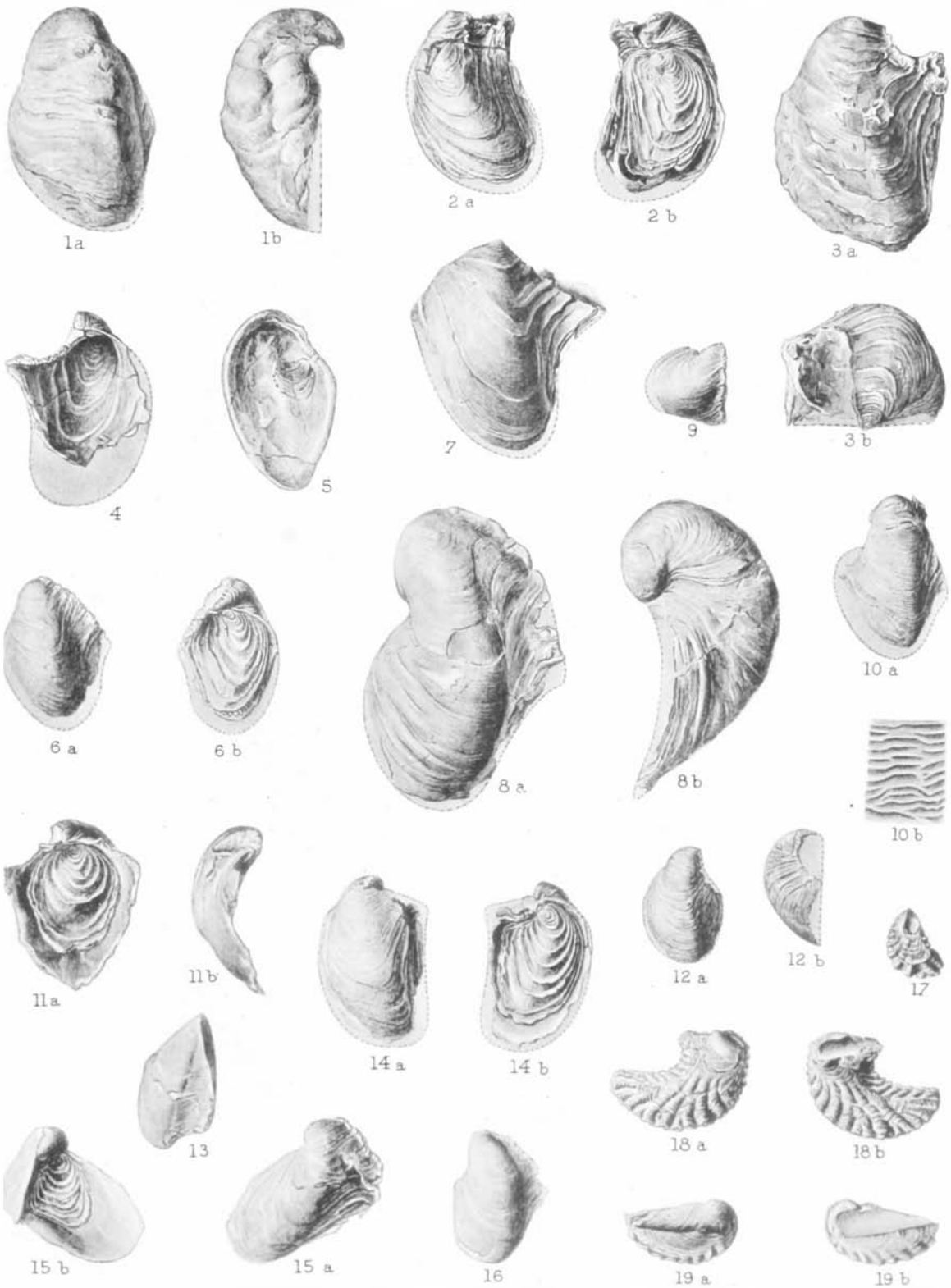
16. Zone of *Belemnitella mucronata*, Alderbury Well. Dr. Blackmore's Collection. Left valve.

17—19. *O. semiplana*, Sow. Upper Chalk. (P. 379.)

17. Zone of *Belemnitella mucronata*, Norwich. Norwich Museum, No. 2135. Left valve.

18. Same horizon, locality and museum. No. 2130. *a*, right valve; *b*, left valve.

19. *Uintacrinus* band, Thanet coast. Dr. Rowe's Collection. *a*, right valve; *b*, left valve.



CRETACEOUS LAMELLIBRANCHIA.

PLATE LVII.

OSTREA (*continued*).

FIGS.

1—13. *O. semiplana*, Sow. Upper Chalk. (P. 379.)

1—4 Zone of *Belemnitella mucronata*, Norwich. Norwich Museum. 1*a*, 2*a*, 3*a*, 4*a*, right valves. 1*b*, 2*b*, 3*b*, 4*b*, left valves.

