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A MONOGRAPH
OF THE
DEVONIAN FAUNA
OF THE
SOUTH OF ENGLAND.

BY
G. F. WHIDBORNE, M.A., F.G.S.

VOL. III.

THE FAUNA OF THE MARWOOD AND PILTON BEDS
OF
NORTH DEVON AND SOMERSET.

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IN the year 1840, Sowerby described twenty-four Devonian species from the beds of the Pilton Series; in 1841 Professor Phillips increased the number to seventy; and in 1852 M'Coy added several species to the list.

Since that time I do not know that many new forms have been described. Professor F. A. Römer in 1855 figured an *Aviculopecten* which appears to have escaped the notice of English geologists; and in 1863 Salter described, without figuring, a species of his new genus *Curtonotus*. Mr. Etheridge, in his list of Devonian Fossils, has catalogued the names of several additional Continental forms.

The present attempt to revise this interesting fauna took its rise in 1890, from a letter of my lamented friend Mr. Thomas Roberts, F.G.S., who drew my attention to the rich collection made by Mr. Townshend Hall, F.G.S., and now in the Barnstaple Athenæum, of which Mr. Roberts prepared, but I do not think published, a list. Soon afterwards I visited Barnstaple by the kind invitation of Mr. Townshend Hall, and began the study of the fauna; and I desire first of all to acknowledge the exceeding kindness with which he and other friends have helped me in an undertaking which has proved much longer and more difficult than I then expected. Nothing could exceed the kindness and courtesy with which the authorities of the British Museum, the Museum of Practical Geology, the Woodwardian Museum, and the Barnstaple Athenæum have permitted me the free use of their fine collections, and in other ways assisted me; and to Dr. Henry Woodward,

F.R.S., Sir Archibald Geikie, F.R.S., Professor T. McKenny Hughes, F.R.S., Mr. J. G. Hamling, F.G.S., and their colleagues my grateful thanks are due. To Mr. Hamling and Miss Partridge, of Barnstaple, I am also under obligations for the loan of specimens from their private collections, and for helping me to collect fossils in the field; my friend Dr. Henry Hicks, F.R.S., has also visited many localities with me, both collecting fossils and making observations, the result of which we propose to give in the sequel. One day, while working in the Barnstaple Athenæum, a gentleman, Mr. Porter, of Pilton, then unknown to me, invited me to see his collection, made through many years; and after showing me his fossils he presented them to me, unsolicited, for the purpose of this work. The generosity of this gift can best be acknowledged by referring the reader to the accompanying plates.

Professor Rupert Jones, F.R.S., Dr. Henry Woodward, F.R.S., Dr. J. W. Gregory, F.G.S., Mr. A. Smith Woodward, F.G.S., Mr. F. A. Bather, F.G.S., Mr. E. T. Newton, F.R.S., Mr. H. A. Allen, F.G.S., Mr. G. C. Crick, F.G.S., and other kind friends have most kindly helped me in guiding me toward the identification of certain of the species; and Mr. W. Rupert Jones, Sub-Librarian of the Geological Society, has shown his usual kindness in helping me to solve perplexing questions of bibliography.

I regret that in the following descriptions¹ so much has often to be left in doubt. Many of the specimens available are casts, many fragmentary, many embedded in matrix, and very many distorted, and sometimes crushed completely out of shape. Probably from such causes errors may in some cases have occurred. It is to be hoped that these may hereafter be corrected through the discovery of more perfect fossils. I can only claim to have done my best to be careful, and to have sought, wherever it was possible, to identify specimens with previously described forms. The present evidence, however, shows that the fauna of these beds is rich and varied, and I believe that we have by no means yet reached the limit of the species that occur in them.

I also regret that some of the localities given are necessarily vague. "Barnstaple" and "Pilton" must be taken as general terms, not indicating a precise spot. Many of the older specimens in museums only bear such general labels. Mr. Porter's fossils were, I understand, for the most part obtained from the immediate neighbourhood of Pilton, but the very richness of the collection prevented me in most cases from learning the exact localities of the various

¹ In the descriptions I have been accustomed to group comparisons with other species under the title of "*Affinities*." It seemed to me a convenient general term, under which points of likeness might be noted without necessarily betokening relationship. As, however, some German authors have criticised me for having sometimes compared species which have only a superficial resemblance, it is as well to observe that I did so *intentionally*, and that I shall continue to do so wherever it may seem advantageous.

specimens. On the other hand, the fossils collected by Mr. Hall, Dr. Hicks, Mr. Hamling, Miss Partridge, and myself bear, as a rule, the accurate name of the place of their occurrence.

It is proposed in the first place to attempt the elucidation of the species, and after that to give the stratigraphical observations made by Dr. Hicks, Mr. Hamling, and myself.

VERTEBRATA.

FISH REMAINS. Pl. I, figs. 1, 1 a.

? 1841. Scales of HOLOPTYCHUS, *Phillips*. Pal. Foss., p. 133, pl. lvii, figs. 256? (Meadfoot), 257 (Baggy).

The only evidence of Vertebrates known to me from the Pilton Beds is a slab containing a few crushed and scattered scales. As far as can be seen, these are wide, flat, oval scales, marked by fine, close, rounded striations, which probably curve parallel to the contour of the margins which are destroyed. The slab was labelled "Fish scales" by the late Mr. Thomas Roberts, F.G.S., and on showing it to Mr. A. Smith Woodward he confirmed this, considering that they are certainly the remains of fish scales, but that, as their shape is quite lost, it is impossible further to decide their character.

Locality.—The Strand, Ashford. A single slab is in the Barnstaple Athenæum.

Phillips figures an elliptic scale from Baggy Point, which appears to be similarly ornamented, and may perhaps be identical.

The scales of *Phyllolepis* and *Pentagonolepis*¹ seem to be similarly ornamented.

ARTHROPODA.

TRACHEATA.

CLASS—MYRIOPODA, *Latreille*, 1796.

1. *Genus*—CARIDERPESTES, n. gen.

1. CARIDERPESTES GYIUS,² n. sp. Pl. I, fig. 2.

Description of Specimen.—The only specimen consists of two portions of the body; one extremity and an intermediate portion of the body being lost. The body is very long, sub-cylindrical, slightly diminishing in width as it approaches the tail.

¹ 1888 Lohest, 'Ann. Soc. Géol. Belg.,' vol. xv, p. 159.

² *Kapis*, a shrimp; *ἐρπήστης*, a crawler; *γυίός*, lame.

The first, which is probably the central portion, contains fifteen narrow somites with straight sides, which are perpendicular to the line of the back, each somite measuring 7 mm. in height by 2 mm. in width. The lower part of the somites appears crossed by a double series of transversely oval concavities, and their front margin seems raised and convexly rounded off at the bottom. To the base of at least every fourth somite remains attached a long narrow appendage or swimmeret (?), which is narrower than the somite, and seems so placed that the front of the somite is in line with the front of its base; it is probable that each somite had a pair of such appendages. These swimmerets (?) show slight signs of segmentation (not visible in the figure), are about 7 mm. in length, slope slightly backwards, and are narrowly lancet-shaped, gradually tapering toward their extremities, where they are rounded off in a blunt point. They are longitudinally bisected by a slight median furrow (ridge in the cast) which traverses them from end to end.

The second portion is less distinct; signs of segmentation occur, but they are apparently oblique to the back, and there are indications of one or two incipient swimmerets (?). Near to the posterior end the body is suddenly constricted by short concavities both above and below, after which it widens out into a caudal prolongation, which seems to consist of some rounded plates, one containing a margined spot, and of a pair of short flapper-like appendages with three segments. The test appears to have been massive, and probably had a granular ornament.

Size.—The total length is 57 mm. The lengths of the two remaining fragments are respectively 23 mm. and 22 mm. The width at the front end is 5 mm., close to the tail 3 mm., and across the tail 7 mm. The length of the first swimmeret (?) is 7 mm.

Locality.—The only specimen is in the Barnstaple Museum, where it is placed among the Sloly fossils; and the character of the matrix appears to indicate that it came from the Lingula beds of the Sloly group.

Remarks.—This fossil is most perplexing and difficult to interpret. Mr. Thomas Roberts, F.G.S., long ago suggested that it might be a spined Myriopod; and, on consulting Dr. Henry Woodward more lately, he made the same suggestion, comparing it with *Euphoberia ferox*, Salter,¹ reviewed by him with other Myriopods in 1887.² The difficulties, however, in the way of assigning it to *Euphoberia* are—(1) there are no signs whatever of dorsal spines, the upper line of the body being continuous and simple, and there being no scars on the somites to indicate sub-dorsal spines; (2) there are no clear signs of dorsal plates overlapping two

¹ 1863, Salter, 'Quart. Journ. Geol. Soc.,' vol. xix, p. 86, fig. 8.

² 1887, Woodward, 'Geol. Mag.,' dec. 3, vol. iv, p. 1, pl. i, figs. 1—12.

³ 1881—5, Scudder, in Zittel's 'Palæoz.,' pt. 2, p. 721.

ventral plates; (3) the appendages, appearing only on every fourth segment, are not proved to have existed on all the rest; and seem blade-like and formed for moving in water; and (4) there is considerable evidence of a peculiar extremity.

Scudder¹ certainly figures an example of *Eu. armigera*² which appears to have appendages only on every alternate ventral segment, one dorsal segment covering four ventral; but he explains this by supposing the ventral segments to be really only two divided plates. Moreover the genera *Xylobius* and *Archiulus*, though placed in the same sub-order, do not seem to show any signs of spines.

The signs of segmentation in the appendages are obscure, but some of those organs, as figured by Scudder,³ seem so closely welded that it is quite possible that in the present instance also segmentation really existed. A central longitudinal line, similar to that which is strongly marked in our specimen, is described by Scudder in some species of *Euphoberia*.

In our fossil the lower part of a few of the segments shows marks which, although very indistinct, have probably significance. Within the straight front margin of the plate the surface seems raised in an indented ridge, receding again backwards at the base like the mullion of a window; and behind this are two ovoid concavities, separated above by a horizontal ridge level with the angle of the scallop or indentation.

Professor Rupert Jones points out some resemblance to it in *Anomalocaris Canadensis*, Whiteaves,⁴ which he thinks to be allied to *Euphoberia*. Whiteaves's figure shows ten segments, each with two simple appendages, and a caudal extremity with three pairs of irregularly placed equal spines. Our species differs from it, among other points, in having the segments much narrower, and the appendages very much longer.

While, however, there is much reason for regarding this fossil as a Myriopod, it bears some resemblance to the bodies of the *Phyllocaridæ*. The latter appear, as a rule, much shorter, and their segments do not generally have appendages, though in *Nebalia* itself the two last body-somites have tufted appendages.

Lastly, our fossil appears to be a marine organism, both because it probably comes from some bed of the *Lingula squamiformis* series, and because the structure of its appendages seems to show that they may have been natatory organs. While, however, Myriopods are essentially terrestrial, Scudder shows that there is reason to suppose that some at least of the Carboniferous forms were more or less aquatic.

¹ 1882, Scudder, 'Mem. Boston Soc. N. Hist.,' vol. iii, p. 160, pl. xiii, fig. 8.

² 1868, Meek and Worthen, 'Geol. Survey Illinois,' vol. iii, p. 556, figs. c, d.

³ 1882, Scudder, 'Mem. Boston Soc. N. Hist.,' vol. iii, p. 143.

⁴ 1892, Whiteaves, 'Canad. Record Science,' vol. v, p. 206, woodcut.

CLASS—CRUSTACEA, *Lamarck*.

SUB-CLASS—MALACOSTRACA, *Latreille*, 1806.

ORDER—PHYLLOCARIDA, *Packard*, 1879.

1. *Genus*—ECHINOCARIS, *Whitfield*, 1880.¹

1. ECHINOCARIS WHIDBORNEI, *Jones and Woodward*, Pl. I, fig. 3.

1889. ECHINOCARIS WHIDBORNEI, *Jones and Woodward*. *Geol. Mag.*, dec. 3, vol. vi, p. 385, pl. xi, fig. 1.

Description.—Carapace bivalved. Each valve subcircular. Dorsal margin straight, about three-quarters the length; front margin slightly curved; ventral and posterior margins much curved. Margins (except the dorsal) bounded by a sharp triangular elevated rim. Surface irregularly convex, divided into three groups of swellings, which are approximately arranged as follows.—A line drawn from the postero-dorsal to the antero-ventral point, and another from nearly the antero-dorsal to the central point, represent furrows or deep concavities dividing the test into three compartments, which we may call the dorsal, the anterior, and the posterior compartments. The dorsal compartment is again divided by shallower grooves into a long narrow hinder swelling, a broad central, and a minute anterior swelling. The anterior compartment is indistinctly divided into a small anterior swelling occupying the extreme antero-superior corner of the test, a large diffuse pyriform swelling, and a minute hinder swelling occupying the posterior angle of the compartment. The posterior compartment has one large diffuse swelling filling it entirely, except its anterior part, which contains a narrow fusiform swelling or promontory starting from the centre, and corresponding to the rear swelling of the dorsal compartment. These swellings are each, except the posterior, ornamented by one or more scattered sharp little tubercles. Two slightly curved longitudinal ridges divide the posterior compartment into three nearly equal petaloid areas, which are transversely slightly concave. These ridges and the rim (at least in the posterior dorsal region) bear a single regular row of similar sharp tubercles.

Size.—Left valve 9·2 mm. long by 7·4 mm. high.

Locality.—A single specimen, found by Mr. Dufton in a quarry near Sloy, close to the third milestone on the Barnstaple and Ilfracombe Road in the shales of the

¹ 1888. Hall and Clarke, 'Pal. N. Y.', vol. vii, pp. 168—181, pls. xxviii—xxx.

Lingula squamiformis beds of the Marwood series, is in the Woodwardian Museum, and a fragmentary specimen from Pilton is in the Porter Collection.

Remarks.—This fossil has been very fully described and illustrated by my friends Professor Rupert Jones and Dr. H. Woodward in the 'Geological Magazine,' and the reader is referred to that article for further information upon it.

Affinities.—Professor Rupert Jones describes it as larger and less ovate than *E. socialis*, Beecher,¹ and as differing from the other species described by Whitfield, by Clarke, and by Hall, in having two (instead of one) tuberculate ridges.

2. Genus—CERATIOCARIS, Salter, 1849.

1. CERATIOCARIS? SUB-QUADRATA, n. sp. Pl. 1, figs. 5, 5 a.

Description.—Carapace-valve ovate-oblong, gently convex. Dorsal and ventral margins gently arching. Anterior margin broad, truncated, with an ogee contour, rounded at the extremities. Posterior margin broad, elliptical. Ventral margin with a strong double rim, vanishing at its extremities. Surface, as seen from the mould, with a few very minute threads or lines arching from the ventral margin over the shell, with the antero-superior corner as a focus.

Size.—Length 19 mm., height 13 mm.

Locality.—Two or three specimens on one slab are in my collection from East Anstey station.

Remarks.—These fossils are in poor preservation, and it is difficult to discern their true nature. It is my strong impression that they are crustacean, and will probably prove to belong either to *Saccocaris* or a kindred genus. The ornament is not unlike that of a Lamellibranch, but several points seem decisive against such an explanation, while somewhat similar markings are seen in *Estheria*.

Though the ogee shape of the one end agrees with one end of *Ceratiocaris*, the valve appears shorter and more truncate than usual; while the threads on the surface take a different direction from the characteristic longitudinal lineation of that group, with which for the present I have provisionally left it.

Affinities.—In general outline it somewhat approaches *C. stygia*, Salter²; while *C. inornata*, M'Coy,³ though longer and more angular has several points of

¹ 1888, Hall, 'Pal. N. Y.,' vol. vii, p. 174, pl. xxx, figs. 1—12.

² 1888, Jones and Woodward, 'Mon. Brit. Pal. Phyllop.,' p. 38, pl. x, figs. 7 a, b; pl. xi, figs. 1 3, and 7; pl. xii, figs. 2 a, b.

³ Ibid., p. 48, pl. x, figs. 2, 3, 5.

resemblance. *Saccocaris major*, Salter,¹ is more similar in its general shape, and has signs of concentric lines though differently arranged.

Orthonotella Faberi, S. A. Miller,² has a strikingly similar appearance, but is much smaller and narrower, and has more numerous striæ, and straighter and more parallel upper and lower margins. This fossil Professor Rupert Jones noted in 1883 as being probably a phyllocarid.

2. CERATIOCARIS ? sp. Pl. I, fig. 6 [cf. Pl. II, fig. 12].

Description.—Shape flatly convex, elongate, nearly regularly oval in outline.

Size.—Length 5 mm., height 2 mm.

Locality.—Two moulds, giving the two sides of one animal, from south-west of Sloy, are in the Woodwardian Museum.

Remarks.—These fossils are exceedingly indistinct, being a double mould so divided that the edges are obscure. Almost the only marks I can observe are a slight sharp notch or dent in the centre of one end, and slight indications of a border on the lower margin, apparently becoming a broad, flat, angular rim at one end. The test was perhaps rather thick. It appears to me that it is in all probability the remains of a crustacean, and what can be seen of it is so strikingly like *Ceratiocaris ? simplex*, Clarke,³ except in size, that it seems best to treat it provisionally as probably akin to that fossil.

Note.—Two somewhat similar convex and elegantly oval casts, differing from each other in contour and size, have a neat rim on the free margins. One of these, Pl. II, fig. 12, which is in Mr. Hamling's Collection from Croyde has about the same dimensions as Pl. I, fig. 6, and its surface apparently has a few indistinct microscopical longitudinal ridges.

It resembles *Cytheropsis ? melonica*, Barrande,⁴ another very indistinct species, which is somewhat undulated in its dorsal contour. The genus "*Cytheropsis*" has been abandoned.

The other specimen, which is in my Collection from Saunton Point, is about ten times as large.

¹ 1893, Jones and Woodward, 'Mon. Brit. Pal. Phyllop.', p. 84, pl. xiv, fig. 6.

² 1882, S. A. Miller, 'Journ. Cincin. Soc. Nat. Hist.', vol. v, p. 117, pl. v, figs. 7, 7b.

³ 1888, Hall, 'Pal. N. Y.', vol. vii, p. 165, pl. xxxi, fig. 2.

⁴ 1872, Barrande, 'Syst. Sil. Bohém.', vol. i, Suppt., p. 509, pl. xxv, figs. 7, 8, Ét. D.

ORDER—CIRRIPEDIA, *Burmeister*, 1843 (?).

I. *Genus*—ANATIFOPSIS, *Barrande*, 1872.

1. ANATIFOPSIS ? ANGLICA, n. sp. Pl. I, fig. 4.

Description.—Form elongate, subcylindrical, flatly convex. Upper margin bluntly elbowed at about one-fourth its length from the proximal end. Lower margin straight, inclined at a small angle to the upper margin. Proximal end concave, bounded by a narrow-margined rim. Distal end defective.

Size.—Length 24 mm., breadth 7 mm.

Locality.—There is a single specimen from Sloly in the Porter Collection.

Remarks.—This fossil shows no definite structure, the markings generally being too much like those on the adjoining matrix to be relied on. Its shape is peculiar, and may be described as resembling the breech portion of a gun. It sufficiently resembles the fossil named *Anatifopsis acuta* by *Barrande*¹ to be regarded as possibly congeneric, differing from it in being much more elongate, and not showing the arching distal end seen in the Bohemian species, which *Barrande* considered as akin to *Lepas*. Two obscure spots, however, occur on the convex surface of our specimen, one of which seems pectiniform. In *Dr. Woodward's* opinion this pectination may indicate the remains of gastric teeth, and therefore imply that it is a *Phyllocarid*.

Affinities.—*A. longa*, *Barrande*,² which approaches it in length, has a straight upper margin.

¹ 1872, *Barrande*, 'Syst. Sil. Bohêm.,' vol. i, Suppt., p. 579, pl. xxvi, fig. 35, Ét. D.

² *Ibid.*, p. 579, pl. xxvi, figs. 42—45, Ét. D.

CLASS—CRUSTACEA.

SUB-CLASS—ENTOMOSTRACA, *Müller*, 1785.ORDER—TRILOBITA, *MacLeay*, 1839.I. *Family*—PHACOPIDÆ, *Salter*, 1864.1. *Genus*—PHACOPS, *Emmerich*, 1839 (emended, 1845).1. PHACOPS LATIFRONS, *Bronn*, sp. Pl. I, figs. 7—10, and Pl. II, figs. 1—4.

1844.	PHACOPS LATIFRONS,	<i>Ferd. Römer</i> .	Rhein. Uebergangsgeb., p. 81.
1864.	—	—	<i>Salter</i> . Mon. Brit. Tril., p. 18, pl. i, figs. 9—16.
1869.	—	—	<i>Verneuil</i> . Append. Faun. Dev. Bosph., p. 16.
1872.	—	—	<i>Kayser</i> . Zeitsch. Deutsch. Geol. Gesell., vol. xxiv, p. 661.
? 1885.	—	—	<i>Maurer</i> . Abhandl. Grossh. Hessisch. Geol. Landes., vol. i, pt. 2, p. 262, pl. xi, figs. 27—30.
1889.	—	—	<i>Whidborne</i> . Mon. Dev. Fauna, vol. i, p. 6, pl. i, figs. 8, 9.

Size.—The largest English specimen which I have seen (locality unknown), exceeds five inches in length.

Localities.—The specimens are almost always either detached heads, bodies, or pygidia. In the Museum of Practical Geology are four from Croyde, one from East Hill, Braunton, three (including a head figured by Salter) from New Road Quarry, Pilton, and one from Baggy Point. In the Barnstaple Athenæum are 2 from Saunton, 3 from Pilton, 10 from Top Orchard, 1 from Bradiford, 1 from Brushford, 5 from Kingdon's, Shirwell, and 1 from Roborough. In the Porter Collection are 4 from Pilton, 1 from Top Orchard, and 1 from Poleshill. In the Woodwardian Museum are 16 from Top Orchard, 1 from west of Saunton Court, 1 from south-west of Sloly, and 60 from Barnstaple. In the British Museum are four from Marwood and Barnstaple.

Remarks.—As the specimens of this well-known Trilobite from these beds, though so numerous, are all imperfect, and generally distorted, I have for the present deferred attempting a detailed description of them, especially as the species has already been fully described by Salter in his Memoir published by the Palæontographical Society.

It appears to me that all the above-named specimens most probably belong to the present species, though they vary very greatly in size, and have in some cases

been referred to *Phacops granulatus*, or *Trimerocephalus lævis*. Some of the specimens in the Woodwardian Museum are at first sight very different, being apparently shorter with narrower segments and a narrower axis, but my impression is that these differences are entirely due to distortion. Even the very small heads appear to have the usual obtuse and perpendicular front margin characteristic of this species, and not the subangular and protruding fronts seen in *T. granulatus* from South Petherwyn.

Again, as a specimen in the Museum of Practical Geology labelled *T. lævis*, Münster, sp., from Brushford, which was probably the grounds for Salter's recording that species from these beds, appears to be exactly similar to our other specimens, I am inclined to delete that species from the Pilton list.

The coarse granulation, absence of furrows, and great width and shortness of the glabella, and especially its unprotruded perpendicular front, seem to be some of the distinguishing marks of the species. The axis of the pygidium shows tubercles in well-preserved specimens.

Affinities.—*P. Potieri*, Bayle,¹ seems to have a narrower, more protruding, and more finely granulated glabella.

P. rana, Green,² has finer tubercles on the glabella and more segments in the pygidium.

P. altaicus, Tschernyschew,³ has a longer glabella, with a more convex and protruding front, and more segments in the pygidium.

II. Family—PROËTIDÆ, Barrande, 1852.

I. Genus—PHILLIPSIA, Portlock, 1843.

1. PHILLIPSIA HICKSII, n. sp. Pl. II, figs. 5—8.

Description.—General form very elongate, ovate; in section deep. Thorax relatively large, the proportionate length of head, thorax, and tail being about 5 mm., 8 mm., and 5 mm.

Head-shield small, nearly semicircular. Glabella large, subcylindrical (*i. e.* considerably elevated, with straight sides and rounded anteriorly), reaching to the

¹ 1878, Bayle, 'Explic. Carte Géol. France, Atlas,' pl. iv, figs. 7—10; and 1889, Kayser, 'Abhandl. Kön. Preuss. Geol. Landes.,' n. s., pt. 1, p. 67, pl. x, figs. 5, 6; and pl. xxiii, figs. 1—6.

² 1832, Green, 'Mon. Trilob. N. Amer.,' p. 42; and 1888, Hall, 'Pal. N. Y.,' vol. vii, p. 19, pl. vii, figs. 1—11; pl. viii, figs. 1—18; and pl. viii A, figs. 21—33.

³ 1893, Tschernyschew, 'Verhandl. Russ. Kais. Miner. Gesell.,' vol. xxx, p. 4, pl. i, figs. 1—5.

rim in front. Basal lobes rather large, subtriangular. Glabella-furrows three (including that which bounds the basal lobe), short, sufficiently clear except the first. Neck-furrow deep. Neck-lobe arching, rather broad. Rim (in front of glabella) rather broad, sigmoid in section. Fixed cheeks exceedingly narrow in front, medianly convex at the eyes. Surface bearing numerous small scattered tubercles. Free cheeks large, gently convex, subtriangular. Genal angles acute, apparently prolonged into short spines. Eyes of medium size, elongate, bean-shaped, rather elevated, situated centrally on the cheeks close to the glabella.

Thorax large, of nine rather broad segments. Axis wide, elevated, semi-cylindrical, bounded by deep axial furrows. Segments divided by a distinct central groove on the limbs.

Pygidium small, probably slightly broader than long, highly ornate, composed of thirteen coalesced somites. Axis deeply convex, slightly flattened above, nearly one-third the width of the pygidium at the proximal end, but diminishing regularly and rapidly, and terminating bluntly at a quarter the length of the pygidium from the posterior margin, followed by an indistinct prolongation. Rings of axis thirteen (of which eleven are distinct), narrow, elevated, each bearing a row of about ten strong sharp tubercles. Limb with eight grooved pleuræ, each of which consists of a narrow raised rib, irregularly tubercled, extending to, and apparently becoming wider at, the border, and of a lower and shorter intermediate rib, similarly ornamented, and placed immediately behind the major rib in the furrow. Border convex, broad, rather distinctly defined by a linear depression, one-fifth the length of the tail behind, and becoming slightly narrower laterally, the tuberculated ribs being visible across it.

Size.—A specimen measures 18 mm. long by 8 mm. wide across the first, and 7 mm. wide across the last thoracic segment. A distorted glabella is 6 mm. long by 3 mm. wide. A distorted pygidium is 7 mm. long by 11 mm. wide.

Localities.—In the Barnstaple Athenæum is a complete but very much decayed specimen from the shore near Fremington, and two beautifully preserved pygidia labelled Pilton and Braunton Road; and in the Porter Collection two pygidia and a glabella from Pottington. All these specimens appear to have been collected by Mr. Porter, and therefore probably all, except the first, may have come from one locality.

Remarks.—The complete specimen, occurring in light brown sandstone and much decayed, is crushed obliquely, which perhaps gives it the appearance of being more elongate than that it actually is, but even so it appears to be distinguishable by the large relative size of the thorax and by its elongate form. It serves the purpose of showing that the more perfectly preserved specimens of detached pygidia and glabella belong to one species.

The other specimens are in a much squeezed and twisted blue limestone; and,

though in a beautiful state of preservation, are so distorted that their exact shape and relative dimensions cannot be ascertained. The pygidia assume, in fact, such different appearances, according to their lie in the stone, as to suggest at first sight that they are specifically distinct; but Dr. Hicks, who has examined them, confirms my opinion that they all undoubtedly belong to a single species.

Affinities.—The present species evidently belongs to the genus *Phillipsia*, and approximates *Ph. truncatula*, Phillips,¹ sp., but differs distinctly in the shape of the glabella, the number of glabella-furrows, the number of somites in the pygidium, and in the presence of a distinct broad elevated convex border round both head and tail.

Ph. gemmulifera, Phillips, sp.,² differs in being broader, and in having a shorter thorax and a smooth glabella, and narrower fixed cheeks.

It may be observed that the ribs of the pygidium seem more definitely distinct and divided than is usual in *Phillipsia* or *Griffithsides*, thus approaching those of *Brachymetopus*. From *B. uralica*, de Verneuil,³ which it simulates in that respect, it differs in its broader and more developed border, and in its rings being only twelve or thirteen instead of seventeen, while its head is of course totally unlike.

2. Genus—BRACHYMETOPUS, M'Coy, 1847.

This genus is distinguished from its neighbours by the small size and triangular form of the glabella, *Dechenella* approaching it most nearly in these respects, but differing as well in the greater size of the glabella and its more defined lobes as in the strong striated margin of the pygidium. Several species have been described by M'Coy, H. Woodward, and others from the Carboniferous beds. The following species carries back the genus to the Devonian; while, as Ehlert⁴ points out, *Proëtus micropygus*, Corda,⁵ represents it in the so-called Silurian Étages E and F of Bohemia.

¹ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 240, pl. xxii, figs. 12, 13; and 1883, H. Woodward, 'Mon. Carb. Trilobites,' pt. 1, p. 21, pl. iii, figs. 9—14.

² 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 240, pl. xxii, fig. 11; and 1883, H. Woodward, 'Mon. Carb. Trilob.,' pt. 1, p. 17, pl. iii, figs. 1—8.

³ 1845, de Verneuil, 'Geol. Russ.,' vol. ii, p. 378, pl. xxvii, figs. 16 *a*, *b*; and 1884, H. Woodward, 'Mon. Carb. Trilob.,' pt. 2, p. 48, pl. viii, figs. 1—8.

⁴ 1885, Ehlert, 'Bull. Soc. Étud. Sci. Angers,' Ann. 1885, p. (9), pl. i, figs. 1, 2, cf. with 4.

⁵ 1852, Barrande, 'Syst. Sil. Bohém.,' vol. i, p. 445, pl. xv figs. 37—39.

1. BRACHYMETOPUS WOODWARDII, n. sp. Pl. II, figs. 9—11.

Description.—Head-shield minute, semicircular, surrounded by a broad flat border. Glabella very elevated, about two-thirds the length of the head, and about twice as long as broad. Cheeks elevated. Eyes small, lunate, situated in the centre of the cheeks. Surface tuberculate.

Pygidium very convex, semicircular. Axis nearly as wide as limb, very elevated, bluntly truncated below, and with eleven or twelve lofty narrow rings, which bear numerous tubercles, of which the central vertical row seems the largest. Limb with seven elevated ribs on each side. Ribs simple, bearing a few coarse tubercles, and extending to the border, which they appear to nodulate, a single corresponding nodule being at the posterior point of the border.

Size.—Head-shield about 3.50 mm. long by 5 mm. wide. A pygidium measures 2 mm. long, 4 mm. wide, 1.25 mm. deep.

Localities.—Two specimens, a head-shield and a pygidium, are in the Porter Collection from Pottington. A head-shield from the lane between Wrafton and Heanton is in my collection.

Remarks.—We have in this case a head-shield and a pygidium of the identity of which there is no direct evidence, but which occur in the same beds, are totally unlike any accompanying species, and have such a general congruity that it appears to be practically safe to assume that they belong to each other (specifically). In this view Dr. H. Woodward agrees, and he confirms me in regarding it as a species of *Brachymetopus* allied to *B. MacCoyi*, from which it differs in the larger size of its glabella, and the fewer somites, greater shortness, broader axis, and more highly ornamented character of its pygidium.

The specimen of the pygidium being in the nature of an internal cast, it is not clear whether the final spines or tubercles of the lateral ribs extend beyond the border, and so break the contour of the margin, but they certainly give indications of doing so; and such a feature is hinted at by M'Coy¹ in his description of the genus.

ORDER—OSTRACODA, Latreille, 1801.

In the examination of the little fossils of this group I have had the advantage of the guidance and assistance of my kind friend Professor Rupert Jones. They have for the most part been the result of very recent discoveries, and probably by

¹ 1847, M'Coy, 'Ann. Mag. N. Hist.,' ser. 1, vol. xx, p. 230.

no means cover the whole ostracodal fauna of the beds. Time did not permit their full study before they were put on the plate, and consequently they were then arranged according to their apparent general similarity. A more minute examination proved that in some cases these resemblances were deceptive, and were due simply to the crushing or corrosion of specimens having really different characters. While this has caused some of the figures to be useless as far as the elucidation of their own species is concerned, it is perhaps not uninteresting as showing how easily one genus may apparently be transformed into another by a slight modification of its characters.

I. *Family*—LEPERDITIIDÆ, Jones, 1868.

1. *Genus*—ISOCHILINA, Jones, 1858 (and 1870).

1. ISOCHILINA CANALICULATA, Krause. Pl. II, figs. 13—15; and Pl. III, figs. 1—2 *b*.

1892. ISOCHILINA CANALICULATA, Krause. Zeitsch. Deutsch. Geol. Gesell.,
vol. xlv, p. 385, pl. xxi, figs.
1 *a, b*.

Description.—Valve suboblong, generally rather short, moderately convex, with a central spot or muscle-mark, Dorsal margin rather shorter than the valve. Free margins bounded by a definite rim.

Size.—Length 2 mm.

Localities.—In the Porter Collection is a slab with several specimens, from Poles Hill; and in my collection two specimens from Upcott Arch Quarry, and one from Saunton Hotel.

Remarks.—These specimens all appear to be casts; they seem always to show the central spot or dent.

Professor Rupert Jones has identified the more perfect specimens with Krause's species. He considers they come very near to *Primitia valida*,¹ but are distinguished by the ventrally protruding convexity of the valves, and by the outstanding lips or borders.

From *P. centralis*, Ulrich,² they seem to differ chiefly by being more convex.

Primitia cestrensis, var. *caldwallensis*, Ulrich,³ and *P. subæquata*, Ulrich,⁴ are also so similar as hardly to be distinguishable except in the same particulars.

¹ 1886, Jones and Holl, 'Ann. Mag. N. H.,' ser. 5, vol. xvii, p. 409, pl. xiv, figs. 7—9.

² 1890, Ulrich, 'Journ. Cincin. Soc. N. H.,' vol. xiii, p. 130, pl. x, figs. 1—3; and 1893, Jones, 'Quart. Journ. Geol. Soc.,' vol. xlix, p. 291, pl. xii, fig. 1.

³ 1891, Ulrich, 'Journ. Cincin. Soc. Nat. Hist.,' vol. xiii, p. 201, pl. xiv, figs. 7 *a—c*.

⁴ *Ibid.*, p. 202, pl. xiv, figs. 8 *a—c*.

2. *Genus*.—APARCHITES, Jones, 1889.

1. APARCHITES LINDSTRÆMI, Jones, var. EXCELLENS, nov. var. Pl. III, fig. 3, 3 a.

1889. APARCHITES LINDSTRÆMI, Jones. Ann. Mag. N. H., ser. 6, vol. iv, p. 272, pl. xv, figs. 14 a, b.

Description.—Valve short, ovate, convex. Anterior end subtruncate, rather narrower than the other, which is rounded. Dorsal edge rather short. Ventral margin strongly arched. Surface bearing a small, low tubercle close to the antero-dorsal corner.

Size.—Length 2 mm., height 1·5 mm.

Locality.—A specimen from Kingdon's, Shirwell, is in the Barnstaple Athenæum.

Remarks.—The figured specimen is embedded in hard limestone, and possibly does not show the true margin all round. Professor Rupert Jones considers it to approach very near to *A. ovatus*, Jones and Holl, sp.¹ It differs, however, from it in being shorter and more evenly convex. *A. simplex*, Jones,² agrees better in these points, but seems more regularly oblong. *A. Lindstræmi*, Jones,³ is almost identical in outline, but is so much smaller and flatter as probably to indicate that our specimen belongs rather to a larger variety than to the described type.

3. *Genus*.—PRIMITIA, Jones and Holl, 1865.

1. PRIMITIA SPARSINODOSA, n. sp. Pl. III, figs. 4—6.

Description.—Valve elongate, oval, convex. Dorsal and ventral borders almost straight. End borders rounded. Valve divided by a deep, broad dorsal furrow, sloping down from the centre forward, and separating it into two flatly swollen convexities, each of which bears a tubercle (not distinctly shown in the figure) near the centre of its lateral face, while another small tubercle is on the angle of the anterior lobe, overhanging the furrow.

Size.—Length ·83 mm.

Locality.—Three specimens are on the slab in Miss Partridge's collection from Saunton Hotel.

¹ 1865, Jones and Holl, 'Ann. Mag. N. H.,' ser. 3, vol. xvi, p. 10, pl. xiii, figs. 13 a—c; and 1891, Krause, 'Zeitsch. Deutsch. Geol. Gesell.,' vol. xliii, p. 492, pl. xxix, figs. 9 a—c.

² 1889, Jones, 'Ann. Mag. N. H.,' ser. 6, vol. iv, p. 272, pl. xv, figs. 13 a—c; and 1891, Krause, 'Zeitsch. Deutsch. Geol. Gesell.,' vol. xliii, p. 491, pl. xxix, figs. 8 a—c.

³ 1889, Jones, 'Ann. Mag. N. H.,' ser. vi, vol. iv, p. 272, pl. xv, figs. 14 a, b.

Remarks.—These specimens are casts, but show the shape rather clearly; they evidently had rather thick tests.

Professor Rupert Jones was inclined to identify these specimens with his *Primitia mundula*, var. *longa*.¹ Our specimens, however, on close examination show several distinct scattered tubercles, which do not seem to exist in *P. mundula*; and, moreover, the sulcus sets forward instead of being nearly vertical, and the shape is more oval.

Bollia? sinuata, Krause,² seems more oval, and the central furrow is more direct, and ends in a circular pit.

Primitia impressa, Ulrich,³ is relatively shorter and more oval.

Ulrichia confluens, Ulrich,⁴ is somewhat similarly nodulated, but its furrow is much wider and more L-shaped.

The small specimen, fig. 4, appears probably to be a young or indistinctly preserved example of the same form.

2. PRIMITIA, sp. Plate III, figs. 7—11.

Description.—Valve elongate, ovate-oblong. Dorsal and ventral edges nearly straight. Ends nearly evenly convex. Surface finely tuberculate, marked with a slight central inequality in the dorsal region.

Size.—Length 1 mm.

Locality.—Two specimens from Pilton are in the Porter Collection; two from Saunton Hotel in Miss Partridge's Collection; and several, which are very doubtful, from Saunton Hotel in my Collection.

Remarks.—These fossils show very little character; there are indications of a central vertical inequality in the valve, which is probably Primitian in character, but has been more or less modified by pressure. The four first-mentioned specimens appear to have been covered with a very fine granulation. In those from Saunton the great squeezing of the beds has very much obscured the natural shape, as will be seen from my two specimens figured from that locality.

¹ 1893, Jones, 'Quart. Journ. Geol. Soc.,' vol. xlix, p. 291, pl. xii, figs. 4 *a*, *b*.

² 1891, Krause, 'Zeitsch. Deutsch. Geol. Gesell.,' vol. xliii, p. 498, pl. xxxi, fig. 2.

³ 1890, Ulrich, 'Journ. Cincin. Soc. N. H.,' vol. xiii, p. 131, pl. x, figs. 3, 4.

⁴ 1891, Ulrich, *ibid.*, vol. xiii, p. 203, pl. xii, figs. 11 *a*, *b*.

3. *PRIMITIA*? sp. Plate III, fig. 12.

Description.—Valve very small, evenly convex, short, subovate. Dorsal border straight, rather short. Anterior border narrow, bluntly subangular. Posterior border semicircular, broad. Ventral border convex.

Size.—Length .5 mm.

Locality.—One indistinct specimen is in a slab with other Ostracods in Miss Partridge's Collection from Saunton Hotel.

Remarks.—This indistinct little fossil seems in general shape extremely like *Leperditia? seneca*, Hall, as given by Jones,¹ but it appears to show a slight sulcus in the dorsal centre followed by a slight posterior elevation, and therefore is probably a species of *Primitia*.

4. *PRIMITIA DORSICORNIS*, Ulrich, sp. Plate III, fig. 13.

1892. *LEPERDITIA DORSICORNIS*, Ulrich. Amer. Geologist, vol. x, p. 267, pl. ix, figs. 24—28.

Description.—Valve very small, flattish, short, sub-ovate. Dorsal border broken by a vertical projection behind a short sulcus. Free borders convex.

Size.—Length .5 mm.

Locality.—One small specimen from Saunton Hotel is in Miss Partridge's Collection.

Remarks.—This specimen Professor Rupert Jones considers sufficiently near to *P. dorsicornis* to be referred to it. It has some alliance to the accompanying *P. sparsinoda* (fig. 7), but that appears distinguished by the absence of a projecting node.

It appears to be a passage-form into the genus *Æchmina*, approaching *Æ. Byrnesi*, Miller,² but with a smaller and more vertical spine.

¹ 1890, Jones, 'Quart. Journ. Geol. Soc.,' vol. xlvi, p. 23, pl. i, figs. 13, 14.

² 1890, Jones, 'Quart. Journ. Geol. Soc.,' vol. xlvi, p. 12, pl. iii, figs. 9—11.

5. PRIMITIA BOVIFRONS, n. sp. Plate III, figs. 25—30.

Description.—Valve suboblong, elongate, flattish. Dorsal margin straight and equal to the length of the carapace. Ventral margin almost straight, oblique. Ends unequally rounded. Anterior portion rather narrower than the posterior. Valves with a broad, shallow central furrow, edged with two slight prominences, extending perpendicularly from the dorsal margin halfway down, and having a sharp elevated tubercle or horn standing out from the valve rather below the antero-superior corner, and in the extreme postero-dorsal angle another horn which is very lofty and tends upwards and backwards. Free margins bordered by a strong impressed rim (fig. 28). Surface covered by a coarse, irregularly honeycomb reticulation, with concave interspaces.

Size.—A large specimen is 4·2 mm. long, and 2·3 mm. high.

Localities.—In the Porter Collection is a slab containing four or five specimens from Pilton; and in my Collection are several specimens from the *Pecten nexilis* bed of the Laticosta Cave, Baggy, one of which (fig. 27) has been squeezed into a symmetrical shape.

Remarks.—This fossil is referred to the genus *Primitia* by my friend Professor Rupert Jones on account of its furrow, but he recognises that its central tubercles, which in some specimens are strongly developed, show a passage toward *Ulrichia*.

It was first known to me by Mr. Porter's specimen, the locality of which was indefinite, but I have since found it in plenty at Baggy Point together with other Ostracods.

6. PRIMITIA VESTITA, n. sp. Plate III, fig. 14.

? 1892. LEPERDITIA MUNDULA, *Ulrich*. Amer. Geologist, vol. x, p. 265, pl. ix, figs. 4—8.