5. *Uintacrinus* band, Thanet Coast. Dr. Rowe's Collection. *a*, left valve; *b*, interior of the same; *c*, right valve of the same specimen.

6. Zone of *Belemnitella mucronata*, Hartford Bridge, Norwich. Dr. Rowe's Collection. *a*, right valve; *b*, left valve.

7. Same zone, Norwich. Norwich Museum. *a*, left valve; *b*, interior of the same.

8, 9. *Uintacrinus* band, Thanet coast. Dr. Rowe's Collection. 8, 9*a*, right valves; 9*b*, left valve.

10—12. Zone of *Belemnitella mucronata*, Norwich. Sedgwick Museum, Cambridge. 10, 11*a*, 12, right valves; 11*b*, left valve; 12*b*, posterior view of 12*a*.

13. Same zone and locality. Norwich Museum, No. 2130. Right valve.

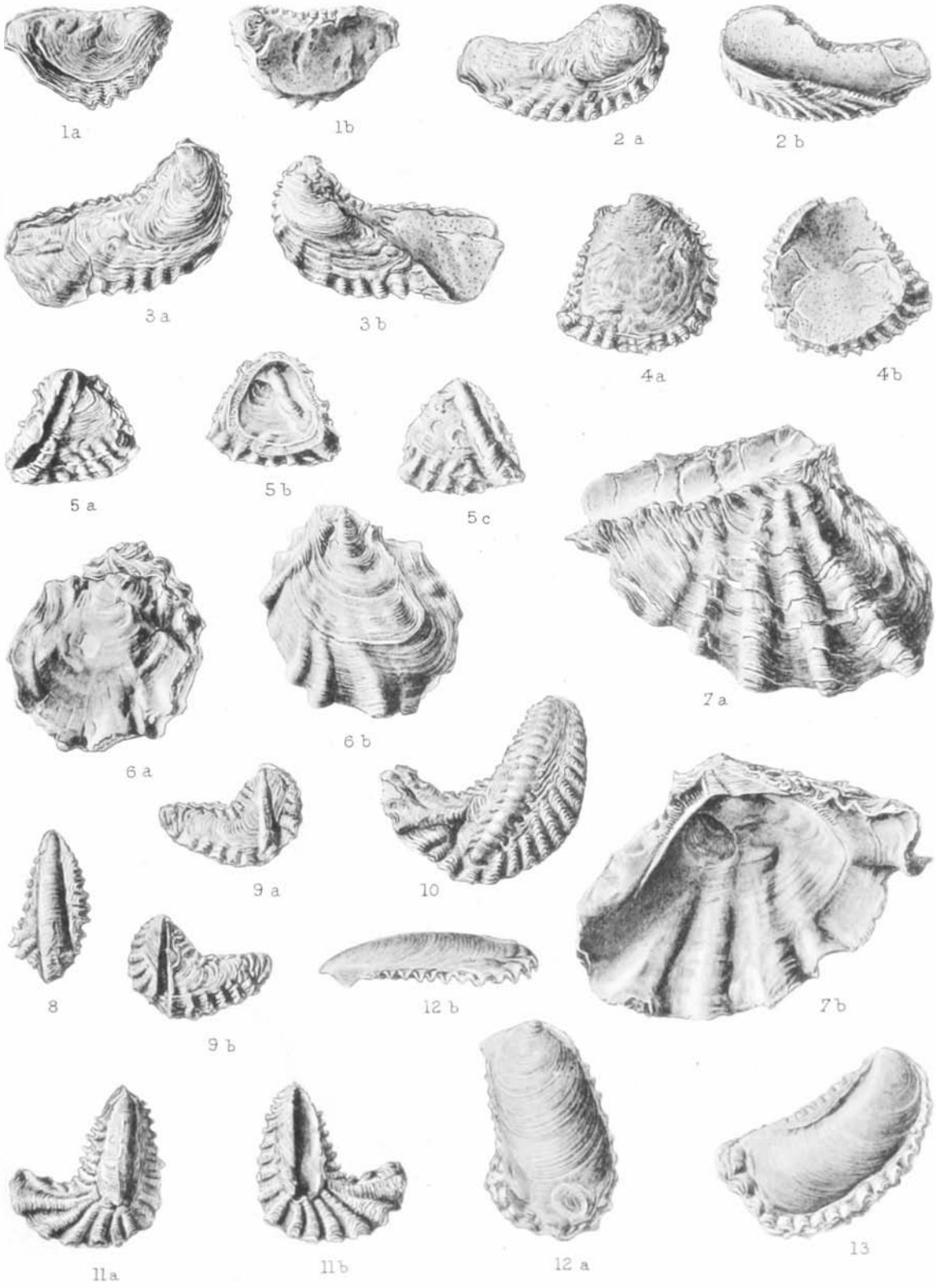

1a
1b
2 a
2 b
3 a
3 b
4a
4b
5 a
5 b
5 c
6 a
6 b
7 a
8
9 a
9 b
10
12 b
7 b
11a
11b
12 a
13

PLATE LVIII.

OSTREA (*continued*).

FIGS.

1—5. *O. semiplana*, Sow. Zone of *Belemnitella mucronata*, Norwich. (P. 379.)

1. Sedgwick Museum. *a*, right valve; *b*, anterior view.
2. Norwich Museum, No. 2129. *a*, right valve; *b*, left valve; *c*, anterior view.
3. Dr. Rowe's Collection. Right valve.
4. Norwich Museum. One of the types of *O. alæformis*, Woodward (pl. vi, fig. 3). *a*, right valve; *b*, interior.
5. Norwich Museum, No. 2085. Right valve.

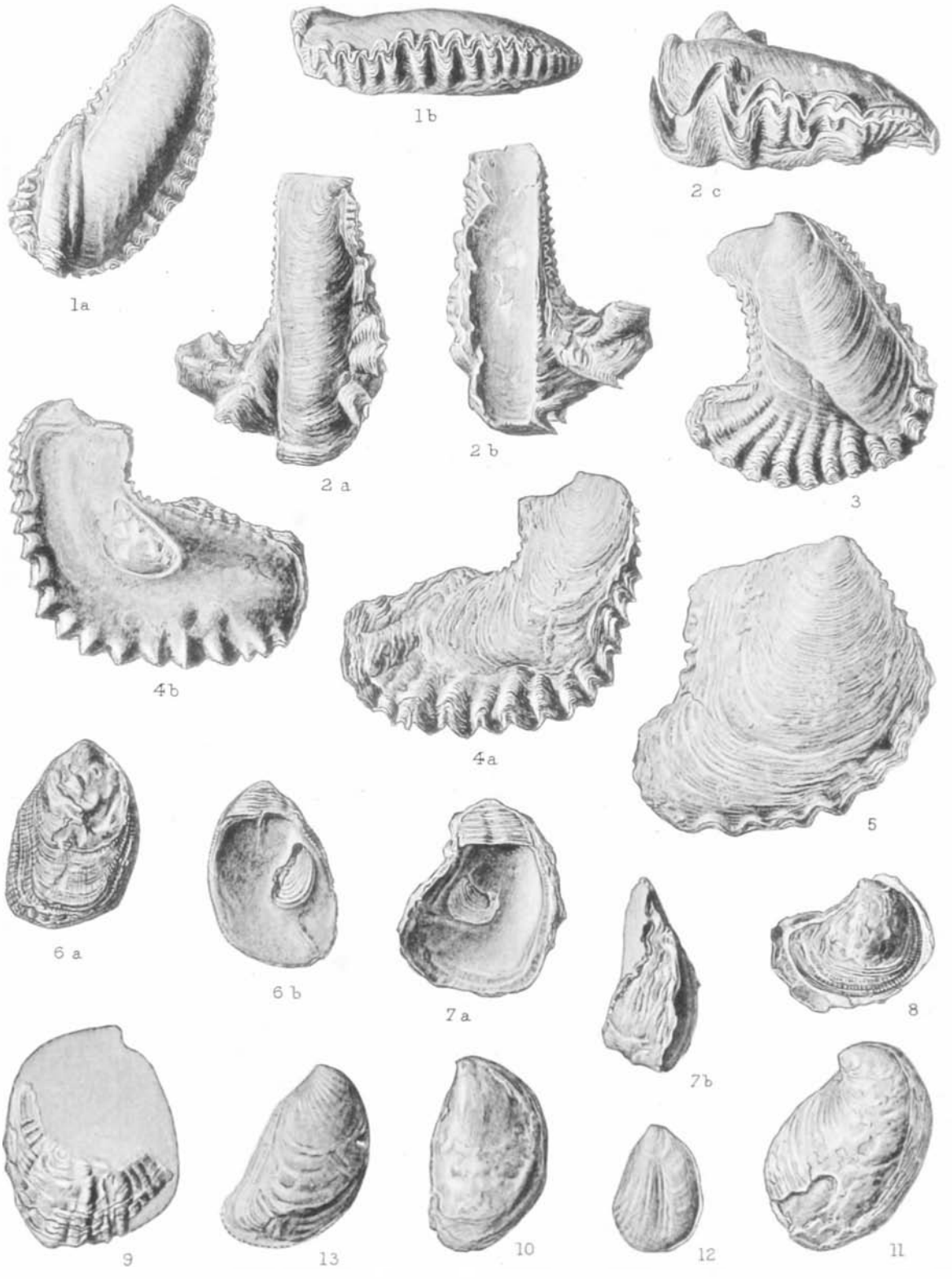
6—9. *O. sarumensis*, Woods. Zone of *Actinocamax quadratus*, East Harnham. Dr. Blackmore's Collection. 6, right valve; 7*a*, 9, left valves; 7*b*, posterior view of 7*a*; 8, right valve. (P. 387.)