Description.—Valve elongate, subovate or bean-shaped, rather flat. Dorsal border straight, nearly as long as the valve. End borders narrow, very convex, angular above and passing insensibly below into the long convex ventral border. Valve with a central oval node defined above and at the sides by an impressed furrow, and with very indistinct and diffused lateral lobes. Ornament of coarse elongated rugosities (not clearly shown in the figure) radiating from the central node. Rim indistinct, oblique or bevelled.

Size.—Length 2·2 mm. ; height 1·3 mm.

Locality.—There is one specimen in the Porter Collection from Pilton, associated with a valve of *Strophalosia productoides*.

Remarks.—This species bears great resemblance in shape, ornament, and markings to *Beyrichia clathrata*, Jones,¹ though differing somewhat in each particular. It appears to stand about halfway² between that species and *Leperditia mundula*, Ulrich,³ being nearer to the former in general contour and ornament and to the latter in outline. It is possibly the same as the latter, though it slightly differs from it in the size and shape of the furrow. In any case, however, as it evidently is a *Primitia*, and has no connection with *P. mundula*, Jones, we are obliged to retain our proposed name.

4. Genus—BEYRICHIA, *M^cCoy*, 1846.

1. BEYRICHIA EQUILATERA, *Hall?* Plate III, fig. 15.

? 1860.	BEYRICHIA EQUILATERA, <i>Hall</i> .	Canad. Nat. and Geol., vol. v, p. 158,	fig. 20.
? 1868.	— — —	<i>Dawson</i> . Acad. Geol., ed. 2, p. 608,	fig. 217.
? 1878.	— — —	Ibid., p. 609,	fig. 217.
? 1890.	— EQUILATERA, <i>Jones</i> .	Quart. Journ. Geol. Soc., vol. xlvi, p. 18,	pl. ii, fig. 6 ; and p. 552.
? 1891.	— — —	Canad. Micro-Palæont., pt. 3, p. 72,	pl. xi, fig. 6.

Description.—Valve short, suboblong, convex. Dorsal border long, straight. Ventral border semicircular. Ends equal, gently and evenly curved. Valve with three subequal parallel lobes, separated by two narrow furrows.

Size.—Length ·7 mm.

Localities.—Several specimens are in my Collection from Saunton Hotel.

Remarks.—The specimens are all very much squeezed out of shape; and, probably, the one figured has been shortened from that cause. On the whole, however, they seem to be distinguished by three elongate equal lobes.

Affinities.—It appears so closely to resemble *B. æquilatera*, Hall, as given by Jones, that I am inclined to think it identical.

¹ 1857, Jones, 'Ann. Mag. Nat. Hist.,' ser. 3, vol. i, p. 242, pl. ix, fig. 1.

² Dr. Holzappel translates this phrase, which I used in vol. i, p. 10, in reference to a Trilobite, by the word "Mittelform," and then proceeds at great length to prove me incorrect in so calling it. The simple answer is that I never called it a "Mittelform" at all. In stating that in appearance it stood midway between two other species I in no way implied, or intended to imply, that it was a passage-form between them.

³ 1892, Ulrich, 'Amer. Geol.,' vol. x, p. 265, pl. ix, figs. 4—8.

In *B. oculina*, Hall,¹ the central lobe seems separated below, and the lateral lobes coalesce beneath it.

Professor Rupert Jones has suggested a comparison of it with the specimen of *B. Klædeni*, M'Coy, figured by him in 1881.² It does not seem to me that the rather numerous though always distorted specimens I have seen show signs of conformability to that species. Their lobes are always long, straight, and evenly joined below.

B. Steusloffii, Krause,³ seems to differ in the same manner.

B. Wilkensiana, Jones, as given by Krause,⁴ seems to have thicker lobes, and a more elaborated anterior end.

2. BEYRICHIA DAMESII, Krause? Plate III, fig. 16.

1891. BEYRICHIA DAMESII, Krause. Zeitsch. Deutsch. Geol. Gesell., vol. xliii, p. 502, pl. xxxii, figs. 1—3.

Description.—Valve small, elongate, suboval. Ventral margin nearly straight. Ends obliquely convex. Valve having three subequal tubercles between two broad shallow furrows; the central tubercle being the most nodular, and the lateral tubercles indistinctly united below.

Size.—Length .6 mm.

Locality.—One specimen from Pilton is in the Porter Collection.

Remarks.—This specimen is indistinct, but as far as can be seen it presents almost exactly the appearance of *B. Damesii*, and therefore I venture to refer it provisionally to this species.

Affinities.—To *B. concinna*, Jones and Holl,⁵ it is very similar, but the lobes appear to be thicker in that species. Several of the varieties⁶ of *B. Klædeni*, M'Coy,⁷ are sufficiently like it to suggest that it possibly may prove nothing beyond a variety of that highly unstable species.

¹ 1890, Jones, 'Quart. Journ. Geol. Soc.,' vol. xlvi, p. 16, pl. i, fig. 4.

² 1881, Jones, 'Geol. Mag.,' dec. 2, vol. viii, p. 337, pl. x, fig. 2.

³ 1891, Krause, 'Zeitsch. Deutsch. Geol. Gesell.,' vol. xliii, p. 505, pl. xxxii, figs. 7—9.

⁴ 1877, *ibid.*, vol. xxix, p. 35, pl. i, figs. 18 *a*, *b*.

⁵ 1886, Jones and Holl, 'Ann. Mag. N. H.,' ser. 5, vol. xvii, p. 356, pl. xii, figs. 22 *a*, *b*.

⁶ 1886, *ibid.*, p. 349, pl. xii, figs. 3, 4; and 1893, Jones, 'Quart. Journ. Geol. Soc.,' p. 301, pl. xiv, fig. 3.

⁷ 1846, M'Coy, 'Syn. Sil. Foss. Ireland,' p. 58, woodcut.

5. *Genus*—BEYRICHIOPSIS, *Jones and Kirkby*, 1886.

1. BEYRICHIOPSIS RUPERTI, n. sp. Plate III, fig. 17.

Description.—Valve rather long, suboblong, flattish. Dorsal margin straight, equal to about two-thirds of the length. Ventral margin nearly straight, horizontal. Ends semicircular. Valve with (1) a small anterior lobe close to the dorsal edge and defined behind by an oblique sulcus; (2) a small indistinct ventrally situated convexity, and (3) a large diffuse posterior lobe bearing in the dorsal corner a small tubercle; and (4) several longitudinal ridges on different parts of the surface. Border bearing a narrow fringe.

Size.—Length .8 mm.

Locality.—There is one specimen from Pilton in the Porter Collection.

Remarks.—It appears to me that this small fossil answers all the requirements of the genus *Beyrichiopsis*, though it was only after the drawing had been made that further examination brought out its true characters, and therefore they are not well seen in the figure.

Affinities.—The smaller size and different position of the lobes distinguish it from *B. fimbriata*, Jones and Kirkby,¹ and *B. fortis*, J. and K.,² and *B. subdentata*,³ J. and K. The large subcentral boss in these species seems to be barely represented in ours.

6. *Genus*—KLÆDENIA, *Jones and Holl*, 1886.

1. KLÆDENIA BURSÆFORMIS, n. sp. Plate III, figs. 18—23.

A series of variously distorted valves from a ferruginous weathered face of limestone assume very diverse appearances, but probably all belong to one species to the true shape of which figs. 18 and 21 perhaps represent the nearest approaches.

Description.—Valve subovate, flattish. Dorsal edge long, straight, nearly as long as the valve. Postero-superior corner angular. Free edges gently convex and bordered with a narrow rim. Anterior portion of the valve narrow. Valve with two deep broad furrows, extending from the back for a greater or less distance downwards and separating three elevated lobes, of which the first and

¹ 1886, Jones and Kirkby, 'Geol. Mag.,' dec. 3, vol. iii, p. 434, pl. xi, figs. 3—10.

² Ibid., p. 435, pl. xii, figs. 1—3.

³ Ibid., p. 437, pl. xii, figs. 1, 2.

third coalesce below, while the central lobe seems sometimes more defined. Posterior lobe sometimes bifid.

Size.—Length 1·5 mm.

Locality.—Numerous specimens from the Ostracod Bed, Laticosta Cave, Baggy (where it seems to occur frequently) are in my Collection.

Remarks.—This species seems variable, but the variation is partly to be accounted for by the immense squeezing and twisting which the beds have undergone, as seen by the shapes assumed by larger fossils. Hence it is hard to arrive at the true form of the species. The specimens numbered 22 and 23 are examples of shortened aspects it assumes under distortion, and at first sight appear to belong to different genera, but on examination prove to be the present species. On the other hand elongate valves with faint ridges, represented by figs. 19 and 20, occur frequently; it seemed at first that these must be distinct, but on tracing out the differences seen in numerous specimens it becomes evident that they are simply due to fossilisation, and that they cannot be separated from the rest even as a variety.

Affinities.—*Klædenia notata*, sp., Hall,¹ seems not unlike, and possibly under varying pressures would present similar forms.

7. Genus—ULRICHIA, Jones, 1890.

1. ULRICHIA INTERSERTA, n. sp. Plate III, fig. 24.

Description.—Valve long, semi-oval. Dorsal border straight, almost as long as the valve. Ventral border elliptic. Ends rather strongly and evenly rounded; with thickened margins rising up from the ventral border. Surface bearing two large, prominent, obliquely oval, median well-defined lobes, not united below.

Size.—Length ·8 mm.

Localities.—There is one specimen in my Collection from the Ostracod bed at Baggy.

Remarks.—This fossil is regarded by Rupert Jones as an *Ulrichia*. It appears, however, to mark a passage from that genus to *Bollia*; for, while the lobes are distinctly defined below, there is a decided thickening of the lower portion of the valve. This passage between the two genera is continued by *Bollia bilobata*, Jones,² which has equally large lobes, united by a low swelling. The latter is also distinguished by being more oblong.

¹ 1890, Jones, 'Quart. Journ. Geol. Soc.,' vol. xlvi, p. 13, pl. iv, figs. 22, 23, and var., fig. 24.

² 1890, Jones, 'Quart. Journ. Geol. Soc.,' vol. xlvi, p. 540, pl. xx, fig. 12.

Beyrichia devonica, Jones and Woodward,¹ is very much larger and longer, and has more confluent lobes.

MOLLUSCA, *Cuvier*, 1812.

CLASS—CEPHALOPODA, *Cuvier*, 1798.

ORDER—TETRABRANCHIATA, *Owen*, 1832.

SUB-ORDER—AMMONOIDEA, *D'Orbigny*, 1840.

I. Family—GONIATITIDÆ, *Gray*, 1840.

1. Genus—GONIATITES, *de Haan*, 1825.

Sub-genus—AGONIATITES, *Meek*, 1877.

1. AGONIATITES, sp. Plate IV, fig. 2.

Description.—Shell of moderate size, discoid, flattish. Umbilicus rather small, shallow, open. Whorls rising steeply from the umbilicus, turning immediately through nearly a right angle to form a sub-angular elbow, and then spreading out flatly towards the back, and bearing on the elbow (or margin of umbilicus) a few slight undefined radiating nodules. Suture arching backwards from the elbow or umbilical margin in a simple lateral saddle for more than half the width of the whorl.

Size.—Diameter about 30 mm.

Locality.—A single imperfect specimen from Kingdon's, Shirwell, is in the Barnstaple Athenæum.

Remarks.—Though a portion only of this shell is visible in the matrix, Mr. Crick points out to me that it evidently, from what is seen of its suture-line, belongs to the group or genus *Agoniatites*, and is closely allied to *Agoniatites transitorius*, Phillips, sp. There are also slight signs of transverse lineations as in that species, but it differs from it by having nodules or swellings on the margins of the whorls just round the umbilicus.

Affinities.—*G. Roemeri*, Holzapfel,² has a smaller umbilicus, more sloping sides, and no nodulations.

¹ 1889, Jones and Woodward, 'Geol. Mag.,' dec. 3, vol. vi, p. 386, pl. ix, figs. 3—5.

² 1882, Holzapfel, 'Palæontographica,' vol. xxviii, p. 234, pl. xlv, figs. 1—1 b.

2. GONIATITES, sp. Plate IV, figs. 1, 1 a.

Description.—Shell very small, globose. Umbilicus minute, deep. Sides of the whorls rising from the margin of umbilicus for a short distance in a gentle curve, and then arching round still more gently to form a broad, regular, and very moderately convex back. Suture-lines unseen. Sulci three (two only being distinctly visible) straight, crossing the whorls perpendicularly.

Size.—Diameters 10 mm. and 9 mm.; width 6 mm.

Locality.—Two small specimens from Barnstaple are in the Woodwardian Museum.

Remarks.—These specimens, which from the nature of their matrix evidently come from the Pilton beds, show little beyond the general form of the species, the chief feature of which is the convexity of the sides as they rise from the umbilicus. The shell is very closely coiled, the backs of succeeding whorls having little room between them, so that the shape of the shell-cavity must have been highly lunate, and the whorls numerous.

Affinities.—*Goniatites micromphalus*, F. A. Römer,¹ of the Wissenbach slates, differs in having the margin of the umbilicus higher and more angular.

Mr. Crick and I compared the specimens with Carboniferous examples of *G. crenistria* (the name these specimens had borne in the Museum), and came to the conclusion that it was in no way connected with that shell. With *G. linearis*, Münster, as given by Phillips, it may have more in common, but I am not certain whether the rounding-in of the shell round the umbilicus occurs in that species.

SUB-ORDER—NAUTILOIDEA, *d'Orbigny*, 1826.I. Family—NAUTILIDÆ, *Owen*, 1836.1. Genus—SUBCLYMENIA, *d'Orbigny*, 1849.

“This genus differs from *Discitoceras* (*Discites*) in the sutures and position of the siphon. The sutures have a deep V-shaped ventral and acute linguiform first pair of saddles, first pair of lateral lobes narrow, a second pair of small lateral saddles near the umbilical shoulders, and dorsal saddles divided by shallow annular lobes with a minute median saddle. The abdomens are hollow, and the dorsal region gibbous, as in the adults of *Aphelæceras*. The siphon is near the venter, but the

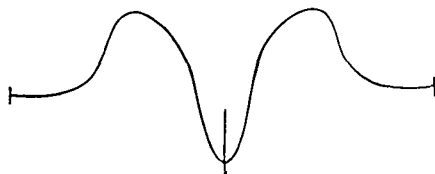
¹ 1850, F. A. Römer, ‘Beitr. Harzgeb.’ pt. 1, p. 19, pl. iii, figs. 30 a, b.

funnels do not approach near enough to interrupt the sutures or affect the depth of the ventral lobes. But one Carboniferous species is known—*S. evoluta*, Phil.”¹

De Koninck proves this genus to belong to the Nautilidæ.

1. SUBCLYMENTIA SYMONDSII, *MS.* Plate VII, figs. 3, 3 a, 4.

Description.—Shell very large, discoid, flattish, of two or three volutions, which appear probably to have been free, and to leave a central vacuity. Whorls rapidly increasing, sub-quadrate, nodose; ventrally broad, concave; dorsally narrow, slightly concave. Sides convex, rising slowly from their dorsal side to the shoulder for about two-thirds their height, and then curving down to the ventral side, where they seem bounded by a sharp angle; barred by distant ridges



which swell into large lofty bluntly conical nodes, at the shoulder, about twelve nodes to a whorl. Body-chamber probably large. Suture-line with a very long V-shaped central saddle, rather deep and convex central lobes, and low lateral saddles. Ornament consisting of small, crowded, unequal, rounded transverse riblets, divided by narrower grooves, running slightly backward from the inner margin to the shoulder, where they vanish; crossed by comparatively few distant impressed threads, which are absent on the shoulder but reappear on the ventral part of the side. Shell-structure probably not massive.

Size of cast.—Diameters 165 mm. and 110 mm. Width 65 mm.

Locality.—In the Museum of Practical Geology are two specimens from Luscott, near Braunton, one of which is a very large cast retaining in one place signs of the surface-markings, and the other the mould or inner surface of a smaller shell.

Remarks.—The largest specimen in the Museum is a splendid fossil, but in many respects it is most difficult to interpret. In the first place it has evidently been subjected to very great slant pressure, which has compressed it, altered the character of its coiling, and obscured the true shape of its whorls. Again, its whorls are so widely separated that it is difficult to imagine that they were in contact unless the shell-structure were immensely thick, which the fact of the cast bearing traces of the surface-ornament renders very improbable. Moreover,

¹ 1884, Hyatt, 'Proc. Boston Soc. N. H.,' vol. xxii, p. 293.

the stone is so covered with cracks and inequalities that anything in the nature of sutures is most difficult to trace. Lastly, several of the nodes on one side are removed by clean-cut concavities in such a way as almost to suggest that it had agglutinated foreign substances after the manner of *Philoxene*.

The species has been quoted in catalogues under the name of *Porcellia Symondsii* in accordance with the old label which the fossil bore in the Museum. Repeated examinations, however, convinced me that it was impossible that it could belong to that genus. Being struck with its great likeness to a Cephalopod, I then consulted Mr. Crick upon the subject, and his practised eye succeeded in tracing several of the suture-lines, and thus settling not only its order but its genus. This at once elucidated several of the perplexities about the fossil. It became evident that its elliptic shape was wholly due to pressure, and also that the same cause had probably exaggerated the originally broad, gently concave ventral surface into a narrow and deeply concave groove. Further, on our examining the specimen figured by Phillips¹ as *Nautilus tetragonus* (= *Discites Omalianus*, de Koninck,² sp., according to Foord³), which Hyatt refers to *Subclymenia*, it was seen that the surface-ornament, though not identical, was of such a kindred nature as to confirm Mr. Crick's conclusion.

Affinities.—Our species is at once distinguished from the type species of the genus, *S. evoluta*, Phillips, sp.,⁴ with which de Koninck⁵ afterwards identified his *Nautilus Omalianus*, by the presence of nodes.

II. Family—GOMPHOCERATIDÆ, Pictet, 1854.

1. Genus.—POTERIOCERAS, M^cCoy, 1844.

1. POTERIOCERAS ? sp. Plate IV, figs. 3, 3 a.

Description.—Shell apparently short, very rapidly tapering, recurved. Section quadrately sub-ovate, wider than deep. Siphuncle small, circular, 1 mm. in diameter, sub-central, being rather near to the convex side. Body-chamber expanding. Septate part apparently rapidly expanding, consisting of very narrow chambers, 3 mm. in height, with rather shallow concave septa, rather oblique, sloping slightly down (?) toward the convex side. Test thin.

Size of fragmentary specimen: height 40 mm.; transverse diameters 26 mm. and 30 mm.

¹ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 233, pl. xvii, fig. 24; and pl. xxii, figs. 33, 34.

² 1851, de Koninck, 'Desc. Anim. Foss. Terr. Carb. Belg.,' Suppt., p. 61, pl. lx, fig. 3.

³ 1891, Foord, 'Catal. Foss. Cephal. Brit. Mus.,' pt. 2, p. 87.

⁴ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 237, pl. xx, figs. 65—68.

⁵ 1880, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. v, pt. 2, p. 83, pl. xiv, figs. 5—6 a.

Locality.—A specimen from Kingdon's, Shirwell, is in the Barnstaple Athenæum.

Remarks.—This is evidently a species of either *Poterioceras* or possibly *Gomphoceras*. Its more central siphuncle (which is situated at a point 10 : 16 on the transverse diameter) distinguishes it from the various species found in South Devon; but the only specimen of it is unfortunately far too imperfect for identification.

2. POTERIOCERAS ? sp. Plate IV, fig. 5.

1841. ORTHOCERAS IMBRICATUM, *Phillips* (not *Hisinger*). Pal. Foss., p. 111,
pl. xlii, fig. 207.
not 1890. — CHAMPERNOWNI, *Whidb.* Mon. Devon. Faun., vol. i, p. 142,
pl. xv, figs. 11, 12.

Size of fragmentary specimen : width 36 mm. by 21 mm.

Locality.—Phillips's figured specimen from Marwood is in the Museum of Practical Geology.

Remarks.—This specimen is as poor as well could be,—consisting of eight crushed chambers from which the external parts are gone. It affords us little knowledge of the shell, except that it shows that there is a distinct wide shallow sinus or bay in the front margins of the septa, which I had not observed in the South Devon specimens, and hence that one point of difference in Phillips' shell from *Actinoceras Sowerbyi*, M'Coy, is removed, though on the other hand the almost exactly central position of the siphuncle is confirmed.

From the apparent rapidity of tapering in the above specimen, it seems to me most probable that it will, after all, prove to be distinct from the South Devon *O. Champernowni*, and to belong to *Poterioceras* or *Gomphoceras*.

III. *Family*.—ORTHO CERATIDÆ, *Broderip*, 1839.

1. *Genus*.—ORTHO CERAS, *Breyn*, 1732.

1. ORTHOCERAS, sp.

- cf. 1839. ORTHOCERAS LUDENSE, *Sowerby*. In Murchison's Silurian Researches,
p. 619, pl. ix, fig. 1.
1841. — — *Phillips*. Pal. Foss., p. 110, pl. xlii, figs. 206 a—c.
1855. — STRIATUM, *M'Coy*. Brit. Pal. Foss., p. 405.
? 1888. ACTINO CERAS STRIATUM ? *Foord*. Catal. Foss. Cephal., p. 187.

Description.—Shell very large, decreasing slowly at the rate of 1 : 12. Section oval, in ratio, 8 : 7. Chambers narrow, being in height about one seventh or one eighth the width of the shell. Septa sloping very obliquely across the short diameter. Siphuncle sub-circular, about one half an inch in diameter, sub-central, consisting of long vasiform or ellipsoidal beads, suddenly constricted into narrow concave necks at the septa, their greatest and least widths being as 7 : 5. Test about 3 mm. thick (in largest specimen), showing no markings.

Size.—A large specimen is five inches by three and a half inches in transverse diameters, but is probably slightly compressed.

Locality.—A large specimen from Top Orchard Quarry is in the Barnstaple Athenæum, and another, slightly smaller, from “North Devon” in the British Museum. The original of Phillips’s figured specimen (fig. 206 *b*) from the Pilton Beds is in the Museum of Practical Geology.

Remarks.—These specimens are fragmentary and insufficient to identify the species, which evidently was very large, probably several feet in length. Whether the other specimen figured by Phillips (fig. 206 *a*) is identical I am not quite sure, as, according to its figure, its tapering is more rapid, viz. 1 in 5 or 6 instead of 1 in 12 ; but it is possible that this apparent difference may be due to accidental circumstances.

Neither is it at present clear that these Devonian fossils have any right to the name of Sowerby’s Silurian *O. Ludense*.

Until more is known about its specific characters, it appears safer not to attempt to identify it with species belonging to a different formation.

It appears from the character of its siphuncle properly to belong to the genus *Orthoceras*, and is therefore probably distinct from the Lummaton species described by me as *Actinoceras devonicans*,¹ and from *A. striatum*, with which M’Coy² and Foord³ had doubtfully identified it.

Affinities.—*Orthoceras Pelops*, Hall,⁴ appears to equal it in size, and to be similar in many characters, but we have not sufficient data for full comparison.

2. ORTHOCERAS SPECIOSUM, Münster. Plate IV, fig. 4, 4 *a*.

1888. ORTHOCERAS, sp., Foord. Catal. Foss. Cephal., pt. 1, p. 98.

1890. — SPECIOSUM Whidborne. Dev. Faun., vol. i, p. 149, pl. xv, figs. 7?, 8—10.

¹ Vol. i, p. 120, pl. xii, figs. 8, 8 *a*.

² 1852, M’Coy, ‘Brit. Pal. Foss.,’ p. 405.

³ 1888, Foord, ‘Catal. Foss. Ceph.,’ vol. i, p. 187.

⁴ 1879, Hall, ‘Pal. N. Y.,’ vol. v, pt. 2, p. 233, pl. xxxv, figs. 1—3 ; pl. xxxva, figs. 1—6 ; pl. xxxvii, figs. 3, 4 ; pl. lxxviiiB, fig. 2.

Localities.—In the Barnstaple Athenæum are four specimens from Kingdon's, Shirwell, a doubtful specimen from Top Orchard, and two more without localities; in the Museum of Practical Geology are two poor specimens from Marwood, one from Baggy, and one from West Angle Bay, Pembrokeshire; in the British Museum is one from Kingdon's, Shirwell; and in the Woodwardian three from Barnstaple.

Remarks.—It appears to me that the Shirwell specimens undoubtedly belong to this species. Their surface is smooth; their section slightly oval (10 : 8); the siphuncle central and rather large; the ratio of the height of the chambers to their width 2 : 5 or 2 : 6; the rate of tapering about 1 in 8. The specimen from that locality in the British Museum is a body-chamber which is 110 mm. long and 36 mm. wide, and appears sub-cylindrical with a rate of tapering of only 1 in 12.

In the specimen from West Angle the shell-structure is rather thick, and the surface though smooth to the naked eye is seen under a strong lens to be covered with multitudinous microscopic impressed lines of which a few are slightly stronger than the rest; a faint carina is seen on its cast similar to that figured on a specimen from Lummaton.¹

F. A. Römer's² version of *Orthoceratites regularis*, Schlotheim,³ seems to be very similar to this species, but that form has much loftier chambers.

O. lineare, Münster, appears to differ in having fine elevated transverse threads instead of simple lineations which do not alter the level of the surface.

3. ORTHOCERAS BARUMENSE, n. sp. Plate IV, figs. 7, 7 a, 8, 8 a, 8 b.

Description.—Shell generally small, vertically straight, elongate, conical, probably tapering at about the rate of 1 in 10, covered by elevated, broad, slightly oblique, arching, convex, undefined rings at the rate (in the wider part) of four rings in a height equal to their width, which are separated by shallow concave constrictions about twice as wide as the rings. Septa gently convex, slightly oblique. Section circular or sub-circular with diameters as 9 : 10. Siphuncle rather large, very nearly central. Chambers broad, being apparently about one half their width in height in the smaller part (and probably decreasing to one quarter their width in height when nearer the body chamber). Surface of the shell entirely covered by minute, sharp, crowded, regular, distant, elevated, transverse threads or striæ, which sometimes slightly undulate, and are at the rate of nine striæ to 1 mm.

¹ Vol. i, pl. xv, fig. 9.

² 1843, F. A. Römer, 'Verst. Harzgeb.', p. 35, pl. x, figs. 4, 5, 8,

³ 1820, Schlotheim, 'Petrefact.', p. 24.

Size.—One specimen about 3 mm. in width is 20 mm. long. The largest fragment I have seen is about 11 mm. wide.

Localities.—In the Barnstaple Athenæum is a small specimen from Brushford; in my Collection one from Ironpost near Dulverton, one from Frankmarsh, and one from Upcott Arch Quarry; in Miss Partridge's Collection one from Lower Orchard Quarry.

Remarks.—At first it seemed that two species were represented by these fossils, the elevated annuli not being noticeable in the smaller specimens. After a careful comparison, however, it appears that they are all identical. The annuli probably became more prominent with the growth of the shell. They were probably conterminous with the chambers, as in one instance they appear to have been so, and if this is the case the height of the chambers varied from one half to one quarter the width of the shell. The ornamentation though minute is very definite, consisting of sharp striations considerably more than their own diameter apart and sometimes occurring in bands of three or four of greater fineness than usual.

Affinities.—From *O. lineare*, Münster,¹ which is similarly lineated, this species is distinguished by the possession of annuli. From *O. ibex*, Sowerby,² and *O. articulatum*, Sowerby,³ it differs in the absence of longitudinal striæ. The same character seems to distinguish it from all the American Devonian forms.

O. ulbense, Tschernyschew,⁴ agrees in form and rate of tapering; but probably differs in having fewer minor striæ, and wider and more horizontal chambers, and in being larger.

O. vertebratum, Sandberger,⁵ appears to differ in the striæ being intermittent, and perhaps in the annuli being larger.

4. ORTHOCERAS VENNENSE, Foord.

1840.	ORTHO CERAS CYLINDRACEUM, Sowerby.	Geol. Trans., ser. 2, vol. v, p. 703,* pl. lii, figs. 6, 7.
1841.	— — —	Phillips. Pal. Foss., p. 113, pl. xliii, figs. 213 a—c.
1888.	— VENNENSE, Foord.	Catal. Foss. Cephal., vol. i, p. 85.

¹ 1840, Münster, 'Beitr.,' pt. 3, p. 99, pl. xix, fig. 1.
² 1839, Sowerby, in Murch. 'Sil. Syst.,' p. 613, pl. v, fig. 30.
³ Ibid., p. 613, pl. v, fig. 31.
⁴ 1893, Tschernyschew, 'Verhandl. Russ. Miner. Gesell.,' vol. xxx, p. 18, pl. iii, figs. 1 a b.
⁵ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 170, pl. xx, figs. 3—3 c; and 1876, Maurer, 'Neues Jahrb. f. Min.,' Ann. 1876, pp. 12 and 23.

Size.—30 mm. long; 5 mm. wide.

Locality.—One specimen from the Marwood Beds of Baggy Point is in the Barnstaple Museum.

Remarks.—The only specimen known to me from the Pilton beds is too poor and doubtful to be worth figuring. Its septa are very unequal, and are often more than half the diameter of the shell in height; though on the whole they seem rather narrower than is usual in Sowerby and Phillips's figures. Phillips compares it with *O. regulare*, Münster,¹ to which it is rather similar in some respects.

It is recorded by Phillips from the Carboniferous localities of Venn and Swimbridge, as well as doubtfully from Baggy Point.

Affinities.—From *O. speciosum* it differs by its very much broader and more unequal chambers.

5. ORTHOCERAS, sp. Plate IV, fig. 6.

Description.—Shell small, straight, tapering at the rate of 1 in 7. Septa slightly oblique. Chambers about one quarter the width of the shell in height. Siphuncle (or endosiphon?) beaded, being constricted just below the septa into narrow necks about half its width, and then swelling out into convex-shouldered, straight-sided beads which are rather wider above than below, have rather stout walls and a microscopically rugose surface, and are clothed with a subsidiary envelope (or exterior siphuncle?). Subsidiary envelope dumb-bell-shaped, being very wide above and suddenly narrowing at about one-quarter its length below the septa, its sides then becoming straight and then sometimes (?) slightly expanding just above the next septum.

Size.—A defective specimen is 30 mm. high by 8 mm. wide.

Locality.—A single specimen from Kingdon's, Shirwell, is in the Barnstaple Athenæum.

Remarks.—This specimen only showing the section of the shell, it is almost impossible to identify it specifically. It seems, however, to be distinguished from accompanying species by the different height of its chambers, so that it probably represents a distinct species.

It seems remarkable for the arrangement of its siphuncular apparatus, which in superficial shape exactly resembles that of *Huronia*. It is seen, however, that the external envelope is entirely filled with white calcareous spar, and instead of a linear endosiphon with expanding tubuli it contains a simple and entire beaded tube. This tube Mr. Crick, who has very carefully examined the specimen with me, regards as the true siphuncle. This being so, the exterior envelope, though

¹ 1840, Münster, 'Beitr.', pt. 3, p. 95, pl. xvii, fig. 4.

evidently bounded by true walls, must be regarded as an organic deposition after the manner of those figured in some species of *Orthoceras* by Barrande.

Hence it appears that whatever the species may be, it probably belongs to the genus *Orthoceras*.

2. Genus—ACTINOCEBAS, Bronn, 1837.

1. ACTINOCERAS? (HURONIA) CRICKII, n. sp. Plate IV, figs. 9? 10—12.

Description.—Shell rather large, straight, tapering rather rapidly at the rate of about 1 : 6. Section elliptic, having the siphuncle situated excentrically, rather in front of the centre along the longer diameter, and considerably distant from the centre along the shorter diameter. Chambers narrow, very slightly oblique, and about one-sixth of the width of the shell in height. Septa shallow, convex, somewhat steeper in front, and having a wide, very shallow bay or sinus on the side farthest from the siphuncle. Siphuncle very large, about two-fifths the width of the shell; consisting of a series of subturbinate or vasiform rosettes, rather wider than high, which sometimes appear thickened by organic (?) deposits; and containing in its centre a slight free subcylindrical endosiphon. Endosiphon suddenly expanding just below the top of each rosette into about four radiating horizontal tubuli, which branch into minor tubuli near their extremities, are supported by ridges below, and are more or less joined to each other by their lateral expansions. Septa meeting the siphuncle only a little below its widest part, and enfolding its lower portion. [? Surface (on the cast) showing a long longitudinal carina and signs of rather distant alternating threads or striæ, fig. 9.]

Size.—A specimen of twenty chambers is 80 mm. long by 25 mm. wide; another, of about eleven chambers, is 55 mm. long by 27 mm. wide.

Localities.—Of external casts, probably belonging to this species, are two specimens from Top Orchard, three from Pilton Vicarage Well, and one from Fremington in the Barnstaple Athenæum; one from Baggy in the Museum of Practical Geology; two from Pilton in the Porter Collection; and two from Barnstaple and one from the south-west of Sloly in the Woodwardian Museum. Of natural sections showing the siphuncle there is one "from Yeotomes" in the the Barnstaple Athenæum; one from Croyde and one from Barnstaple in the Woodwardian Museum; and one from the Marwood Beds in the British Museum.

Remarks.—Most of the exterior specimens are very poor, and some are very doubtful, and could hardly be identified specifically by themselves; but from the dimensions of their chambers and other points they appear most probably to

belong to the same species as the remarkable natural sections last enumerated. Signs of the ornament are only seen in a single specimen from Baggy, but they appear sufficient to show its distinctness from the South Devon *O. laterale*, Phillips.

The internal arrangements seem peculiarly perplexing ; while they approximate those of *Actinoceras*, they appear to present several characteristics strongly indicative of the Lower Silurian genus *Huronia* as differing from *Actinoceras* itself, *e. g.* (1) in the vasiform shape of the rosettes ; (2) in having the tubuli not in the centre but at the summit of the rosettes ; (3) in the rosettes not being interseptal, but sunk into the bases of the septa ; (4) in the sides of the siphuncle being probably unsymmetrical, one side appearing as though it were more evenly nummuloid than the other ; (5) in the siphuncle possibly not occupying a symmetrical position in the shell. On the other hand, in the present species the septa and shell are generally preserved, having only perished in one specimen, whereas in *Huronia* they are hardly ever preserved.

Mr. Crick has most kindly taken much trouble in comparing these sections with Cephalopods in the British Museum, and we together came to the conclusion that they were so exceedingly like *Ormoceras vertebratum*, Hall,¹ = *Ormoceras Bayfieldi*, Stokes,² as in all probability to be congeneric. Hence the question arises, as *O. vertebratum* is the type of the genus *Ormoceras*, whether that genus ought to be united to *Actinoceras* after Foord or to *Huronia*. Mr. Crick regards Stokes's type (which is in the British Museum) as very enigmatical, but its structure seems to correspond with, and to be explained by, our specimens ; and it would seem, if we read the present species correctly, that *Ormoceras* is only *Huronia* in a different state of preservation, and that therefore *Huronia* has as much right as *Ormoceras* to be classed as a synonym, or perhaps a group, of *Actinoceras*.

The fact that in *Huronia* the siphuncle is almost always the only part preserved, which is said to prove the extreme tenuity of the shell, does not seem a bar against this, for it is easy to imagine that some species of the genus might have had thinner shells than others, or that shells in a siliceous deposit might have more easily perished than a limestone. Moreover in one of our own sections the siphuncle is the only part preserved, and in the other three the shells are retained in a very imperfect and indistinct condition. It may be noted that Stokes has, on the same plate as his *Ormoceras*, figured two sections of *Huronia*, which seem extremely like our fossils.

At the same time there can be no doubt that the general affinities of this species to *Actinoceras* are very great, and if the relationships to *Huronia* above noted be verified by future specimens they will probably be found to be evidence

¹ 1852, Hall, 'Pal. N. Y.,' vol. ii, p. 94, pl. xix, figs. 1 a—g.

² 1840, Stokes, 'Geol. Trans.,' ser. 2, vol. v, pt. 3, p. 709, pl. lx, fig. 1.

not that *Huronina*, as distinct from *Actinoceras*, existed in the Devonian, but that *Huronina* itself is merely a condition or, at most, a group of the genus *Actinoceras*.

Taking these sections in connection with the probable indications of external ornament, there seem to be sufficient characters known to warrant the suggestion of a name for the species.

Affinities.—The large *Orthoceras Ludense*, Phillips (not Sowerby), from these beds seems distinguished by its much greater size, wider chambers, and the shape of its siphuncle.

Actinoceras striatum, Sowerby¹ (= *O. lineale*, de Koninck²), differs in having much finer and more numerous equal lineations. It may be noted, however, that in the Woodwardian Museum there are specimens from Mudstone Bay and from Mawgan, which seem, in the few points visible, exactly like our fossils, and which are there labelled *Orthoceras striatum* (probably on the authority of Prof. M'Coy).

A. subconicum, d'Orbigny,³ is, as figured originally by Sowerby,⁴ remarkably like our sections, but has narrower chambers and more central tubuli.

CLASS—GASTEROPODA, *Goldfuss*, 1820.

1. ORDER—PTEROPODA, *Cuvier*, 1798.

I. *Family*—CONULARIIDÆ, *Walcott*, 1890.

1. *Genus*—CONULARIA, *Sowerby*, 1818.

1. CONULARIA DEFLEXICOSTA, *Sandberger*? Plate IV, fig. 13.

- ? 1847. CONULARIA DEFLEXICOSTA, *G. Sandberger*. *Bronn's Jahrb., Ann.* 1847, p. 16, pl. i, fig. 6.
 ? 1853. — — — *Sandberger*. *Verst. Rhein. Nassau*, p. 243, pl. xxi, figs. 1, 1 a.
 ? 1879. — CONTINENS, var. RUDIS, *Hall*. *Pal. N. Y.*, vol. v, pt. 2, p. 215, pl. xxxiv A, figs. 7, 8.

Description.—Shape probably a rather short pyramid. Faces without a central groove, but probably with a deep (angular?) marginal channel. Striæ distant,

¹ 1814, Sowerby, 'Min. Conch.,' vol. i, p. 129, pl. lviii; and 1888, Foord, 'Catal. Foss. Cephal.,' pt. 1, p. 190.

² 1880, de Koninck, 'Ann. Mus. Roy. N. H. Belg.,' vol. v, p. 79, pl. xli, figs. 9—9 c; and pl. xliii, figs. 8—8 e.

³ 1849, d'Orbigny, 'Prodrome,' vol. i, p. 2.

⁴ 1839, Sowerby, in Murchison's 'Sil. Syst.,' p. 642, pl. xxi, fig. 21.

about $\frac{2}{3}$ mm. apart, elevated, coarse, sloping upward, and curving in the centre so as sometimes to alternate and interlock at an angle of about 160° , or sometimes to meet in a continuous curve; alternating and interlocking at the margins. Interstitial spaces about four times the width of the striæ, transversely but irregularly lineated inside, and showing signs of coarse crenulation within immediately under the striæ, and very fine oblique lines on the outer surface.

Locality.—One specimen from Pilton is in the Porter Collection.

Remarks.—While this fossil gives abundant evidence that it belongs to the genus *Conularia*, it is insufficient for very definite determination. It is flattened and too fragmentary to show its exact shape, and the inner surface is the only part well displayed. At the same time several characters are more or less clearly indicated. Besides the points which are at first sight apparent, there may be observed signs of a deep angular grooving at the corners, and in one portion, where the cast of the outside surface seems exposed, a very fine and oblique lineation is visible, which may, however, be partly due to accident. The striæ are not perfectly regular, seventeen on one side of a face corresponding to twenty on the other.

In the points observable it appears so closely to resemble *C. deflexicosta*, Sandberger, that these seem sufficient reason to refer it (presumptively) to that species.

C. continens, var. *rudis*, Hall, seems only to differ from Sandberger's figure in being more strongly ornamented, and being rather shorter in shape, and in these points perhaps more nearly resembles our specimen.

Affinities.—Of the species described by d'Archiac and de Verneuil it seems most nearly to resemble *C. ornata*,¹ but its striæ are not so strongly angulated, while those of *C. Brongniarti*, d'Arch. and de Vern.,² are centrally continuous.

C. Salinensis, Whiteaves,³ has much coarser and fewer tubercles.

II. Family—TENTACULITIDÆ, Walcott.

1. Genus—TENTACULITES, Schlotheim, 1820.

1. TENTACULITES CONICUS, F. A. Römer. Plate IV, figs. 14, 14 a, 14 b.

1850. TENTACULITES CONICUS, F. A. Römer. Beitr. Harz., pt. 2, p. 80, pl. xii, figs. 20 a, b.

¹ 1842, d'Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 352, pl. xxix, figs. 5, 5 a.

² Ibid., p. 352, pl. xxxi, figs. 6—6 c.

³ 1891, Whiteaves, 'Cont. Canad. Pal.,' vol. i, pt. 3, p. 244, pl. xxxii, figs. 9, 9 a.

Description.—Test conical, rather elongate, regular, slightly oblique. Section apparently circular. Rate of increase 1 in 3. Surface divided by about twenty-two sharp, raised, slightly irregular annuli, which are not quite parallel near the aperture; with slightly concave, wide interspaces, which are finely and obliquely striated from right to left (thus // /) when viewed with the apex at the bottom.

Size.—Height 7 mm., width at aperture 2.5 mm.

Locality.—A single specimen, mould and cast, from Top Orchard is in the Barnstaple Athenæum.

Remarks.—The specimen is somewhat crushed, so that it is not possible to be certain that it was circular in section; and from the roughness and decomposition of the matrix the oblique striation can only be seen with great difficulty.

It is evidently a Tentaculite, and so closely approaches *Tentaculites conicus*, F. A. Römer, of the Wissenbach Slates, that I think it may probably be referable to that species. The only differences I can see are that the German fossil is slightly more elongate, increasing at the rate of two in seven instead of two in six, and that the striation is not seen in the figures. The latter is, however, so very minute that it might very well not have been noticed, and in specimens from Wissenbach in the British Museum, Mr. Crick and I discovered a similar striation, though it seemed direct rather than oblique. The former difference is probably due to the English shell being a little flattened out. I therefore have little doubt that they are identical.

Affinities.—This is distinguished from *Tentaculites tentacularis*, Phillips, sp., by its very much lower rate of tapering.

T. subconicus, Geinitz,¹ is much narrower, increasing at the rate of two in eleven, but Geinitz hesitates whether to regard it as more than a variety. He states² that *T. annulatus*, Schlotheim,³ is very much larger, and that Schlotheim's fig. 8 a is Silurian, but fig. 8 b is Devonian.

Orthoceras Ausavense, Steininger, is considerably larger and more elongate, but is otherwise very similar in general appearance.

T. durus, Ludwig,⁴ seems narrower and larger.

T. acuaris, Richter,⁵ as given by Kayser,⁶ has fewer annuli, and the striæ are longitudinal, not oblique.

¹ 1853, Geinitz, 'Verst. Grauwack. Saschen,' pt. 2, p. 73, pl. xix, fig. 15.

² Ibid., p. 73.

³ 1820, Schlotheim, 'Petrefact.,' p. 377, pl. xxix, fig. 8 a.