10—13. *O. incurva*, Nilss. Right valves. (P. 388.)

10, 11. Totternhoe Stone (zone of *Holaster subglobosus*), Burwell. Sedgwick Museum.

12. Zone of *Terebratulina lata*, South Devon Coast. Dr. Rowe's Collection.

13. Zone of *Actinocamax quadratus*, East Harnham. Dr. Blackmore's Collection.



CRETACEOUS LAMELLIBRANCHIA.

PLATE LIX.

OSTREA (*continued*).

FIGS.

1—16. *O. incurva*, Nilsson. Upper Chalk. Right valves, except 13*c*. (P. 388.)

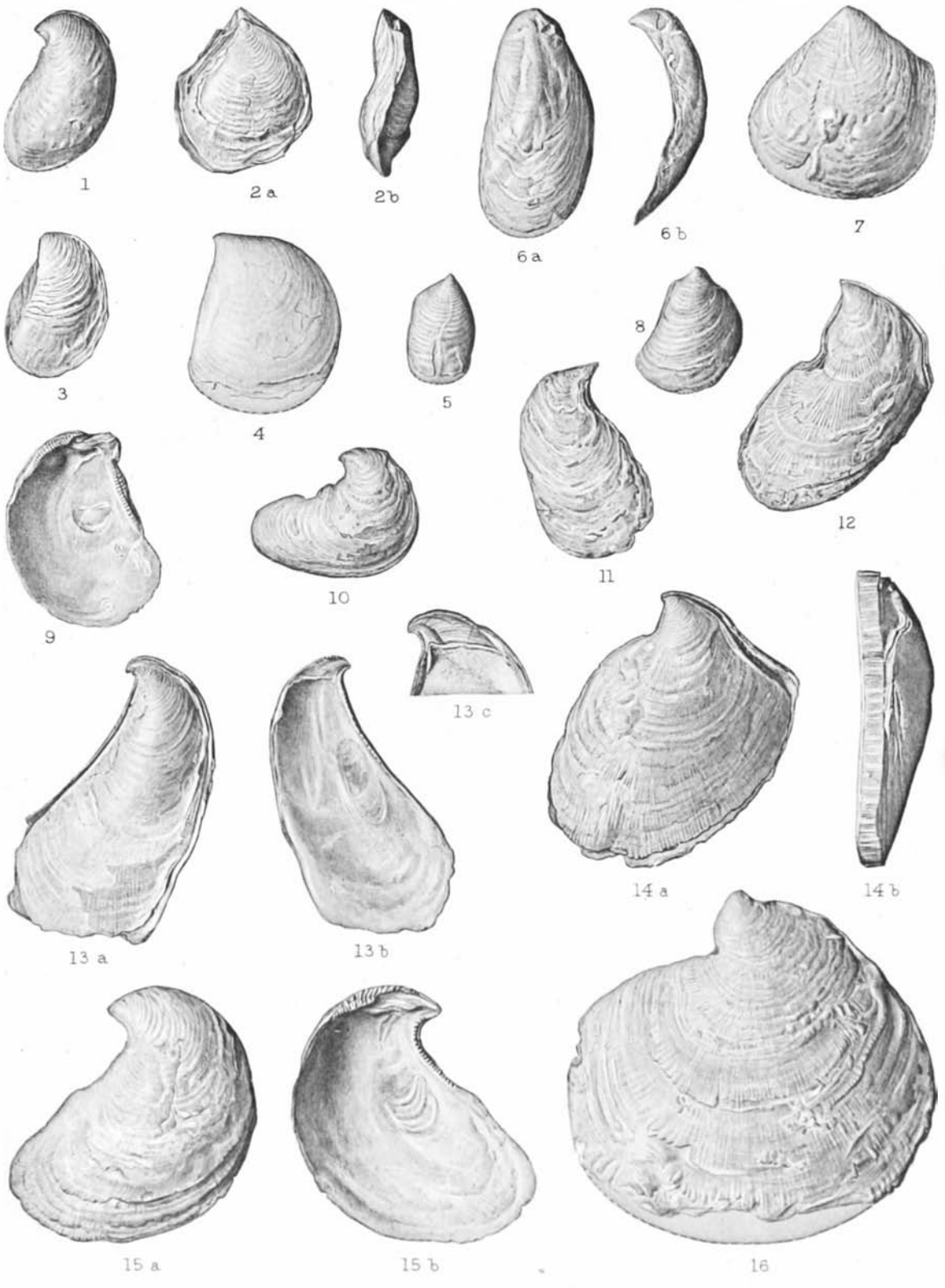
1. Zone of *Micraster cor-anguinum*, Croydon. Sedgwick Museum.

2, 3. *Uintacrinus* band, Devizes Road, Salisbury. 2*b*, posterior view of 2*a*. Dr. Blackmore's Collection.

4, 5. Zone of *Actinocamax quadratus*, Whaddon. Dr. Blackmore's Collection.