⁴ 1864, Ludwig, 'Palæontograph.,' vol. xi, p. 318, pl. 1, figs. 3 a, b.

⁵ 1854, Richter, 'Zeitsch. Deutsch. Geol. Gesell.,' vol. vi, p. 285, pl. iii, figs. 3—9.

⁶ 1878, Kayser, 'Abhandl. Geol. Specialk. Preuss.,' Band ii, pt. 4, p. 112, pl. xxxi, figs. 1—3.

Sub-genus—*COLEOLUS*, Hall, 1879.

Shell tubularly conical or slightly curved, very elongate; walls rather thick, smooth interiorly, annulated with transverse or oblique striæ or rings externally.

It is very doubtful whether there is any reason for separating this group from *Tentaculites* proper, on account of its smooth, simple interior, thicker walls, &c.

2. *TENTACULITES* (*COLEOLUS*?) *TENTACULARIS*, Phillips, sp. Plate IV, fig. 15.

1841. *ORTHO CERAS TENTACULARE*, Phillips. Pal. Foss., p. 112, pl. xliii, figs. 210 a—e.
- ? 1845. *TENTACULITES TENUIS*, Keyserling. Wissensch. Beob. Petschora-Land, pp. 272, 273.
- ? 1850. — *TENUICINCTUS*, F. A. Römer (pars?). Beitr. Harzgeb., pt. 1, p. 28, pl. iv, figs. 19 a?, b.
- ? 1853. — — Sandberger. Verst. Rhein. Nassau, p. 250, pl. xxi, fig. 13.
- ? 1887. — — Tschernyschew. Mém. Com. Géol., vol. iii, No. 3, p. 42, pl. vii, fig. 14.

Description.—Test very elongate, conical, circular in section, increasing at the rate of about 1 : 20, internally smooth, externally banded by very numerous, regular, elevated, rather distant annuli, about five or seven in a space equal to width, and with a few finer irregular striæ. Structure rather thick.

Size.—An imperfect specimen is 15 mm. long and 2 mm. in diameter.

Localities.—A slab in the Porter Collection contains six imperfect specimens from Pilton. Phillips quotes it from Baggy Point and from Meadfoot (near Torquay).

Remarks.—These specimens are evidently identical with Phillips's North Devon shell, though the annuli are generally closer. He regards it as an *Orthoceras*, because he considered that he saw septa in some of the specimens. He remarks, however, "that they are not satisfactory in regard to the siphuncle and septa," and he does not state whether it was in the North or the South Devon specimens that he observed these appearances. I should have very great difficulty in regarding those fossils which I have examined as Cephalopods, both on account of the thickness of their walls and the smooth simple casts of their interior, which show no signs of septa. The lines indicating septa in Phillips's figure might, I think, easily be accounted for by the shrinkage of sediment in a long tube. Septa, however, exist near the apical end of *T. attenuatus*, Hall.¹

¹ 1889, Nicholson and Lydekker, 'Manual Palæont.,' vol. i, p. 809, fig. 725.

T. tenuicinctus, F. A. Römer, has often broader rings, *i. e.* only four in a space equal to the width, but in other respects seems to agree, as far as can be judged by Römer's figure. As given by Sandberger and Tschernyschew, it is so very much smaller than the English fossil that it is *unlikely* to be identical.

Affinities.—*T. glaber*, Trautschold,¹ is very similar in shape and arrangement, but the annuli are so fine that the fossil is said to have the appearance of a *Bactrites* or a crinoidal tentacle.

Orthoceras, n. sp., Holzapfel,² may be compared as being similar in ornament, but considerably larger.

2. ORDER—PROSOBRANCHIA, *Milne-Edwards*, 1848.

There seem indications of a considerable number of univalves in the Pilton beds, especially in one or two bands near the base, where some minute species occur in considerable abundance. In the Marwood zone only two species are at present known to have existed.

I. *Family*—PSEUDOMELANIIDÆ, *Fischer*, 1887.

1. *Genus*—MACROCHILINA, *Bayle*, 1880.

1. MACROCHILINA TURBINEA, n. sp. Plate V, figs. 1, 2.

Description.—Shell small, elongate, turbinate, of three or four volutions. Spire equal to half the height of the shell, convex, the upper whorls being smaller in proportion than the lower. Suture simple, shallow. Whorls much exposed, very broad, convex, arching out from the upper suture, flattened on the back, and slightly incurving to the lower suture. Shell-structure very thin. Surface smooth.

Size.—A defective specimen is 16 mm. long and 8 mm. wide.

Localities.—In the Barnstaple Athenæum is a specimen from Kingdon's, Shirwell, and another from Vicarage Well, Pilton.

Remarks.—This species, though imperfectly known, appears characterised by its turbinate form, resulting from the increasingly disproportionate diminution of its spire, and by its very broad whorls. The surface is shown to be smooth by a small fragment of shell remaining on the figured specimen from Shirwell.

¹ 1881, Trautschold, 'Dev. Foss. Schelong,' p. 5, pl. v, fig. 5.

² 1882, Holzapfel, 'Palæontographica,' vol. xxviii, p. 247, pl. xlvii, fig. 5.

Affinities.—It appears to be nearest to *M. elevata*, Whidborne,¹ from Lummaton, but to be distinguishable by its still broader whorls, and turbinate instead of conical spire.

Mr. Roberts seems to have been inclined to identify it with *Loxonema linctum*, Phillips, sp.;² but it appears separable from that shell by its broader and more exposed whorls, its loftier spire, and its smooth surface.

It is very distinct from all the Carboniferous shells described by de Koninck.

2. MACROCHILINA PUSILLA, n. sp. Plate V, fig. 3.

Description.—Shell very small, rather elongate, of four or five volutions. Spire conical, elevated, turritid, less than half the height of the shell. Suture rather deep and subacute. Whorls narrow, very much exposed, rapidly increasing, convex on the shoulder, rather flattened on the back, and curving in to the lower suture. Body-whorl large, diffuse, subglobose, rapidly narrowing in front. Surface smooth.

Size.—Height 3 mm., width 2 mm.

Localities.—There are two specimens from Pilton and one from Frankmarsh in the Porter Collection, and one from Upcott Arch Quarry in Miss Partridge's Collection.

Remarks.—It is of course possible that these minute shells may be the fry of a larger species, but I know of none with which there is reason to identify them. It seems to me, therefore, that they must be regarded as a new form.

Affinities.—It appears to have a higher spire and less enveloped whorls than *M. imbricata*, Sowerby, sp.;³ more convex and less enveloped whorls than *M. subimbricata*, d'Orbigny, sp.;⁴ and much narrower whorls than any of the other South Devon species.

It seems to have a higher spire than *M. monodontiformis*, de Koninck,⁵ and a wider body-whorl than *M. minor*, de Koninck.⁶

¹ 1891, vol. i, p. 170, pl. xvii, figs. 11—12 a.

² Ibid., p. 170, pl. xvii, fig. 13.

³ Ibid., p. 164, pl. xvii, figs. 1—4.

⁴ Ibid., p. 166, pl. xvii, figs. 5—7.

⁵ 1881, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. vi, pt. 3, p. 28, pl. iii, figs. 32, 33.

⁶ Ibid., p. 35, pl. iii, figs. 28, 29.

2. Genus—LOXONEMA, Phillips, 1841.

1. LOXONEMA HALLII, n. sp. Plate V, fig. 8.

Description.—Cast small, elongate, tapering, of seven or eight whorls. Spire conical, much larger than the body-whorl. Sutures very slight. Whorls nearly flat and very broad. Apex acute. Surface apparently smooth.

Size.—Height about 12 mm.; width about 4 mm.

Locality.—One specimen from Vicarage Well, Pilton, is in the Barnstaple Athenæum.

Remarks.—This appears to be an almost perfectly conical shell, the sutures being very slightly indented, and the whorls obliquely flattened. Though the only specimen is in a very poor and rather crushed condition, it seems to give sufficient evidence of its distinctness from any other Devonian forms with which I am acquainted.

Affinities.—It comes very near in general shape to the Carboniferous *Loxonema leviusculum*, de Koninck,¹ but differs in having considerably broader and fewer whorls, and probably a larger body-whorl. Its mouth is not preserved, so that its genus can be only decided by its general affinity to other species; and as numerous similar shapes are referred by de Koninck to *Loxonema*, I have placed it in that genus.

It bears considerable resemblance to *Macrochilina ejecta*,² from South Devon, especially in the breadth and flattening of its whorls, but differs in its more elongate spire.

2. LOXONEMA TROCHLEATUM, Münster, sp. Plate V, figs. 4, 4 a, 5, 5 a.

1840. TURBITELLA TROCHLEATA, Münster. Beitr., pt. 3, p. 88, pl. xv, fig. 18.

1843. LOXONEMA SUBULATA, F. A. Römer. Verst. Harzgeb., p. 31, pl. viii, figs. 12, 12 a.

1853. — — Sandberger. Verst. Rhein. Nassau, p. 229, pl. [xxvi, fig. 10.

Description.—Shell very small, many-whorled, slowly increasing, aciculate. Whorls nearly as broad as high, with a narrow, oblique, flat rim under the suture,

¹ 1881, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. vi, p. 44, pl. iv, figs. 28, 29.

² 1891, Whidborne, 'Dev. Fauna,' vol. i, p. 170, pl. xvii, fig. 13.

which is bounded by a blunt angle at the shoulder, the rest of the whorl being gently convex. Surface smooth, shell-structure rather thick.

Sile.—An imperfect specimen is 6 mm. long and 2 mm. wide.

Locality.—In the Barnstaple Athenæum are two specimens from Kingdon's, Shirwell, and one from Vicarage Well, Pilton.

Remarks.—These specimens are portions of an extremely elongate shell, which increases very slowly, the diameter of the highest remaining whorl being more than half that of the fifth below it. As far as can be seen they exactly correspond with the species described by Sandberger, which, as stated by him, is a synonym of *Turritella trochleata*, Münster. The latter shell, he says, is different from *Turbonilla trochleata*, Geinitz,¹ which certainly seems to have narrower and more convex whorls than our specimens.

To Römer's own shell they bear less likeness, as that is described as finely striated on the body-whorl, and has perhaps even broader whorls. As, however, the body-whorls of our specimens seem lost, and the surface of the shell is in rather obscure preservation, and as Sandberger distinctly describes the whorls as smooth, there appears to be no reason to separate them on that account.

A kindred specimen in the Woodwardian Museum from west of Saunton Court is noteworthy, though it is too poor for identification. Three or four whorls are seen, which increase much more rapidly in height than in width, so that the lower whorls are one and a half times as high as wide. Possibly it is only a distorted variety of the present species, but it presents great similarity to species of the genus *Subulites*, to which it may perhaps belong.

Affinities.—The very similar specimen figured by Frech² appears from his description to be a *Murchisonia*, having a sinus-band.

3. LOXONEMA PRISCUM, Münster, sp?

1891. LOXONEMA PRISCUM, *Whidborne*. Dev. Faun., vol. i, p. 181, pl. xviii, figs. 17—19.

Localities.—There are several small specimens in the Woodwardian Museum from the west of Saunton Court.

Remarks.—These specimens, which are in a very poor state of preservation, seem very similar to the fossils from Lummaton and Wolborough, which I have referred to this species.

Affinities.—They differ from the Shirwell specimens referred to *L. trochleatum*

¹ 1853, Geinitz, 'Verst. Grauw. Sachs.,' pt. 2, p. 42, pl. xi, fig. 7.

² 1887, Frech, 'Zeitsch. Deutsch. Geol. Gesell.,' vol. xxxix, p. 730, pl. xxviii, fig. 1.

in being much shorter shells with fewer, narrower, and more rapidly increasing whorls.

Their smooth surface at once distinguishes them from *L. Hennahianum*,¹ to which they have been referred, as well as from *Holopella antiqua*, Goldfuss,² sp., which I formerly confused with that shell. Since describing certain Lummaton fossils³ under the name of *H. Hennahiana*, Sowerby, I have seen the type specimen of that species in the Museum of the Geological Society, and find that it is evidently distinct from them. It is very much more coarsely ribbed than they are, and is more nearly akin to *L. nexile*, Phillips. Those Lummaton shells ought therefore to bear the name *Holopella antiqua*, Goldfuss, sp., instead of *H. Hennahiana*, Sow., which must be restricted to the Plymouth species.

4. LOXONEMA ANGLICUM, *d'Orbigny*. Plate V, fig. 6.

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|-------|--------------------------------------|--|
| 1841. | LOXONEMA RUGIFERA, <i>Phillips</i> . | Pal. Foss., p. 101, pl. xxxviii, fig. 188. |
| 1849. | — ANGLICA, <i>d'Orbigny</i> . | Prodrome, vol. i, p. 62. |
| 1867. | — RUGIFERUM, <i>Trenkner</i> . | Paläont. Novitat., pt. 1, p. 11, pl. i, fig. 19. |
| 1884. | — — <i>Clarke</i> . | Neues Jahrb. f. Min., Beil.-Band 3, p. 366, pl. v, figs. 24, 25. |
| 1895. | — RUGIFERA, <i>Vénukoff</i> . | Syst. Dev. Chaine des Mongodjares, p. 153, pl. iii, fig. 12. |

Description.—Shell large, many-whorled, subulate, very elongate, with apparently rather undulating sides to the spire. Apex aciculate. Spire consisting of ten or eleven very broad whorls, which are higher than the width of the shell near the apex, and gradually diminish in ratio, so that the height of the tenth whorl is about two-thirds of its width. Suture simple, shallow, obtuse. Whorls sloping from the suture in a sigmoid curve, the upper part being slightly and obliquely concave, and the lower part wide and convex; ornamented with about twelve very large, prominent, transverse, rounded ribs, which are largest in the central parts of the whorl, and are rather oblique and slightly sigmoid, and so arranged that they frequently form continuous ribs down the spire. "Mouth roundish."

Size.—A specimen in the Museum of Practical Geology measures 45 mm. high by 11 mm. wide.

Localities.—There are four specimens from Braunton Down in the Museum of Practical Geology, and one from Frankmarsh in Mr. Hamling's Collection. A very poor cast from Kingdon's in the Barnstaple Athenæum appears to belong to this species.

¹ 1840, Sowerby, 'Geol. Trans.,' ser. 2, vol v, pt. 3, pl. lvii, fig. 22.

² 1844, Goldfuss, 'Petref. Germ.,' vol. 3, p. 110, pl. cxcvii, fig. 14.

³ 1891, Whidborne, 'Dev. Fauna,' vol. i, p. 228, pl. xviii, figs. 16, 16 a.

Remarks.—This beautiful species is well described and represented by Phillips in the ‘Pal. Foss.,’ but it appears to be distinct from the Yorkshire *L. rugiferum* (Ph.),¹ with which he identifies it. It is distinguished by the fact that the ribs are continuous over the whole surface in the adult shell, as well as in the young form. This distinction is observable even in Phillips’s own descriptions of his two shells. The evanescence of the upper part of the ribs in adult shells in the Carboniferous species is still more clearly seen in de Koninck’s figures,² who separates the Devonian form from it on the authority of d’Orbigny under the name of *L. anglicum*. On the other hand, in all the Devonshire specimens of *L. anglicum*, even in the largest which I have seen, the continuity of the ribs is clear; and these ribs also seem slighter, more continuously uniform in size, and rather more flexuous. The same characters are shown by both Clarke’s and Trenkner’s figures of the German Devonian shell.

At the same time the two forms have many characters in common, and it is quite possible that the examination of a larger series of examples than we have at present might break down the line of distinction between them.

Affinities.—*L. angulosum*, F. A. Römer,³ is a shorter, fewer-whorled shell, with more arching ribs.

Holopella moniliformis, F. A. Römer,⁴ differs in having its ribs twice as numerous, and twice as fine.

II. *Family*—NATICIDÆ, Forbes, 1838.

1. *Genus*—NATICOPSIS, M^cCoy, 1844.

1. NATICOPSIS HALLII, n. sp. Plate V, figs. 11, 12, 13?

Description.—Shell rather small, subglobose, rather oblique. Spire low, turbiniform, consisting of between three and four rapidly increasing convex volutions, which are less than half exposed. Sutures shallow, obtuse. Body-whorl more than two-thirds the total height of shell, voluminous, convex. Mouth pear-shaped, longer than wide, entire, acute behind. Inner lip sigmoidal, somewhat produced below, where it forms a spurious columella, and covered with a spreading callosity. Umbilicus apparently closed. Surface smooth.

¹ 1838, “*Melania rugifera*,” Phillips, ‘Geol. Yorks.,’ vol. ii, p. 229, pl. xvi, fig. 26.

² 1881, de Koninck, ‘Ann. Musée Roy. d’Hist. Nat. Belg.,’ vol. vi, p. 59, pl. vi, figs. 12, 13.

³ 1850, F. A. Römer, ‘Beitr. Harzgeb.,’ pt. 1, p. 3, pl. i, fig. 5.

⁴ 1866, *ibid.*, pt. v, p. 8, pl. xxxiv, figs. 5a, b.

Size.—Two specimens measure respectively 14 mm. high by 12 mm. wide, and 18 mm. high by 16 mm. wide.

Localities.—In the Barnstaple Athenæum are two casts and one mould from Sloly, and in the Museum of Practical Geology, seven casts from the Marwood beds, and four from "Pilton beds, Croyde Bay," besides another poor specimen from Croyde, which appears to have come from a higher horizon. A minute cast (fig. 13) from the Cucullæa beds of Baggy Point, in Mr. Hamling's Collection, which has a very low spire, seems to be the young form of this species.

Remarks.—These fossils have been variously referred to *Natica meridionalis*, *Macrocheilus imbricatum*, and *Pleurotomaria*, but they certainly have nothing to do with either. With two exceptions they have a red ferruginous matrix, indicating that they came from the top of the Sloly beds. The surface is seen from the mould to be distinctly smooth. The shape of the mouth is well shown in some specimens, the outer lip curving regularly to the front, until it meets the inner lip, where it curls round, forming the free margin of a long oblique cylinder of shell, which is a kind of spurious columella. The height of the spire is rather variable, and probably increases with age. This species is named after Townshend M. Hall, Esq., F.G.S., who made the Collection now in the Barnstaple Athenæum.

Affinities.—It is easily distinguished from *N. meridionalis*, Phillips,¹ by its smoothness, and its greater size and shortness.

Natica striolata, F. A. Römer,² differs in being finely striated, and in having a rather higher spire.

Natica purpura, F. A. Römer,³ is much more elongate, and has a much higher spire.

Naticopsis elegantula, Ehlert and Davoust⁴ (which appears to agree generically), is very similar to the young form of our shell, but seems distinguished by having transverse and also fine longitudinal striæ.

2. Genus—NATICA, Adanson, 1757.

1. NATICA? MERIDIONALIS, Phillips. Plate V, fig. 14.

1841. NATICA MERIDIONALIS, Phillips. Pal. Foss., pl. xxxvi, fig. 173.

Description.—"Shell small, with equidistant undulations, which are most prominent on the upper part of the whorl, and pass thence in a directly longitudinal direction" (Phillips).

¹ 1841, Phillips, 'Pal. Foss.,' p. 94, pl. xxxvi, fig. 173.

² 1850, F. A. Römer, 'Beitr. Harz.,' pt. 1, p. 33, pl. v, fig. 7.

³ Ibid., pt. 1, p. 34, pl. v, fig. 8.

⁴ 1880, Ehlert and Davoust, 'Bull. Soc. Géol. Fr.,' ser. 3, vol. vii, p. 712, pl. xv, figs. 3—3 c.

Size.—Height 2 mm., width 1·5 mm.

Localities.—Baggy (*vide* Phillips). One or two small casts from Ironpost, near Dulverton, in my collection, appear to belong to this species.

Remarks.—I have not met with any undoubted specimens of this shell, but the above-mentioned casts probably belong to it. They are globose shells with half-exposed, quickly-increasing whorls, which (in the cast) are convex on the shoulder and nearly flat on the broad back. They agree with Phillips's figure in dimensions, except that perhaps they are slightly wider.

Affinities.—From *Naticopsis Hallii* they differ in being much smaller, less oblique, and more elongate and turreted.

III. *Family.*—CAPULIDÆ, *Fleming*, 1828.

1. *Genus.*—CAPULUS, *Montfort*, 1810.

1. CAPULUS ROSTRATUS, *Trenkner*? Plate V, fig. 15? 16.

? 1867. CAPULUS ROSTRATUS, *Trenkner*. Paläont. Novit., pt. 1, p. 12, pl. i, fig. 22.

1891. — — ? *Whidborne*. Devon. Faun., vol. i, p. 207, pl. xx, figs. 6—8.

Locality.—One or perhaps two small specimens are in the Porter Collection from Pilton.

Remarks.—Mr. Porter's specimen undoubtedly agrees, I think, with Wolborough and Lummaton fossils referred by me to this somewhat doubtful species. The body-whorl is deeply concave below and very much flattened. The apex would seem to be much closer to the plane of the mouth than it is in the South Devon specimens.

A very similar specimen was found by Dr. Hicks and myself at Freshwater West, Pembrokeshire.

2. CAPULUS TERMINALIS, *Whidborne*. Plate V, figs. 17, 17 a.

? 1885. CAPULUS DORMITANS, *Maurer*. Abhandl. Grossh. Hessisch. Geol. Landes., vol. i, pt. 2, p. 239, pl. x, figs. 14, 14 a.

? 1885. — HAINENSIS, *Maurer*. Ibid., p. 239, pl. x, figs. 16—20.

1890. — TERMINALIS, *Whidborne*. Devon. Fauna, vol. i, p. 211, pl. xx, figs. 16, 16 a.

Locality.—There are two specimens in the Porter Collection from Pilton.

Remarks.—One of Mr. Porter's specimens is a fine though slightly distorted cast, and appears accurately to agree with the South Devon form. The second is a mould, and is consequently doubtful, as the shape of the upper part of the whorl is hidden.

The English fossils closely resemble and are midway between Maurer's two species, *C. dormitans* and *C. Hainensis*. These two species seem to differ only in the length of the body-whorl, and the latter of them itself is seen to vary considerably in that particular. If the three forms are identical, *C. dormitans* would be its rightful name. It may, perhaps, be well for the present to leave them unblended, as in the upper part of the inner side of the English specimens is a strong longitudinal fold not seen in the German specimens, and we have not at present sufficient material to show whether this is an accidental or permanent character.

3. CAPULUS COMPRESSUS, *Goldfuss*, sp. Plate V, figs. 18, 18 a.

1891. CAPULUS COMPRESSUS, *Whidborne*. Dev. Faun., vol. i, p. 209, pl. xx, figs. 9—11.
1895. PLATYCERAS COMPRESSUM, *Kayser*. Ann. Soc. Géol. Belg., vol. xxii, p. 184, pl. iv, figs. 1—3.
1895. — — — *Holzappel*. Abhandl. k. Preuss. Geol. Landes., n.s. pt. 16, p. 176, pl. xi, figs. 5, 6, 9; pl. xiv, figs. 8—11; and pl. xv, figs. 1—3.

Size.—Height 8 mm., width 17 mm., depth 17 mm.

Localities.—In the Barnstaple Athenæum are three casts from Top Orchard, Croyde Bay, and Pilton respectively.

Remarks.—These specimens are not very clear, being too much crushed and obscured by matrix to be easily identified. In its present condition the best preserved specimen so closely resembles *C. compressus*, especially as figured by Kayser from Belgium, that it seems most probable that they are identical.

Affinities.—From South Devon specimens of *C. rostratus*, Trenkner, it differs by its less flatness, by the concavity of its lower side, and by indications of longitudinal folds near the mouth. It is quite possible that, as Holzappel asserts, *C. rostratus* may prove to be only a variety of *C. compressus*; but I can by no means follow him in uniting such totally distinct shells as *Diaphorostoma* (= *Platystoma*) ? *sigmoidale*, &c., with the latter species.

C. Zinckeni, F. A. Römer,¹ as given by Barrois,² has a less incurved and rounded apex, and a much more rapidly increasing whorl.

2. *Sub-genus*—*ORTHONYCHIA*, Hall, 1843.

1. *ORTHONYCHIA ROTUNDA*, n. sp. Plate V, figs. 19, 19 a.

Description.—Shell rather large, elevated, campanulate, not involute. Apical extremity small, bent forward; the perpendicular from the apex to the plane of the mouth falling within the aperture at one-third of the diameter from its front or inner side. Whorl very rapidly expanding, indented by four indistinct shallow depressions, which run from near the apex to the corners of the mouth. Mouth very wide, expanding, sub-quadrate, considerably wider than long, with a rather undulating margin, which is lobed by the indistinct concavities at the corners. Surface apparently rather irregular, and covered with coarse undulating growth-lines.

Size.—Height 24 mm.; width across mouth 26 mm., from mouth to apex 15 mm.

Locality.—A single specimen from Pilton is in the Porter Collection.

Remarks.—This fossil, while approaching *Orthonychia quadrangularis*, mihi,³ from South Devon, appears to differ specifically by having a more central and recurved apex, a more oblique inner side, a rougher surface marked with undulating growth-lines, and a less quadrate mouth, which is undulated by several concavities round the margins. The apex itself is defective both in the mould and cast of our specimen.

Affinities.—It approaches *Platyceras dubium*, Barrois,⁴ but seems to differ in being less transverse and less botryoidal, and in having a recurved apex.

2. *ORTHONYCHIA ACUTA*, F. A. Römer, sp. Plate V, figs. 20, 21; and Plate VI, figs. 1, 1 a, 2, 2 a.

1855. *ACROCULIA ACUTA*, F. A. Römer. Beitr. Harzgeb., pt. 3, p. 6, pl. ii, fig. 11.

1855. — *BISCHOFII*, F. A. Römer. Ibid., pt. 3, p. 6, pl. ii, fig. 10.

¹ 1843, F. A. Römer, 'Verst. Harzgeb.', p. 17, pl. vii, fig. 4.

² 1889, Barrois, 'Mém. Soc. Géol. Nord,' vol. iii, p. 197, pl. xiii, figs. 6—6 c.

³ 1891, Whidborne, 'Devon. Faun.,' vol. i, p. 223, pl. xxi, figs. 8—8 b.

⁴ 1889, Barrois, 'Mém. Soc. Géol. Nord,' vol. iii, p. 191, pl. xiii, figs. 1 a, b.

1858. *CAPULUS ACUTUS*, *Giebel*. Sil. Faun. Unterharz., p. 18, pl. iii, figs. 14, 17, 18.
1858. — *BISCHOFII*, *Giebel*. Ibid., p. 19, pl. iii, figs. 1, 3, 13.
1858. — *ACUTISSIMUS*, *Giebel*. Ibid., p. 19, pl. iii, fig. 9.
- ? 1858. — *SELCANUS*, *Giebel*. Ibid., p. 20, pl. iii, fig. 8.
1861. *PLATYCERAS CONICUM*, *Hall*. Desc. New Species Fos., p. 3.
1861. — *QUINCYENSIS*, *McChesney*. Desc. New Palæoz. Foss., p. 90.
1865. — — — Ibid., Illust., pl. vi, figs. 6 *a*, *b*.
1867. — *QUINCYENSE*, *McChesney*. Trans. Chicago Acad. Sci., vol. i, p. 49, pl. vi, fig. 6.
1868. — (*ORTHONYCHIA*) *QUINCYENSE*, *Meek and Worthen*. Geol. Surv. Illinois, vol. iii, p. 510, pl. xv, figs. 5 *a*, *b*.
- ? 1868. — — — *SUBPLICATUM*, *Meek and Worthen*. Ibid., p. 457, pl. xiv, figs. 4 *a*—*c*.
- ? 1868. *CAPULUS CONICUS*, *Trenkner*. Palæont. Novitat., pt. 2, p. 21, pl. vii, fig. 14.
1878. — *HERCYNICUS*, *Kayser*. Abhandl. Geol. Specialk. Preuss, Band 2, pt. 4, p. 89, pl. xiv, figs. 1—14; and pl. xv, figs. 10—11 *b*.
1879. *PLATYCERAS (ORTHONYCHIA) CONICUM*, *Hall*. Pal. N. Y., vol. v, pt. 2, p. 3, pl. i, figs. 13—23.
- ? 1885. — *SELCANUS?*, *Maurer*. Abhandl. Grossh. Hessisch. Geol. Landes., vol. i, pt. 2, p. 242, pl. x, figs. 23, 24.
1889. *PLATYCERAS ACUTUM*, *Barrois*. Mém. Soc. Géol. Nord., vol. iii, p. 198, pl. xiii, fig. 7.
1889. — *ACUTISSIMUM*, *Barrois*. Ibid., p. 199, pl. xiii, fig. 8.
1889. — *HERCYNICUM*, *Barrois*. Ibid., p. 189.
- ? 1889. — *SELCANUM*, *Barrois*. Ibid., p. 190, pl. xii, fig. 7.
- ? 1889. — *DUBIUM*, *Barrois*. Ibid., p. 191, pl. xiii, fig. 1.
1893. — *CULTELLUS*, *Tschernyschew*. Mém. Com. Géol., vol. iv, No. 3, p. 157, pl. i, fig. 27.

Description.—Shell elongate, not involute, very variable. Apex blunt, vertical, situate somewhat in front of the perpendicular from the centre of the plane of the mouth. Whorl more or less conical or fusiform, increasing with variable rapidity, and generally bearing several concavities and convexities, which radiate from the apex, and which render the oral margins irregularly lobate. Mouth large, sub-oval. Surface apparently marked by indistinct growth-lines.

Size.—Height 12 mm., width 12 mm.

Localities.—There is a specimen from Sowden, near Barnstaple, and one from Top Orchard, in the Barnstaple Athenæum; another from Top Orchard in the Woodwardian Museum; and three, respectively from Pilton, Fremington, and Marwood Parish, in the Porter Collection.

Remarks.—The above specimens vary very greatly in shape. No two of them

are alike, and the great difference in apical height may be seen by comparing the two first figures on Pl. VI. No doubt this is partly due to pressure during fossilization, but the amount of natural variation was evidently very great. Nevertheless, there do not appear to be any definite characters by which any of them might be specifically distinguished from the rest, and there seems every reason to suppose that they all belong to a single very variable species.

This view is borne out by a comparison with the foreign forms described by F. A. Römer, with which our English specimens evidently agree. They are shown by Kayser to form part of an extremely variable species, to which he gives the name *C. hercynicus*, but which, as it appears to me, the laws of nomenclature oblige us to call either *C. Bischoffi* or *C. acutus*. The limits which Kayser assigns to his species are still wider than those shown by our Pilton specimens. There is no English evidence of the elongate *C. acutissimus* or the smooth *C. selcanus* which he includes among its varieties. Even, however, excluding the two latter forms, the variation of the German shell is fully as great as ours.

Barrois, it is true, re-divides Kayser's species, but he intimates that he does so simply on artificial grounds, and it seems possible that some of his other forms, besides those enumerated above, may also belong to it.

Tschernyschew's *P. cultellus* is a flattened form almost exactly like the specimen here figured on Pl. V, fig. 20, and cannot possibly be specifically distinct from that shell.

C. conicus, Hall, seems exactly to correspond.

The American Carboniferous form *Platyceras quincyense*, McChesney, appears to have its base more oblique, so that the front margin seems perpendicular to it. This, if not a mere accident, is possibly not more than a varietal difference. It seems to fall well within the limits of the present species, but its apex is unknown.

One of Mr. Porter's Pilton specimens is interesting from the fact that it is attached to, and seems totally to envelope, a specimen of *Actinocrinus Porteri*.

Affinities.—*Platyceras Lovieri*, de Verneuil,¹ is distinguished by its whorl being much more incurved and considerably overhanging the inner margin of the mouth.

Platyceras dentalium, Hall,² differs by having the longitudinal ribs and furrows twisted instead of straight.

Capulus quadratus, Maurer,³ seems distinguished by its quadrate section, its sharp apex, and its perpendicular inner side.

¹ 1850, de Verneuil, 'Bull. Soc. Géol. Fr.,' ser. 2, vol. vii, p. 779; and 1881, Ehlert, 'Mém. Soc. Géol. Fr.,' ser. 3, vol. ii, p. 14, pl. ii, figs. 1 a--d.

² 1861, Hall, 'Desc. New Species,' p. 1; and 1879, Hall, 'Pal. N. Y.,' vol. v, pt. 2, p. 2, pl. i, figs. 3--8; and 1881, Ehlert, 'Mém. Soc. Géol. Fr.,' ser. 3, vol. ii, p. 15, pl. ii, figs. 2 a--c.

³ 1885, Maurer, 'Abhandl. Grossh. Hessisch. Geol. Landes.,' vol. i, pt. 2, p. 243, pl. x, figs. 26--28.

The Carboniferous *C. rectus*, de Ryckholt,¹ approaches so close as to show no points of difference in the original figure; but, as given by de Koninck,² who unites with it *C. corpuratus*, de Ryckholt,³ it is distinguished by having a sharper, more regular and curved apex, and a convex back. De Koninck³ also doubtfully joins to it *C. subplicatum*, Meek and Worthen, which seems indistinguishable from low forms of the present shell.

IV. *Family*—SCALARIIDÆ, Broderip, 1839.

1. *Genus*—HOLOPELLA, M'Coy, 1852.

1. HOLOPELLA TENUISULCATA, Sandberger. Plate V, fig. 7; and Plate VI, figs. 3, 3 a.

1891. HOLOPELLA TENUISULCATA, Whidborne. Dev. Fauna, vol. i, p. 255, pl. xvii, fig. 20; and pl. xviii, fig. 10.

Size.—Length 24 mm., width 10 mm.

Localities.—Three specimens from Kingdon's, Shirwell, are in the Barnstaple Athenæum.

Remarks.—These fossils, though almost entirely in the form of casts, seem undoubtedly to correspond with the South Devon shell. A small portion of the surface remaining on one of them shows the oblique transverse striæ characteristic of the species.

2. *Genus*—ACLISINA, de Koninck, 1881.

This genus was formed by de Koninck for elongate shells with convex spirally striated walls; oval mouth; smooth, entire, and unexpanding outer lip; slightly thickened and unbent columella; and imperforate axis.

He distinguishes it from *Murchisonia* by the absence of a sinus-band; from *Loxonema* by its spiral striæ; from *Turritella* by its more convex whorls and deeper suture; and from *Aclis* by its simple columella.

¹ 1867, de Ryckholt, 'Mélange Pal.' pt. 1, p. 36, pl. i, figs. 5, 6.

² 1883, de Koninck, 'Ann. Mus. Roy. H. S. Belg.', vol. viii, pt. 4, p. 171, pl. xlvi, figs. 14—16, 23, 24.

³ 1867, de Ryckholt, 'Mélange Pal.' pt. i, p. 38, pl. i, figs. 11, 12.

1. *ACLISINA LONGISSIMA*, n. sp. Plate V, fig. 10.

Description.—Shell minute, aciculate, of very numerous whorls. Whorls nearly evenly convex, very narrow, very slowly increasing, much exposed. Sutures simple, rather deep. Ornament consisting of six fine, acute, elevated, distant, spiral threads, placed at equal distances on the whorl, and separated by wide concave interspaces.

Size.—A fragment with seven whorls is about 3 mm. long.

Locality.—There is a specimen showing seven whorls in the Porter Collection from Pilton.

Remarks.—This tiny fossil differs from M'Coy's description of *Loxonema polygyratum*,¹ from the Yellow Sandstone Group of the Irish Carboniferous, by having six ridges instead of five, by having narrow whorls, and by being still more aciculate. De Koninck regards that species as belonging to *Aclisina*, and not to *Murchisonia*.

Affinities.—*Aclisina multicristata*, Ehlert,² is distinguished by having decidedly more numerous spiral ridges.

From *Murchisonia similis*, Trenkner,³ it differs in being much more aciculate and having more numerous ridges.

V. *Family*—SOLARIIDÆ, Chenu, 1859.1. *Genus*—EUOMPHALUS, Sowerby, 1814.1. *EUOMPHALUS VERMIS*, n. sp. Plate VI, figs. 4, 4 a.

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|-------|--|---|
| 1841. | <i>EUOMPHALUS SERPENS</i> , Phillips (pars). | Pal. Foss., p. 94, pl. xxxvi, figs. 172 c—e (only). |
| 1844. | — | — M'Coy. Synopsis Carb. Foss. Ireland, p. 37. |
| 1853. | — | — Geinitz. Verst. Grauw. Sachsen, pt. 2, p. 43. |
| 1890. | — | sp., Whidborne. Dev. Fauna, vol. i, p. 243. |

Description.—Shell minute, nearly discoid. Spire of about four whorls, very slightly elevated above the body-whorl. Whorls slowly increasing, nearly circular

¹ 1844, M'Coy, 'Syn. Carb. Foss. Ireland,' p. 30, pl. iii, fig. 1.

² 1887, Ehlert, 'Bull. Soc. Étud. Sci. Angers,' 1887, p. 10, pl. viii, figs. 4, 4 a.

³ 1867, Trenkner, 'Paläont. Novitat.,' pt. 1, p. 10, pl. i, fig. 17.

in section, very convex at the shoulder, gently convex on the back. Sutures deep not wide. Umbilicus very large, and moderately shallow.

Size.—Approximate measurements : width 6 mm., height 2·5 mm.

Localities.—In the Barnstaple Museum are four specimens from Frankmarsh, one from Kingdon's, Shirwell, and two from Vicarage Well. In the Porter Collection are several specimens from Pilton ; in the Museum of Practical Geology one from Brushford ; in my Collection one from Frankmarsh ; and in Mr. Hamling's Collection, one from the Kiln, Croyde Bay.

Remarks.—These shells evidently belong to one of the species included by Phillips under the name *Eu. serpens*, viz. that represented by his figures 172 *c, d, e*. They are perfectly distinct from the much larger species which is common in South Devon, and which is, as I believe, generally regarded as *Eu. serpens*, although Phillips's description had evidently chief reference to the present shell. To that larger species I have, therefore, proposed to restrict Phillips's name ; and consequently it is necessary to find some other term for the Pilton form.

This species is distinguished by its uniformly small size, by its spire being definitely, though slightly, elevated above the body-whorl, and by the section of its whorls being almost subangular, and as long or longer than wide. It shows very little variation in size or general shape. It is decidedly gregarious ; upon one small slab I have counted seven specimens. But, though evidently very common, I have not been fortunate in obtaining good specimens for figuring, and the one which I have had drawn is a small imperfect cast, not giving specific characters as definitely as could be wished.

Affinities.—It differs from all the South Devon forms in other points beside size. Its spire is more elevated than that of *Philoxene lævis*, and less so than that of *Eu. Dionysii*.

2. EUOMPHALUS, sp.

Remarks.—In the Barnstaple Athenæum is a large specimen about 15 mm. in diameter from Vicarage Well, Pilton, which is too imperfect for specific determination, but appears to be quite distinct from the small species common in these beds. Only three fourths of the outer whorl remain. It appears to be discoidal in shape, to have a sunken spire, and to be perfectly circular in the section of the whorls.

2. Genus—RHAPHISTOMA, Hall, 1847.

These are small low shells, with a rather small umbilicus, which often bears a small marginal keel. The mouth is sub-trigonal. The whorls bear a narrow band produced by a sinuosity in the aperture. The surface shows growth-lines or fine crenulations at the suture. It occurs in the Lower Silurian and the Carboniferous, and de Koninck remarks on its supposed absence from Upper Silurian and Devonian rocks.

It has generally been regarded as belonging to the *Pleurotomariidæ*; but de Koninck, and perhaps Hall, are inclined to class it with the *Solariidæ*. Possibly it really goes to show the relationship between these two families.

Fischer¹ regards it as synonymous with *Scalites*, Conrad, 1842.

1. RHAPHISTOMA JUNIUS, de Koninck. Plate VI, figs. 5—7.

- ? 1841. PLEUROTOMARIA EXPANSA, *Phillips*. Pal. Foss. (not Geol. Yorks.), p. 97,
pl. xxxvii, fig. 179.
1843. EUOMPHALUS RADIANS, de Koninck (pars). Desc. Anim. Foss. Carb. Belg.,
p. 442.
1854. — — *Morris*. Catal., p. 248.
1876. — — *Armstrong, Young, and Robertson*. Catal. West Scot.
Foss., p. 56.
1881. RHAPHISTOMA JUNIOR, de Koninck. Ann. Mus. Roy. H. N. Belg., vol. vi,
p. 135, pl. xii, figs. 15—17.

Description.—Shell very small, sub-conical, but so much depressed as to be nearly discoidal. Spire consisting of about five rather slowly increasing volutions, much enveloped, the lower walls covering nearly half of the upper half of the whorl above. Apex elevated, sharp. Suture slight, facing upwards. Whorls, in section, much wider than high; in outline, turning suddenly outward from the suture and spreading out obliquely and almost flatly to the centre of the back, where they curve round so suddenly as almost to form a blunt rounded angle, and then proceed with a slight convex curvature to the umbilicus. Ornament consisting of a row of strong, short, transverse ridges, close to the suture, which vanish immediately; the rest of the surface showing no ornament except occasionally very slight and indistinct continuations of some of the striæ of the sutural crown, which arch backwards, and then perhaps turn suddenly forwards just above the angle of the back. Umbilicus small, bordered by a small sunken keel.

Size.—Height 4 mm., width 7 mm.

Localities.—A specimen from Pilton is in the Porter Collection; three others

¹ 1887, Fischer, 'Manual Conchyl.', p. 851.

from the west of Saunton Court in the Woodwardian Museum; one from Ironport in my Collection; and one from Kingdon's, Shirwell, in the Barnstaple Athenæum.

Remarks.—This little species so exactly agrees with the Carboniferous shell from Belgium, Scotland, and the Isle of Man, described by de Koninck as *Rhaphistoma junius*, that there can be no doubt of their identity. The agreement extends both to shape and markings, umbilicus and umbilical keel. Almost the only difference is that our shells are decidedly smaller, and that de Koninck does not notice the downward continuation of the sutural corona, which is very obscurely observable in one only of our specimens. De Koninck also mentions a depression like a sinus-band, which, however, he regards, not as a true sinus-band, but as a band similar to that seen in some forms of *Euomphalus*, in the neighbourhood of which he therefore places the genus. In our shells this character cannot be distinctly observed.

This species seems to bear very much likeness to the *Pleurotomaria expansa*, Phillips, of the 'Pal. Foss.,' and it is most probable that Phillips's figure represents a specimen of it. That specimen I have not been able to find. In its figure there are indications of a ribbed sinus-band, which certainly does not exist in our present species. On comparing, however, this figure with his description (which is quoted from the description of *Pl. expansa* in the 'Geol. Yorks.')

it seems most likely that this appearance in the figure was due to a confusion with the adjoining matrix. At all events, it is pretty clear that the shell he described from Devonshire is quite distinct from the true *Pl. expansa*, Phillips, of Yorkshire, which is clearly a *Pleurotomaria*, is both spirally and obliquely striated, and has no signs of any sutural crown.

Whether *Pl. gracilis*, Phillips, is more than a variety of this species is questionable. Our specimens seem intermediate between Phillips's figures of his two species, but I have been unable to find the types of either, and the data given by him are too meagre for a satisfactory conclusion. If, however, the species which I have described from Lummaton is really identical with Phillips's *Pl. gracilis*, then that shell is certainly distinct from the present, and differs from it by having a more distinct and elevated sinus-band.

Affinities.—*Natica discus*, F. A. Römer,¹ is very similar in shape, but is microscopically striated. It perhaps belongs to the same genus, but is so much larger that it is probably a distinct species.

Trochus oxygonus, F. A. Römer,² has a much sharper basal angle, and perhaps a slightly lower spire.

The flat variety of *Pleurotomaria crenatostriata*, Sandberger,³ is very similar,

¹ 1852, F. A. Römer, 'Beitr. Harzgeb.,' pt. 2, p. 88, pl. xiii, figs. 11 a, b, c.

² 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 29, pl. viii, fig. 5.

³ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 188, pl. xxiii, figs. 2—2 d.

differing in having the ornament continued all over the whorls, and in having a very definite sinus-band, bounded by threads. The longer variety figured by Sandberger is a totally different shell from ours.

VI. *Family*—PLEUROTOMARIIDÆ, *d'Orbigny*, 1842.

I. *Genus*—PLEUROTOMARIA, *DeFrance*, 1826.

1. PLEUROTOMARIA GRACILIS, *Phillips*.

1892. PLEUROTOMARIA GRACILIS, *Whidborne*. Dev. Fauna, vol. i, p. 303, pl. xxviii, fig. 18.

Remarks.—I have found no specimens referable to this species in the Pilton Beds, but Phillips quotes it from Brushford and Baggy Point. His figure shows a distinct sinus-band, and if that is correct it is certainly distinct from *Rhaphistoma junius*, which approaches it in general shape.

2. PLEUROTOMARIA HAMLINGII, n. sp. Plate VI, figs. 9, 9 a.

1841. PLEUROTOMARIA ASPERA, *Phillips* (*pars*) (not *Sowerby*). Pal. Foss., p. 96, pl. xxxvii, figs. 177 a, b (only).
 1889. — DISTINGUENDA, *Whidborne*. Geol. Mag., dec. 3, vol. vi, p. 30.
 1892. — — — — — Dev. Fauna, vol. i, p. 290.

Description.—Shell small, trochiform, turritid, of equal height and width. Spire elevated, rather slowly increasing, consisting of at least four whorls. Suture obtuse. Whorls narrow, sloping out from the suture in a concave curve to the shoulder, where they suddenly turn through a blunt angle, and then proceed perpendicularly downwards for about the same distance to the lower suture. Sinus-band situate on the shoulder, and consisting of an excavate groove, which is bounded above and below by a thread-like ridge, and has a row of small beads or nodules along its centre. Ornament consisting of (1) a row of small nodules, halfway between the suture and the sinus-band, and a second row of still smaller nodules halfway between this first row and the sinus-band; (2) two equidistant rows of small nodules, the upper row of which is the smallest, situate upon the lower or perpendicular part of the whorl; and (3) minute, transverse elevated threads, which arch gently backwards on the upper part of the whorl, and,

recurving in the sinus-band, become straight and perpendicular across the lower part of the whorl. Cast of shell showing signs of a deep sinus at the mouth.

Size.—Height 10 mm., width 10 mm.

Localities.—There are five specimens (including a very doubtful cast) in the Barnstaple Athenæum, from Kingdon's, Shirwell; two doubtful casts in the Porter Collection, from Pilton; one in the Woodwardian Museum from Barnstaple; and a large cast in the Museum of Practical Geology from Braunton Down.

Remarks.—I have long believed that the shells figured by Phillips as *Pl. aspera*, Sowerby, included two species, and in 1889 I suggested the name *Pl. distinguenda* for those, which specifically differed from Sowerby's type in the Woodwardian Museum. It appears, however, that Tawney in 1873 pre-occupied that name for an Oolitic species, and therefore it requires to be changed.

With this form, as figured by Phillips, these North Devon fossils closely agree, and I believe them to belong to a well-marked species. Our described specimen retains the upper whorls in a beautiful state of preservation, but its body-whorl is defective. It is distinguished from *Pl. aspera* by the spire being more angular or step-shaped, and by the sinus-band being at the shoulder instead of near the lower suture.

M'Coy¹ unites *Pl. aspera* to *Pl. interstitialis*, Phillips.² I have compared specimens of the latter with the present shell, and believe them to be quite different. In *Pl. interstitialis* the whorls are more rounded, the spiral marks are more numerous and different, and there are no nodules in the sinus-band. From the true *P. aspera* it is still further removed, though in a different direction.

3. PLEUROTOMARIA (GYROMA) ASPERA, Sowerby. Plate VI, figs. 10—13.

1840.	PLEUROTOMARIA ASPERA, Sowerby.	Geol. Trans., ser. 2, vol. v, pt. 3, pl. liv, fig. 16.
1841.	— — Phillips (pars).	Pal. Foss., p. 96, pl. xxxvii. figs. 177 c and d, and 177* ? (only)
1852.	— INTERSTITIALIS, M'Coy (pars).	Brit. Pal. Foss., p. 398.
?? 1852.	— { MINUTA, } F. A. Römer.	Beitr. Harzgeb., pt. 2, p. 81. pl. xii, figs. 17 a, b.
1893.	— ASPERA, Collins.	Trans. Roy. Geol. Soc. Cornwall, vol. xi, p. 42.

Description.—Shell moderately elevated, conical, of almost equal height and width. Apex blunt. Suture rather broad and shallow. Whorls convex, wider than high in section, sloping regularly from the suture in a gentle, convex, oblique

¹ 1855, M'Coy, 'Brit. Pal. Foss.,' p. 398.

² 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 227, pl. xv, figs. 10, 10a.

curve over the shoulder, and becoming slightly concave or sigmoidal at the centre and widest part of the whorl, at which is situated a very elevated rounded sinus-band, and below which the outline of the body-whorl passes round with a circular curvature to the umbilicus. Umbilicus wide and deep. Ornament, above the sinus-band, consisting of three or four equidistant, very narrow, distant, spiral threads, between which alternate similar finer threads, crossed by slightly oblique and sigmoidal, similar and similarly-placed transverse threads, so as to form hollow squares, which become rather nodose at the corners by the intersection of the threads. Sinus-band situated close to the lower suture, and bounded by two very minute entire threads, between which it is very elevated and rounded, and crossed by numerous close rounded ridges, which are probably again crossed by about six similar spiral threads. Ornament of the body-whorl below the sinus-band very similar to that above.

Size.—Height 13 mm., width 12 mm.

Localities.—In the Barnstaple Athenæum is one poor specimen from Vicarage Well, and one from Top Orchard; in the Museum of Practical Geology are two (a specimen and a cast) from South Petherwyn, and an external cast from "Marwood Beds, East of Barnstaple"; in the Woodwardian Museum is Sowerby's original type, and a fine cast from South Petherwyn, and a poor specimen from Top Orchard; in the Porter Collection a fragmentary specimen from Roborough.

Remarks.—The above description is taken chiefly from South Petherwyn shells. The figured mould from Barnstaple differs slightly from the rest. It has closer and slighter transverse threads, and three subsidiary minute threads between the larger spiral threads, and its sinus-elevation is sharper. There seems considerable variation in height. The cast from South Petherwyn, in the Museum of Practical Geology, is so like Phillips's fig. 177*, that it may be its original; if so, that figure belongs to the present species, and not to *Pl. victrix*¹ as I formerly thought possible.

Affinities.—*Pl. Hamlingii* is distinguished by the section of its whorl being approximately quadrangular instead of triangular, and by its sinus-band being situated high on the shoulder and followed below by a broad perpendicular back, on which are several distant spiral threads.

Pl. minima or *minuta*, F. A. Römer, is a cast very similar to that represented by fig. 12, and might very well belong to this species; but, as its ornament is undescribed, it is impossible definitely to identify it. It occurs in the Wissenbach Slates.

Pl. Orbigniana, D'Arch. and de Vern,² and its variety, *Pl. Beaumonti*, d'Arch. and de Vern,³ are distinguished among other points by their sunken sinus-band.

¹ 1891, Whidborne, 'Dev. Faun.,' vol. i, p. 301, pl. xxviii, figs. 15, 16.

² Ibid., p. 283, pl. xxvii, fig. 4.

³ 1842, D'Arch. and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 361, pl. xxxiii, figs. 1, 1 a.

Pl. (Gyroma) Baconnierensis, Ehlert,¹ has a deeper suture-line, a smaller and less conical spire, a coarser ornament, and a concave sinus-band.

Pl. interstitialis, Phillips² differs in the character of its sinus-band and other particulars.

4. PLEUROTOMARIA, sp. Pl. V, fig. 9; and Pl. VI, fig. 8.

Description.—Shell minute, very elevated, of several rather broad and slowly-increasing, convex whorls. Suture deep. Surface ornamented with several high, unequal, subacute, concentric ridges, which are crenulated by more numerous elevated, rounded, transverse threads, arching backwards from the upper suture, and very strong on the sinus-band, which appears to be elevated, rounded, and situated at or about the centre or wider part of the back in the body-whorl.

Size.—Length about 4 mm.

Localities.—In the Porter Collection are two imperfect specimens from Pilton.

Remarks.—It appears to me that these specimens are more likely to belong to some very lofty species of *Pleurotomaria* than to *Murchisonia*, but their state of preservation is too imperfect to permit any definite opinion to be formed at present upon them.

2. Genus—MURCHISONIA, Phillips, 1841.

1. MURCHISONIA ANGLICA, d'Orbigny. Pl. VI., fig. 14.

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| 1841. | MURCHISONIA ANGULATA, Phillips. | Pal. Foss. (not Geol. Yorks.), p. 101,
pl. xxxix, fig. 189. |
| 1849. | — | ANGLICA, d'Orbigny. Prodrôme, vol. i, p. 76. |
| 1891. | — | TURBINATA (pars)? Whidborne. Dev. Fauna, vol. i, p. 307. |

Description.—Shell small, elevated, turritid, of comparatively few whorls. Spire conical, exceeding the body-whorl in height. Whorls very broad, convex, arching out obliquely from the suture with a gentle curvature to the widest part, which is three-quarters the way down, and then rapidly curving in to the lower suture. Sinus-band broad, elevated, concave, angular, situated near the base of the whorl.

¹ 1887, Ehlert, 'Bull. Soc. Étud. Sci. Angers,' Ann. 1887, p. 32, pl. viii, figs. 7—7 c.

² 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 227, pl. xv, figs. 10, 10 a.

Size.—A fragment containing three whorls, measures 9 mm. long, and 5 mm. wide.

Locality.—One specimen is in the Porter Collection from Pilton; and one in my Collection from Pouch Bridge. Phillips records it from Brushford and South Petherwyn.

Remarks.—When describing *M. turbinata*, Schlot., from South Devon, I was unable to find the specimen which Phillips figured in his 'Pal. Foss.' under the name of *M. angulata*, Ph., and it then appeared to me that it might very probably be a crushed or contorted specimen of Schlotheim's most variable shell. Since then, however, I have obtained specimens which exactly agree with Phillips's figure, and show that it represented the true form of the shell. These prove it to be undoubtedly a distinct species, distinguished by the great breadth of its rapidly increasing whorls, by its sinus-band being situated very near the lower suture, and by the obliquely convex shape of the whorls, as well as by its very small size.

The sinus-band is formed of two coalesced keels, but my specimen, probably from its imperfect state, does not show the lower (third) keel described by Phillips.

Miss Donald, who, as well as Mr. J. F. Whiteaves, discusses the various shells under the name *M. angulata*, shows that the Devonian species is distinct from the two Carboniferous species to which Phillips had previously applied the same name. Hence it must bear the name under which D'Orbigny long ago separated it from them.

While, however, these two references to Phillips and D'Orbigny must be removed from the list of synonyms of *M. turbinata*, there seems no doubt that the *M. angulata* of d'Archiac and de Verneuil, Goldfuss, and other later authors is distinctly a variety of Schlotheim's shell, and has nothing to do with the present form.

2. MURCHISONIA, sp. Plate VI, fig. 15.

Size.—Height 18 mm., width 9 mm.

Locality.—An obscure cast from Baggy Point is in the Museum of Practical Geology.

Remarks.—The above-named specimen appears to me to be quite distinct from *M. anglica*. It is much larger, its whorls are much narrower, and the sinus-band seems only slightly below the centre of the whorls. It thus is much more like *M. turbinata*, and perhaps may be the cast of one of the varieties of that shell; but it is in much too imperfect a condition to make it safe to refer it to it without further evidence.

It may be noticed that the sutural angle varies considerably, the spire having been imperfectly coiled as often happened in *M. turbinata*.

3. MURCHISONIA SIMILIS, *Trenkner*. Plate V, figs. 22—23 a.

1867. MURCHISONIA SIMILIS, *Trenkner*. Paläont. Novitat., pt. 1, p. 10, pl. i, fig. 17.
 1868. — QUADRICINCTA, *Trenkner*. Ibid., pt. 2, p. 22, pl. vii, fig. 10.
 1884. — SIMILIS, *Clarke*. Neues Jahrb. f. Min., Beil.-Band 3, p. 346, pl. v, fig. 14.
 1893. — sp., *Tschernyschew*. Mém. Com. Géol., vol. iv, pt. 3, p. 38, pl. 3, fig. 12.

Description.—Shell very small, elongate, conical, turritid, of seven or eight slowly increasing whorls. Apex sharp. Sutures simple, rather shallow. Whorls rather narrow, convex, much exposed. Ornament consisting of a fine elevated crenulated thread immediately below the suture, two other threads bounding the sinus-band, which lies just below the centre of the back, and a fourth thread not quite half-way from the sinus-band to the lower suture; the whole crossed by microscopical, close and regular, transverse lines, which are nearly straight, and slope very obliquely backward from the sutures, and then arch to meet on the sinus-band. Body-whorl possibly rather larger than the others. Umbilicus apparently shallow and concave.

Size.—A specimen retaining the four lowest whorls is 5 mm. high by 2 mm. wide.

Localities.—There are five specimens (moulds) from Vicarage Well, Pilton, in the Barnstaple Athenæum.

Remarks.—The three lower longitudinal threads divide the whorl into four bands, and are so placed that the two central bands, the upper of which is the sinus-band, are rather narrower than the upper, and sometimes than the lower, marginal band. The transverse ornament is very minute, and only visible in good lights. I did not observe it till after the figures were drawn, and, in fact, it is too fine to be represented in them. It is, however, very regular and definite, and proves the shell to belong to *Murchisonia*.

Our specimens appear to agree with *Trenkner*'s figure of *M. similis*, but to be less aciculate than the fossil given by him as *M. quadricincta*, and refigured by *Clarke*. The latter name has been applied by *Pacht*¹ to another small species which is perhaps distinguished by being shorter, by having more angular whorls, and by a different arrangement of the longitudinal threads.

¹ 1854, *Pacht*, 'Dev. Kalk. Livland,' p. (295), plate, fig. 1; and 1858, *Pacht*, in *Baer* and *Helmersen*'s 'Beitr. Russ. Reiches,' vol. xxi, p. 101, pl. v, figs. 9 a, b.

Affinities.—*Aclisina longissima* seems distinguished by its much more aciculate form, and more numerous threads, and by the absence of transverse lines and sinus-band.

Loxonema gracillimum, Whiteaves,¹ is a longer shell with broader whorls, direct transverse threads and no sinus-band.

M. bistriata, F. A. Römer,² seems longer and more conical, and has only two spiral threads. As given by Geinitz,³ it is much more like our shell, but is described as having only three spiral threads.

VII. Family—BELLEROPHONTIDÆ, M^cCoy, 1851.

1. Genus—BELLEROPHON, de Montfort, 1808.

1. BELLEROPHON (BUCANIA) ELEGANS, d'Orbigny. Pl. VII, figs. 1, 1 a.

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| 1840. | BELLEROPHON ELEGANS, de Ferussac and d'Orbigny. | Nat. Hist. Ceph.,
p. 203, (Bellerophon) pl. vii, figs. 15—18. |
| ? 1840. | — CLATHRATUS, de Ferussac and d'Orbigny. | Ibid., p. 204, pl. v,
figs. 24—27, and pl. vii, figs. 12—14. |
| ? 1842. | — ELEGANS, d'Archiac and de Verneuil. | Geol. Trans., ser. 2,
vol. vi, pt. 2, p. 354, pl. xxix, figs. 2, 2 a, |
| ? 1843. | — DECUSSATUS, de Koninck (pars). | Desc. Anim. Foss. Carb.
Belg., p. 339, pl. xxix, fig. 3, and pl. xxx, fig. 3. |
| 1848. | — ELEGANS, Bronn. | Index Palæont., p. 163. |
| 1849. | — DECUSSATUS, d'Orbigny (pars). | Prod., vol. i, p. 126. |
| ? 1883. | BUCANIA ELEGANS, de Koninck. | Ann. Mus. Roy. H. N. Belg., vol. viii, pt. 4,
p. 151, pl. xli, figs. 18—21. |
| ? 1883. | — ARCHIACI, de Koninck. | Ibid., p. 151. |

Description.—Shell small, discoid, rather flat. Aperture expanded. Whorls convex, rather obliquely flattened on the sides, and rapidly curving in round the umbilicus. Keel large, elevated, sub-triangular or rounded. Umbilicus open. Surface ornamented with distant, strong, rather unequal, radiating threads, crossed by finer and closer arching threads or lines of growth.

Size.—About 2.5 mm. wide and 2.5 mm. high.

Locality.—One tiny specimen from Pilton is in the Porter Collection.

Remarks.—Our specimen is decorated, and partly embedded in matrix. The striæ are clear near the mouth, but the ornament of the keel cannot be traced. It is possible from its small size and general appearance that it may be a young shell.

¹ 1892, Whiteaves, 'Contr. Canad. Pal.,' vol. i, pt. 4, p. 337, pl. xlv, fig. 10.

² 1850, F. A. Römer, 'Beitr. Harzgeb.,' pt. 1, p. 37, pl. v, fig. 26.

³ 1853, Geinitz, 'Verst. Grauw. Sachsen,' pt. 2, p. 42, pl. xi, fig. 9.

It closely resembles and probably belongs to the Devonian *Bellerophon elegans*, d'Orbigny, although its ornament seems to be set more closely. In that respect it agrees with the Carboniferous *B. clathratus*, d'Orbigny, which its describer distinguishes from the former species by its having only three longitudinal threads on the keel instead of numerous finer lines. These two species de Koninck unites; but he separates from them *B. elegans*, d'Archiac and de Verneuil, on account of its wider and flatter keel. It appears to me that in that particular our fossil agrees with *B. elegans*, as originally given by d'Orbigny, and comes exactly half-way between d'Archiac and de Verneuil's and de Koninck's versions of it. On the whole it may prove that the species was variable and long-lived.

Affinities.—From *Euphemus Barumensis*, the only North Devon species at all resembling it, it is at once distinguished by its open umbilicus and elevated keel.

B. Vogulicus, Tschernyschew,¹ is a narrow, more rapidly-increasing form with a closed umbilicus.

2. BELLEROPHON LABYRINTHODES, n. sp. Plate VIII, figs. 1—2 b.

Description.—Shell small, convex, globose, horizontally symmetrical, probably of rather numerous whorls. Umbilicus rather large, expanding laterally. Whorls nearly evenly convex, bearing a central narrow elevated sinus-band, which is bordered by elevated threads and crossed by minute arching striæ. Surface-ornament very minute, so as to be invisible to the naked eye, consisting of close zigzag rows of puncta between sharp ridges, which are scored by the puncta, about four zigzags occupying each side of the shell-surface; beneath which are sometimes seen indications of larger transverse arching growth-lines and radiating ribs.

Size.—Height 11 mm., width 8 mm.

Localities.—In the Barnstaple Athenæum are several specimens on two slabs from Kingdon's, Shirwell, and one from Top Orchard, all of which are casts except one. In the Museum of Practical Geology is a specimen from Baggy Point.

Remarks.—This is a very beautiful and highly ornamented species. The ornament is microscopical, but it is much in the style of *B. Hicksii*,² except that it is much finer and more definitely zigzag. Roughly speaking, the pattern is reticulate, the zigzagging being only visible in some lights. The Baggy specimen is rather more coarsely and definitely marked, and under the superficial ornament it shows signs of transverse ribs like those of *B. costatus*, and radiations like those of *Eu. Urvii*. It is possible that the latter are the true ornaments, and that the finer

¹ 1893, Tschernyschew, 'Mém. Com. Géol.,' vol. iv, No. 3, p. 159, pl. iii, figs. 1 a—d.

² 1891, Whidborne, 'Dev. Faun.,' vol. i, p. 326, pl. 31, figs. 7—8 a.

pattern may have been superficially super-imposed by a mantle. Occasionally the cast shows indications of the sinus-band by an obscure elevation.

Affinities.—The casts of *Salpingostoma? macromphalus*, F. A. Römer, sp., from Kingdon's, Shirwell, are somewhat similar to this species, though their possession greatly and rapidly expanding lips, which makes it probable that they are identical with the smooth-shelled German fossil, clearly distinguishes them; and the present shell also differs in being much higher and more definitely globose. It seems to me that they are undoubtedly distinct.

This species sufficiently approaches d'Archiac and de Verneuil's version¹ of *Bellerophon tuberculatus*, de Ferussac, to raise the question whether it might not be identical. On referring, however, to d'Orbigny's² description and figures it is at once seen to be distinguished by the much finer and less moniliform character of its ornament. In the latter shell the tubercles are definite, and though a quincuncial arrangement is mentioned, the elaborate zigzagging of the intermediate furrows is hardly if at all apparent. It is also a much larger shell, and its whorls seem to increase somewhat less rapidly.

3. BELLEROPHON SUBGLOBATUS, *M'Coy*. Plate VIII, figs. 3, 3 a.

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|-------|-----------------------|--|--|
| 1841. | BELLEROPHON GLOBATUS? | <i>Phillips</i> (not <i>Sowerby</i>). | Pal. Foss., p. 108,
pl. xl, fig. 202 a—b |
| 1854. | — | — | <i>Pacht</i> . Dev. Kalk. Livland, p. 206. |
| 1855. | — | SUBGLOBATUS, <i>M'Coy</i> . | Brit. Pal. Foss., p. 400. |
| 1858. | — | GLOBATUS, <i>Pacht</i> . | In Baer and Helmersen's, Beitr. Russ. Reiches, vol. xxi, p. 102. |

Description.—Cast of shell small, globose, horizontally symmetrical, apparently of numerous, slowly increasing, involute whorls. Whorls generally very much flattened on the back and deeply convex on the sides, but occasionally sub-angular on the back and obliquely flattened on the sides. Umbilicus very small and deep.

Size.—Height 9 mm., diameter through sinus-band 7 mm.

Locality.—In the the Barnstaple Museum are four specimens (including a slab with indeterminate fragments) from Sloly, and four from Baggy Point. In the Museum of Practical Geology are six from the Marwood Beds, and eight from Shirwell (Marwood Beds). In the Woodwardian Museum is one from Baggy Point.

Remarks.—These specimens are all casts in soft brown sandstone, and hence

¹ 1842, D'Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. ii, p. 353, pl. xxviii, fig. 9.

² 1840, de Ferussac and d'Orbigny, 'Hist. Nat. Ceph.,' p. 191, (*Bellerophon*) pl. i, fig. 10, and pl. iii, figs. 7—10.

do not admit of a complete description. The matrix shows that they belong to the Marwood series. The rate of increase of the whorls is very slow, and in none of them is there any sign of any labial expansion. In one of the specimens there is a slight indication of a central depression on the back; and in another (which is figured on Pl. VIII) there is an equally slight suggestion of a central keel. In the latter specimen there also appears an oblique flattening of the back on each side of the median line, which is not usually seen. In one or two cases very faint and doubtful marks exist, which possibly indicate that it was ornamented in the style of *B. lineatus*, Sandberger.¹

These appear to be the shells described by Phillips as *B. globatus*, Sow.,² from "Marwood, Pilton, Brushford, &c.," though in his figures the umbilicus seems larger, and there seems some indication of ornament. The central of his six figures is the most like our shells. They were separated from *B. globatus* by M'Coy on account of their small umbilicus, and they also differ from it in the slow rate of increase of their whorls. Whether they are distinct from all the accompanying shells whose ornament is known cannot at present be positively asserted. They bear some likeness to young or imperfect specimens of *S. ? macromphalus* of the Pilton beds, but differ in being smaller, and in having a smaller umbilicus, and no signs of any labial expansion.

They also approach in general shape *B. labyrinthodes*, but seem to have more slowly increasing whorls.

4. BELLEROPHON ? sp. Plate VIII, fig. 7.

Description.—Cast of shell small, discoid, oval, flattish. Spire consisting of three rapidly increasing whorls, deeply sunken, probably very similar above and below. Whorls vertically narrow, horizontally wide, convex (the convexity being much greatest on the back), slightly involute (the outer whorl enveloping one-third of the whorl within). Umbilicus open, with a spiral concavity formed by the suture. Mouth slightly expanded. Margin of lip convex. Back deeply and evenly convex, not keeled.

Size.—Height about 4 (?) mm., width 6 mm., depth 9 mm.

Localities.—Two specimens from Vicarage Well, Pilton, are in the Barnstaple Museum.

Remarks.—These specimens are very indistinct and puzzling. They give so

¹ 1896, Whidborne, 'Dev. Fauna,' vol. i, p. 321, pl. xxxi, figs. 3—6. Holzapfel calls this species *B. striatus*, Bronn, 1839, but Fleming, in 1828, described a Carboniferous form like *B. elegans* under the same name, and his description is definite, though unaccompanied by a figure.

² 1839, Sowerby, in Murchison's 'Sil. Syst.,' p. 604, pl. iii, fig. 15.

few characters that it is impossible to be sure about their right position. On the whole it seems most likely that they belong to a discoidal form of *Bellerophon*.

Affinities.—From *B. compressus*, Sandberger,¹ which is the same as *B. Murchisoni*, d'Orbigny,² it differs by having flatter sides and a more convex back.

B. Troostii, d'Orbigny,³ is very similar on the back, but much deeper.

In *B. capuloides*, Maurer,⁴ a sinus-band is visible.

On the other hand, *Capulus immersus*, Barrande,⁵ *C. contortus*, F. A. Römer,⁶ and Giebel,⁷ *C. gracilis*, Sandberger,⁸ approach it in shape, but their spires do not seem in any case so regular and complete.

While, again, species of *Goniatites* often closely resemble it, it does not seem worth while to compare it with any of them in the absence of any indication of septa or suture-lines.

2. Genus or Sub-genus—SALPINGOSTOMA, F. Römer, 1876.

This genus is distinguished by having an interrupted or evanescent sinus-band, a very wide open umbilicus, and a very widely and rapidly expanded simple mouth.

1. SALPINGOSTOMA[?] MACROMPHALUS, F. A. Römer, sp. ? Plate VIII, figs. 4, 4 a, 5, 5 a.

1843. BELLEROPHON MACROMPHALUS, F. A. Römer. Verst. Harzgeb., p. 32, pl. ix, figs. 3, 3 a.
 ? 1844. — MACROSTOMA, F. Römer. Rhein. Uebergangsgeb., p. 80, pl. ii, figs. 6 a, b.
 ? 1853. — — Sandberger. Verst. Rhein. Nassau, p. 182, pl. xxii, figs. 8, 8 a, 4 b.
 ? 1876. SALPINGOSTOMA MACROSTOMA, F. Römer. Pal. Leth., pl. xxv, figs. 5, 5 a.
 1884. BELLEROPHON MACROMPHALUS, Beushausen. Abhandl. Geol. Specialk. Preuss., Band vi, pt. 1, p. 44, pl. ii, fig. 1.

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 180, pl. xxii, figs. 6—6f.

² 1840, de Ferussac and d'Orbigny, 'Hist. Nat. Ceph.,' p. 210, (Bellerophon) pl. vii, figs. 1—3, and pl. viii, fig. 14.

³ Ibid., p. 206, (Bellerophon) pl. vii, figs. 19, 20.

⁴ 1880, Maurer, 'Neues Jahrb. f. Min.,' Beil.-Band i, p. 31, pl. ii, fig. 7.

⁵ Ibid., p. 33, pl. ii, fig. 15.

⁶ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 26, pl. vii, figs. 1, 2.

⁷ 1858, Giebel, 'Sil. Faun. Unterharz.,' p. 24, pl. iii, fig. 7.

⁸ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 236, pl. xxvi, figs. 17, 17 a.

- ?1886. BELLEROPHON SANDBERGEBI, *Maurer*. Faun. Rechrhein. Unterdev.,
p. 20.
1891. — MACROMPHALUS, *Whidborne*. Dev. Fauna, vol. i, p. 327,
pl. xxxi, figs. 10, 10 a.

Description.—Cast of shell rather large, subglobose, rather flattened, horizontally symmetrical. Spire elliptically coiled? Whorls flattened on the back, regularly and moderately convex round the upper and lower sides. Sinus-band indicated by a central depression in the cast until it approaches the aperture, where it rather suddenly rises into a rounded ridge. Umbilicus wide, curving regularly round, continuously with the lateral curves of the whorl. Mouth expanding rapidly to form broad transverse wings or expansions, so that the diameter of the mouth is three times that of the height of the shell a short distance behind it.

Size.—Height 40 mm. across the expanded mouth, 14 mm. across the umbilicus near the mouth; width through sinus-band 24 mm.

Localities.—In the Barnstaple Athenæum are five specimens from Kingdon's, Shirwell; and in the Museum of Practical Geology two from the Pilton Limestone of Marwood.

Remarks.—Though our specimens are all casts, a very minute fragment of shell remains on one of the figured specimens of them, and appears to show a minute ridge-like ornament.

This species is either identical with or very near akin to *S. macrostoma*, F. Römer; our specimens do not show an unbroken circle in the expansion of the mouth, perhaps simply on account of their imperfect condition, nor have they so wide an umbilicus.

Bellerophon macromphalus, F. A. Römer, has, according to his own figure and description, a very much larger and flatter umbilicus with more numerous narrow whorls; but, as revised by Beushausen, it seems almost exactly to agree with the present species. While all the material is confined to casts, it is hopeless to arrive at certain conclusions, but it seems clear that *B. macromphalus* and *B. macrostoma* are generically identical, and no reason seems assignable why they should not also be so specifically. The South Devon shells which I described from Chircombe Bridge show, I think, no difference from the North Devon fossils, except that they are circularly coiled, and that they are sometimes rather more angulated round the umbilicus—points which need not be indicative of specific distinction, as neither of them seems constant.

Affinities.—*B. Gostariensis*, F. A. Römer,¹ is said to differ from *S. macrostoma*, F. Römer, by its more involute and fewer whorls, the more sudden widening of

¹ 1855, F. A. Römer, 'Beitr. Harzgeb.', pt. 3, p. 14, pl. iii, fig. 17.

the mouth, the strong keel on the back of the expansion, and the much smaller size of the spire. Whether in these particulars it agrees with the English shell I am not sure.

It may be noted that figures given by Hall¹ of his *B. pelops* show a similar keel in the cast, but a regular small round keel in the perfect shell. From our shells they differ in not having the mouth so extremely expanded.

3. Genus or Sub-genus—TROPIDODISCUS, Meek, 1866.

This genus or sub-genus contains shells akin to *B. trilobatus*, Sow., which are very flat, with very wide and open umbilici, and with a rounded convexity bounded by two concavities on the back of the whorl, but without any definite sinus-band.

De Koninck proposed to replace Meek's name by *Tropidocyclus*, because Stein in 1850 had used the name *Tropidiscus*. As Meek had himself emended the latter name, which he had used at first, there appears to be no reason for a further change.

Fischer² regards Meek's name as a synonym of *Cyrtolites*, Conrad, 1838.

1. TROPIDODISCUS TRILOBATUS, Sowerby ? var. BISULCATUS, F. A. Römer. Plate VIII, figs. 6, 6 a.

? 1839.	BELLEOPHON TRILOBATUS, Sowerby.	In Murchison, Sil. Syst., p. 604, pl. iii, fig. 16.
1840.	— —	<i>de Ferussac and d'Orbigny</i> . Hist. Nat. Ceph., p. 209, (Bellerophon) pl. vii, figs. 34—37, and pl. viii, fig. 13.
1841.	— —	<i>Phillips</i> . Pal. Foss., p. 107, pl. xl, figs. 200 a—e.
1843.	— BISULCATUS, F. A. Römer.	Verst. Harzgeb., p. 32, pl. ix, figs. 1 a, b.
? 1843.	— TRILOBATUS, F. A. Römer.	Ibid., p. 32, pl. xii, fig. 39.
1853.	— —	var. TYPUS, <i>Sandberger</i> . Verst. Rhein. Nassau, p. 177, pl. xxii, figs. 2, 2a.
1855.	— BISULCATUS, M' Coy.	Brit. Pal. Foss., p. 400.
1877.	— TRILOBATUS, <i>Ehlert</i> .	Bull. Soc. Géol. Fr., ser. 3, vol. v, p. 580.

¹ 1879, Hall, 'Pal. N. Y.,' vol. v, pt. 2, p. 95, pl. xxii, figs. 7—13.

² 1887, Fischer, 'Manuel Conchyl.,' p. 854.

1884. BELLEPHON BISULCATUS, *Beushausen*. Abhandl. Geol. Specialk. Preuss.,
vol. vi, pt. 1, p. 45, pl. ii, fig. 3.
1893. — — — ? *Collins*. Trans. Roy. Geol. Cornwall, vol. xi,
p. 38.

Description.—Shell very small, not quite horizontally symmetrical, wider than high. Spire rapidly increasing. Umbilicus very large. Whorls deeply convex on the shoulder, then becoming concave till they rise in the central part into a large elevated convexity, and returning with the same sweep reversed to the umbilicus. Surface quite smooth, with no signs of sinus-band or ornament.

Size.—Height 7 mm., width 8 mm.

Localities.—In the Museum of Practical Geology are two specimens from Baggy Point and one from West Angle Bay, Pembrokeshire; and in the Woodwardian Museum one from west of Saunton Court.

Remarks.—Whether *B. trilobatus*, Sowerby, is a long-lived and variable species, or whether there are several distinct kindred forms bearing the same facies, is a question on which I have not yet been able to arrive at a satisfactory conclusion.

As figured by Sowerby and F. A. Römer, *B. trilobatus* is a much more globose form. Sandberger gives three varieties, *acutus*, *typus*, and *tumidus*; the first almost flatly discoidal, the second corresponding to *B. bisulcatus*, F. A. Römer, and the third as globose as Sowerby's types. Of these, Ehlert remarks that he has collected all three in Mayenne in the midst of intermediate forms. Again, Phillips gives three varieties from Devonshire, one of which agrees with Sowerby's shell in globosity, and this is apparently the one which he quotes from Baggy.

Furthermore, the specimens which I have myself seen agree with *B. bisulcatus*, F. A. Römer, though they do not seem distinguishable from Silurian specimens in the Museum of Practical Geology, with which I have compared them.

M'Coy in 1855 separated the Devonshire shell from the Silurian under the name *B. bisulcatus*, Römer.

Beushausen in 1884 treated *B. trilobatus*, *B. bisulcatus*, and *B. tumidus*¹ as distinct species, while in 1889 Sandberger² himself separated *B. tumidus* from *B. trilobatus*. In this he is followed by Kayser³ in 1895, who, moreover, describes a distinct sinus-band with marginal threads on some specimens of *B. tumidus* from Pepinster.

The *B. trilobatus* of d'Orbigny appears exactly to agree with *B. bisulcatus*, F. A. Römer, and our specimens.

On the whole it seems best, at least as a provisional arrangement, to treat

¹ 1884, Beushausen, 'Abhandl. Geol. Specialk. Preuss.,' vol. vi, pt. 1, p. 44.

² 1889, Sandberger, 'Jahrb., Nass. Ver. Naturk.,' vol. xlii, pp. 13, 25.

³ 1895, Kayser, 'Ann. Soc. Géol. Belg.,' vol. xlii, p. 182, pl. iv, figs. 5—8.

our shell (which may be taken as identical with *B. bisulcatus*) as a variety of Sowerby's species.

At the same time the *B. tumidus* of Kayser, and perhaps also that of Beushausen, must, from their defined keel, be regarded as distinct, though there is possibly more reason for retaining *B. trilobatus*, var. *tumidus*, Sandberger, as a variety of Römer's shell.

Affinities.—De Koninck's three Carboniferous species of the genus are all distinguished by elaborate ornament.

B. compressus, Sandberger,¹ which is the same as *B. Murchisoni*, d'Orbigny,² has a striated keel and no lateral concavities.

4. Genus or Sub-genus—EUPHEMUS, M'Coy, 1844.

This genus was formed by M'Coy, and revived by Waagen and de Koninck, for shells of the type of *Bellerophon Urvii*, Fleming. It appears individualised by several definite characters, among which may be mentioned the nature of the ornament, which de Koninck seems to regard as produced by the animal only on the old parts of its shell, and as taking the place of the smooth callosities seen in those parts in other genera of the family. The sinus-band is often well marked in the newer part of the shell, but is more or less obliterated in the striated portion.

De Koninck describes five species from the Carboniferous of Belgium, all of which seem very closely allied.

1. EUPHEMUS BARUMENSIS, n. sp. Plate VII, fig. 2.

1841. BELLEROPHON URVIL, *Phillips* (not *Fleming*). Pal. Foss., p. 106, pl. xl, figs. 199 a—d.

1843. — — — ?, *F. A. Römer*. Verst. Harzgeb., p. 32, pl. xii, fig. 38.

Description.—Shell very small, globose. Whorls evenly and spherically rounded, and transversely symmetrical, bearing about twenty fine, regular, simple, erect, very distant spiral lines, which are most distant at the centre of the back, and seem to vanish at the apex and umbilicus. Interspaces flat. Shell-structure massive.

Size.—About 4 mm. high, 5 mm. wide.

Locality.—In the Museum of Practical Geology is a specimen from Baggy Point, which is the original of Phillips's fig. 199 b.

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 180, pl. xxii, figs. 6—6f.

² 1840, De Ferussac and d'Orbigny, 'Hist. Nat. Ceph., p. 210 (Bellerophon), pl. vii, figs. 1—3.

Remarks.—Phillips figures two specimens, and adds the following particulars:—aperture very expanded; no umbilicus, no band; ridges crenulated; furrows crossed by fine lines of growth, retroflexed from the mouth. Interior of the shell quite smooth.

There is certainly no keel, but there is a slight sign of a sinus-band between the two central ridges, shown by a faint indication of recurved growth-lines in it. The lateral lines of growth retroflexed from the mouth are also just visible. There are no signs whatever in our specimen of the crenulations on the spiral ridges which are described by Phillips. It seems, however, possible that Phillips's enlarged pattern ('Pal. Foss.,' fig. 199 *d*) may have been taken from this specimen as well as his other figure, and if so the signs of crenulation in it are deceptive, being due to a slight fracture of the summits of the ridges.

Affinities.—It is difficult to define the species from the small portion visible in our only specimen. From the true *Eu. Uriei*,¹ as restricted by de Koninck,² it is distinguished by the absence of an elevated keel. *Eu. Orbignii*, de Koninck,³ has coarser and closer spiral ridges. *Eu. Horioni*, de Koninck,⁴ has more numerous striæ. *Eu. inevitabilis*, de Koninck,⁵ has more unevenly arranged ridges, and is a flatter shell. *Eu. filusus*, de Koninck,⁶ seems to approach nearest to it, but differs in the same particulars. As, however, our specimen only shows the inner whorl, it is hard to say whether these distinctions would remain true if a perfect specimen of it could be compared. At the same time it seems most probable that they would, and that they are sufficient to give this form a claim to a distinct name; especially considering that, as it belongs to a different formation from the above-mentioned shells, the presumption is that they are distinct. Moreover, though Römer's figure of his Devonian shell is very poor, it shows that, if it represents the present species, its shape is very different from that of any of the Belgian forms.

D'Orbigny figured the young shell of *Oxygyrus Keraudreni*, Rang,⁷ of which he remarked that it is so like in shape and ribbing that it would be hard to distinguish it if it came from beds of the same age, and which he considered to be evidence of the relationship of *Bellerophon* to the *Atlantidæ*.⁸

¹ 1828, Fleming, 'Hist. Brit. Anim.,' p. 338.

² 1883, de Koninck, 'Ann. Mus. Roy. Hist. Nat. Belg.,' vol. viii, p. 157, pl. xlii, figs. 40—43.

³ *Ibid.*, p. 156, pl. xlii, figs. 5—7; and pl. xliii, figs. 9—13.

⁴ *Ibid.*, p. 159, pl. xliii, figs. 18—21.

⁵ *Ibid.*, p. 159, pl. xliii, figs. 22—25.

⁶ *Ibid.*, p. 160, pl. xliii, figs. 14—17, 26—34.

⁷ 1840, de Ferussac and d'Orbigny, 'Hist. Nat. Ceph.,' p. 198 (*Bellerophon*), pl. vi, figs. 1, 2.

⁸ 1887, Fischer, 'Manuel Conchyl.,' p. 582, fig. 347.

CLASS—LAMELLIBRANCHIATA, *Blainville*, 1814.

The abundance of bivalves in these beds is marked, though except in a few cases it is rather in the form of a variety of species than a profusion of individuals. In some cases, especially in the Marwood zone, specimens occur in crowds; for instance, *Cucullæa unilateralis*, Sowerby, and *Ptychopteria Damnoniensis*, Phillips, sp., are evidently gregarious, while *Prothyris scalprata*, n. sp., completely covers one rock-surface. In the Marwood beds, however, the number of species is few; but as we advance into the Pilton Zone we find, though shells are fewer, species are greatly increased; and there, though some are found commonly, most are only known by one or two examples.

Sixteen species were quoted from this area by Phillips, but of these, five seem only synonyms. On the other hand, many of his South Petherwyn species are found also to occur here. Not a few of the fresh forms bring out the relationship to the American Devonians, and it seems remarkable how often light has been thrown on our English species by the resemblance, not generally amounting to specific identity, of Transatlantic shells.

1. ORDER—DESMODONTA, *Neumayr*, 1883.¹I. *Family*—PRÆCARDIIDÆ, *Rudolf Hörnes*, 1884.1. *Genus*—PANENKA, *Barrande*, 1881.

This genus being known only by its external characters, its position is doubtful. Fischer includes it and its congeners, *Præcardium*, &c., in a provisional family of his sub-order *Anatinacea*; Neumayr (1891) places it under his order *Palæoconcha*, Beushausen under *Cardioconcha*, Zittel under *Homomyaria*. Possibly its rightful place will ultimately be found to be near some genera now included in the enlarged order *Desmodonta*.