6—11. Zone of *Actinocamax quadratus*, East Harnham. Dr. Blackmore's Collection. 6*b*, posterior view of 6*a*.

12—16. Zone of *Belemnitella mucronata*, Norwich. 12, Museum of Practical Geology, No. 25983; the left valve is entirely attached to a slightly convex surface. 13, Dr. Rowe's Collection; 13*b*, interior of right valve 13*a*; 13*c*, area and hinge of left valve. 14, Norwich Museum. Type of *O. triangularis*, Woodward, pl. vi, fig. 7; 14*b*, posterior view showing portion of *Inoceramus* to which the left valve was entirely attached. 15, Norwich Museum; exterior and interior of a right valve. 16, Sedgwick Museum, Cambridge.



CRETACEOUS LAMELLIBRANCHIA.

PLATE LX.

OSTREA (*continued*).

FIGS.

1—15. *O. Boucheroni*, Coq. Upper Chalk. (P. 391.)

1. Zone of *Actinocamax quadratus*, Wield. Mr. Brydone's Collection. Left valve. 1*b*, posterior view.

2–4. Zone of *Marsupites testudinarius*, Brighton. 2, 3, Brighton Museum. 4, British Museum, No. L 11795. Left valves. 3*b*, posterior view of 3*a*.

5. *Uintacrinus* band, Thanet coast. Dr. Rowe's Collection. *a*, left valve; *b*, right valve; *c*, anterior view.

6. Zone of *Marsupites testudinarius*, Brighton. Brighton Museum, *a*, left valve; *b*, posterior view; *c*, right valve.

7. Zone of *Micraster cor-anguinum*, Loam Pit Hill, Lewisham. Sedgwick Museum. Left valve.

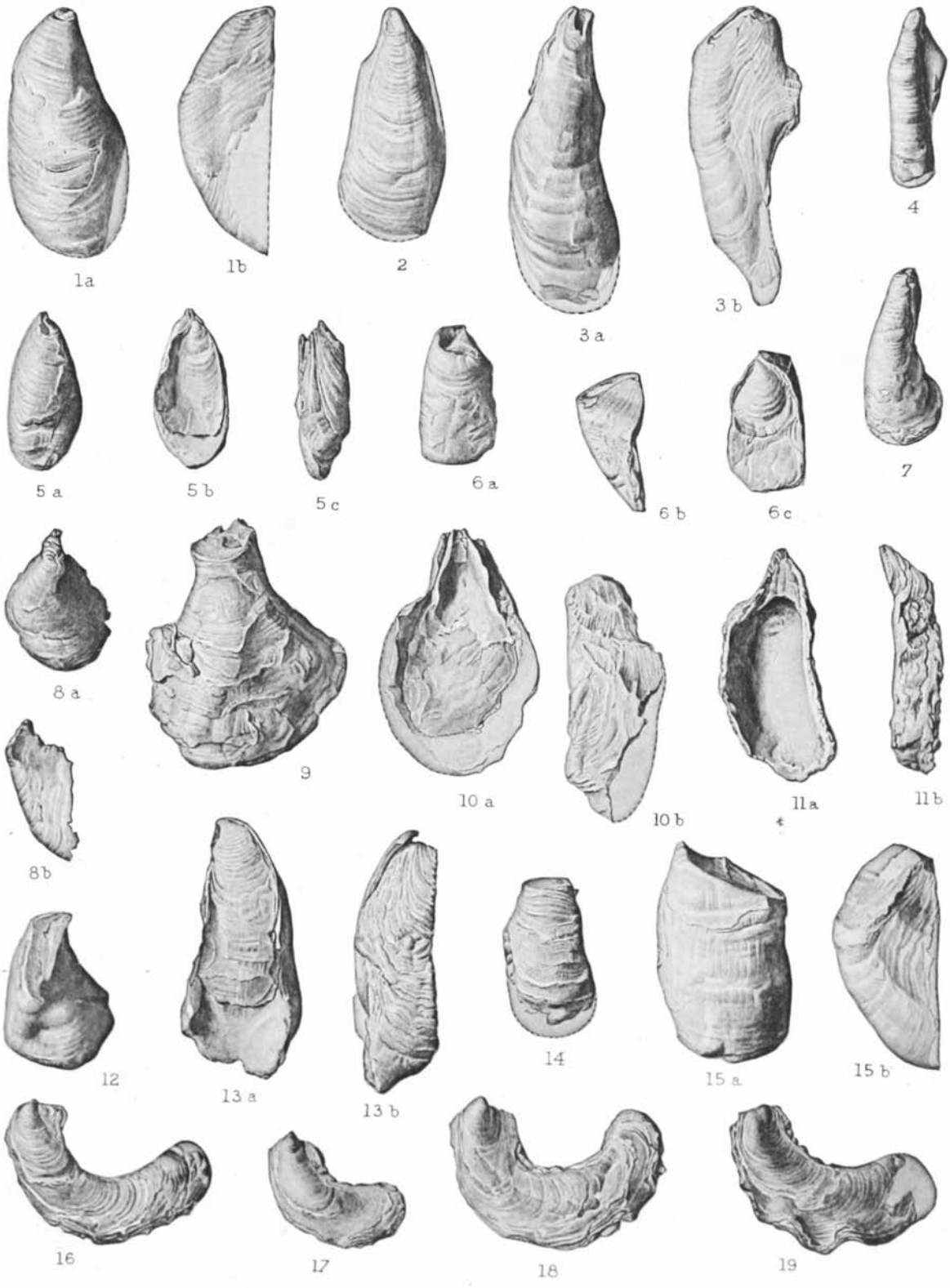
8, 9. Zone of *Micraster cor-anguinum*, Gravesend. 8, Museum of Practical Geology, No. 25977. 9, Sedgwick Museum. Left valves; 8*b*, posterior view of 8*a*.