1. PANENKA ANGLICA, n. sp. Plate VIII, figs. 10, 11, 11 a.

Description.—Shell large, transverse, convex. Umbo small, incurved, facing forward, and situated at about the anterior third of the length. Lunule large but undefined. Surface covered by 35 or 45 regular, even, close-set, rounded rays, of

¹ Neumayr's classification has been mainly adopted by Zittel in his 'Palæozoologie,' 1895, who is followed here.

which the eight or ten situated medianly are decidedly narrower than those on each side, and which seem gradually to increase in size laterally, and are divided by concave furrows narrower than the ribs. Transverse ornament consisting of numerous regular, fine, close, strong, transverse striæ or threads, which cross the ribs as well as their intervals.

Size of a distorted specimen : height 60 mm., length 70 mm., depth 15 mm.

Localities.—An imperfect and distorted specimen from Top Orchard is in the Barnstaple Athenæum; another from Braunton in the Museum of Practical Geology; and a third from Barnstaple in the Woodwardian Museum.

Remarks.—The first two specimens have been regarded as the *Avicula pectinoides*, Sowerby,¹ but a comparison of the type of that species and M'Coy's description of it with our specimens and with *Aviculopecten (Meleagrina) rigida*, M'Coy,² which M'Coy doubtfully identified with it,³ shows that it is quite impossible for them to belong to it. Moreover the third specimen is sufficiently perfect to remove all doubt.

On the other hand, their likeness to the lengthy series of species referred by Barrande to his genus *Panenka* is so great that there can remain no question against their belonging to that genus. While, however, their generic position may be regarded as certain, the very vastness of the numbers of species described from Bohemia renders it the more difficult to decide whether our crushed and distorted English shells agree with any of them. At present I know of no Bohemian species with which it seems safe to unite the present form.

Its chief characteristics seem to be (1) the smallness of the central ribs, five of which occupy the same space as four of the lateral ribs; (2) the strong, close, thread-like, transverse striæ; and (3) the strength of the ribbing on the latero-superior parts of the shell.

The Bohemian shell that agrees best with our specimens in the second of these points is *Panenka sphæroides*, Barrande,⁴ and of it Barrande only figures a single specimen, which is as imperfect and distorted as ours. The shell may be more convex, and the umbo more central and more elevated than it is in ours, but it is impossible at present to decide whether these distinctions are valid, the true shape of neither form being known.

In *P. Bohemica*, Barr.,⁵ and *P. domina*, Barr.,⁶ the threading is finer, and the marginal ribbing generally fainter.

¹ 1840, Sowerby, 'Geol. Trans.,' ser. 2, vol. v, pt. 3, pl. liv, fig. 2.

² 1844, M'Coy, 'Synopsis Carb. Foss. Ireland,' p. 80, pl. xiii, fig. 16.

³ 1855, M'Coy, 'Synopsis Brit. Pal. Foss.,' p. 393.

⁴ 1881, Barrande, 'Syst. Sil. Bohême,' vol. vi, pl. cccxxviii, figs. 7—10, Ét. G.

⁵ Ibid., pl. lxxvii, figs. 4, 7—10; pl. xcvi, figs. 2, 1—4; pl. cxxxvii, figs. 1—10; pl. cxxxviii, figs. 1—22; pl. cxl, figs. 10—12; pl. cli, figs. 19—21; pl. ccliv, figs. 11—13, Ét. E; and pl. cccxxxvi, figs. 1—4, Ét. G.

⁶ Ibid., pl. cxvii, figs. 7, 8, and pl. cxx, figs. 4, 5, Ét. G.

In *P. amabilis*, Barr.,¹ the umbo is central and direct, and more acute.

In *P. intricans*, Barr.,² the threading is complicated by every fourth thread being larger.

In *P. obsequens*, Barr.,³ the threading is somewhat similarly complicated and the umbo more central.

In *P. expansa*, Barr.,⁴ the ribs, though expanding laterally, become small again almost immediately.

P. gracilis, Barr.,⁵ closely resembles the specimen in the Barnstaple Athenæum in shape, and apparently is rather coarsely threaded, but it shows no signs of the central diminution of ribs. It is probable, however, that our shell has not retained its true shape, and the Bohemian shell too has signs of being distorted.

Cardium rigidum, F. A. Römer,⁶ appears congeneric, but seems distinguished by having a more anterior umbo, rather more numerous ribs, no transverse threading, and no central diminution of the ribs.

P. grandis, Whiteaves,⁷ is much larger and more transverse, and has still wider lateral ribs, and no transverse threads.

P. potens, Hall,⁸ comes very close, but seems to have a more central and erect umbo and less strong concentric marks, and its ribs are fainter above.

II. Family—GRAMMYSIIDÆ, Rudolf Hoernes, 1884.

1. Genus—LEPTODOMUS, M^cCoy, 1844.

Shell oblong, transverse, trapezoidal, convex; anterior end rounded; posterior end truncated and gaping; surface transversely ribbed, generally with a central constriction; umbo arched, prominent, anterior; lunule deep; hinge straight, toothless; muscular impressions slight.

It appears to bear strong resemblance to the genus *Pholadomya*, but its pallial line is stated to be entire.

¹ 1881, Barrande, 'Syst. Sil. Bohém.,' vol. vi, pl. cxx, figs. 6, 7, and pl. cccxxxvi, figs. 9—11, Ét. G.

² Ibid., pl. cxxxv, figs. 1—7, Ét. E.

³ Ibid., pl. cli, figs. 5—18, Ét. E.

⁴ Ibid., pl. cliii, figs. 7—9, and pl. cclxxxiv, figs. 24, 25, Ét. F.

⁵ Ibid., pl. ccexi, figs. 7—9; pl. cccxxv, figs. 8, 9; and pl. cccxxxiii, figs. 1—6, Ét. G.

⁶ 1866, F. A. Römer, 'Beitr. Harzgeb.,' pt. v, p. 10, pl. xxxv, fig. 1.

⁷ 1891, Whiteaves, 'Canad. Record of Science,' Ann. 1891, p. 401, pl. i.

⁸ 1885, Hall, 'Pal. N. Y.,' vol. v, pt. 1, No. 2, p. 422, pl. lxix, figs. 8, 10.

1. LEPTODOMUS CONSTRICTA, M'Coy. Plate VIII, figs. 8, 9.

1841. *CYPRICARDINIA IMPRESSA* ? Phillips (not Sowerby). Pa Foss., p. 36,
pl. xvii, fig. 58.
1855. *LEPTODOMUS CONSTRICTUS*, M'Coy. Brit. Pal. Foss., p. 396, pl. ii A,
fig. 10*.

Description.—Left valve large, transverse, subquadrate, convex. Umbo very large, wide and prominent, depressed in the centre, much elevated above the hinge-margin, situated at about the median third of the length. Hinge-margin long, slightly concave behind the umbo. Anterior margin arched, being oblique from the umbo to the anterior corner, which is rapidly rounded, and then oblique and moderately convex in its inferior part. Inferior margin long, slightly oblique, and convex but depressed in the centre. Posterior margin roundly convex, straighter and oblique above, and rounding into the hinge-margin. Lunule apparently long, lanceolate, excavate, bounded by a straight elevated line from the front of the umbo to the anterior point. Contour of back convex, with a wide, well-marked, subangular depression (running from the middle of the umbo straight and obliquely to the centre of the inferior margin) from each side of which the contour rises with a gentle convexity, being bounded laterally by the ridge of the lunule in front, and sloping gradually to the margin behind. Surface covered by about eleven or twelve large, low, rounded transverse ridges, which divaricate from the front, are lost in the median constriction, become again prominent for a short distance, and then vanish on the posterior part of the shell.

Size (of left valve).—Length 50 mm., height 33 mm., depth 11 mm.

Localities.—A fine specimen from Marwood is in the Museum of Practical Geology; M'Coy's type specimen and another small specimen from Marwood, and a poor specimen from Top Orchard, are in the Woodwardian Museum; another from Roborough is in the Porter Collection.

Remarks.—This is evidently the species to which M'Coy has given the name *L. constricta*, when describing its right valve from three specimens from Marwood.¹ He was inclined to think it the same as "the shell referred by Phillips (in the 'Pal. Foss.') to the Silurian *Cypricardia impressa* of Sowerby," and this, I think, our two figured specimens prove undoubtedly to be the case.

Cypricardia ? impressa, Sowerby,¹ itself is probably closely allied, but it seems to be smoother and more transverse, and to have a smaller and more anterior umbo.

Affinities.—It appears to me that the present species is closely allied to the German shell described by F. Römer as *Myacites impressus*,² but specifically differs

¹ 1839, Sowerby, in Murchison's 'Sil. Syst.,' p. 609, pl. v, fig. 3.

² 1844, F. Römer, 'Rhein. Uebergangsgeb.,' p. 79, pl. ii, fig. 4.

in having a larger umbo, in being much less transverse, in being more produced and angular on the anterior side, and in its concentric ridges fading rather more rapidly behind (so as to leave a rather larger smooth postero-superior portion), and also on the front side of the median depression.

Myacites striatulus, F. Römer,¹ which is nearer in shape, has strong radiations.

Allorisma plicatella, Ehlert,² is very similar, except that it has no median constriction, the concentric ribs being continuous over the whole back of the shell. It thus shows the proximity of *Leptodomus* to *Allorisma*.

Grammysia constricta, Hall,³ which its author first described as *Grammysia* (*Leptodomus*?) *constricta*,⁴ but without any reference to M'Coy's species, appears to be a rather variable form, usually with considerably more numerous concentric ridges, and of greater transverseness; the American specimens figured by Hall being normally twice as long as high, while ours, though perhaps variable, seem to be only half as long again as the height. If this means that the species are distinct, the name of the American form should become *Leptodomus Hallii*.

Grammysia Hannibalensis, Shumard,⁵ agrees more nearly with our shell in dimensions, but its umbo is more anterior and oblique, and its constriction seems to range more backward.

Leptodomus Canadensis, Billings,⁶ is closely allied, only differing in having a much smaller umbo and in being longer.

2. LEPTODOMUS SEMISULCATA, Sowerby, sp. ? Plate IX, figs. 23, 24, 24 a.

? 1839. MODIOLA ? SEMISULCATA, Sowerby. In Murchison's Sil. Syst., p. 617, pl. viii, fig. 6.

1841. CYPRICARDIA SEMISULCATA, Phillips. Pal. Foss., p. 36, pl. xvii, figs. 57 a—c.

Description.—Shell moderate in size, very convex, transverse. Inferior margin apparently slightly concave in front, gently convex behind. Postero-inferior margin very convex. Postero-superior margin oblique. Valve with a vertical concave constriction very near the anterior side; and covered in with twenty or thirty strong, elevated, regular undulations, which vanish rather suddenly before reaching the posterior slope, and which are divaricated in the anterior constrict-

¹ 1844, F. Römer, Rhein. Uebergangsgeb., p. 79, pl. ii, figs. 5, 5 a.

² 1881, Ehlert, 'Mém. Soc. Géol. Fr.,' ser. 3, vol. ii, p. 34, pl. vi, figs. 3—3 b.

³ 1885, Hall, 'Pal. N. Y.,' vol. v, pt. 1, No. 2, p. 377, pl. lix, figs. 4, 5?, 13—20, and pl. lxxvii, figs. 26, 27.

⁴ 1870, Hall, 'Prelim. Notice Lamellib.,' pt. 2, p. 58.

⁵ 1885, Hall, 'Pal. N. Y.,' vol. v, pt. 1, No. 2, p. 381, pl. lxi, figs. 29, 30, 33.

⁶ 1874, Billings, 'Palæozoic Fossils Canada,' vol. ii, pt. 1, p. 54, pl. v, fig. 1.

tion so that their number is greatly reduced in front. Surface also ornamented with finer minute radiations and concentric lines (fig. 24 *a*).

Size.—Length about 35 mm.

Localities.—One specimen from Landlake is in the Museum of Practical Geology; one in the Barnstaple Museum from Sloly; and two in the Woodwardian Museum from S. W. of Sloly.

Remarks.—The crushed and fragmentary or obscured state of these specimens renders them very difficult to understand, but a comparison with Phillips's figures (the originals of which I have not seen) makes me believe that they are identical with them, while the type of Sowerby's Ludlow shell in the Museum of the Geological Society, though considerably larger, so closely resembles them that I do not see the way to separate them in the absence of more perfect specimens. As far as can be seen they appear to belong to the genus *Leptodomus*, but are distinguished from *L. constricta* by the much more anterior position of the constriction, the character of their ornament, their greater obliquity, and other points.

2. *Genus*—SANGUINOLITES, *M'Coy*, 1844.

This genus was originally defined by M'Coy, but made by himself and others to include many shells which are not congeneric. It has since been restricted by Hall, de Koninck, and Fischer.

1. SANGUINOLITES PORTERI, n. sp. Plate IX, figs. 2, 2 *a*.

Description.—Shell of moderate size, suboval, convex, very transverse. Hinge-line very long, straight. Umbo very much flattened, incurved, depressed, proximate, curving forward, extending slightly above the hinge-line, and situated about one-fifth or one-sixth from the anterior end. Anterior margin subangular, being concave above and convex below the angle. Inferior margin very wide, gently and evenly convex. Postero-inferior point produced, bluntly angular. Posterior margin short, straight, oblique. Keel, acute at first, then obscure, running from behind the umbo to the postero-inferior point, and dividing the shell into two portions, of which the postero-superior is obliquely concave and smooth, and the anterior transversely convex, and covered by about forty very regular, rounded, rather elevated, transverse ridges. Ridges divided by rather narrower furrows, and seeming to diminish in size from the keel forwards, and only to amalgamate very close to the anterior margin. Signs of a narrow lunule.

Size.—Height 14 mm., length 34 mm., depth of one valve about 4 mm.

Locality.—One specimen in the Porter Collection in rubbly brown stone from Pilton.

Remarks.—This fossil is distinguished from *S. mimus*, n. sp., by the great regularity, prominence, and number of its ribs. Thus it approaches *Cardinia Devonica*, Geinitz,¹ but shows little sign of the lessening of the ribs on the marginal parts or of any median depression, and is further distinguished by its stronger keel and rounded base, and by the ribs being absent on the postero-superior region.

From *Leptodomus constricta*² it is distinguished by much more numerous ribs, lower umbo, and the absence of a median constriction.

Sanguinolites angustatus, Phillips, sp.,³ the type of the genus, is much more transverse; and *S. discors*, M'Coy,⁴ (Fischer's type), is very similar, but longer and more rounded in front.

2. SANGUINOLITES MIMUS, n. sp. (MS. Museum of Practical Geology). Plate IX, figs. 4, 6, 7 ?

Description.—Shell of medium size, transverse, convex, suboval. Umbo wide, depressed, flattened, proximate, situate at the anterior fourth of the length. Anterior side somewhat produced, flattened. Anterior margin obliquely convex below. Inferior margin long, slightly convex. Posterior margin roundly convex. Hinge-margin long, straight, slightly oblique. Contour of back vertically convex, horizontally slightly convex, but becoming steeply concave in front of umbo, and gently concave in the postero-superior slope. Postero-superior slope bounded by a convexity or incipient keel from rear of umbo to postero-inferior point, which is followed above by a linear concave depression running from beneath the umbo to the upper part of the posterior margin, and above that by a rounded thickening of the shell over the hinge-margin. Surface bearing about seventeen rather unequal and irregular concentric rounded ridges, separated by rather wider concave intervals and being smallest near the umbo, occasionally divaricating in front and becoming suddenly faint and invisible on the postero-superior slope. Minor ornamentation (at least on posterior parts) consisting of crowded microscopic transverse lineations.

Size of left valve.—Height 16 mm., length 34 mm., depth 5 mm.

Localities.—In the Museum of Practical Geology is a specimen from Croyde;

¹ 1853, Geinitz, 'Verst. Grauwack Sachsen,' pt. 2, p. 46, pl. xii, fig. 3.

² 1841, Phillips, 'Pal. Foss.,' p. 36, pl. xvii, fig. 58.

³ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 208, pl. v, fig. 2.

⁴ 1844, M'Coy, 'Synopsis Carb. Foss. Ireland,' p. 49, pl. viii, fig. 4.

in the Barnstaple Athenæum one from Marwood, a cast and mould from Sloy, and a large fragment of the posterior side from Sloy, which shows the minor ornament; and in the Porter Collection two from Pilton.

Remarks.—One of the characteristics of this species seems the indistinct double swelling of the posterior slope. Its rather prominent and irregular ornament, which abruptly vanishes behind, seems another distinguishing feature.

Affinities.—*Pullastra complanata*, Sow.,¹ as given by Phillips,² differs by having the inferior margin concave, the posterior ridge stronger, and the surface smoother. Sowerby's own shell is also more deltoidal.

Leptodomus semisulcata, Phillips, sp.,³ approaches it in ornament, but is very different in shape, being more convex, with a more anterior umbo and a dorsal constriction.

Sanguinolaria lirata, Phillips,⁴ though looking somewhat similar in Phillips's figure, is really totally different in shape, character, and ornament. It belongs to the genus *Ctenodonta*.

Glossites Manitobensis, Whiteaves,⁵ simulates it in ornament, but is narrower, and is more definitely flattened and smoothed behind.

Sanguinolites concentricus, Goldfuss,⁶ or rather, Beushausen,⁷ sp., appears to have stronger and more regular markings, which are continued over the posterior slope, and also a smaller and lower umbo. It was described by Goldfuss⁸ under the name *Sanguinolaria sulcata*, Phillips,⁹ but the original *S. sulcata* is very different, being wider behind, and without any posterior compression or truncation.

3. Genus—EDMONDIA, de Koninck, 1842.

Shell equivalve, oval or subcircular. Beaks central or anterior. Surface with concentric striæ, and sometimes obscure rays. Hinge narrow, edentulous. Ligament external. Muscle-marks superficial. Pallial line simple.

¹ 1839, Sowerby, in Murchison's 'Sil. Syst.,' p. 609, pl. v, fig. 7.

² 1841, Phillips, 'Pal. Foss.,' p. 35, pl. xvii, fig. 56.

³ Ibid., p. 36, pl. xvii, figs. 57 a—c.

⁴ Ibid., p. 136, pl. lviii, figs. 53* a, b.

⁵ 1892, Whiteaves, 'Cont. Canad. Pal.,' vol. i, pt. 4, p. 310, pl. iv, fig. 7.

⁶ 1832, Goldfuss, in De la Beche's 'Handbuch,' p. 531.

⁷ 1895, Beushausen, 'Abhandl. k. Preuss. Geol. Landes.,' n. s., pt. 17, p. 289, pl. xxvi, figs. 10, 11.

⁸ 1834–40, Goldfuss, 'Petref. Germ.,' vol. ii, p. 278, pl. clix, fig. 11.

⁹ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 209, pl. v, fig. 5.

1. EDMONDIA BODANA, *F. A. Römer*, sp. Plate IX, figs. 5?, 8.

1860. *CARDINIA BODANA*, *F. A. Römer*. Beitr. Harzgeb., pt. 4, p. 163, pl. xxv, figs. 15 a, b.
1862. *EDMONDIA BURLINGTONENSIS*, *White and Whitfield*. Proc. Bost. Soc. Nat. Hist., vol. viii, p. 301.
1884. *CARDINIA?* *BODANA*, *Clarke*. Neues Jahrb. f. Min., Beil.-Band. iii, p. 379.
1883. *EDMONDIA BURLINGTONENSIS*, *Hall*. Pal. N. Y., vol. v, pt. 1, pl. lxiv, figs. 19—29.
1885. — — — *Hall*. Ibid., pt. 1, No. 2, p. 390, pl. lxiv, fig. 22, and pl. xcv, figs. 13, 14.
- ? 1885. — *SUBOVATA*, *Hall*. Ibid., p. 389, pl. lxiv, figs. 10, 18—21, 27, 28, and pl. xcv, figs. 9—12.

Description.—Shell rather small, transversely oval, rather strongly convex. Hinge-line unseen, but apparently about two-thirds the length. Anterior and posterior margins roundly and evenly convex, slightly oblique. Inferior margin long, slightly convex. Umbo apparently prominent, broad, rounded, and incurved, situated at about the anterior fourth of the length. Lunule undefined. Contour convex vertically, nearly flat transversely on the back, convex posteriorly. Surface with about ten irregular undulations of growth, covered by numerous finer lines, the ornament continuing strong on the posterior slope.

Size.—Length 19 mm., height 12 mm., depth of one valve 4 mm.

Localities.—In the Barnstaple Athenæum is one example from Kingdon's, Shirwell, and one from Sloy; in the Museum of Practical Geology one from Braunton, and one from West Angle Bay, Pembrokeshire; in the Porter Collection one from Roborough.

Remarks.—The species seems distinguished by its almost regularly oval shape, slight transverseness, comparative smoothness, and the absence of any posterior angle on the back.

Our figured specimen appears exactly similar to *F. A. Römer's* figure of his *Cardinia Bodana*, except that it is very slightly more transverse.

It also seems perfectly like *E. Burlingtonensis*, *White and Whitfield*, with which *Hall* at first associated shells which he afterwards separated as *E. subovata*, *Hall*, but which present so close a resemblance that it is hard to trace in his various figures the slight differences which he points out.

Affinities.—*E. unioniformis*, *Phillips*, sp.¹ which is *de Koninck's* type of the genus, differs in being more circular.

Leptodomus semisulcata, *Sowerby*, sp., as given by *Phillips*,² is more ovate,

¹ 1836, *Phillips*, 'Geol. Yorks.', vol. ii, p. 209, pl. v, fig. 18.

² 1841, *Phillips*, 'Pal. Foss.', p. 36, pl. xvii, figs. 57 a—c.

and more swollen behind, and has more definite, divaricating ribs, and a distinct anterior dorsal constriction.

Sanguinolites mimus is longer, more regularly and coarsely ribbed, and has a definitely depressed posterior slope.

Sphenotus Hicksii, n. sp., is longer and less regularly oval, has a more depressed back, a post-umbonal keel, and a depressed posterior slope.

2. EDMONDIA? ATHENÆ, n. sp. Plate IX, fig. 3.

Description.—Shell very small, transversely oval, moderately convex. Umbo small, low, proximate, situated at about the anterior third of the length. Anterior margin apparently deeply convex. Inferior margin long, nearly straight. Posterior margin deeply convex. Back transversely flattened. Surface with about eight or ten strong, regular, elevated, rounded, concentric ridges, separated by similar depressions.

Size.—Height 5 mm., length 8 mm.

Locality.—One specimen from Bradiford is in the Barnstaple Athenæum.

Remarks.—The only specimen of this shell that I know is very poor, but it seems to be distinguished from accompanying species by its transverse oval form, and its very strong, sharpish, regular striæ. On the same slab are several specimens of *Cypricardinia scalaris*, but it does not seem possible that it could have affinity to that rather variable species.

It approaches in shape, and agrees in ornament with, several of the numerous Carboniferous species referred by de Koninck to this genus.

It is so similar in general appearance to *Sanguinolites Ungerii*, F. A. Römer,¹ that for a long time I thought it belonged to that species; but F. Römer shows that shell to be congeneric with his *Venulites concentricus*,² and a Belgian specimen in the Woodwardian Museum shows the latter species to be widely removed, and more in the style of an *Astarte*. The shell given by Kayser³ as *Allorisma Ungerii*, F. A. Römer, sp., differs in having finer and much more numerous striations.

¹ 1843, F. A. Römer, 'Verst. Harzgeb.', p. 26, pl. vi, figs. 26 a, b.

² 1844, Ferd. Römer, 'Rhein. Uebergangsgeb.', p. 79, pl. ii, figs. 3 a—c.

³ 1878, Kayser, 'Abhandl. Geol. Specialk. Preuss.', Band ii, pt. 4, p. 118, pl. xx, fig. 7.

3. EDMONDIA? HAMLINGII, n. sp. Plate XI, fig. 3.

Description.—Shell large, transverse, sub-equilateral, very convex. Umbo large, rounded, incurved, direct, extending above the hinge-line, and situated a little in front of the centre. Anterior and posterior margins evenly and deeply convex, the latter being the broader. Inferior margin long, gently convex. Hinge-line shorter than the length of shell. Contour of back evenly convex. Surface covered with very numerous, fine, irregular growth-lines.

Size.—Height 23 mm., length 32 mm., depth of valve about 10 mm.

Locality.—One specimen is in Mr. Hamling's Collection, in a pebble from the beach at Saunton Point.

Remarks.—The umbo and hinge of this fine specimen are obscured by the hard gritty matrix, and it is impossible to decide its exact generic position. It appears far removed from any of the other species of our beds, being marked by its remarkably regular, convex, oval form, and the central position of its umbo. As it bears most general resemblance to some species of *Edmondia* described by de Koninck, it seems best to refer it provisionally to that genus. In the same pebble, specimens of *Strophalosia productoides*, *Athyris concentrica*, and *Orthis interlineata* occur.

Affinities.—It seems to have a larger umbo than *E. orbitosa*, de Ryckholt¹ and *E. praelata*, de Roninck.²

4. Genus—SPHENOTUS, Hall, 1885.

Shell equivalve, very unequilateral, elongate, sub-trapezoidal. Anterior end short. Posterior end obliquely truncate. Beaks sub-anterior. Hinge-line long, nearly straight. Umbonal ridge defined. Postero-superior slope marked characteristically with a median ridge. Back with a broad median depression, sometimes producing a constriction in the margin. Surface concentrically striated. Hinge narrow, with two short narrow central teeth in right valve, and two extremely slender lateral teeth. Ligamental groove slender, external. Anterior muscle-scar strong, marginal. Posterior scar shallow. Pallial line simple.

The above description is condensed from Hall, who states that the genus differs from *Sanguinolites* and *Allorisma* by its umbonal and post-cardinal ridges, its trapezoidal shape, its central cincture, and the character of the hinge.

Judging by the external characters, the following species appear referable to it.

¹ 1885, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. xi, p. 36, pl. xiii, figs. 18–26.

² Ibid., p. 36, pl. xiii, figs. 26, 27.

1. SPHENOTUS HICKSII, n. sp. Plate IX, fig. 9.

1841. PULLASTRA? COMPLANATA, *Phillips* (not *Sowerby*) Pal. Foss., p. 35,
pl. xvii, fig. 56.

Description.—Shell rather small, convex, transverse, subquadrate. Hinge-margin with two long, transverse, lateral teeth. Umbo prominent, wide, flattened, incurved, anteriorly truncate, situated at about the anterior third of the length. Anterior margin rather broad, deeply convex. Inferior margin long, straight, or very slightly concave. Postero-inferior corner much produced, roundly convex. Posterior margin probably oblique. Contour of back vertically convex, transversely flattened and slightly depressed in the middle; curving rapidly in front to form an undefined lunule, which is bisected by the produced margins; bounded behind by a more or less distinct rounded angle or ridge from the umbo to the postero-inferior corner. Posterior slope obliquely flattened. Surface with ten or fifteen irregular undulations, less marked on the sides, and with a minor ornament of minute, crowded, sharpish transverse lines, only seen where the shell is well preserved. Shell-structure thin.

Size.—Length 25 mm., height 13 mm., depth of valve 5 mm.

Localities.—In the Museum of Practical Geology is a specimen from the new Ilfracombe Road near Barnstaple; in the Barnstaple Athenæum, eight from Kingdon's, Shirwell; and in the Porter Collection two from Pilton.

Remarks.—While these fossils clearly belong to the species described by Phillips as *Pullastra complanata*, Sowerby, they are perfectly distinct from Sowerby's own species.¹ The latter is a much more oblique and trigonal shell, with a very narrow anterior end, and altogether has a more mytiloid appearance, as seen by his type in the Museum of the Geological Society.

None of our specimens are very perfect, or give the full shape. The amount of depression in the back and of the transverseness seems to vary considerably.

One of Mr. Porter's specimens is a cast, and seems to show two long posterior teeth. This is not, however, very clear.

2. SPHENOTUS SOLENOIDES, *Hall*? Plate IX, figs. 10, 11.

1870. SANGUINOLITES SOLENOIDES, *Hall*. Prelim. Notice Lamell., pt. 2, p. 38.

1883. — — — *Hall*. Pal. N. Y., vol. v, pt. 1, Plates, pl. lxxv,
figs. 21—28.

1885. SPHENOTUS SOLENOIDES, *Hall*. Ibid., vol. v, pt. 1, No. 2, p. 398, pl. lxxv,
figs. 21—28.

¹ 1839, Sowerby, in Murchison's, 'Sil. Syst.', p. 609, pl. v, fig. 7.

Description.—Shell obliquely convex, very transverse, of moderate size. Umbo situated at about the anterior third of the length, small, much flattened and truncated, incurved, tending forward. Hinge-line probably nearly the length of the shell. Anterior margin produced, narrow, evenly convex. Inferior margin very long, nearly straight, slightly oblique. Posterior margin broad, gently convex. Contour of back gently convex on the line of greatest depth from umbo to postero-inferior corner, in front of which it is obliquely flat, and behind which it is gently convex. Surface with a few rather irregular and divaricating, rounded growth-ridges on the back, which almost vanish on and behind the aforesaid line.

Size.—Height 10 mm., length 24 mm.

Locality.—There are three specimens from “the top of the Baggy Stage,” S.W. of Sloly, in the Woodwardian Museum.

Remarks.—These shells are very indistinct, but they appear so closely to correspond with the figures given by Hall of his *Sphenotus solenoides*, that there seems great probability that they are identical. Our best preserved specimen (fig. 10) appears still more transverse, but this is evidently due to the squeezing to which the beds have been so much subjected, and possibly the greater flattening and depression of its umbo may be due to the same cause. The posterior ridge or keel seems sharper in the American shell, and the inferior margin sometimes slightly concave.

3. SPHENOTUS? SOLENIFORMIS, *Goldfuss*, sp. Plate XII, figs. 1, 1 a.

1834-40. SANGUINOLABIA SOLENIFORMIS, *Goldfuss*. Petref. Germ., vol. ii, p. 277, pl. cliii, fig. 7.

1895. SPHENOTUS SOLENIFORMIS, *Beushausen*. Abhandl. k. Preuss. Landes., n. s., pt. 17, p. 215, fig. 19; and pl. xviii, figs. 1, 2.

Description.—Shell (cast) rather large, extremely transverse, subconvex, quadrate. Umbo flattened, adpressed, proximate, curved forward, and situated at about the anterior tenth of the length. Hinge-line straight, about five-sixths the length of shell. Anterior margin probably sloping obliquely from umbo to the anterior angle, which is one-third way down, and then becoming obliquely convex. Inferior margin very long, direct, straight. Postero-inferior corner rather produced, apparently deeply convex. Posterior margin very short, slightly convex and oblique. Contour of back rounded in front, slightly concave beneath umbo, and with a blunt keel running from behind umbo in a slight curve to postero-inferior corner. Posterior slope flat and oblique, and marked with a few strong

unequal growth-ridges. Anterior muscle-scar apparently large, and occupying the anterior corner. Posterior muscle-scar large, circular, and indistinct, and situated below the end of hinge-line on the posterior slope. Escutcheon very long, narrow, and apparently concave and defined.

Size.—Height 16 mm., length 52 mm., depth of the closed shell 12 mm.

Locality.—There is a specimen in the Mantell Collection in the British Museum without a locality, but resembling in the mineral character the fossils of the Marwood *Cucullæa* beds.

Remarks.—The only specimen of this shell, though very remarkable in form, is so badly preserved that it is very difficult to say what it is. The hind margin is gaping, but the front is so much worn away that its true shape is doubtful. It appears to me very closely to resemble the figure which Beushausen gives in the text of his latest work as the undistorted form of Goldfuss's *Sanguinolaria soleniformis*. This, as far as can be judged, chiefly differs from ours in being slightly shorter, and slightly less concave in the post-umbonal slope, and in having a rather longer front margin; differences probably due to the German fossil having the shell. Whether Beushausen is right in identifying his shell with Goldfuss's, which is totally different in appearance, I have no means of judging, but if he is, it seems clear that our fossil may also be referred to it.

Beushausen places his shell under *Sphenotus*, with which it appears agreeable except in its extreme length. Our specimen has so much the appearance of straight-hinged species of Hall's genus *Cimitaria* (regarded by Beushausen as a synonym of *Leptodomus*, to which it is at all events allied), that it is quite possible it may prove to belong to it, but that cannot be ascertained till a specimen showing the true shape of its front side be found.

5. Genus—PHTHONIA, Hall, 1870.

1. PHTHONIA, sp. Plate IX, fig. 19.

? 1895. PHTHONIA, cf. CYLINDRICA, Kayser. Ann. Soc. Géol. Belg., vol. xxii, p. 201, pl. i, fig. 9.

Description.—Shell small, convex, extremely transverse (umbo and anterior parts unknown). Upper and inferior margins very long, straight, and nearly parallel. Posterior margin roundly and evenly convex. Contour of back straight horizontally, roundly convex vertically. Surface with a few unequal, indistinct, transverse striæ.

Size.—Length more than 17 mm., height 6 mm., depth of valve 2 mm.

Localities.—A single specimen from Top Orchard is in the Barnstaple Athenæum, its mould being in the Porter Collection.

Remarks.—Though this specimen is so imperfect that its full shape, &c., cannot be ascertained, I have figured it, as it does not seem at all in accord with any of our other fossils. Its extreme elongation and the uniformity of its contour is remarkable, even if partially induced, as is indicated by a specimen of *Orthis interlineata*, Sow., on the same slab being slightly distorted in the same direction. The nearest approach to it is the shell recently described by Dr. Kayser, from Belgium, under the name *Phthonia*, cf. *cylindrica*, Hall,¹ which is so like that it may perhaps prove identical. From Hall's own species the differences are greater.

A fragmentary shell, from South Petherwyn, in the Museum of Practical Geology has nearly the same dimensions, but differs so much in detail as evidently to be distinct.

III. *Family*—PROTHYRIDÆ, S. A. Miller, 1889.

I. *Genus*—PROTHYRIS, Meek, 1869.

Shell equivalve, very inequilateral and transverse, moderately convex, concentrically striated, gaping and rectangularly notched in front, close or slightly gaping behind; umbo depressed, subterminal, with a small (elevated) fold running from it to the anterior notch; inferior margin direct, convex or re-curved.

There seems one discrepancy between the genus as generally defined, and the characters shown by English species, viz. that the notch in the latter is the termination of an elevated ridge running from the umbo, and not of a groove, as appears indicated by Meek, Hall, Zittel, Fischer, &c. Whether this points to a real difference I cannot say, but the character of the ridge in the English shells is clear.

The species appear to be gregarious.

1. PROTHYRIS RECTA, n. sp. Plate IX, figs. 12—14.

Description.—Shell rather small, transverse, slightly convex. Umbo low, incurved, situated at about the anterior third of the length, inclined forward. Hinge-margin long (details unknown). Anterior margin broad, roundly convex, with a small triangular notch or nick at its centre. Inferior margin long, very slightly convex. Postero-inferior corner produced, narrow, very convex. Posterior margin nearly straight, very oblique. Surface with unequal, low,

¹1885, Hall, 'Pal. N. Y.,' vol. v, pt. 1, No. 2, p. 473, pl. lxxviii, figs. 1—4.

convex growth-swellings, separated by deep impressed lines, and apparently covered with finer lineations, and with one or two impressed rays on the postero-superior slope. Contour flattish on the back, steeply convex on the supero-posterior part, where a narrow groove runs from the rear of the umbo to the margin, and broken in front by an arching ridge running from before the umbo to the anterior marginal nick, and defining a lunule. Shell-structure massive. Pallial line at some distance from the margin. Posterior muscle-scar apparently small, and situated near the posterior point. Anterior muscle-scar near the umbo. Interior of the shell with grooves and pits.

Size.—Height 12 mm., length 18 mm., depth of one valve about 3 mm.

Localities.—There are twenty-six specimens in the Museum of Practical Geology from Baggy Point, "South Cave," and "just over the grits" in blackish Limestone.

Remarks.—Though these shells were evidently common in their locality, it has been difficult to find sufficiently perfect specimens to define the species, especially as it seems to have been rather variable in shape.

Affinities.—It differs from *Prothyris contorta* in being shorter and less oblique, and in having a convex base.

2. PROTHYRIS CONTORTA, n. sp. Plate IX, figs. 15, 16, 16a.

Description.—Shell small, convex, subquadrate, very transverse. Hinge-line unseen, but apparently about half the length of the shell. Umbo small, low, oblique, flattened, and situate near the anterior end. Anterior margin very convex, but broken at about its centre by a small, deep, concave notch, which is the termination of a rounded elevated conical ridge, running to it from the front of the umbo. Inferior margin very long, convex in front, straight or even slightly concave in the median region, becoming convex behind. Postero-inferior corner produced and very deeply convex. Posterior margin oblique above. Contour of back very evenly convex except for the tubular ridge. Cast marked with one or two deep linear furrows running along the postero-superior edge, and with a triangular perpendicular clavicular groove under the umbo. Muscle-marks *apparently* large and not marginal. Pallial sinus *apparently* deeply indented. Surface covered with very numerous microscopic, impressed, concentric striæ, and having five or six fine sharp sub-parallel ridges running along the postero-superior side of the shell immediately below the hinge-margin. Shell-structure rather thick for the size of the shell.

Size.—Height 8 mm., length 22 mm., depth of one valve 2 mm. (approximately).

Locality.—There are several small specimens in the Barnstaple Athenæum from Kingdon's, Shirwell, and two or three in the Porter Collection from Pilton.

Remarks.—While in many respects good, the specimens leave much that is doubtful about this species. It seems to be distinguished by its very long subquadrate or rhomboidal shape and slightly sigmoid inferior margin.

3. PROTHYRIS SCALPRATA, n. sp. Plate IX, figs. 17, 18, 18 *a*; and (?) Plate X, figs. 16—17 *a*.

Description.—Shell small, equivalve, gently convex, lancet-shaped, very transverse. Umbo wide, low, proximate, slightly rounded, very oblique, arching forward, concavely truncate in front. Anterior margin produced, broad, very convex, but suddenly and deeply notched at the medio-anterior point, below which it immediately curves with a slight convexity into the inferior margin. Inferior margin very long, and gently and evenly convex. Posterior side long and narrow. Posterior margin produced to an almost sharp median angle, with similar gently convex sides; the upper side becoming slightly concave as it meets the end of the hinge-margin rather behind the middle line of the shell. Hinge-margin straight, about half the length of the shell. Hinge with three or four long, linear, parallel (or radiating), transverse, posterior lateral teeth. Lunule deep, ovate, defined by a raised tubular ridge, which arches from the umbo to the notch in the anterior margin. Contour of back vertically gently convex, horizontally nearly flat, obliquely truncated in the extreme supero-posterior part, concave in the antero-superior part or lunule, and broken by the squarish conical arching ridge running from the front of the umbo to the anterior notch. Surface ornamented with distant impressed striæ or growth-lines, especially near the margins, and with two or three slight sunken radiating threads on the postero-superior part of the shell.

Size.—Length 16 mm., height 7 mm., depth 3 mm.

Localities.—There is a specimen (of the open valves) from Croyde, and another from the Sloly beds of Plaistow Mill Quarry, near Barnstaple, in the Museum of Practical Geology; there are numerous specimens from Sloly in the Barnstaple Athenæum, from S.W. of Sloly in the Woodwardian Museum, and from the Sloly Quarry in my Collection.

Remarks.—This species, though rarely found in at all good preservation, is evidently an abundant and characteristic fossil of the Sloly beds. In the Sloly Quarry Dr. Hicks and I observed a bed near the *Lingula squamiformis* bed which

is absolutely covered with their crowded valves, though so decayed and often so distorted that they cannot be individually recognised, and it is only by means of an occasionally better preserved specimen that the species can be made out. The totally different appearance sometimes produced by the extreme distortion is illustrated by the two figures on Pl. X, which were not recognised as the present species till long after they were drawn.

Affinities.—From the two accompanying species of this genus the present shell is at once distinguished by its long lancet-like shape and its angular posterior side. It appears confined to the Sloy beds, while the other two occur higher in the series, the one near the base, and the other in the middle of the Pilton beds.

It is something like *Ctenodonta tumida*, Sandberger,¹ in general shape, but is totally different in detail.

2. ORDER—HOMOMYARIA, Zittel, 1881.

I. Family—UNICARDIIDÆ, Fischer, 1887.

1. Genus—SCALDIA, de Ryckholt, 1847.

I have placed the following species under this genus as being possibly in accord with it, but sufficient is not known of the shell to determine its true affinities.

1. SCALDIA? LONGA, n. sp. Plate X, figs. 1, 1 a, 2.

Description.—Shell small, transversely oval, very convex. Umbo nearly central, prominent, slightly arching forward. Anterior and posterior margins nearly similar and approximately semicircular. Inferior margin gently convex. Contour rather flat transversely, very convex vertically, becoming concave in the superior corners. Umbonal slopes rounded. Muscle-scars extremely large, irregularly subcircular, situated on the superior side not far from the umbo. Shell-structure very thick.

Size.—A single valve is about 12 mm. long, 9 mm. high, 3 mm. deep.

Locality.—Two specimens are in the Museum of Practical Geology from South Cave, Baggy Point.

Remarks.—The nearly central umbones and sub-equilateral transversely oval form distinguish these little shells from any that otherwise approach them.

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 277, pl. xxix, figs. 6, 6 a.

They are evidently casts of a very thick shell, and show traces of a few transverse ridges of growth. In the neighbourhood of the umbo are a few prominences, indicating indented pits in the inner surface of the valve. The muscle-scars seem rounded and unusually and equally large; the anterior scar is situated halfway from the apex to the centre of the anterior margin, and the posterior scar much nearer to the centre of the posterior side.

II. *Family*—ARCTICIDÆ, *R. B. Newton*, 1891.
CYPRINIDÆ, *Gray*, 1840.

1. *Genus*—CYPRICARDINIA, *Hall*, 1859.

1. CYPRICARDINIA SCALARIS, *Phillips*, sp. Plate IX, figs. 20, 21.

1841. MODIOLA SCALARIS, *Phillips*. Pal. Foss., p. 137, pl. lx, fig. 62*.
 ? 1858. CYPRICARDIA IMPRESSA, In Baer and Helmersen's Beitr. Russ. Reiches,
 Band xxi, p. 106, pl. iv, figs. 4 a, b.
 1892. CYPRICARDINIA SCALARIS, *Whidborne*. Dev. Faun., vol. ii, p. 5, pl. i,
 figs. 6—8.
 ? 1894. — SANDBERGERI, *Holzappel*. Abhandl. k. Preuss. Geol.
 Landes., n. s., pt. 16, p. 181, pl. xvi, fig. 3.
 1895. — LIMA (*Schnur*), *Beushausen*. Ibid., n. s., pt. 17, p. 182,
 pl. xvi, fig. 1.
 1895. — SCALARIS, *Beushausen*. Ibid., p. 179, pl. xvi, fig. 2.
 ? 1895. — SANDBERGERI, *Beushausen*. Ibid., p. 181, pl. xvi, fig. 3.

Localities.—In the Barnstaple Athenæum are two specimens on a slab from Bradiford and one from Top Orchard; in the Porter Collection two from Pilton; and in my Collection six from the lane between Wrafton and Heanton.

Remarks.—After comparing these with specimens from Lummaton I feel no doubt that they belong to Phillips's species. As their surface is often much decayed, their markings are not always so definite, but their character seems the same, and their shape varies within the same limits. They seem still smaller in size.

I much regret that I am unable to follow Beushausen in separating the three species quoted above from his recent masterly work. Even if the distinctions which the learned German draws are permanent in the Continental specimens, it appears to me that they are unlikely to indicate more than local varieties. As far as I can see, English specimens might be selected which would be ranked in each of them. It would seem that it is not always the same valve which is the largest in the English species, and that the median constriction varies much in its strength.

C. impressa, Paecht, appears to agree in form and ribbing, but is of a much larger size.

2. CYPRICARDINIA ? sp. Plate IX, fig. 22.

Description.—Shell small, oblique, transverse. Anterior side much contracted, possibly subangular. Antero-inferior margin rather long, oblique. Inferior margin moderately short, very slightly convex. Postero-inferior corner rounded, very convex. Hinge-margin about three-quarters (?) of the length. Umbo broad, flat, prominent, curving forward, and situate anteriorly. Contour of back flattened horizontally between lines of curvature which run from the umbo to the lower part of the sides. Surface covered by about twenty large, broad, low, subangular, concentric ridges, apparently marked with minute crenulations.

Size.—13 mm. long, 9 mm. wide.

Localities.—A specimen from Sloly is in the Barnstaple Athenæum.

Remarks.—This specimen is very obscure. It has every appearance of belonging to the genus *Cypricardinia*, though there seems no positive evidence that it does so.

3. CYPRICARDINIA, sp.

Description.—Shell minute, suborbicular, very convex, oblique. Umbo elevated, prominent, incurved, direct, anterior. Anterior margin narrow, apparently nearly straight. Inferior margin oblique, slightly convex. Postero-inferior corner subangular, produced. Posterior margin long, oblique, slightly convex. (Hinge-margin unseen, perhaps half the length of shell.) Lunule apparently deep and undefined. Contour very convex, divided by a blunt angle from umbo to postero-inferior corner, behind which it is flatter and steeper. Surface covered with numerous strong parallel ridges on the back.

Size.—About 2 mm. long, 1.5 mm. high, and .5 deep.

Locality.—A single specimen from Marwood is in the Barnstaple Athenæum.

Remarks.—This tiny shell seemed too indistinct for figuring, but by a minute examination many of its details have become evident. It reminds one strongly of the general form of *Opis*, but no doubt is really a species of *Cypricardinia*.

Affinities.—It differs from *C. scalaris* by its shortness, convexity, and much finer striation, in the last point coming nearer the species last described.

III. *Family*—TRIGONIIDÆ, *Fleming*, 1828.I. *Genus*—MYOPHORIA, *Bronn*, 1835.

Salter established the genus *Curtonotus*, and Neumayer *Kefersteinia*, for shells which are similar or identical with Devonian species referred to *Schizodus*, but which are shown by Beushausen to be included within the limits of *Myophoria*.

1. MYOPHORIA INFLATA, *F. A. Römer*, sp. Plate X, figs. 3, 3 a, 4, 4 a.

1843. TELLINA INFLATA, *F. A. Römer*. Verst. Harzgeb., p. 28, pl. vi, fig. 22.
 ? 1844. AXINUS NUCULOIDES, *M'Coy*. Syn. Carb. Ireland, p. 63, pl. xi, fig. 9.
 1849. CARDINIA INFLATA, *d'Orbigny*. Prodrome, vol. i, p. 76.
 1855. — — *F. A. Römer*. Beitr. Harzgeb., pt. 3, p. 13, pl. iii, fig. 12.
 1855. — TRAPEZOIDALIS, *F. A. Römer*. Ibid., p. 13, pl. iii, fig. 11.
 1857. SCHIZODUS INFLATUS, *Keferstein*. Zeitsch. Deutsch. Geol. Gesell., vol. ix, p. 153, pl. iv, figs. 1—3.
 1884. — — *Beushausen*. Abhandl. Geol. Specialk. Preuss., vol. vi, pt. 1, p. 99, pl. vi, fig. 6.
 1884. — KEFERSTEINI, *Beushausen*. Ibid., p. 100, pl. v, fig. 13.
 1884. — TRAPEZOIDALIS, *Beushausen*. Ibid., p. 101, pl. vi, fig. 9.
 1895. MYOPHORIA INFLATA, *Beushausen*. Abhandl. k. Preuss. Geol. Landes., n. s., vol. xvii, p. 122, pl. ix, figs. 6, 7.
 1895. — cf. INFLATA, *Beushausen*. Ibid., p. 123, pl. ix, figs. 8—10.

Description.—Cast moderate in size, almond-shaped, transverse. Umbo rounded, inclined slightly forward, situated behind the anterior third. Hinge-line long, large, gently convex. Hinge-teeth large, broad, oblique. Anterior margin broad, very convex. Inferior margin long, slightly convex. Posterior corner produced, narrow, subangular. Postero-superior margin long, oblique. Contour of back convex, becoming steeper in front, obliquely flattened in the postero-superior part, sometimes with two indistinct rounded angles on the cast, which radiate to the infero-posterior region. Anterior muscle-scar large, angular, deep, situated near the umbo; posterior scar more elongate and less distinct. Shell massive.

Size.—Height 19 mm., length 26 mm., depth of one valve 9 mm.

Localities.—Three specimens are in the Museum of Practical Geology from county Cork, and five poor and doubtful specimens in the Woodwardian Museum from west of Saunton Court.

Remarks.—It is very doubtful whether this shell should be included in our list, the five Devonshire specimens being so poor as to be almost undecipherable. The shells figured appear to belong to the Infra-carboniferous of Ireland.

Keferstein united *Tellina* or *Cardinia inflata*, F. A. Römer, with *C. trapezoidalis*, F. A. Römer. These Beushausen in 1884 again separated into three species, calling Keferstein's *Sch. inflatus* by the name *Sch. Kefersteini*. It appears to me that Beushausen's figure of *Sch. Kefersteini* is almost exactly like Römer's figure of *C. trapezoidalis* and Römer's first figure of *T. inflata*, while his figure of *Sch. inflata* seems more like Römer's second figure and Keferstein's. To the latter of these one of our specimens is very similar; and a second, which is not figured, equally resembles the former. Our own material was insufficient to prove anything, but as other species of the genus are evidently liable to much variation, I was led to the conclusion that the balance of probability was on the side of Keferstein's view. It is interesting, therefore, to find that in his later work Beushausen has reversed his former judgment, and reunited all three as *M. inflata*, though at the same time adding another form, which seems to me also to be identical.

Axinus nuculoides, M'Coy, though much smaller, may perhaps be the young or a dwarfed variety of the same species.

2. MYOPHORIA DELTOIDEA, *Phillips*, sp. Plate X, figs. 5—8.

1841. CYPRICARDIA DELTOIDEA, *Phillips*. Pal. Foss., p. 37, pl. xvii, fig. 59.
 1842. NUCULITES CHEMUNGENSIS, *Conrad*. Journ. Acad. Nat. Sci. Philad., vol. viii, p. 247, pl. xiii, fig. 13.
 1842. — ADPRESSA, *Conrad*. Ibid., p. 248, pl. xv, fig. 4.
 ? 1843. CYPRICARDIA ? RHOMBEA, *Hall*. Geol. Surv. N. Y., Rept. 4th Dist., p. 291, pl. cxxxix, figs. 2, 3.
 ? 1844. AXINUS ORBICULARIS, *M'Coy*. Syn. Carb. Foss. Ireland, p. 64, pl. viii, fig. 28.
 1844. — DELTOIDEUS, *M'Coy*. Ibid., p. 63.
 1855. ANODONTOPSIS DELTOIDEUS, *M'Coy*. Brit. Pal. Foss., p. 396.
 ? 1863. CURTONOTUS ELEGANS, *Salter*. Quart. Journ. Geol. Soc., vol. xix, p. 495, figs. 3 a, b.
 1870. SCHIZODUS ADPRESSUS, *Hall*. Prelim. Notice Lamell., pt. 2, p. 95.
 ? 1870. — RHOMBEUS, *Hall*. Ibid., p. 95.
 1883. CYTHERODON ADPRESSUS, *Hall*. Pal. N. Y., vol. v, pt. 1, plates, pl. lxxv, figs. 3—9.
 ? 1883. — RHOMBEUS, *Hall*. Ibid., figs. 19—23.
 1883. — QUADRANGULARIS, *Hall*. Ibid., figs. 31—36.
 1883. — CHEMUNGENSIS, *Hall*. Ibid., figs. 37—40.

1885. SCHIZODUS ADPRESSUS, *Hall*. Pal. N. Y., vol. v, pt. 1, No. 2, p. 449,
pl. lxxv, figs. 3—9.
- ? 1885. — RHOMBEUS, *Hall*. Ibid., p. 452, pl. lxxv, figs. 19—23.
1885. — CHEMUNGENSIS, *Hall*. Ibid., p. 453, pl. lxxv, figs. 31—34, 36—
41, 45.
1885. — ÆQUALIS, *Hall*. Ibid., p. 458, pl. lxxv, fig. 35; and pl. xciv,
fig. 29.
1893. CYPRICARDIA DELTOIDEA, *Collins*. Trans. Roy. Geol. Soc. Cornwall, vol.
xi, p. 36.
1893. SCHIZODUS DELTOIDEUS, *Collins*. Ibid., p. 38.

Description.—Shell moderate in size, convex, slightly transverse, subquadrate. Umbo small, direct, incurved, slightly truncate behind, and situate rather in front of the centre. Hinge-margin short, convex. Hinge containing a large, triangular central tooth, and a smaller, more elongate, and indistinct posterior tooth. Anterior margin broad and roundly convex. Inferior margin rather long, slightly convex. Postero-inferior corner rather produced and subangular. Posterior margin oblique and slightly convex. Contour of back divided by a blunt angle running from the umbo to the postero-inferior point, in front of which it is transversely flat, becoming convex in front, and behind which it is oblique and flat. Posterior muscle-scar high up near the centre of the posterior hinge-margin.

Size.—Height 16 mm., length 20 mm., depth of one valve 5 mm.

Localities.—In the Museum of Practical Geology are two specimens from Marwood, six from Shirwell, one from Petherwyn, and one from West Angle Bay, Pembrokeshire. In the Porter Collection is one from Marwood; in the Woodwardian one from Marwood and two very obscure specimens from Baggy Point.

Remarks.—The Petherwyn specimen almost exactly agrees with Phillips's figure, the only difference being that it is perhaps slightly more transverse. Being in the Museum which contains so many of his figured specimens, it is probable that it is the original type of his *Cypricardia deltoidea*, and it is to be observed that Phillips noted its resemblance to *Axinus*.

M'Coy states it to be not uncommon in the sandstones of Baggy Point, and it seems probable that the beds to which he refers are those which have contributed eight specimens from Shirwell and Marwood to the same museum. The first question, therefore, is whether these specimens can be identified with the type. They differ at first sight in being flatter and in having a less prominent umbo, above which the hinge is seen, whereas it is invisible in the type specimen. At this point Mr. Porter's specimen may be noted as uniting them in shape, and partially showing the teeth. These Marwood specimens are, indeed, of all shapes, long and high, but this is probably largely due to fossilisation, or at least to similar causes to that which produced such variations in the specimens of *Cucullæa* and *Avicula* of the same

beds. It is also to be observed that one of them so exactly resembles *Curtonotus elegans*, Salter, as to render it very probable that it is only a variety of the same species.

We next come to some American forms which are strikingly like our supposed type-specimen, but which appear generally to differ from our fossils by having more elevated umbones. This seems probably to be due to the American fossils retaining their shells, while our specimens are all in the nature of casts.

Schizodus quadrangularis, Hall, and *Sch. Chemungensis*, Conrad, appear identical with each other and with the present shell, except that they are about half as large again—a fact which could hardly give them more than varietal rank, as both the English and American shells vary considerably in size. *Schizodus adpressus*, Conrad, is regarded by Hall as “probably only a variety of *Sch. Chemungensis* which lived under different conditions.” *Sch. æqualis*, Hall, is separated by him from *Sch. Chemungensis*, var. *quadrangularis*, as having “the base more broadly rounded and the anterior portion more expanded below;” but, if he be correct in making the latter form a variety of *Sch. Chemungensis*, it is difficult to see why the former also should not be included in it, and that form is approached by the specimen from West Angle. As given by Whiteaves,¹ however, *Sch. Chemungensis* is wider and more rounded.

On the whole there seems reason for regarding these various forms as not more than varieties of one variable species.

Schizodus rhombeus, Hall, may also possibly be a variety; but, though equalling the English shells in size, it seems essentially to differ from the adjacent forms in being longer, and in having less anterior inflation.

Axinus orbicularis, M'Coy, has much the appearance of being the young or dwarfed form.

Affinities.—*C. centralis*, Salter,² seems distinguishable by its larger and more terminal muscle-scars, its more central umbo, and its more oval form, without signs of posterior truncation.

Schizodus obrotundatus, Beushausen,³ appears to have a slightly larger hinge, and not to be flattened and angulated on the posterior side.

Axinus obliquus, M'Coy,⁴ seems to have a much less inflated anterior side.

¹ 1891, Whiteaves, 'Contr. Canad. Pal.,' vol. i, pt. 3, p. 241, pl. xxx, figs. 5, 5 a.

² 1863, Salter, 'Quart. Journ. Geol. Soc.,' vol. xix, p. 495, figs. 4 a, b.

³ 1884, Beushausen, 'Abhandl. Geol. Specialk. Preuss.,' Band vi, pt. 1, p. 95, pl. vi, figs. 7, 8.

⁴ 1844, M'Coy, 'Syn. Carb. Foss. Ireland,' p. 64, pl. v, fig. 29.

long. In the Porter Collection, however, are two specimens which seem to be specifically identical, and which show that its outline was sometimes more circular, and in the young form more transverse and trigonal. Comparing these Devonshire specimens with *Curtonotus unio*, Salter,¹ which occurs in profusion at West Angle Bay, Pembrokeshire, it appears that they are closely allied, and possibly only varieties of the same species. My Pembrokeshire specimens are unfortunately all defective, it being impossible to extricate them from the hard, crystalline, purple limestone in which they are embedded, but they appear to be very similar in shape, except that they are usually more transverse and quadrate than the Devonshire specimens. It is, however, clear that they themselves varied very considerably in relative measurements.

Turning next to foreign specimens, we find that Keferstein's figure of *Schizodus trigonus* exactly agrees with our Woodwardian specimen, except that it is not quite so high. This shell he identifies with *Thetis (?) trigona*, F. A. Römer, which is smaller, and much more transverse and trigonal, and appears exceedingly like the smaller of Mr. Porter's two specimens. If this identification by Keferstein is correct, there seems no reason against regarding all the above-mentioned English shells as equally belonging to the same species.

Affinities.—*Schizodus ovalis*, Keferstein,² differs in being more perfectly oval; and, according to Beushausen,³ it has strong concentric striæ.

Curtonotus elongatus, Salter,⁴ is a very high form. Not having seen any specimens of it, I am not certain whether his figures represent undistorted shells, but, if so, they appear specifically distinct in outline, being long and straight behind the umbo and deeply convex below.

IV. *Family*—NUCULIDÆ, *d'Orbigny*, 1843.

1. *Genus*—NUCULA, *Lamarck*, 1801.

1. NUCULA LINEATA, *Phillips*. Plate X, figs. 13, 14.

1841. NUCULA LINEATA, *Phillips*. Pal. Foss., p. 39, pl. xviii, figs. 64 *a a—d*,
β a, b.

¹ 1863, Salter, 'Quart. Journ. Geol. Soc.,' vol. xix, p. 495.

² 1857, Keferstein, 'Zeitsch. Deutsch. Geol. Gesell.,' vol. ix, p. 155, pl. iv, fig. 6.

³ 1895, Beushausen, 'Abhandl. k. Preuss. Geol. Landes., n. s., pt. 17, p. 119, pl. x, figs. 15, 16.

⁴ 1863, Salter, 'Quart. Journ. Geol. Soc.,' vol. xix, p. 496, figs. 5 *a—d*.

1863. *NUCULA LINEATA*, *Semenow and Möller*. *Mélange Phys. et Chim.*, vol. v,
p. 678, pl. iv, fig. 11.
- ? 1868. — *PLICATA*, *Dames*. *Zeitsch. Deutsch. Geol. Gesell.*, vol. xx,
p. 502, pl. x, figs. 8 *a*, *b*.

Description.—Shell small, subtriangular, oblique, very convex. Umbo large, prominent, elevated, rounded, situated at or about the posterior third of the length, and tending somewhat backward. Hinge-line convex, about half the length of the shell, and ending abruptly at the sides, bearing a fossette and a few very minute teeth under the umbo, about four large, high, perpendicular, parallel, posterior lateral teeth, and about six still larger and loftier, perpendicular, parallel, anterior lateral teeth. Anterior margin much produced, straight and oblique above, and deeply convex round the anterior corner. Inferior margin long, gently convex. Posterior margin broad, roundly convex. Surface with ten or or twelve fine, sharp, elevated, very distant concentric ridges, between which several very fine intermediate concentric striæ are seen. Shell-structure very thick.

Size.—Height 5 mm., length 9 mm., depth of both valves 3 mm.

Localities.—In the Barnstaple Athenæum is a specimen from Upcott, and another from Brushford; in the Museum of Practical Geology one from Saunton, and another (which is very poor) from east of Ashford Inn; in the Woodwardian Museum three from west of Saunton Court; and in my collection one from Upcott Arch Quarry. Phillips records it from "Baggy Point."

Remarks.—From Phillips's description the species varied considerably in length, size, and sculpture. The variation in contour is seen in our specimens, which seem as a rule rather more transverse than his. Our specimens are, with one exception, casts. It seems doubtful whether the possible crenulation of the striæ mentioned by Phillips is not simply due to fracture. In casts of the double shell the impress of the lofty interlocked teeth leave a beautiful scalloped pattern, and the margins protrude sharply at the ends of the hinge-line.

2. *Genus*—*CTENODONTA*, *Salter*, 1851.

Ehlert,¹ who discusses the question fully, points out that *Tellinomya*, Hall, and *Ctenodonta*, Salter, having the same type species, are synonymous, and considers the latter to be the valid name.

He regards it as a genus distinguished from *Palæoneilo*, Hall, by its more

¹ 1888, Ehlert, 'Bull. Soc. Géol. Fr.,' ser. 3, vol. xvi, p. 653.

central and loftier umbones, its more largely rounded anterior side, the absence of a postero-superior depression, and the subrostrated shape, which is after the manner of *Leda*. On the other hand, Beushausen points out that the type species of *Ctenodonta* had a depression behind; and on the whole it is probable that *Palæoneilo*, and (Beushausen adds) *Kænenia*, should not be counted as more than groups or sub-genera of *Ctenodonta*.

1. CTENODONTA NEWTONII, n. sp. Plate X, fig. 15.

1895. CTENODONTA, sp., *Beushausen*. Abhandl. k. Preuss. Geol. Landes., n. s., pt. 17, p. 78, pl. v, fig. 23.

Description.—Cast small, transversely ovate, sub-equilateral. Umbo small, depressed, slightly recurved, and situated somewhat in front of the centre. Hinge-line gently bent, about two-thirds of the length, and bearing five or six very minute perpendicular teeth, uninterrupted by a fossette, under the umbo, five or six large, parallel, perpendicular anterior teeth, and about twelve large, lofty, parallel, perpendicular posterior teeth. Posterior side broad, much produced, with a deeply convex margin. Inferior margin very long, gently convex. Anterior side broader, with a more evenly convex margin. Surface covered by very numerous, regular, minute, distant, concentric striæ. Contour of back gently convex, steeper in front than behind.

Size.—Height 9 mm., length 12 mm., depth of the cast of one valve 2 mm.

Localities.—In the Barnstaple Museum are two specimens from Fremington; and in my Collection two from Frankmarsh, and a fragment from Ironpost.

Remarks.—These shells seem to agree in shape and ornament with the imperfect valve which Beushausen figures from the Upper Coblenzian of Sehelden.

Though our specimens are chiefly casts, evidence of the nature of the ornament is obtainable.

The species is named after R. B. Newton, F.G.S., whom I have to thank for kind assistance.

Affinities.—*Nucula fornicata*, Goldfuss,¹ is similarly marked, but is larger and deeper, and has a loftier and more lateral umbo and a fossette.

N. lineata, Phillips, is more convex and oblique, and has a much coarser ornamentation.

It appears to be sometimes approached by the very variable *N. domina*, Barrande,² which seems similarly ornamented.

¹ 1834-40, Goldfuss, Petref. Germ., vol. ii, p. 151, pl. cxxiv, figs. 5 a-c.

² 1881, Barrande, 'Syst. Sil. Bohême,' vol. vi, pl. cclxxiv, fig. 1, 5-16, Ét. D.

N. plicata, Phillips,¹ has a terminal umbo and more quadrate shape; and I expect will prove to be a *Cypricardinia*, perhaps identical with *C. scalaris*, Phillips, sp.

2. CTENODONTA (PALÆONEILO) LIBATA, *Phillips*, sp. Plate XII, figs. 12, 13, 13 a; and Plate XIII, figs. 1—4.

1841. PULLASTRA ANTIQUA, *Phillips* (not *Sowerby*). Pal. Foss., p. 35, pl. xvii, figs. 55 a, b.

1843. SANGUINOLARIA LIBATA, *Phillips*. Pal. Foss., p. 136, pl. lviii, figs. 53* a, b.

? 1884. PALÆONEILO BREVIS, *Beushausen*. Abhandl. Geol. Specialk. Preuss., Band vi, pt. 1, p. 79, pl. iii, fig. 13.

Description.—Shell rather small, suboval, convex, transverse, nearly twice as long as high. Umbo small, low, proximate, rather sharp, without a clavicular process, curving somewhat forward, and situated at or about the anterior third of the length. Anterior margin broad, very convex. Inferior margin long, gently convex, indented behind. Posterior margin very narrow and convex. Hinge-line nearly as long as the shell, slightly bent at the umbo, nearly straight, bearing in front of the umbo about ten small, short, obliquely vertical teeth which increase in size anteriorly, and in rear of the umbo more than thirty-seven still smaller teeth which increase in size posteriorly. Surface covered by twenty or thirty very distant, sharp, erect, very elevated threads, between which several minute minor striæ are sometimes apparent, and which are usually regular over the whole valve, but fold into each other as they curve in on the hinge-margin. Contour convex, but with a broad and shallow concave depression, between two slight convex radiating swellings, running from the rear of the umbo to the posterior end of the inferior margin. Lunule deep, ovate, undefined. Shell-structure thin. Muscular scars large, oval, situate respectively at the anterior point, and just under the posterior end of the hinge-line. Pallial line simple, rather distant from the margin.

Size.—A large valve from Saunton measures 29 mm. in length, 19 mm. in height, and 6 mm. in depth.

Localities.—In the Barnstaple Athenæum are two specimens from Saunton, four from Bradiford, two from Croyde Bay, and one from Top Orchard. In the Woodwardian Museum are two poor specimens from west of Saunton Court. In the Museum of Practical Geology are Phillips's type specimen of the species from

¹ 1841, Phillips, 'Pal. Foss.,' p. 38, pl. xviii, figs. 63 a, b.

Pilton, another specimen figured by Phillips as *Pullastra antiqua*, Sow., from Barnstaple, another from Croyde, a specimen of the valves in contact from "North Devon," and one showing the hinge from Baggy. In the Porter Collection are two specimens from Pilton. In my Collection are specimens from Saunton Hotel, from the *Laticosta* Beds of Baggy, from Kingdon's, Shirwell, and from Pouch Bridge.

Remarks.—This species is evidently one of the commoner and more widely spread bivalves of these beds, though, probably from its tenuity, the specimens are almost always defective or distorted. Examples of the extent to which this may go are to be seen from Pl. XIII, figs. 1 and 3, the transverseness of which is, I believe, entirely due to artificial elongation. The same causes also often more or less obscure the posterior depression, which seems one of the most distinctive features of the species. Under these circumstances it is extremely difficult to be certain that it is more than a variety of *Ct. antiqua*, or to define the distinguishing points if they really exist. After an examination, however, of numerous specimens, including the originals of Sowerby's and Phillip's figures, I am inclined to the opinion (1) that the two are probably distinct; (2) that they both belong to *Palæoneilo*; (3) that Sowerby's *Ct. antiqua* is to be recognised by its more evenly ovoid form, by its concentric ribs being smaller and more numerous, and by the depression on the posterior region being smaller, weaker, and not so greatly deflecting the margin; (4) that the present shell seems to be characteristic of the Pilton beds proper, while *Ct. antiqua* appears to belong to the Marwood beds; and, lastly, that the specimen Phillips figured as *Ct. antiqua*, Sowerby, sp., really belongs to *Ct. lirata* and not to *Ct. antiqua*, as it shows the same characters, especially the posterior depression, and is a Pilton, not a Marwood fossil.

The surface of some of the specimens is very well preserved, and shows four or five concentric ridges between each of the major ribs. My impression is that this may be another distinguishing mark where the fossil is sufficiently well preserved to retain it. A cast in my collection from Kingdon's shows that the interior of the shell under the umbo is a good deal pitted, but had no internal sulcus like that belonging to the kindred genus *Nuculites*. The specimens from the *Laticosta* Beds show much variation in the number and regularity of the ribs.

Affinities.—*Palæoneilo Rauliniana*, Rouault,¹ appears to differ only in having more numerous and irregular striations.

The type species of *Palæoneilo*, *P. constricta*, Conrad,² has much finer striæ than either of the Devonshire species, and is more acute behind. *P. filosa*, Conrad,³ which approaches nearer in ornament, appears to be more angulated, and its striæ are more lamellar, and its posterior depression broader and flatter.

¹ 1888, Ehlert, 'Bull. Soc. Géol. Fr.,' ser. 3, vol. xvi, p. 650, pl. xvi, figs. 4, 4 a.

² 1885, Hall, 'Pal. N. Y.,' vol. v, pt. 1, No. 2, p. 333, pl. xlvi, figs. 1—20.

³ 1885, Hall, *ibid.*, p. 343, pl. xlix, figs. 33—38.

Beushausen has described several species of *Palæoneilo* from the Spirifer-sandstein of the Oberharz, but being for the most part casts they are not easy to compare; *P. brevis*, Beushausen,¹ looks exceedingly like our specimens.

Ctenodonta unioniformis, Sandberger,² as given by Beushausen,³ seems to approach nearly, but it is larger and more unevenly ornamented, while *Ct. gibbosa*, Goldfuss,⁴ not Sow., sp., as given by him, seems also to be a shorter shell. I should not, however, be surprised if they both prove to be varieties of the present species.

3. CTENODONTA (PALÆONEILO) ANTIQUA, Sowerby, sp. Plate XIII, fig. 5.

1840. PULLASTRA ANTIQUA, Sowerby. Geol. Trans., ser. 2, vol. v, pt. 3, pl. liii, fig. 28.

1855. NUCULA PULLASTRIFORMIS, M'Coy. Brit. Pal. Foss., p. 397.

1893. CTENODONTA ANTIQUA, Collins. Trans. Roy. Geol. Soc. Cornw., vol. xi, p. 36.

? 1895. — DALEIDENSIS, Beushausen. Abhandl. k. Preuss. Geol. Landes., n. s., pt. 17, p. 85, pl. vi, fig. 6.

Description.—Shell rather small, transversely ovate, moderately convex. Umbo small, proximate, rather prominent, incurved, tending forwards, and situated at the anterior third of the length. Hinge-margin long, straight posteriorly. Anterior margin deeply convex or subangular. Inferior margin long, gently and evenly convex. Posterior margin convex, rather broad. Contour gently convex, with a very slight and narrow posterior slope. Surface with about thirty distant, regular, elevated concentric lines.

Size.—Height 12 mm., length 19 mm.

Localities.—Six specimens from Marwood are in the Barnstaple Athenæum; one from Marwood is in the Museum of Practical Geology; and Sowerby's type from Marwood is in the Woodwardian Museum.

Remarks.—This species seems to characterise the Sloly Beds, and to be variable in shape, its transverseness decreasing with age.

Its name was changed by M'Coy on placing it in the genus *Nucula*, but as it belongs to *Ctenodonta* or *Palæoneilo*, it may resume its original name. The posterior depression is very narrow and indistinct, perhaps even more so than

¹ 1884, Beushausen, 'Abhandl. Geol. Specialk. Preuss.,' Band vi, pt. 1, p. 79, pl. iii, fig. 12.

² 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 277, pl. xxix, fig. 1.

³ 1895, Beushausen, 'Abhandl. k. Preuss. Geol. Landes.,' n. s., pt. 17, p. 84, pl. vi, figs. 10—15.

⁴ 1834—40, Goldfuss, 'Petref. Germ.,' vol. ii, p. 278, pl. clix, fig. 10.

⁵ 1895, Beushausen, 'Abhandl. k. Preuss. Geol. Landes.,' n. s., pt. 17, p. 83, pl. vi, fig. 16.

appears from our figure, which was carefully drawn from the very indistinct type-specimen and its cast.

Affinities.—From *Ct. lirata* it differs in its flatness and even contour, its smaller and plainer posterior slope, and its finer striæ.

Ct. elliptica is much less transverse, but the larger specimens of the present shell seem gradually to approach it, though still differing in having a narrow posterior margin, and in not having the striæ so broadly parallel to that margin.

The North Devon shell, referred to *Nuculites latissimus*, Phillips, sp., is more transverse, less ovate, less truncated behind, and more finely striated.

Palæoneilo filosa, Conrad,¹ is a narrower shell with a much wider posterior slope and finer striæ.

Sanguinolaria gibbosa, Goldfuss,² not Sowerby, which Beushausen³ refers to this genus, is rather similar in shape and markings, except that, according to the latter author, the ridges are numerous and crowded near the margins, and the shell shorter and the umbo higher.

The Carboniferous *Ct. Hallii*, Barrois,⁴ agrees in shape, but differs in its less defined and regular ornament.

Oucullæa antiqua, Sowerby,⁵ the type of which is in the Museum of the Geological Society, is almost exactly the same in shape, but it has a long stout clavicular ridge, is more convex, and is described as smooth. Sowerby does not appear to unite the two shells, which he places in different genera, though giving them the same specific name.

4. CTENODONTA? ELLIPTICA, *Phillips*, sp. Plate XIII, fig. 6.

1841. PULLASTRA ELLIPTICA, *Phillips*. Pal. Foss., p. 35, pl. xvii, fig. 54.

1893. CTENODONTA ELLIPTICA, *Collins*. Trans. Roy. Geol. Soc. Cornwall, vol. xi, p. 36.

Description.—Left valve of moderate size, flat, oblique, subcircular. Umbo somewhat anterior, flat, depressed, small and hardly defined. (Apex and hinge-line unseen.) Anterior margin broad, slightly convex. Inferior margin gently and regularly convex. Posterior margin convex below, straight and oblique above. Contour of back nearly flat, but sinking suddenly and rapidly close to the

¹ 1885, Hall, 'Pal. N. Y.,' vol. v., pt. i, No. 2, p. 343, pl. xlix, figs. 33—38.

² 1834—40, Goldfuss, 'Petref. Germ.,' vol. ii, p. 279, pl. clix, fig. 10.

³ 1895, Beushausen, 'Abhandl. k. Preuss. Geol. Landes.,' n. s., pt. 17, p. 83, pl. vi, fig. 16.

⁴ 1882, Barrois, 'Mém. Soc. Géol. Nord,' vol. ii, No. 1, p. 339, pl. xvii, figs. 3—3 c.

⁵ 1839, Sowerby, in Murchison's 'Sil. Syst.,' p. 602, pl. iii, figs. 1 b and 12 a.

margins, especially the inferior margin. Surface covered by about forty very distant, fine, sharp, elevated, erect, concentric threads, which occasionally become slightly irregular, are closer and smaller on the supero-lateral parts, and are crossed in the marginal regions by numerous microscopic radiating lineations, which, however, may possibly have been induced by other causes instead of being a true testaceous ornament.

Size.—About 24 mm. long, 22 mm. high, and 3 mm. deep.

Locality.—In the Barnstaple Athenæum is a fine but not very perfect example from Bradiford. Phillips describes his shell from South Petherwyn.

Remarks.—Our figured specimen exactly agrees with Phillips's figure, so that there can be no doubt of its identity. As its umbo and hinge are hidden, there is little direct evidence as to its genus. In general shape it closely mimics shells like *Astarte*, but its resemblance to adjacent species leaves little doubt that it belongs to the present genus.

Its transverse ornament is precisely similar to that of *Ct. antiqua*, Sowerby, sp., and it is quite within the range of possibility that further specimens might afford ground for regarding it as the aged form of a variety of that variable shell.

The present form has, however, such a distinctive, obliquely subquadrate shape, that, judging from what we know of it at present, there appears to be just grounds for believing Phillips to be right in regarding it as a distinct species.

Affinities.—*Paracyclas lirata*, Conrad, as given by Hall,¹ is identically ornamented, and approaches it in shape, but is more convex, and has much fewer ribs, and could claim kinship only on the assumption that the present species did *not* belong to the *Nuculidæ*.

5. CTENODONTA ? TENSA, n. sp. Plate XII, figs. 8, 9 ? 9 a ?

? 1842. NUCULITES SULCATINA, *Conrad*. Journ. Acad. Nat. Sci. Philad., vol. viii, p. 250, pl. xv, fig. 10.

? 1881. LEDA PERDENTATA, *Barrande*. Syst. Sil. Bohém., vol. vi, pl. cclxx, fig. 2, 1-9.

? 1885. PALÆONEILO SULCATINA, *Hall*. Pal. N. Y., vol. v, pt. 1, No. 2, p. 347, pl. 1, figs. 42-46.

Description.—Shell of moderate size, convex, ovoid, very transverse, but narrower behind than in front. (Umbo unseen but apparently low, indistinct, and situated near the anterior end.) Hinge-line apparently very long, gently

¹ 1885, Hall, 'Pal. N. Y.,' vol. v, pt. 1, No. 2, p. 441, pl. lxxii, figs. 2-19; and pl. xcv, fig. 19.

arched, bearing, at least on the posterior side, very numerous, small, short, parallel, oblique teeth. Posterior hinge-margin long, nearly straight, slightly oblique. Posterior margin narrow, and so deeply convex as to be nearly subangular. Inferior margin very long and gently convex. Contour of back moderately and evenly convex. Surface covered by numerous minute, irregular, parallel, sharpish, concentric striæ, one or two of which are definitely larger than the rest.

Size.—Height 10 mm., length 27 mm., depth of one valve about 3·5 mm.

Locality.—A fine specimen and its mould from Sloy are in the Barnstaple Athenæum. A cast from Barnstaple in the Museum of Practical Geology may belong to the same species.

Remarks.—As its interior is not certainly known its genus cannot be decided. The cast from Baggy differs so much that it is very doubtful if it is identical. The species appears to be well characterised, although there may be a little uncertainty about its exact shape, owing to the great amount of squeezing which the beds have evidently undergone. It occurs in the *Lingula squamiformis* beds.

Affinities.—*Leda perdentata*, Barrande, which belongs to the genus *Nuculites*, may possibly prove to be the same species.

The vaguely figured and described *Nucula latissima* of Phillips, seems broader behind, and is more likely to represent the shell described below than the present species.

From *Ctenodonta livata* and *Ct. antiqua* it differs by its much greater length, and by its much finer and more irregular ornament, as it shows little or no signs of the lofty regular concentric bars which cover the surface of those shells.

Cucullella tumida, Sandb.,¹ which has somewhat the same dimensions, differs in being still longer and more trigonal.

Nucula solenoides, Goldfuss,² has a concave hinge-line, and *N. prisca*, Goldfuss,³ appears to be more trigonal.

Palæoncilo attenuata, Hall,⁴ has a median constriction on the back; and *P. sulcatina*, Hall, though closely resembling it, seems to have a loftier umbo and more lamellar ornament.

Sanguinolaria elliptica, F. A. Römer,⁵ not Phillips,⁶ approaches in shape, but

¹ 1853, Sandberger, 'Verst. Rheiu. Nassau,' p. 277, pl. xxix, figs. 6, 6 a.

² 1834-40, Goldfuss, 'Petref. Germ.,' vol. ii, p. 151, pl. cxxiv, fig. 9.

³ Ibid., p. 151, pl. cxxiv, fig. 7.

⁴ 1885, Hall, 'Pal. N. Y.,' vol. v, pt. 1, No. 2, p. 346, pl. 1, figs. 34-39.

⁵ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 26, pl. vi, fig. 27; and 1884, Beushausen, 'Abhandl. Geol. Specialk. Preuss.,' Band vi, pt. 1, p. 73, pl. iv, fig. 24.

⁶ 1841, Phillips, 'Pal. Foss.,' p. 34, pl. xvii, fig. 53.

its surface is undescribed. It may be distinguished by having a loftier umbo and blunter anterior side, and perhaps by its hinge-line.

Ct. hercynica, Beus.,¹ is a similarly doubtful analogue.

Sub-genus—KOENENIA, *Beushausen*, 1884.

Beushausen separated this as a genus on account of its bent hinge-line and the absence of a marginal area to it, giving *Nucula Jasii*, Römer, as the type species; but in his later work (1895) he sinks it as a group of *Ctenodonta*.

6. CTENODONTA (KOENENIA) cf. OBSOLETA, *Goldfuss*, sp. Plate XII, fig. 10.

Description.—Shell of moderate size, very transverse, very convex. Umbo large, flattened, incurved, and probably proximate, situated at or about the anterior third, and tending forward. Inferior margin long, nearly straight. Lateral margins apparently narrow and very deeply convex. Hinge-line gently arched, nearly as long as the shell, and very wide, imperfectly seen but bearing four or five very large, massive, vertical teeth at its extremities, and probably many others between them, which appear to become very minute near the umbo. Contour deeply and regularly convex, being steepest on the anterior side. Shell-structure very massive. Surface unknown. No clavicular process.

Size.—A defective valve measures about 17 mm. high, 30 mm. wide, and 7 mm. deep.

Localities.—Two casts from Braunton and one from Baggy Point are in the Museum of Practical Geology, and another from Frankmarsh is in my Collection.

Remarks.—These fragmentary casts show no signs of any clavicular process. They seem remarkable for the great size of the hinge and of the teeth; the latter having an appearance of being joined by slight transverse bars, which may, however, be due to accident. They certainly seem distinct from any accompanying species; but unfortunately the most characteristic specimens are too imperfect for figuring.

They bear resemblance to *Nucula obsoleta*, Goldfuss,² and to *Cucullæa Jasii*, F. A. Römer,³ but in neither case is it easy to form an accurate idea of the exact shape of these German shells. Beushausen,⁴ indeed, describes a shell more fully

¹ 1884, Beushausen, 'Abhandl. Geol. Specialk. Preuss.,' Band vi, pt. 1, p. 76, pl. iii, fig. 12.

² 1834-40, Goldfuss, 'Petref. Germ.,' vol. ii, p. 151, pl. cxxiv, fig. 6.

³ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 24, pl. vi, fig. 15.

⁴ 1884, Beushausen, 'Abhandl. Geol. Specialk. Preuss.,' Band vi, pt. 1, p. 73, pl. iii, figs. 6, 7.

which he refers to Goldfuss's species, with some, as it seems to me, very reasonable doubt.¹

3. Genus—NUCULITES, Conrad, 1841.

“Equivalve; hinge with cardinal teeth as in *Nucula*, but apparently uninterrupted beneath the apex; an interior rib, like that of *Solecurtus*, but narrower, extends from the apex either direct or slightly oblique towards the base, never passing much beyond the middle of the valve.”

Conrad thus defines his genus, remarking that it has “much the exterior aspect of *Nucula*,” but that the deep sinus in the cast gives the same distinction as between *Solen* and *Solecurtus*, and that it has no fossette in the hinge. *N. lamellosa*, Conrad, is the first of the nine species which he places under it. According to Fischer some of these species belong to *Nucula*, and some, with a clavicular ridge, to *Cleidophorus*, Hall, 1847. But Hall in 1883–5 appears to have sunk the latter genus, referring such ridged shells to *Nuculites*, and (*inter alia*) *Cleidophorus ovatus*, Sowerby, sp.

Conrad's generic definition seems perfectly clear and valid, whether or not he has been consistent in the species he has referred to it.

Cucullella, M'Coy, 1851, *Adranaria*, Munier-Chalmas, 1876, and *Cadomia*, de Tromelin, 1876, appear to be synonyms.

1. NUCULITES? LATISSIMUS, Phillips, sp.? Plate XII, figs. 11, 11 a, 11 b.

1841. NUCULA LATISSIMA, Phillips. Pall. Foss., p. 137, pl. lviii, fig. 65*.

? 1841. — OVATA, Phillips (pars, not Sowerby). Ibid., p. 39.

Description.—Shell rather small, oval, very convex and transverse. Umbo small, low, rounded, turning rather forward, situated at or about the anterior fifth of the length, and apparently bearing internally a median clavicular process which extends halfway down the back. Hinge-line very long, rather curved, with about four very minute, thin, radiating, central teeth under the umbo, nine large, oblique, strong anterior lateral teeth and about forty short, rather stout, perpendicular, parallel posterior lateral teeth. Anterior margin broad, and deeply and evenly convex. Inferior margin long and very slightly convex. Posterior margin much produced, and so deeply convex as to be almost bluntly angular. Contour of back very convex, sinking steeply in front. Surface ornamented by about thirty-

¹ 1895, Beushausen, 'Abhandl. k. Preuss. Geol. Landes.', n. s., pt. 17, p. 74, pl. viii, figs. 8–10.

five very regular, minute, parallel, very distant, erect threads. Shell-structure apparently thick.

Size.—Height 12 mm., length 24 mm., depth of one valve 4 mm.

Localities.—Two specimens from Fremington are in the Barnstaple Athenæum; one defective specimen from Frankmarsh in my Collection; and one very obscure specimen from Barnstaple in the Woodwardian Museum.

Remarks.—Phillips's description of his *Nucula latissima* is only—"its great width is its chief characteristic." His figure is only the outline and hinge; his locality Pilton. All that can be said is that the present shell seems to agree exactly in shape, though Phillips's drawing perhaps implies rather fewer teeth. I have been unable to find his type specimen, and can therefore only refer our shell to his species doubtfully.

Again, Phillips identifies a shell from Meadfoot Sands with Sowerby's *Cucullæa ovata*,¹ and at the same time refers to a small doubtful specimen from Pilton. To whatever species the Meadfoot fossil may belong, the specimens before us appear distinctly to differ from Sowerby's shell by their much greater transverse-ness and less ovoid shape, though, as he has only figured a cast, the ornament cannot be compared. The doubtful specimen which he quotes from Pilton may possibly belong to the present species.