10—13. *Uintacrinus* band, Thanet coast. Dr. Rowe's Collection. 10*a*, right valve and margin of left valve; 10*b*, posterior view of 10*a*. 11, left valve with large surface of attachment; *b*, posterior view. 12, left valve. 13*a*, right valve; 13*b*, anterior view of both valves showing large surface of attachment.

14. Zone of *Micraster cor-anguinum*, Loam Pit Hill, Lewisham. Sedgwick Museum. Left valve.

15. *Uintacrinus* band, Devizes Road, Salisbury. Dr. Blackmore's Collection. Left valve. *b*, posterior view.

16—19. *O. lunata*, Nilss. Zone of *O. lunata*, Trimingham. Mr. R. M. Brydone's Collection. Left valves. (P. 393.)



CRETACEOUS LAMELLIBRANCHIA.

PLATE LXI.

OSTREA (*continued*).

FIGS.

1—6. *O. lunata*, Nilss. Zone of *O. lunata*, Trimingham. 1, 5, 6, Mr. R. M. Brydone's Collection. 2—4, Sedgwick Museum. 1*a*, 2—5*a*, 6*a*, left valves. 1*b*, right valve of 1*a*; 1*c*, anterior view of 1*a*. 5*b*, right valve of 5*a*. 6*b*, anterior view of 6*a*. (P. 393.)

Genus—EXOGYRA, *Say*.

7—11. *E. tuberculifera*, Koch and Dunk. Lower Greensand. (P. 404.)

7. Crackers, Atherfield. British Museum, No. L 6461. *a*, right valve; *b*, left valve.

8. *Perna*-bed, East Shalford. Sedgwick Museum. Left valve.

9—11. Hythe Beds, Lympne. Museum of Practical Geology, Nos. 25957, 25958, 25968. Left valves. 11*a*, interior of 11*b*.

12. *E. sigmoidea*, Reuss. Zone of *Micraster cor-anguinum*, Boxford. Mr. Ll. Treacher's Collection. Right valve. (P. 419.)

13. *E. sinuata* (Sow.). *Perna*-bed, Atherfield. British Museum, No. L 6306. Left valve. Variety of the *lævigata* form with ribs. (P. 395.)

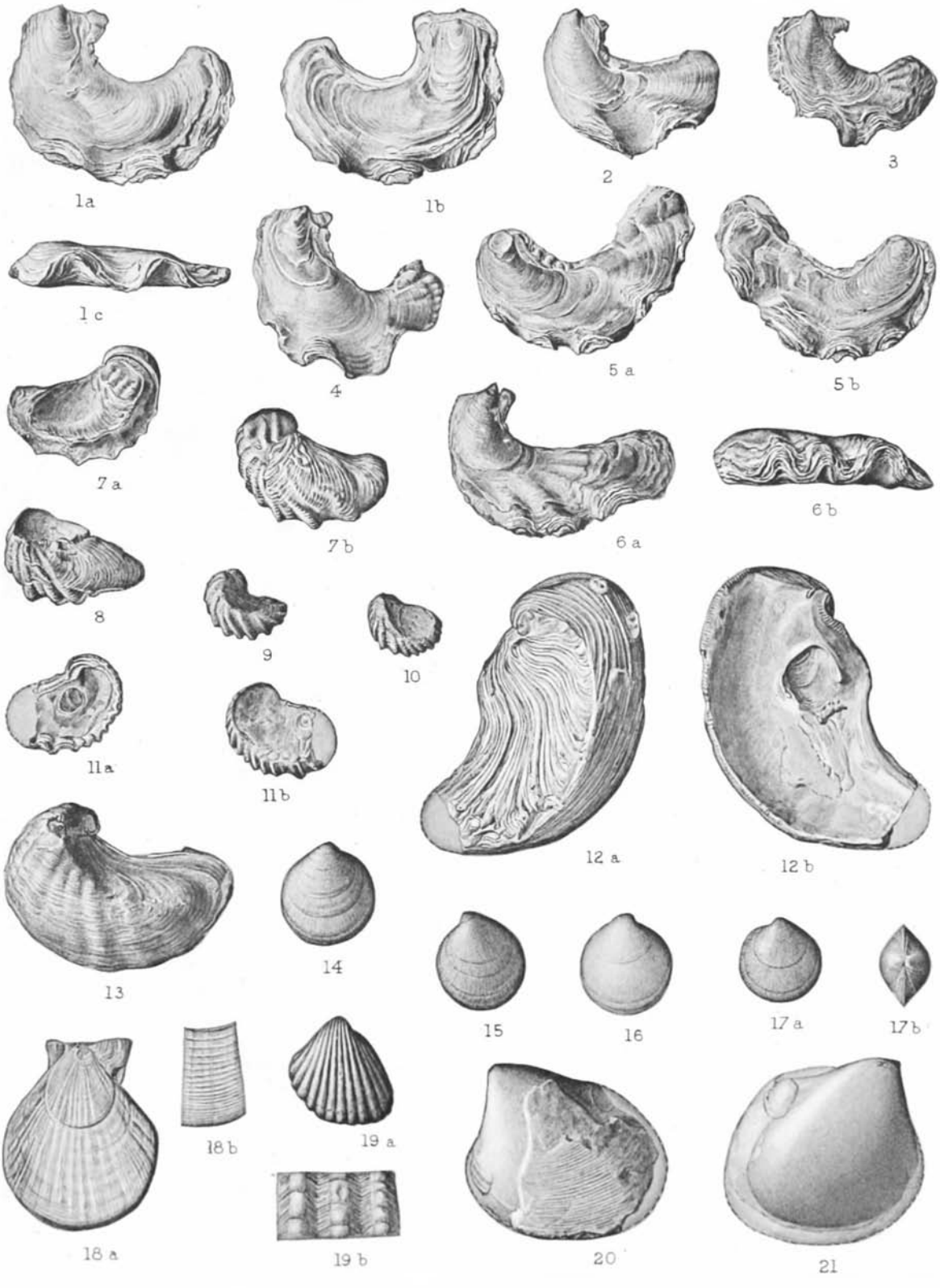
Supplementary figures.

14—17. *Crenella orbicularis* (Sow.). Upper Greensand (zone of *Schlœnbachia rostrata*), Blackdown. Sedgwick Museum. 14, 16, right valves. 15, 17*a*, left valves. 17*b*, dorsal view of 17*a*. × 2. (P. 423.)

18. *Pecten* (*Chlamys*) *britannicus*, Woods. Zone of *Micraster cor-anguinum*, Bromley. Sedgwick Museum. *a*, right valve; *b*, portion above the middle of the valve × 5. (P. 424.)

19. *Lima* (*Limea ?*) sp. Speeton Clay, Speeton. Sedgwick Museum. *a*, right valve; *b*, portion × 6. (P. 425.)

20, 21. *Crassatellites ? equisulcatus* (Woods). Chalk Rock, Cuckhamsley. Sedgwick Museum. 20, left valve; 21, internal cast of right valve. (P. 426.)



CRETACEOUS LAMELLIBRANCHIA.

PLATE LXII.

Supplementary Figures.

FIGS.

1. *Crassatellites? equisulcatus* (Woods). Chalk Rock, Cuckhamsley. Sedgwick Museum. Internal cast. *a*, right valve; *b*, dorsal view. (P. 426.)

2, 3. *Cyprina Meyeri*, Woods. *Perna*-bed, Sandown. 2, Sedgwick Museum. 2*a*, left valve; *b*, dorsal view; *c*, hinge. 3, Museum of Practical Geology, No. 16747. Right valve. (P. 427.)

4. *Cyprina? rectiana* (Forb.). Lower Greensand (Crackers), Atherfield. Sedgwick Museum. *a*, left valve; *b*, dorsal view; *c*, portion × 4. (P. 427.)

5, 6. *Unicardium? compressum*, Woods. Lower Greensand (Crackers), Atherfield. Sedgwick Museum. 5*a*, 6, left valves. 5*b*, dorsal view of 5*a*. (P. 428.)

7—9. *Unicardium? Mailleanum* (d'Orb.). Base of Chalk (zone of *Schlœnbachia varians*). 7, Beaminster; Oxford Museum; right valve. 8, Cerne Abbas; Oxford Museum; left valve, internal cast. 9, Maiden Newton. Sedgwick Museum. *a*, left valve; *b*, dorsal view. (P. 428.)

10. *Tellina? phaseolina* (Phill.). Speeton Clay, Speeton. York Museum. Perhaps the type. Internal cast. *a*, left valve; *b*, dorsal view. (P. 429.)