The existence of a clavicular process is not very certain, as the surface of the figured specimen is decayed about that part. Hence the genus must remain doubtful.

Affinities.—*Nucula Krotonis*, F. A. Römer,² which is the same as *Cucullella tenuiarata*, Sandberger,³ is similar and possibly may prove identical. It seems, however, to differ in its more ovate shape. It appears, according to Beushausen, not to have a true clavicular ridge.

Ct. livata, Phillips, sp., has a slighter hinge-line, fewer and stronger threads; no clavicular ridge, and a posterior constriction and emargination.

Nucula tumida, F. A. Römer,⁴ and *N. polydonta*, F. A. Römer,⁵ seem shorter and more oval, and the former at least has no clavicular ridge.

Nuculites oblongatus, Conrad,⁶ sp., which Hall⁷ compares with *Nucula* (*Nuculites*) *ovata*, Phillips, appears to differ in having longer, closer teeth, forming an unbroken sweep and not extending so far in front.

¹ 1839, Sowerby, in 'Murchison Sil. Syst.,' p. 602, pl. iii, fig. 12 *b*.

² 1850, F. A. Römer, 'Beitr. Harzgeb.,' pt. i, p. 13, pl. iii, fig. 5, and 1895, Beushausen, 'Abhandl. k. Preuss. Geol. Landes.,' n. s., pt. 17, p. 72, pl. v., figs. 24 *a, b*, 25.

³ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 276, pl. xxix, figs. 4, 4 *a*.

⁴ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 24, pl. xii, fig. 30.

⁵ 1855, F. A. Römer, 'Beitr. Harzgeb.,' pt. 3, p. 12, pl. iii, fig. 8.

⁶ 1841, Conrad, 'Geol. Surv. N. Y., Ann. Rept.,' p. 50, plate, fig. 8.

⁷ 1885, Hall, 'Pal. N. Y.,' vol. v, pt. 1, No. 2, p. 324, pl. xlvii, figs. 1—12.

V. *Family*—ARCIDÆ, Gray, 1840.

1. *Genus*—CUCULLÆA, Lamarck, 1801.

The arrangements of the teeth show that the first and therefore probably both of the following species do not belong to *Dolabra*, M'Coy. There seems no reason for removing them from the genus in which they were placed by Sowerby and by Phillips.

1. CUCULLÆA UNILATERALIS, Sowerby. Plate XI, figs. 4—13, and Plate XIII, figs. 10, 10 a, 11.

1840. CUCULLÆA UNILATERALIS, Sowerby. Geol. Trans., ser. 2, vol. v, pt. 3, pl. liii, fig. 23.
1840. — TRAPEZIUM, Sowerby. Ibid., pl. liii, fig. 24.
1840. — ANGUSTA, Sowerby. Ibid., pl. liii, fig. 25.
1840. — HARDINGII, Sowerby. Ibid., pl. liii, figs. 26, 27.
1841. — AMYGDALINA, Phillips. Pal. Foss., p. 40, pl. xviii, figs. 66 a—d.
1841. — HARDINGII, Phillips. Ibid., p. 40, pl. xviii, figs. 67 a, b; and pl. xix, figs. 67 a, b.
1841. — ANGUSTA, Phillips. Ibid., p. 41, pl. xix, figs. 68 a—c.
1841. — UNILATERALIS, Phillips. Ibid., p. 41, pl. xix, figs. 69 a—c.
1841. — TRAPEZIUM, Phillips. Ibid., p. 41, pl. xix, fig. 70.
1855. DOLABRA ANGUSTA, M'Coy. Brit. Pal. Foss., p. 393.
1855. — HARDINGI, M'Coy. Ibid., p. 395.
1855. — UNILATERALIS, M'Coy. Ibid., p. 395.
1895. — — var. CONDUSORUM, Beushausen. Abh. k. Preuss. Geol. Landes., n. s., pt. 17, p. 34, pl. viii, figs. 25—28.
1895. — cf. ANGUSTA, Beushausen. Ibid., p. 35, pl. viii, fig. 29.

Description.—Shell large, convex, very variable in shape. Umbo large, more or less anteriorly situated, elevated above the hinge-margin, incurved, tending obliquely forward, and more or less truncated behind. Hinge-area large, flat, triangular, transversely striated. Hinge-line straight, large, shorter than the length of the shell, bearing a few subparallel, long, transverse teeth both before and behind. Anterior margin roundly convex, narrower than the posterior margin. Inferior margin slightly convex, usually oblique. Postero-inferior corner produced, rounded. Posterior margin oblique, straight or rather convex. Contour of back very convex, greatest depth on line from umbo to postero-

inferior corner. Surface covered with numerous sharpish, rather irregular transverse lines and undulations of growth.

Size.—Specimens measure 55 mm. long by 55 mm. high by 35 mm. deep; or 40 mm. long by 35 high by 20 deep.

Localities.—Numerous specimens are in the Woodwardian (including Sowerby's types) and the British Museums, the Barnstaple Athenæum, the Museum of Practical Geology (including the seven specimens figured by Phillips¹), and Mr. Hamling's and my own collections from Sloy, Marwood, Shirwell, Baggy Point and Knowle Quarry near Braunton, North Moulton (one), and Tiverton (four).

Remarks.—Sowerby and Phillips have divided the *Cucullææ*, which are so common in, and so characteristic of, a zone in the Marwood beds, into five or six species; but it may be observed that at least Professor Phillips had great doubts as to the correctness of so doing.

Of *C. angusta*, *C. unilateralis*, and *C. trapezium* he writes, "The three last species are so very closely allied, that on looking over many specimens we find it doubtful whether the differences observed are other than those of degree. The same thing is observable at Marwood in regard to *Avicula damnoniensis*, which varies so much in its proportions as to require the pointing out of three distinct forms."

M'Coy, uniting *C. amygdalina* to *C. unilateralis*, and *C. trapezium* to *C. Hardingii*, reduced Phillips's five species to three. But *C. amygdalina* is intermediate between *C. angusta* and *C. unilateralis*, and *C. Hardingii* bears much the same relation to *C. angusta* which *C. amygdalina* bears to *C. trapezium*. It may be said indeed, on the other hand, that these five forms, though bearing evident relationship, are easily distinguishable, and can be definitely defined, and that it is possible to class specimens under them. But, even so, it soon appears, when any large number of specimens are under examination, (1) that hardly any two that may be placed under any of these forms are exactly alike, showing that each group is merely a collection of very variable shapes bearing some resemblance in general features; and (2) that many specimens may with equal justice be classed under more than one of the five forms: that is to say, that they not only vary within themselves, but run in all directions into each other. It seems, therefore, necessary to believe that we have really only a single very variable species, and that the five forms are not even local varieties, but simply accidental variations of shape. It must further be remembered that these fossils have been subjected to a good deal of squeezing and pressure, and that consequently some amount of the variability of the specimens may be due to that, and therefore have no real zoological existence at all. Lastly it may be remarked that the five forms described by no means exhaust the shapes which the species assumes; and that the only consistent course is either to

¹ 1841, Phillips, 'Pal. Foss.,' pp. 40, 41, pls. xviii and xix, figs. 66—70.

describe a number of new forms in addition to those already described, or to unite all in one single species.

I should perhaps hardly have ventured upon the latter course had not my own view been confirmed by the remarks of Mr. Townshend Hall, who has collected at different times vast numbers of these fossils, and who remarked to me, when first I saw his collection, that he thought they ought all to be united, and that he had arranged several hundred specimens in one continuous chain. He has since favoured me with the following note, which he made in 1877. "Between *C. amygdalina* on the one hand, and *C. angusta* on the other, there are various intermediate forms, to which the names *C. Hardingii*, *unilateralis*, and *depressa* have been given. Is *C. Hardingii* a good species? *C. unilateralis* is the mean between *C. amygdalina* and *C. trapezium*."

On examining the specimens at Barnstaple with me, Dr. Hicks expressed himself as inclined to the same view.

For the sake of definition it may perhaps be convenient to retain the five names, *amygdalina*, *Hardingii*, *unilateralis*, *trapezium*, and *angusta* for the classification of shapes, provided it be understood that no zoological import be attached to them.

In figuring the species I have attempted chiefly to show forms intermediate between these named varieties.

It may be observed that young shells are often flatter, and have smaller and less prominent umbones.

2. CUCULLÆA DEPRESSA, *Phillips*. Plate XI, fig. 14 and Plate XII, figs. 2, 3, 3 a.

1841. CUCULLÆA DEPRESSA, *Phillips*. Pal. Foss., p. 42, pl. xix, figs. 71 a—c.

1841. — COMPLANATA, *Phillips*. Ibid., p. 214.

1855. DOLABRA DEPRESSA, *M'Coy*. Brit. Pal. Foss., p. 394.

Description.—Shell large, convex, slightly inequivalve and inequilateral, variable in shape, trigonal. Hinge-margin short, straight, about one-third of the length. Umbones prominent, incurved, rather distant, inclined somewhat forward, and situated subcentrally. Cardinal area apparently rather broad and concave. Anterior margin broad, prominent, and roundly convex. Inferior margin oblique, nearly straight. Postero-inferior corner steeply rounded. Posterior margin oblique, nearly straight, meeting the hinge-margin at a low obtuse angle. Contour deeply convex on the line of greatest depth from umbo to the postero-inferior corner; before which it slopes flatly out to the margins, becoming slightly concave near the anterior end of hinge-line; and behind which it is almost perpendicular, becoming concave to form a small angular posterior wing. Surface smooth?

Anterior muscle-scar small, circular, situated marginally immediately under the anterior end of hinge-margin.

Size.—Height 58 mm., length 78 mm., depth 40 mm.

Localities.—There are three specimens from Marwood in the Museum of Practical Geology, two of which were figured by Phillips; and several from Marwood in the Woodwardian Museum.

Remarks.—This species is remarkable for its short hinge, and its peculiar trigonal, wedge-like form. The few specimens known are very various in shape, but appear to be probably different from the common and equally variable *Cucullæa* by which they are accompanied. Phillips observes, "The extreme depression of this shell (compared with the former) is remarkable, and does not depend on distortion or pressure, but it is very uncertain how much must be allowed to accidental or local variations of form."

2. Genus—PARALLELODON, Meek and Worthen, 1866.

1. PARALLELODON PYGMÆUS, *Whiteaves*, var. INFANS, var. nov. Plate XII, figs. 4, 5.

1892. MACRODON PYGMÆUS, *Whiteavess*. Cont. Canad Pal., vol. i, pt. 4, p. 299, pl. xxxix, figs. 2, 3.

Description.—Cast minute, convex, semi-oval, transverse, and very oblique. Umbo small, acute, oblique, tending forward, distant, elevated a little above the hinge, and situated between the anterior one-third and one-fourth of the length. Hinge apparently broad and massive, equal (or very nearly so) to the greatest length, bearing two very long and strong obliquely transverse teeth. Anterior margin very narrow, obliquely convex. Inferior margin very long, obliquely straight in front, roundly convex behind. Posterior margin almost vertical, broadly convex. Contour of cast concave on hind wing, roundly convex on the line of greatest depth from umbo to postero-inferior corner, depressed behind the line from umbo to antero-inferior corner, and very deep in front. Shell-structure very massive.

Size.—A specimen measures 2.5 mm. high by 3.5 mm. long.

Localities.—In the Barnstaple Atheneum is a specimen on the same slab as *Crenipecten auritus* from Bradiford, and in the Porter Collection are two specimens on a slab from Poleshill.

Remarks.—Only the cast of this minute shell is known. It appears evidently to belong to the genus *Parallelodon*.

PLATE I.

Fish Remains. (Page 3.)

FIG.

1. Slab containing several detached fragments of scales, $\times 3$. 1 *a*, portion of a scale, $\times 15$, showing structure. Strand, Ashford. Barnstaple Athenæum.

CARIDERPESTES GYIUS, n. sp. (Page 3.)

2. Specimen showing numerous segments, every fourth of which bears an elongated lance-like appendage, $\times 2$. The body appears gradually to narrow till it expands at the extremity, where there are obscure signs of a pair of stout jointed appendages. Sloly? Barnstaple Athenæum.

ECHINOCARIS WHIDBORNEI, *Jones and Woodward.* (Page 6.)

3. Type specimen figured by Jones and Woodward, $\times 3$. Sloly. Woodwardian Museum.

ANATIFOPSIS? ANGLICA, n. sp. (Page 9.)

4. A fragmental specimen, showing a narrow proximal rim and an angulated superior margin. Sloly. Porter Collection.

CERATIOCARIS? SUBQUADRATA, n. sp. (Page 7.)

5. A slab containing two specimens, showing the general shape, the inferior rim, and the oblique ornament, $\times \frac{3}{2}$. 5 *a*, contour of anterior end which is hidden under the matrix. East Anstey. My Collection.

CERATIOCARIS? sp. (Page 8.)

6. An indistinct specimen, $\times 6$. S.W. of Sloly. Woodwardian Museum.

PHACOPS LATIFRONS, *Bronn,* sp. (Page 10.)

7. Pygidium, showing tuberculated segments, especially on the axis, $\times 3$. Barnstaple. Woodwardian Museum.
8. Large, but laterally squeezed, specimen. 8 *a*, side view. Barnstaple. Woodwardian Museum.
9. A small but well-preserved head, $\times 2$. 9 *a*, side view. Top Orchard. Porter Collection.
10. Pygidium, $\times \frac{3}{2}$. 10 *a*, side view. Barnstaple. Museum of Practical Geology.

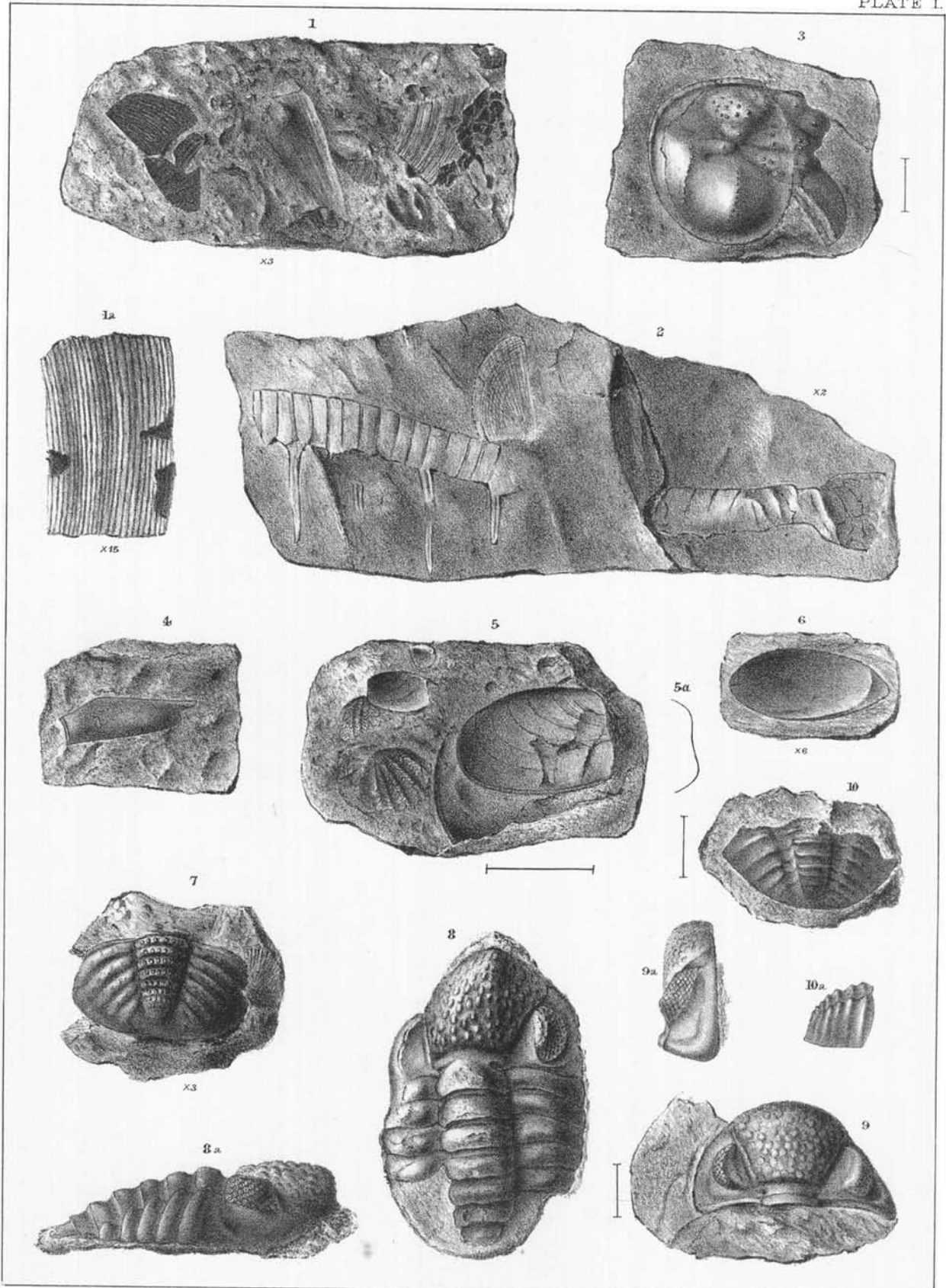


PLATE II.

PHACOPS LATIFRONS, *Bronn*, sp. (Page 10.)

FIG.

1. Body and tail of a very short specimen, the shape of which is perhaps due to pressure, $\times 2$. 1 *a*, side view. Barnstaple. Woodwardian Museum.
2. A large and undistorted specimen of the eleven segments of the body. 2 *a*, side view. Top Orchard. Barnstaple Athenæum.
3. A similar but obliquely compressed specimen, perhaps regarded by Salter as *Ph. lævis*, $\times 1\frac{1}{2}$. Brushford. Museum of Practical Geology.
4. A small pygidium, similar to that indistinctly seen in fig. 1, $\times \frac{3}{2}$. Barnstaple. Museum of Practical Geology.

PHILLIPSIA HICKSII, n. sp. (Page 11.)

5. A perfect but very much decayed specimen, which shows (in the specimen) the position of the eye, the cheek-spine, and the characters of the tail and nine segments in the body, $\times 3$. Shore near Fremington. Barnstaple Athenæum.
6. A very perfect though slightly distorted pygidium, taken from a wax impression of the mould, showing the ornament, the rings of the axis (except the terminal ones, which are blurred), the divided segments of the limbs, and the defined rim, $\times 3$. Pilton. Barnstaple Athenæum.
7. Another similar specimen, which has been elongated by pressure, and shows well the numerous rings of the axis, $\times 3$. Braunton Road. Barnstaple Athenæum (and cast, Porter Collection).
8. A glabella, which has been elongated by pressure, but shows the ornament, the margins of the facial suture, and the lobes, $\times 6$. Pottington. Porter Collection.

BRACHYMETOPUS WOODWARDII, n. sp. (Page 14.)

9. A very small and much distorted head, $\times 10$. Pottington. Porter Collection.
10. Another more perfect specimen, showing the glabella and one of the eyes, $\times 7$. Lane between Wrafton and Heanton. My Collection.
11. A pygidium probably belonging to the same species, $\times 7$. 11 *a*, side view. 11 *b*, rear view. Pilton. Porter Collection.

CERATIOCARIS? sp. (Page 8.)

12. A flat specimen, showing the rim, $\times 12$. Croyde. Hamling Collection.

ISOCHILINA CANALICULATA, *Krause*. (Page 15.)

13. Right valve, partially showing the rim, $\times 15$. 13 *a*, dorsal view. Pilton. Porter Collection.
14. Small distorted valve, showing the rim, $\times 25$. 14 *a*, ventral view. Saunton Hotel. My Collection.
15. Valve of a very short specimen, $\times 15$. Pilton. Porter Collection.

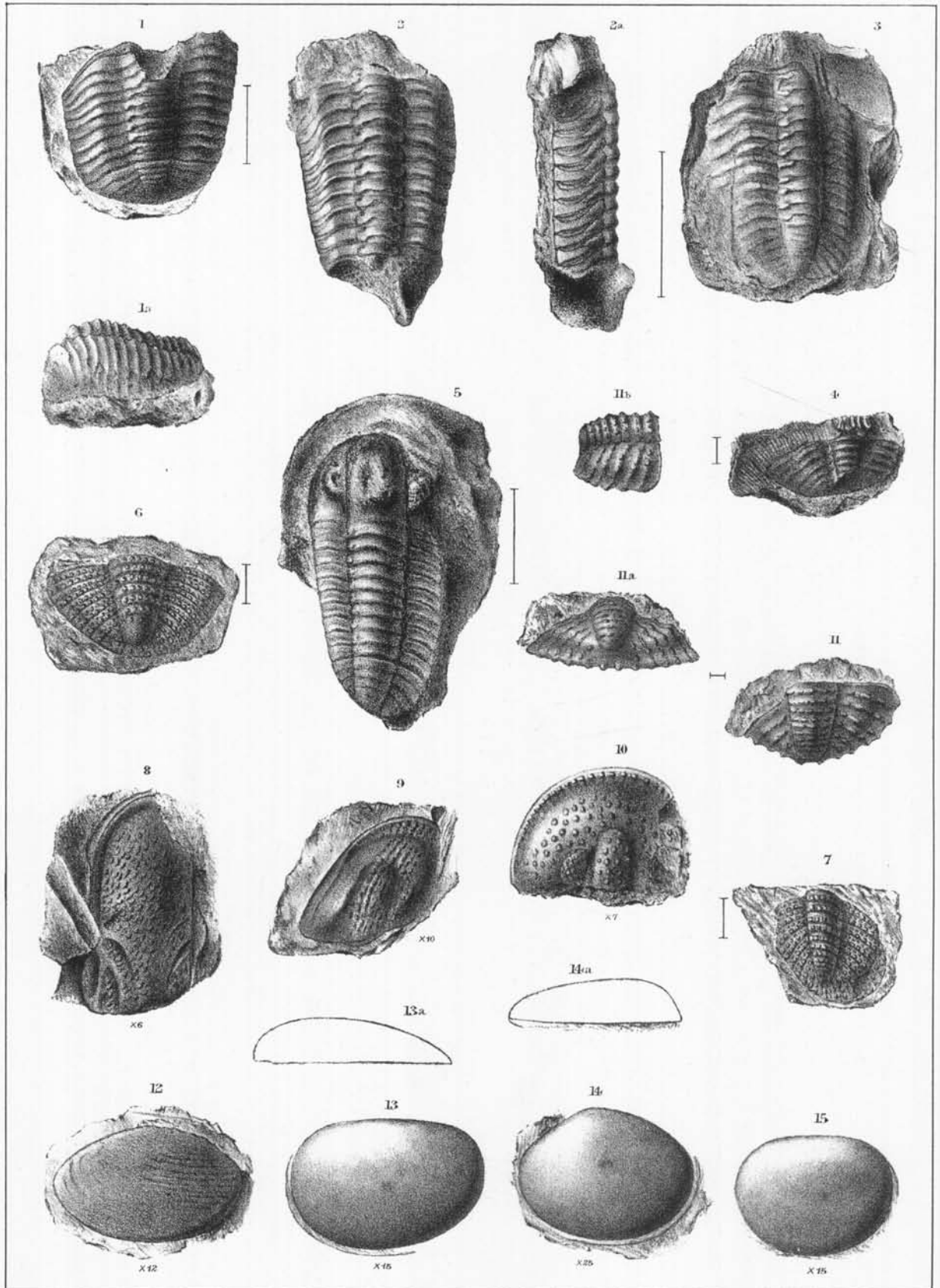


PLATE III.

All the figures in this Plate are from specimens in my Collection, except where otherwise stated.

- FIG. ISOCHILINA CANALICULATA, *Krause*. (Page 15.)
1. Right (?) valve, × 15. 1 *a*, ventral view. 1 *b*, end view. Upcott Arch Quarry.
 2. Left valve, × 15. 2 *a*, ventral view. 2 *b*, end view. Upcott Arch Quarry.
- APARCHITES LINDSTRÖMI, *Jones*, var. EXCELLENS, n. v. (Page 16.)
3. Left valve, × 15. 3 *a*, ventral view. Kingdon's, Shirwell. Barnstaple Athenæum.
- PRIMITIA SPARSINODOSA, n. sp. (Page 16.)
4. Small left valve, × 30. Saunton Hotel. Partridge Collection.
 5. Large right valve, × 30, having small tubercles, which are not, however, distinctly shown in the figure. Saunton Hotel. Partridge Collection.
 6. Ventral view of another right valve, × 30, showing one of the tubercles. Saunton Hotel. Partridge Collection.
- PRIMITIA, sp. (Page 17.)
7. Specimen, × 30, showing the indistinct furrow and roughened surface. Pilton. Porter Collection.
 - 8, 9. Specimens, × 30, showing the dorsal furrows more clearly, and a rim at the posterior end. Saunton Hotel. Partridge Collection.
 - 10, 11. Very much distorted valves, doubtfully referred to this species, × 25. Saunton Hotel.
- PRIMITIA ? sp. (Page 18.)
12. Left valve, × 30, showing the slight furrow. Saunton Hotel. Partridge Collection.
- PRIMITIA DOBSICORNIS, *Ulrich*, sp. (Page 18.)
13. Right valve, × 30, showing the small dorsal projection. Saunton Hotel. Partridge Collection.
- PRIMITIA VESTITA, n. sp. (Page 19.)
14. Specimen, × 15. Pilton. Porter Collection.
- BEYRICHTIA ÆQUILATERA, *Hall*? (Page 20.)
15. Specimen, × 30, showing furrows, but perhaps shortened by pressure. Saunton Hotel.
- BEYRICHTIA DAMESII, *Krause*? (Page 21.)
16. Left valve, × 30, showing the lobes. Pilton. Porter Collection.
- BEYRICHTIOPSIS RUPERTI, n. sp. (Page 22.)
17. Right valve, × 30, showing the tubercles, the longitudinal ridges, and the fringed border. Pilton. Porter Collection.
- KLÆDENIA BURSEFORMIS, n. sp. (Page 22.)
18. Right valve, × 15, showing the median defined lobe and the confluent lateral lobes, probably lengthened by pressure. 18 *a*, ventral view. Laticosta Cave, Baggy.
 - 19, 20. Two valves, × 15, lengthened by pressure, indistinctly showing the lobes. Same locality.
 21. Left valve, × 15, shortened by pressure, with rim and small lobes. 21 *a*, ventral view. 21 *b*, end view. Same locality.
 22. Right valve, × 15, shortened by pressure, in which the lobes appear long and narrow, and the front lobe apparently bifid. 22 *a*, ventral view. Same locality.
 23. Left valve, × 15, obliquely distorted, in which the posterior lobe seems small and oval and the ventral side low and flattened. Same locality.
- ULRICHTIA INTERSERTA, n. sp. (Page 23.)
24. Left valve, × 30, showing the thickened elevated ends and the two defined central lobes. Laticosta Cave, Baggy.
- PRIMITIA BOVIFRONS, n. sp. (Page 19.)
25. Left valve, × 10, showing the surface, the central margined furrow, and the position of the horns; perhaps slightly shortened by pressure. Laticosta Cave, Baggy.
 26. Cast of left valve, × 10, showing the horns, slightly distorted. Same locality.
 27. Mould of a small right valve, × 15, showing the ornament and the border; squeezed into a symmetrical shape. Same locality.
 28. Portion of another specimen, × 30, showing the character of the ornament and the crenulated border. Same locality.
 29. Very large right valve, × 10, drawn from an external mould. (The posterior horn is restored.) Pilton. Porter Collection.
 30. Cast of a right valve, × 10, much elongated by pressure, showing the horns. Laticosta Cave, Baggy.

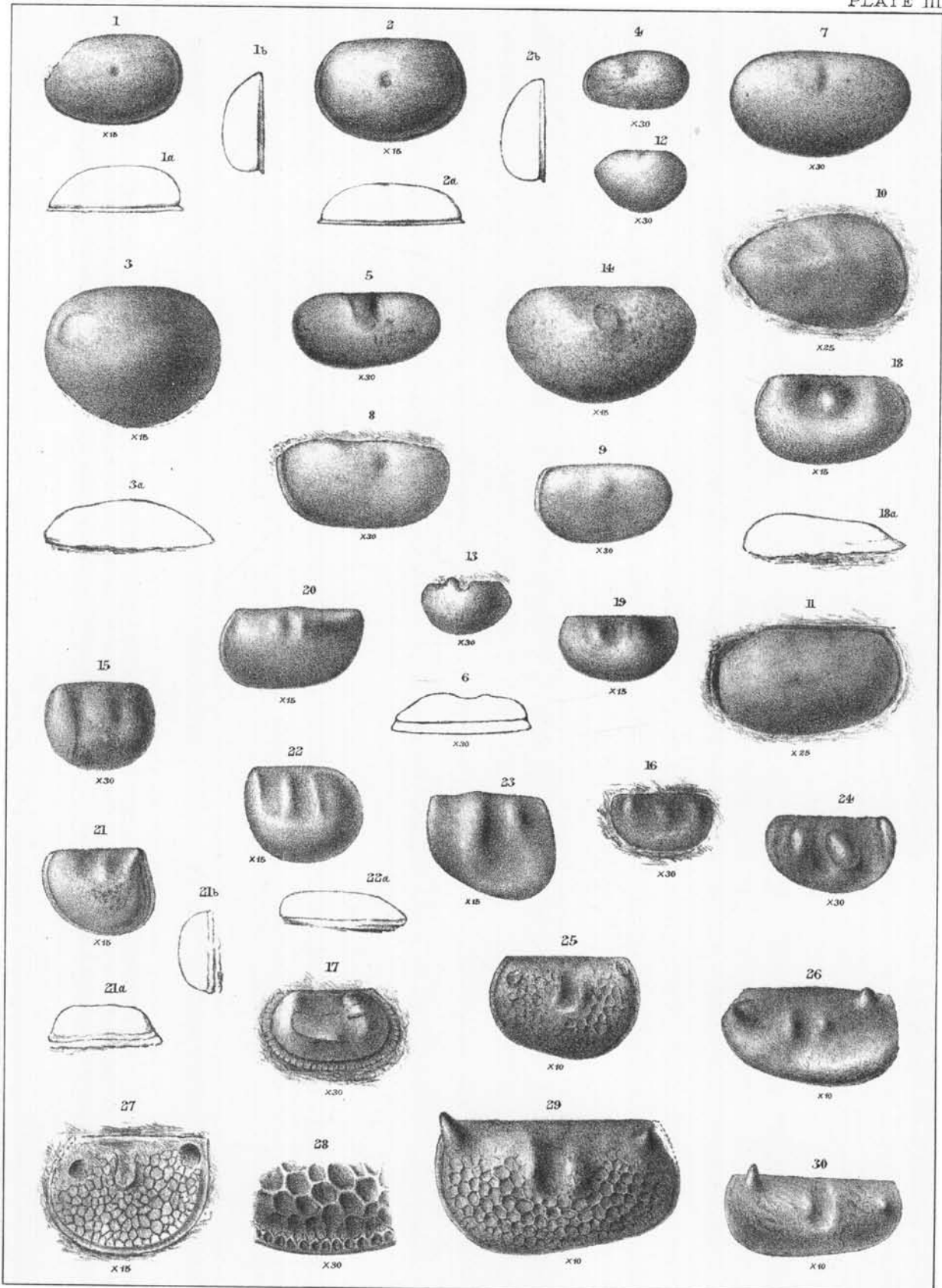


PLATE IV.

GONIATITES, sp. (Page 25.)

FIG.

1. Specimen, showing the inflexion of the whorls about the umbilicus, $\times 2$. 1 *a*, another view. Barnstaple. Woodwardian Museum.

AGONIATITES, sp. (Page 24.)

2. Specimen, much obscured by matrix, but retaining signs of septa and of tubercles round the umbilicus. Kingdon's, Shirwell. Barnstaple Athenæum.

POTERIOCERAS ? sp. (Page 27.)

3. Specimen, much obscured by matrix, but giving the general shape. 3 *a*, another view, showing the position of the siphuncle. Kingdon's, Shirwell. Barnstaple Athenæum.

ORTHO CERAS SPECIOSUM, Münster. (Page 29.)

4. Specimen, showing the septa. 4 *a*, transverse section. Kingdon's, Shirwell. Barnstaple Athenæum.

POTERIOCERAS ? sp. (Page 28.)

5. Specimen, figured by Phillips as *Orthoceras imbricatum*, Hisinger. Marwood. Museum of Practical Geology.

ORTHO CERAS, sp. (Page 32.)

6. Natural section of a specimen showing the septa, the siphuncle, and the vasiform envelope of the siphuncle, $\times 2$. Kingdon's, Shirwell. Barnstaple Athenæum.

ORTHO CERAS BARUMENSE, n. sp. (Page 30.)

7. Small fragmentary specimen, showing the ornament, but not very clear signs of the annuli, $\times 5$. 7 *a*, lower view. Ironpost, near Dulverton. My Collection.
8. Larger specimen, showing the annuli and the rate of tapering, $\times 1$. 8 *a*, section of lower end. 8 *b*, a portion of its mould, $\times 10$. Frankmarsh. My Collection.

ACTINO CERAS ? (HURONIA) CRICKII, n. sp. (Page 33.)

9. Specimen, probably belonging to this species, wanting the surface, but showing the septa and a longitudinal carina, and with signs of longitudinal striæ. Baggy. Museum of Practical Geology.
10. Natural section, much decayed, showing the siphuncular arrangement. Locality? Barnstaple Athenæum.
11. Another specimen, of which the exterior parts are lost, but in which the siphuncular arrangements are preserved in good condition, $\times \frac{3}{2}$. Barnstaple. Woodwardian Museum.
12. Another specimen, showing the siphuncular arrangements and retaining the septa. 12 *a*, portion, $\times 2$. 12 *b*, side view. "Marwood Beds." British Museum.

CONULABIA DEFLEXICOSTA, Sandberger ? (Page 35.)

13. A fragmentary specimen, seen from within, $\times 2$. Pilton. Porter Collection.

TENTACULITES CONICUS, F. A. Römer. (Page 36.)

14. Mould of a specimen, $\times 5$. 14 *a*, cast. 14 *b*, transverse section. Top Orchard. Barnstaple Athenæum.

TENTACULITES (COLEOLUS ?) TENTACULARIS, Phillips, sp. (Page 38.)

15. A somewhat worn specimen, $\times 3$. Pilton. Porter Collection.

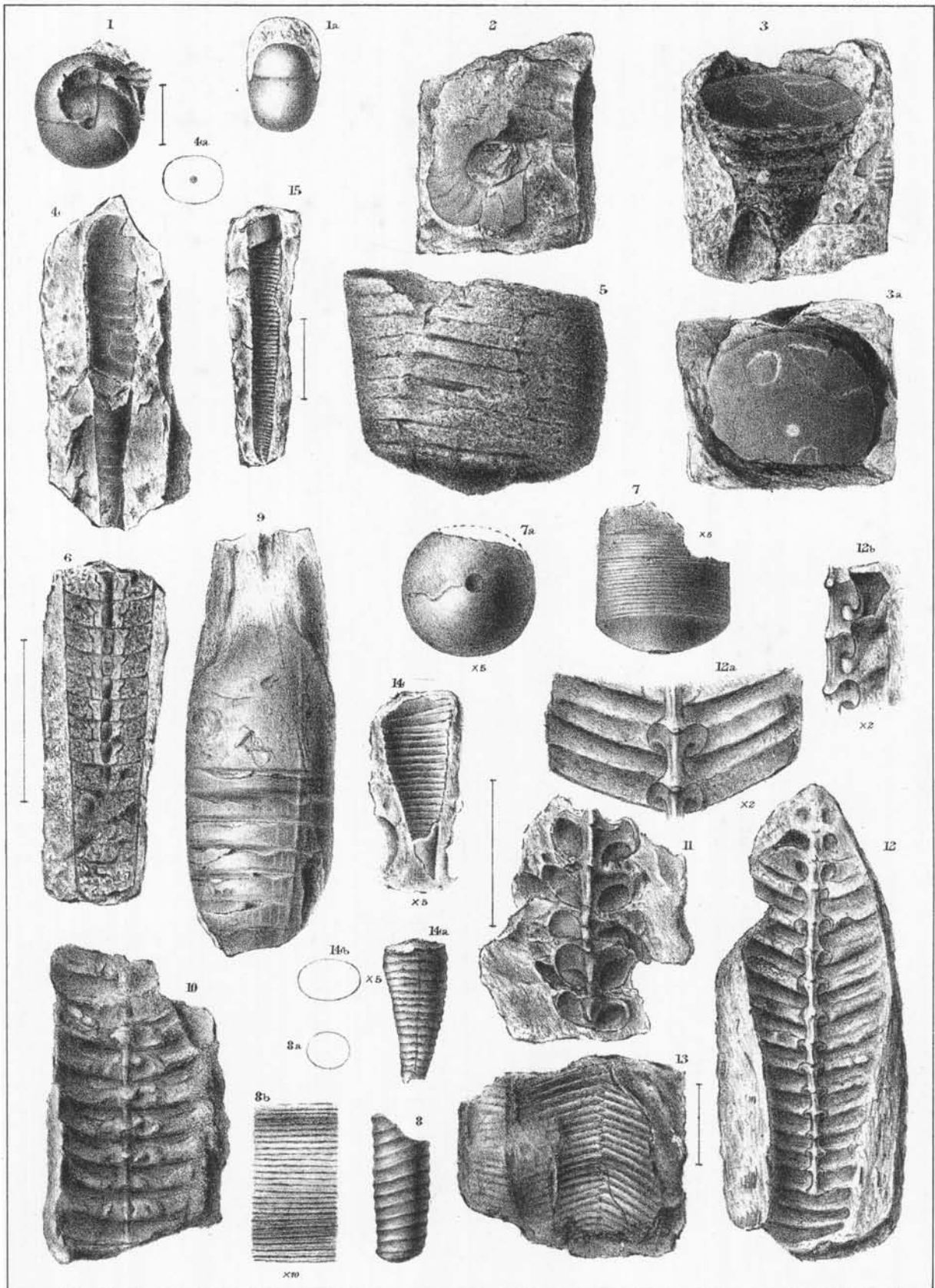


PLATE V.

- FIG. MACROCHILINA TURBINEA, n. sp. (Page 39.)
1. Specimen, obscured by matrix, $\times \frac{3}{2}$. Kingdon's, Shirwell. Barnstaple Athenæum.
 2. A crushed and rather doubtful specimen, $\times 3$. Vicarage Well, Pilton. Barnstaple Athenæum.
- MACROCHILINA FUSILLA, n. sp. (Page 40.)
3. Specimen, wanting the surface, slightly obscured by matrix, $\times 10$. Pilton. Porter Collection.
- LOXONEMA TROCHLEATUM, Münster, sp. (Page 41.)
4. Specimen, retaining the surface on lowest whorl, $\times 3$. 4 a, lowest whorl, $\times 10$. Kingdon's, Shirwell. Barnstaple Athenæum.
 5. Another similar specimen, $\times 3$. 5 a, lowest whorl but one, $\times 10$. Kingdon's, Shirwell. Barnstaple Athenæum.
- LOXONEMA ANGLICUM, d'Orbigny. (Page 43.)
6. Mould of a specimen, showing the ornament. Braunton. Museum of Practical Geology.
- HOLOPELLA TENUISULCATA, Sandberger. (Page 51.)
7. Cast of a specimen, much embedded by matrix, $\times \frac{3}{2}$. Kingdon's, Shirwell. Barnstaple Athenæum.
- LOXONEMA HALLII, n. sp. (Page 41.)
8. Specimen, drawn from a defective mould and cast, $\times 3$. Vicarage Well, Pilton. Barnstaple Athenæum.
- PLEUROTOMARIA, sp. (Page 59.)
9. Cast of a defective specimen, which retains some signs of ornament, though hidden in the drawing, $\times 10$. Pilton. Porter Collection.
- ACLISINA LONGISSIMA, n. sp. (Page 52.)
10. Mould of a portion of a small shell, retaining eight whorls, showing the ornament and the narrowness of the whorls, $\times 10$. Pilton. Porter Collection.
- NATICOPSIS HALLII, n. sp. (Page 44.)
11. Cast of an elongate specimen, showing the inner lip and the columella, $\times \frac{3}{2}$. Marwood Beds. Museum of Practical Geology.
 12. Cast of a shorter specimen, $\times \frac{3}{2}$. Marwood Beds. Museum of Practical Geology.
 13. Cast of a very small and short specimen, probably the young form of this species, $\times 6$. Baggy Point. Hamling Collection.
- NATICA? MERIDIONALIS, Phillips. (Page 45.)
14. Cast of a small and doubtful specimen, $\times 10$. Ironpost. My Collection.
- CAPULUS ROSTRATUS, Trenkner? (Page 46.)
15. Apical view of a small and very doubtful specimen (now mislaid).
 16. Basal view of a small specimen, $\times 3$. Pilton. Porter Collection.
- CAPULUS TERMINALIS, Whidborne. (Page 46.)
17. Lateral view of the cast of a large specimen, slightly distorted at the apex. 17 a, lower view Pilton. Porter Collection.
- CAPULUS COMPRESSUS, Goldfuss, sp. (Page 47.)
18. Upper view of the cast of a compressed specimen, $\times \frac{3}{2}$. 18 a, lateral view. Top Orchard Quarry. Barnstaple Athenæum.
- ORTHONYCHIA ROTUNDA, n. sp. (Page 48.)
19. Upper view of a specimen, slightly enlarged. 19 a, apical view, showing the shape of the oral margin. Pilton. Porter Collection.
- ORTHONYCHIA ACUTA, F. A. Römer, sp. (Page 48.)
20. Upper view of a compressed specimen, $\times \frac{3}{2}$. Sowden, near Barnstaple. Barnstaple Athenæum.
 21. Another specimen, which is attached to the tegmen of *Actinocrinus Porteri*, n. sp., $\times \frac{3}{2}$. Pilton. Porter Collection.
- MURCHISONIA SIMILIS, Trenkner. (Page 61.)
22. Specimen possessing transverse striæ reflexed in the sinus-band, which are not, however, shown in the drawing, which is reversed from the mould, $\times 5$. Vicarage Well, Pilton. Barnstaple Athenæum.
 23. Mould and cast (?) of a fragmentary specimen, $\times 3$. 23 a, mould enlarged, showing the four spiral threads. Vicarage Well, Pilton. Barnstaple Athenæum.