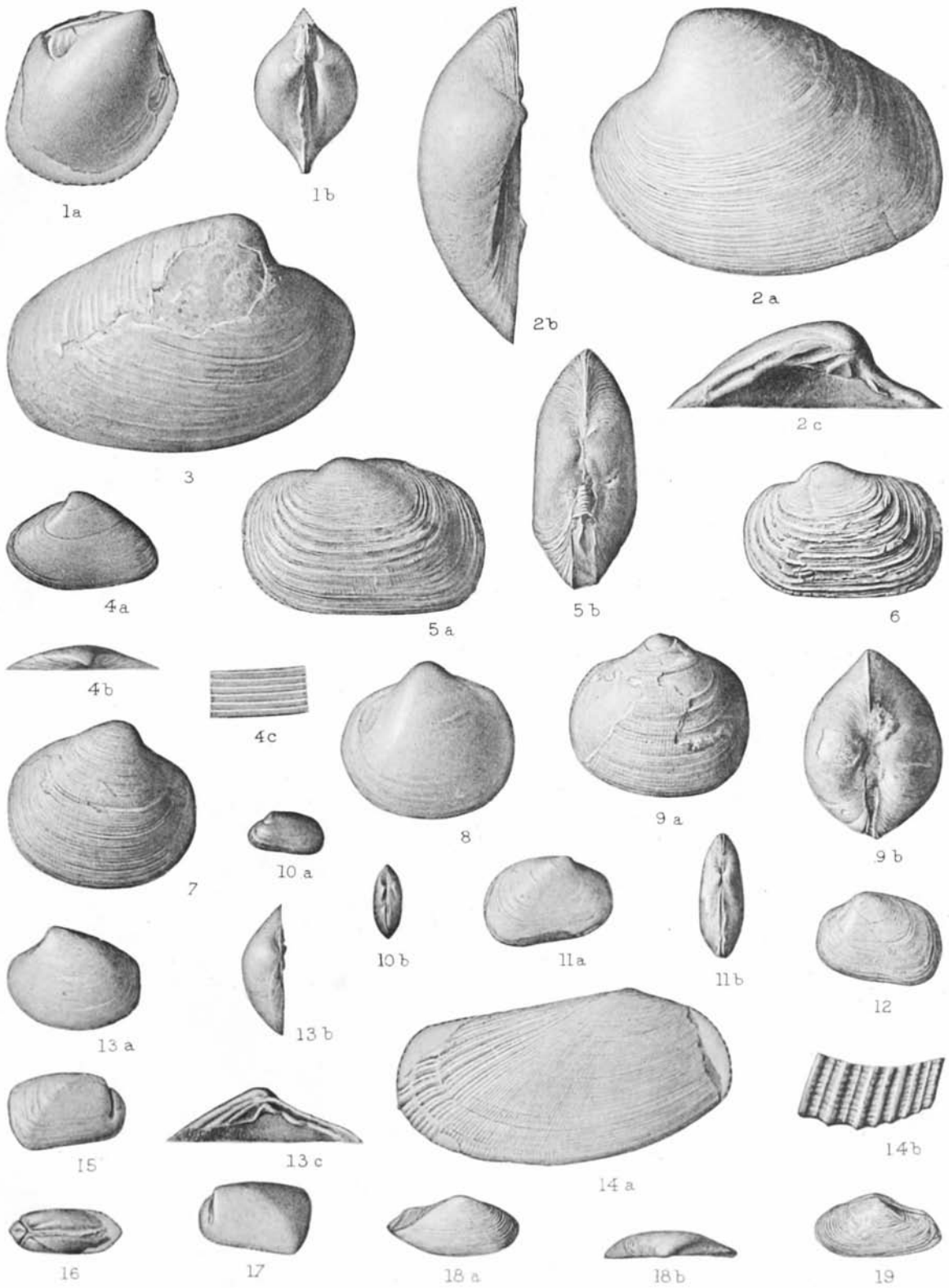
11, 12. *Tellina? subphaseolina* (d'Orb.). Gault, Folkestone. 11, British Museum, No. L 4982; *a*, right valve; *b*, dorsal view. 12, Sedgwick Museum; left valve. × 1½. (P. 430.)

13. *Cyprimeria* (*Cyclorisma*) *submersa* (Sow.). Upper Greensand (zone of *Schlœnbachia rostrata*), Blackdown. Exeter Museum. *a*, left valve; *b*, dorsal view; *c*, hinge × 2. (P. 431.)

14. *Tapes* (*Icanotia*) sp. Upper Greensand (zone of *Schlœnbachia rostrata*). Blackdown. British Museum, No. L 17225. *a*, right valve; *b*, posterior part × 4. (P. 431.)

15—17. *Leptosolen? rectangularis* (Woods). Chalk Rock, Cuckhamsley. Sedgwick Museum. Internal casts. 15, right valve. 16, dorsal view of both valves. 17, left valve. (P. 432.)

18, 19. *Thracia? gracilis* (Sow.). Upper Greensand (zone of *Schlœnbachia rostrata*), Blackdown. Sedgwick Museum. 18*a*, right valve; 18*b*, dorsal view. 19, left valve. (P. 432.)



CRETACEOUS LAMELLIBRANCHIA.