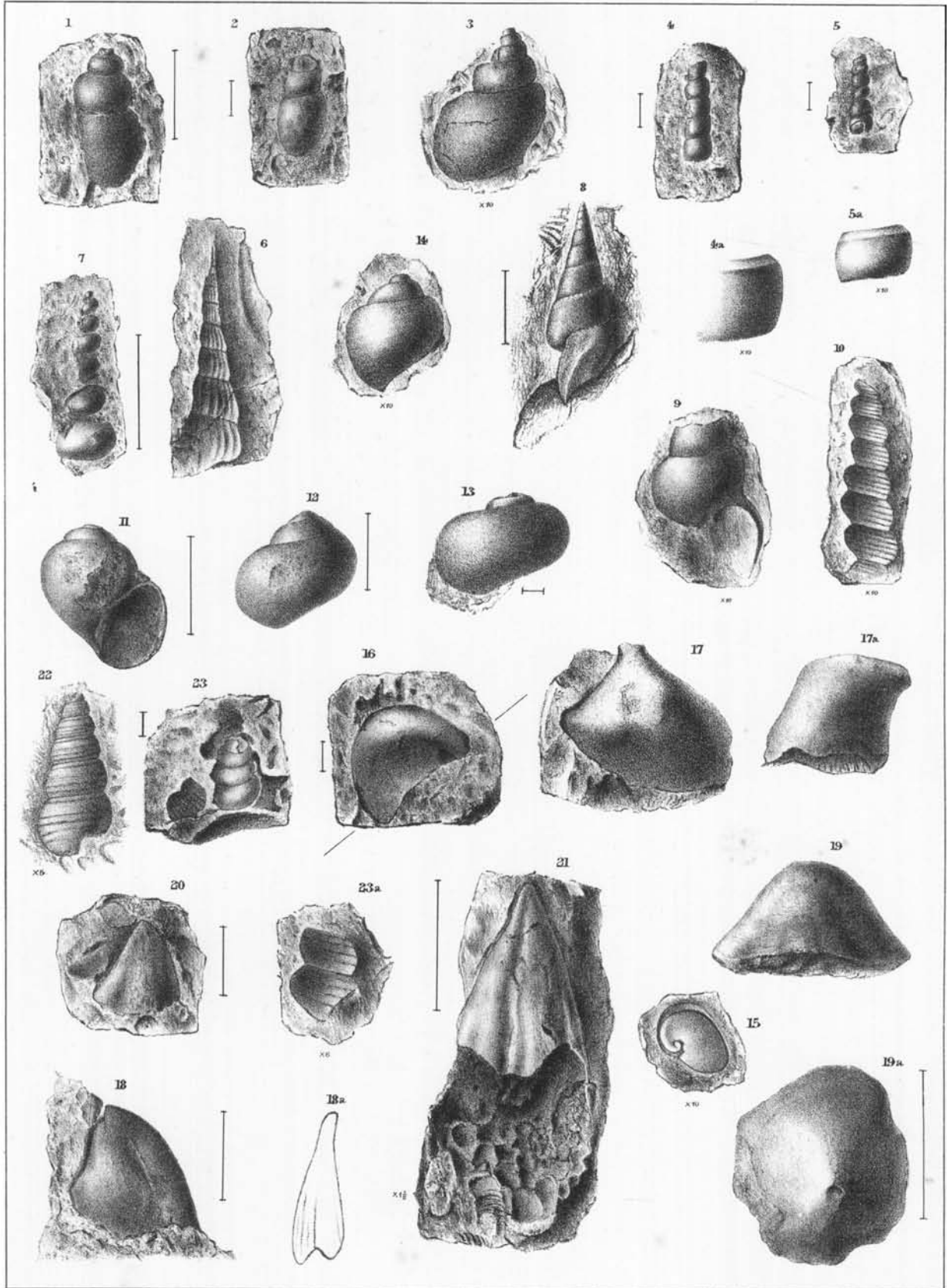


PLATE VI.

ORTHONYCHIA ACUTA, *F. A. Römer*, sp. (Page 48.)

FIG.

1. Lateral view of a very elongate specimen, defective near the apex, $\times \frac{3}{2}$. 1 *a*, apical view, showing the size and shape of the oral margin. Top Orchard Quarry. Woodwardian Museum.
2. Lateral view of a shorter specimen, which has been somewhat compressed in fossilisation. 2 *a*, apical view. Marwood Parish. Porter Collection.

HOLOPELLA TENUISULCATA, *Sandberger*. (Page 51.)

3. Cast of a small specimen, retaining a small portion of its surface, $\times 3$. 3 *a*, surface, $\times 10$. Kingdon's, Shirwell. Barnstaple Athenæum.

EUOMPHALUS VERMIS, n. sp. (Page 52.)

4. Lateral view of a very small specimen, $\times 10$. 4 *a*, apical view. Pilton. Porter Collection.

RHAPHISTOMA JUNIUS, *de Koninck*. (Page 54.)

5. Lateral view of a specimen, retaining part of the surface, $\times 3$. 5 *a*, apical view. 5 *b*, upper surface of a portion of a whorl, $\times 10$, showing the ornament. Pilton. Porter Collection.
6. Lateral view of another specimen, $\times 5$. West of Saunton Court. Woodwardian Museum.
7. Lateral view of a rather lofty variety, $\times 5$. 7 *a*, apical view showing the ornament, which is continued further from the suture than usual. West of Saunton Court. Woodwardian Museum.

PLEUROTOMARIA, sp. (Page 59.)

8. A doubtful and imperfect specimen, partly retaining the ornament, but obscured in shape by lying aslant on the slab, $\times 10$. Pilton. Porter Collection.

PLEUROTOMARIA HAMLINGII, n. sp. (Page 56.)

9. A well-preserved specimen, showing its shape and the sinus-band at the shoulder of the whorls, $\times 3$. 9 *a*, portion of whorl, $\times 10$. Kingdon's, Shirwell. Barnstaple Athenæum.

PLEUROTOMARIA ASPERA, *Sowerby*. (Page 57.)

10. Specimen of a mould, showing an unusually fine ornament, $\times 3$. 10 *a*, wax cast taken from the same specimen, $\times 6$; the elevated sinus-band is not clearly shown. 10 *b*, portion of whorl, $\times 10$. "Marwood beds, east of Barnstaple." Museum of Practical Geology.
11. Another specimen, of rather elongate form and with coarser ornament, showing the convexity of the sinus-band, $\times 4$. Petherwyn. Museum of Practical Geology.
12. Cast of a specimen, which may be the original of Phillips's fig. 177*. Petherwyn. Museum of Practical Geology.
13. Cast of a small specimen very doubtfully referred to this species, $\times 5$. Poleshill. Porter Collection.

MURCHISONIA ANGLICA, *d'Orbigny*. (Page 59.)

14. A small specimen, showing sinus-band, and apparently identical with the species figured by Phillips from Barnstaple, $\times 3$. Pilton. Porter Collection.

MURCHISONIA, sp. (Page 60.)

15. Specimen of a cast, but showing sinus-band, and very similar to an ordinary form of *M. turbinata*, Schlotheim, $\times \frac{3}{2}$. Baggy Point. Museum of Practical Geology.

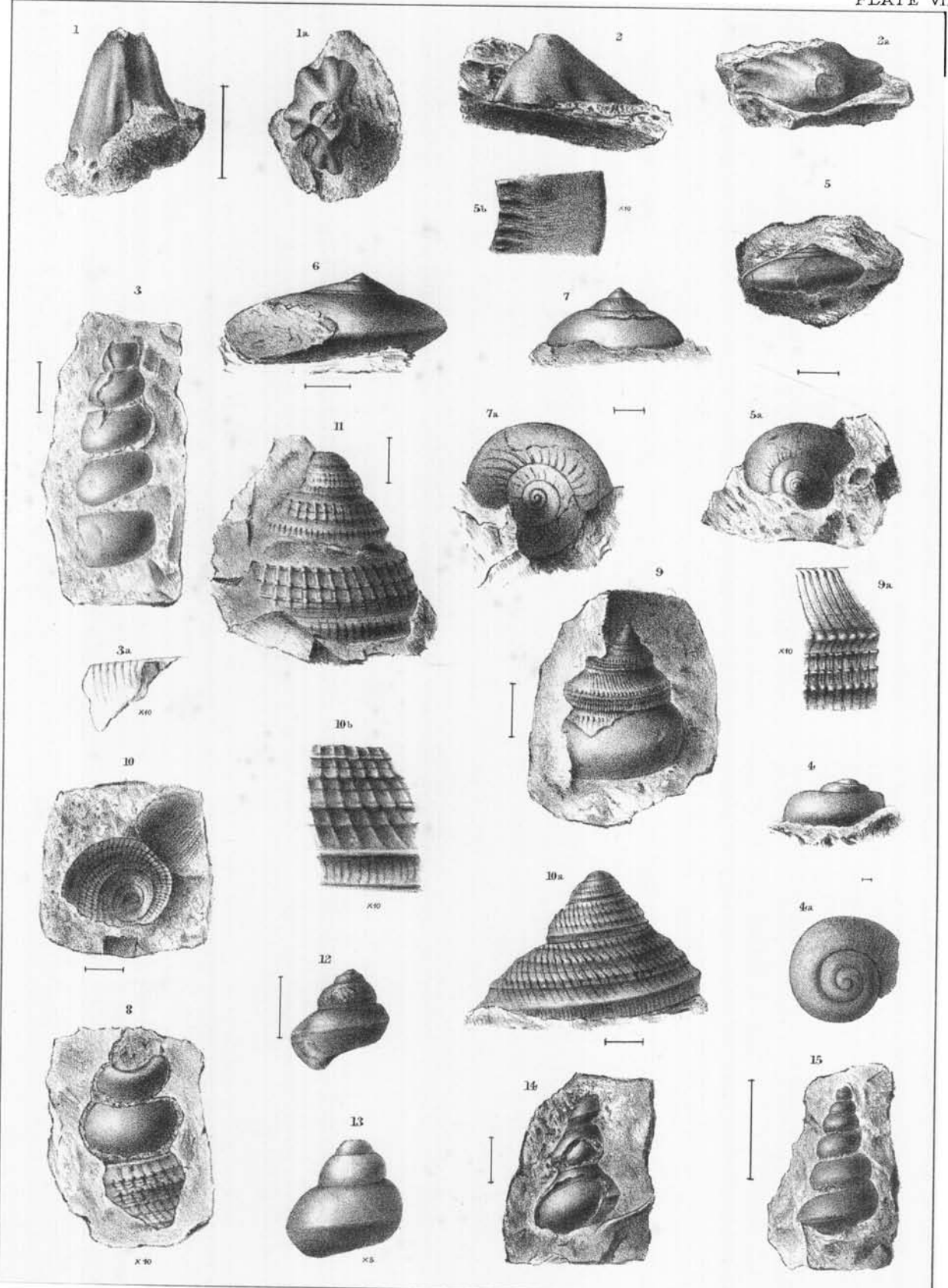


PLATE VII.

BELLEROPHON (BUCANIA) ELEGANS, *d'Orbigny*. (Page 62.)

1. Small specimen, imperfectly showing surface, $\times 6$. 1 *a*, portion of surface, $\times 25$, showing spiral and very fine transverse lines. Pilton. Porter Collection.

EUPHEMUS BARUMENSIS, n. sp. (Page 70.)

2. Specimen figured by Phillips as *Bellerophon Urvii*, Fleming, $\times 6$. Baggy Point. Museum of Practical Geology.

SUBCLYMENIA SYMONDSII, MS. (Page 26.)

3. Very large specimen, almost entirely a cast, but occasionally showing signs of surface-ornament. [The suture-lines, not having been observed until this drawing had been completed, are not represented in it.] Luscott, near Braunton. Museum of Practical Geology.
4. Wax cast from a smaller fragmental specimen of the mould, showing the external ornament, $\times 2$. Luscott? Museum of Practical Geology.

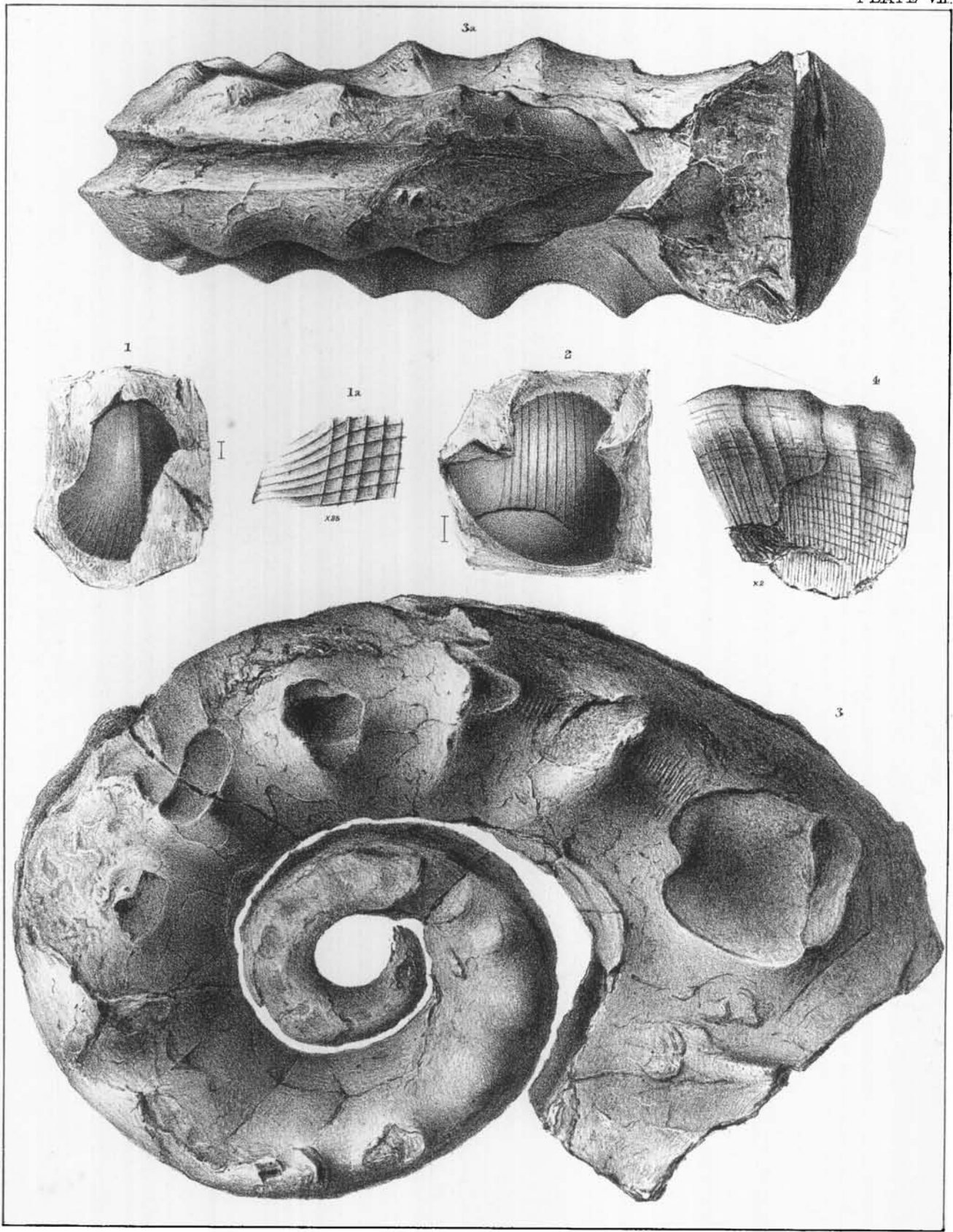


PLATE VIII.

BELLEROPHON LABYRINTHODES, n. sp. (Page 63.)

FIG.

1. Specimen, retaining the surface, $\times 3$. 1 *a*, portion of surface $\times 8$. Kingdon's, Shirwell. Barnstaple Athenæum.
2. Specimen with still finer ornament, $\times 6$. 2 *a*, upper view showing the zigzag course of the superficial ornament, and the traces of transverse lines beneath it. 2 *b*, portion of surface, $\times 15$. Baggy Point. Museum of Practical Geology.

BELLEROPHON SUBGLOBATUS, *M'Coy*. (Page 64.)

3. Specimen of a cast which has more obliquely flattened sides than usual, $\times 2.5$. 3 *a*, upper view, showing umbilicus. Marwood Beds. Museum of Practical Geology.

SALPINGOSTOMA? MACROMPHALUS, *F. A. Römer*, sp. (Page 66.)

4. Specimen of a cast defective about the mouth, showing the rising of the sinus-band, $\times \frac{4}{3}$. 4 *a*, upper view, showing the large umbilicus and elliptic coiling. Kingdon's, Shirwell. Barnstaple Athenæum.
5. Another specimen, much obscured by matrix, but showing some part of the oral expansion. 5 *a*, another view, showing the contour of the whorl near the mouth. Kingdon's, Shirwell. Barnstaple Athenæum.

TROPIDODISCUS TRILOBATUS, *Sowerby*, sp. ? var. BISULCATUS, *F. A. Römer*. (Page 68.)

6. Specimen, showing the concavity of the sides, and the extremely wide umbilicus, $\times 3$. 6 *a*, lateral view. Baggy Point. Museum of Practical Geology.

BELLEROPHON, sp. (Page 65.)

7. Lower view of a specimen in poor preservation, $\times 3$. Vicarage Well, Pilton, Barnstaple Athenæum.

LEPTODOMUS CONSTRICTA, *M'Coy* (Page 75).

8. A large specimen, slightly invaded by matrix below. Marwood. Museum of Practical Geology.
9. Small specimen, lying rather obliquely in the matrix, which slightly overlaps its anterior and inferior margins, and presenting a great likeness to Phillips's figure of his *Cypricardia impressa*, Sow. Roborough. Porter Collection.

PANENKA ANGLICA (Page 72.)

10. A large specimen, apparently somewhat shortened by pressure, in which the median ribs are narrower than those on each side. Top Orchard. Barnstaple Athenæum.
11. Another specimen, longitudinally compressed, showing the recurved umbo and the narrowness of the median ribs. 11 *a*, upper view. Barnstaple. Woodwardian Museum.

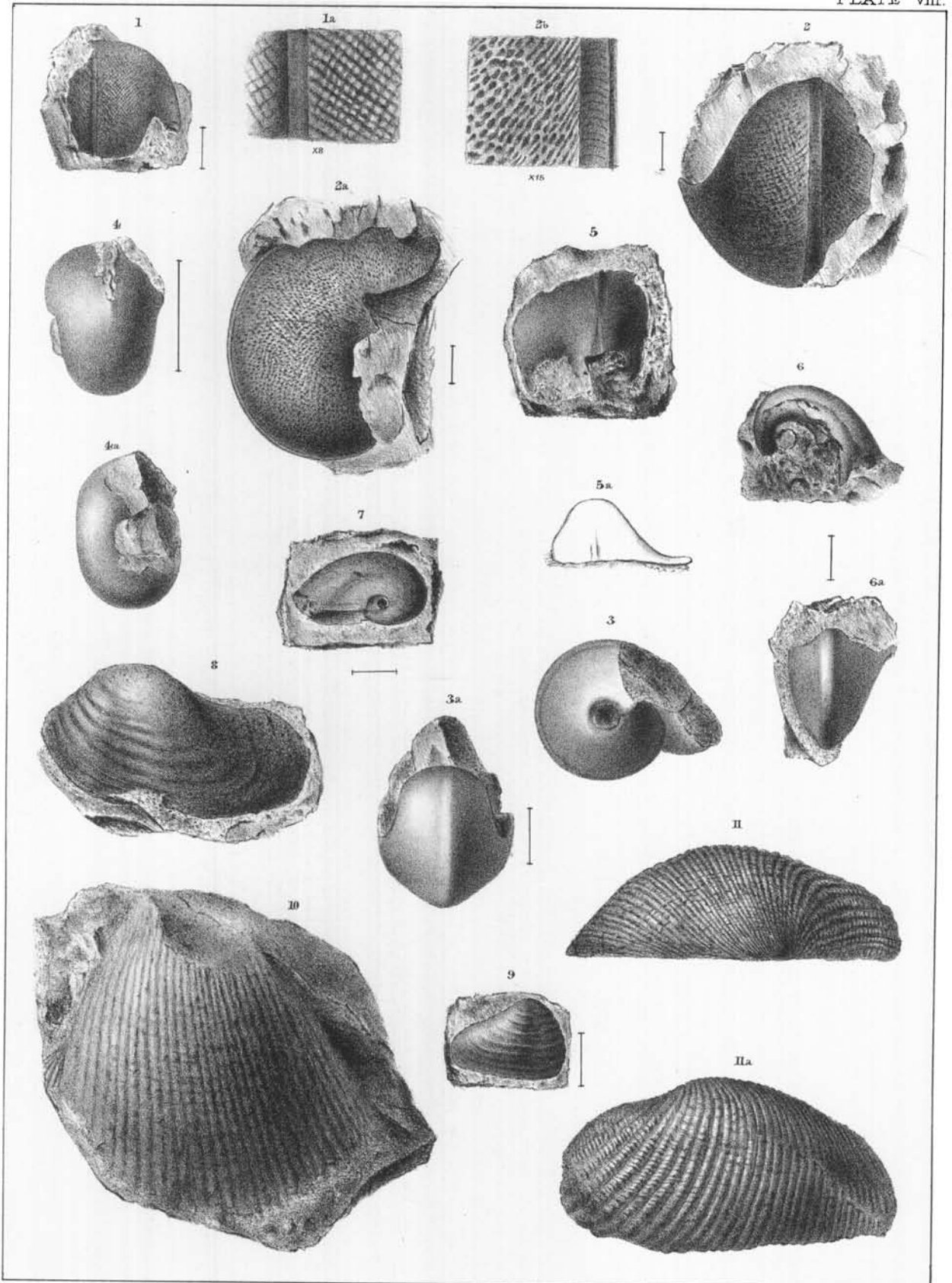


PLATE IX.

FIG.

SPATHELLA MUNDA, n. sp. (Page 115.)

1. Specimen, wanting the surface, but showing the ornamentation and the shape of the shell, $\times \frac{3}{2}$.
1 a. Anterior view. Fremington. Porter Collection.

SANGUINOLITES PORTERI, n. sp. (Page 77.)

2. Specimen, showing the shape and ornament, $\times \frac{3}{2}$. 2 a. Anterior view. Pilton. Porter Collection.

EDMONDIA ? ATHENÆ, n. sp. (Page 81.)

3. Specimen, defective in front, $\times 3$. Bradiford. Barnstaple Athenæum.

SANGUINOLITES MIMUS, n. sp. (Page 78.)

4. Specimen, slightly defective in the supero-anterior part. "Marwood Beds." Museum of Practical Geology.
6. Specimen, vertically compressed. Pilton. Porter Collection.
7. Specimen of a cast, $\times 2$. Poleshill. Porter Collection.

EDMONDIA BODANA, *F. A. Römer*, sp. (Page 80.)

5. Doubtful specimen, defective above, $\times \frac{3}{2}$. Roborough. Porter Collection.
8. Specimen, retaining the surface, $\times 2$. Kingdon's, Shirwell. Barnstaple Athenæum.

SPHENOTUS HICKSII, n. sp. (Page 83.)

9. Specimen, defective above, but showing the angular keel and the depressed back, $\times \frac{3}{2}$. Ilfracombe Road, near Barnstaple. Museum of Practical Geology.

SPHENOTUS SOLENOIDES, *Hall ?*. (Page 83.)

10. Specimen, retaining the surface, but possibly laterally distorted, $\times 2$. South-west of Sloly. Woodwardian Museum.
11. Very imperfect and distorted specimen. South-west of Sloly. Woodwardian Museum.

PROTHYRIS RECTA, n. sp. (Page 86.)

12. Right valve, showing the surface-ornament, but slightly overlapped by matrix in front. South Cave, Baggy. Museum of Practical Geology
- 13, 14. Casts of two valves, showing the anterior notch and the internal ridges. South Cave, Baggy. Museum of Practical Geology.

PROTHYRIS CONTORTA, n. sp. (Page 87.)

15. Cast of right valve, showing the anterior notch and the internal radiating ridges, $\times 2$. Kingdon's, Shirwell. Barnstaple Athenæum.
16. Similar cast, very defective above, but possessing the anterior notch and three transverse teeth, $\times 2$. 16 a. Portion of surface, more enlarged, showing the very fine threads. Kingdon's, Shirwell. Barnstaple Athenæum.

PROTHYRIS SCALPRATA, n. sp. (Page 88.)

17. Specimen of both valves in contact, showing the shape and the anterior notch, $\times 2$. Plaistow Mill Quarry (Sloly Beds). Museum of Practical Geology.
18. Another specimen, defective at the umbo, but showing the ornament and the anterior notch, $\times 2$. South-west of Sloly. Woodwardian Museum.

PHTHONIA, sp. (Page 85.)

19. Specimen of the posterior part of a shell $\times \frac{4}{3}$. Top Orchard. Barnstaple Museum (and mould, Porter Collection).

CYPRICARDINIA SCALABIS, *Phillips*, sp. (Page 90.)

20. Elongate specimen, distorted by pressure, $\times 3$. Pilton. Porter Collection.
21. Shorter specimen, showing hind wing, $\times 3$. Poleshill. Porter Collection.

CYPRICARDINIA ?, sp. (Page 91.)

22. Specimen, much obscured by matrix, $\times \frac{3}{2}$. Sloly. Barnstaple Athenæum.

LEPTODOMUS SEMISULCATA, *Sowerby*, sp. (Page 76.)

- 23, 24. Imperfect specimens. 24 a. Portion of surface, showing part of one of the transverse ridges, $\times 15$. South-west of Sloly. Woodwardian Museum.

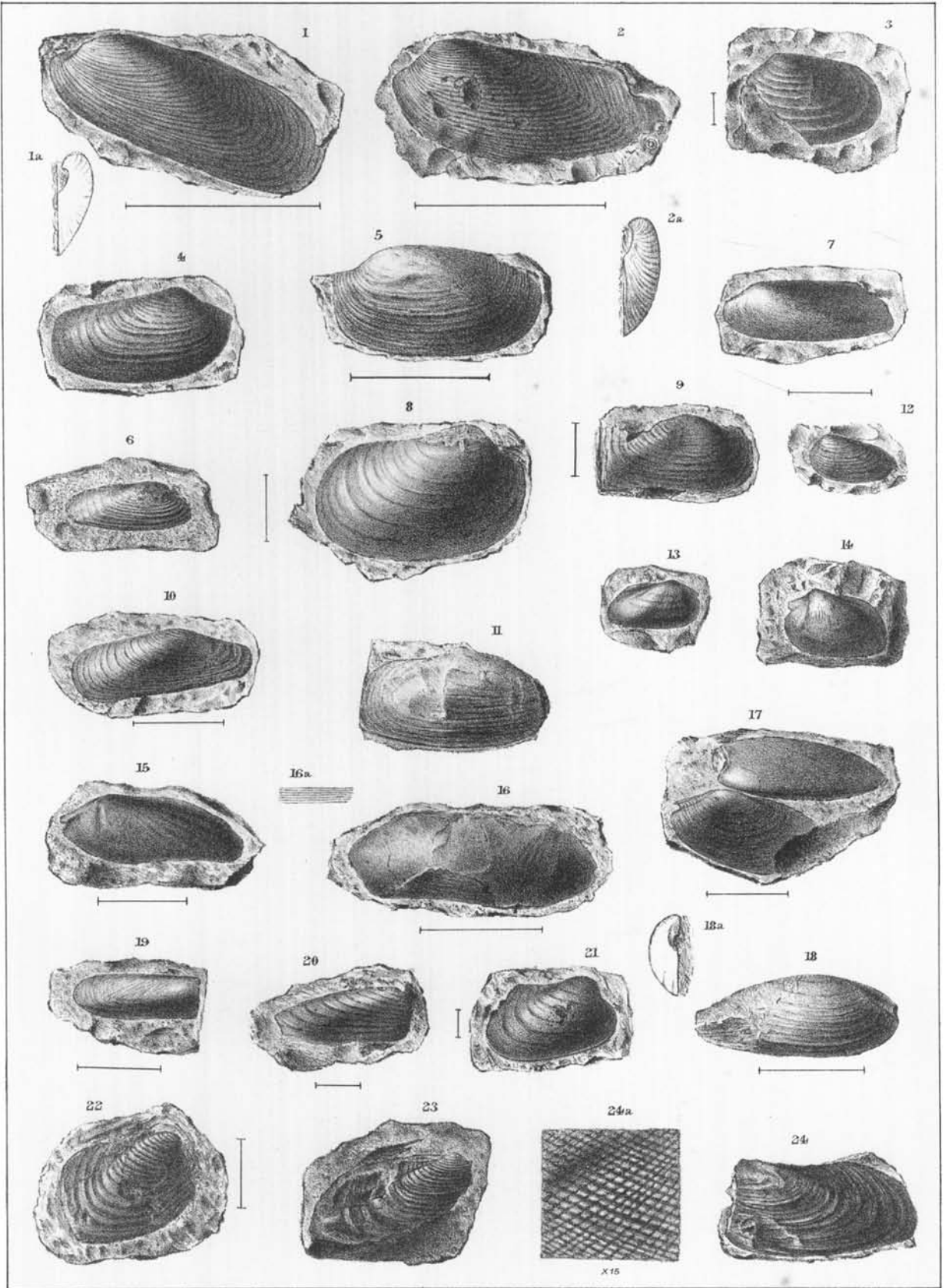


PLATE X.

SCALDIA? LONGA, n. sp. (Page 89.)

FIG.

1. Small specimen, retaining surface, with a nearly central umbo, $\times 2$. 1 *a*. Lateral view. Baggly Point, South Cave. Museum of Practical Geology.
2. Similar specimen of a left valve, $\times 2$. Baggly Point, South Cave. Museum of Practical Geology.

MYOPHOBIA INFLATA, F. A. Römer, sp. (Page 92.)

3. Cast of left valve, showing the hinge and the anterior muscle-scar. 3 *a*. Hinge-line, $\times \frac{3}{2}$. Coomhola Grits, County Cork. Museum of Practical Geology.
4. Specimen of a similar right valve. 4 *a*. Section. Coomhola Grits, County Cork. Museum of Practical Geology.

MYOPHOBIA DELTOIDEA, Phillips, sp. (Page 93.)

5. Cast, with a very small umbo. 5 *a*. Hinge-line, $\times \frac{3}{2}$. 5 *b*. Anterior view. Marwood. Museum of Practical Geology.
6. Cast, showing the posterior muscle-scar, $\times \frac{3}{2}$. 6 *a*. Anterior view. Marwood. Porter Collection.
7. Specimen, which is possibly the type of Phillips's species. 7 *a*. Posterior view. Petherwyn. Museum of Practical Geology.
8. Hinge-line of another specimen, showing the posterior muscle-scar, $\times 4$. Marwood. Museum of Practical Geology.

MYOPHOBIA TRIGONA, F. A. Römer, sp. (Page 96.)

9. Large specimen, showing the hinge and the general outline, though probably rather distorted. Richards's Summer House, Croyde Bay. Museum of Practical Geology.
10. Large cast, much distorted by oblique compression, showing the hinge, the pallial line, and the posterior spoon-like process. 10 *a*. Hinge, $\times 2$, showing the teeth. Barnstaple. Museum of Practical Geology.
11. Cast of the closed valves, preserving the natural shape, showing the position of the muscle-scars, the pallial line, and the spoon-like process, $\times 2$. 11 *a*. Upper view, showing the umbones and the interlocking of the teeth. Barnstaple. Woodwardian Museum.
12. Cast of a right valve, showing the anterior muscle-scar and the marginal concavity, which indicates the thickness of the shell, $\times \frac{3}{2}$. Pilton. Porter Collection.

NUCULA LINEATA, Phillips. (Page 97.)

13. Cast of the closed valves, showing the umbo and the sudden termination of the hinge, $\times 3$. 13 *a*. Lateral view. Upcott. Barnstaple Athenæum.
14. Small fragmentary specimen, retaining surface, and showing the ornament, $\times 5$. West of Saunton Court. Woodwardian Museum.

CTENODONTA NEWTONII, n. sp. (Page 99.)

15. Specimen, showing the general form, $\times 3$. Fremington. Barnstaple Athenæum.

PROTHYRIS SCALPRATA? n. sp. (Page 88.)

16. Specimen, so greatly distorted that the umbo assumes a central position, $\times 3$. 16 *a*. Portion of surface, showing the lineations behind the umbo, $\times 15$. Sloly. Barnstaple Athenæum.
17. Another extremely distorted specimen, $\times 4$. 17 *a*. Portion of lineated surface behind the umbo, $\times 15$. South-west of Sloly. Woodwardian Museum.

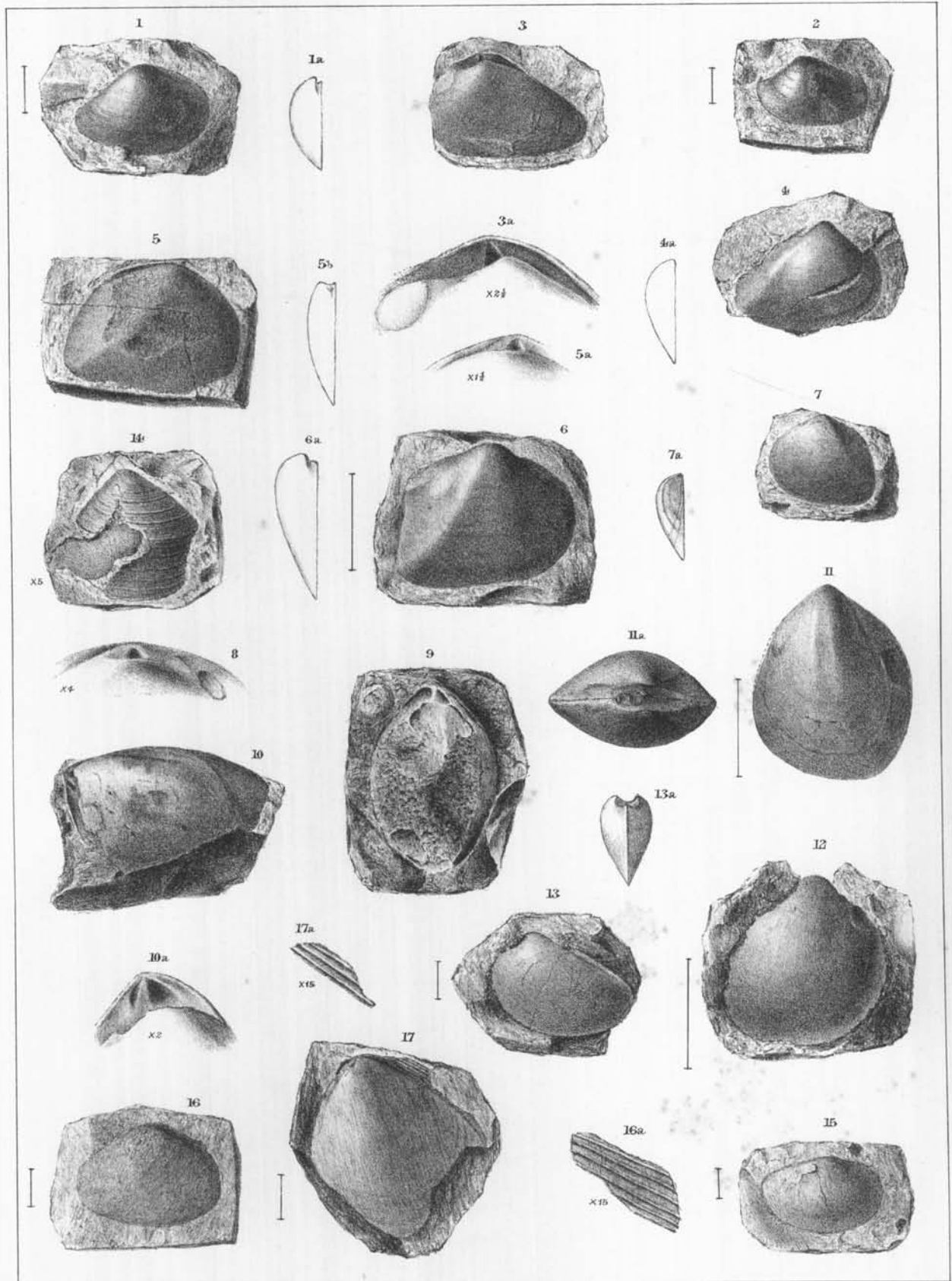


PLATE XI.

SPATHELLA MUNDA, n. sp. (Page 115.)

FIG.

- 1, 2. Casts of the right and left valves, showing the punctated umbo and the anterior muscle-scar, $\times 2$. Frankmarsh. My Collection.

EDMONDIA ? HAMLINGII, n. sp. (Page 82.)

3. Specimen, showing the surface and the position of the umbo. Rolled block from Saunton Point. Hamling Collection.

CUCULLÆA UNILATERALIS, Sowerby (Page 109.)

4. A young shell, between varieties *unilateralis* and *amygdalina*. Marwood. Woodwardian Museum.
5. Flat specimen of the variety *Hardingii*. Sloy. Barnstaple Athenæum.
6. Rather flat specimen, between varieties *unilateralis* and *amygdalina*. Braunton. Hamling Collection.
7. Small, deep, and very inequivalved specimen, between the varieties *angusta* and *unilateralis*. Marwood. Woodwardian Museum.
8. Very deep specimen with very large umbo, exceeding the variety *unilateralis*. Marwood. Woodwardian Museum.
9. The hinge of a specimen of var. *amygdalina*, drawn obliquely to show the teeth which are nearly transverse, but slope slightly upwards from each side of the umbo. Baggy Point. Barnstaple Athenæum.
10. Specimen, beyond variety *unilateralis* in obliquity and the large size of the umbo. Braunton. Hamling Collection.
11. Specimen, between varieties *angusta* and *trapezium*, and differing from them in the large size of its umbo. Sloy. Barnstaple Athenæum.
12. Specimen, beyond variety *amygdalina* in depth and transverseness. Marwood. Woodwardian Museum.
13. Cast of extreme variety beyond *trapezium* in obliquity, with very elongate and distant umbones, showing anterior muscle-scars. Barnstaple. Woodwardian Museum.

CUCULLÆA DEPRESSA, Phillips. (Page 111.)

14. Specimen showing the pallial line, the impression of the hinge, and two or three faint rays near the inferior margin. Marwood. Woodwardian Museum.

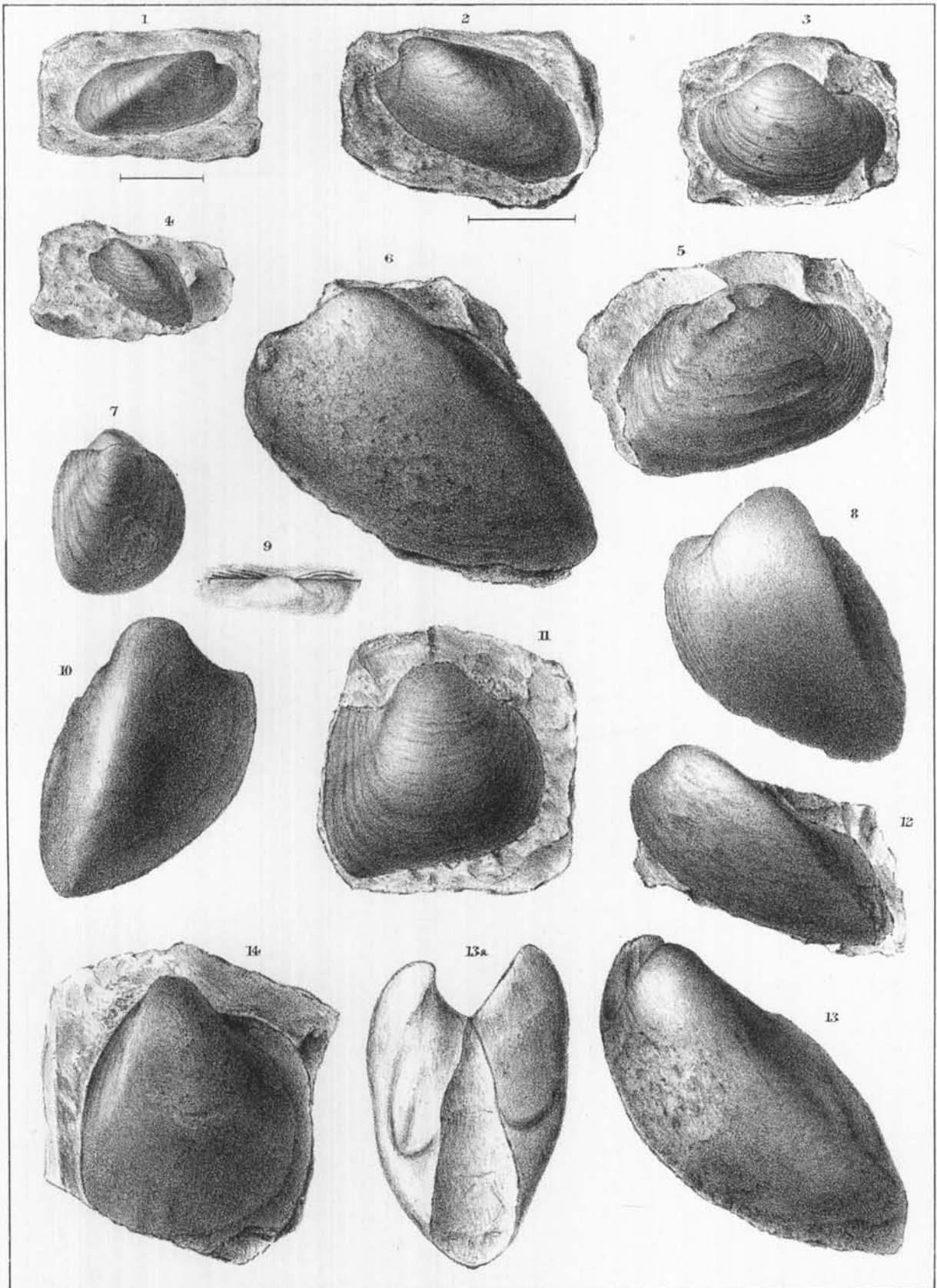


PLATE XII.

SPHENOTUS? SOLENIFORMIS, *Goldfuss*, sp. (Page 84.)

FIG.

1. Specimen, much worn, but showing the anterior muscle-scar, and the flattened posterior slope.
1 *a*. Upper view, showing the umbones and the posterior gape. Locality? Mantell Collection, British Museum.

CUCULLÆA DEPRESSA, *Phillips*. (Page 111.)

2. Very large and long specimen, slightly displaced or squeezed, so that the umbo of the right valve has come into view behind the other. Marwood. Museum of Practical Geology.
3. Phillips's type, which is shorter and much more curtailed behind. 3 *a*. Upper view. Marwood. Museum of Practical Geology.

PARALLELODON PYGMEUS, *Whiteaves*, var. INFANS, n. v. (Page 112.)

- 4, 5. Two minute casts, which seem to vary in length, one of which shows the posterior teeth, $\times 10$. Poleshill. Porter Collection.

PARALLELODON PRISCUS, *Goldfuss*, sp. (Page 113.)

6. Cast of a left valve, $\times \frac{3}{2}$. Ironpost. My Collection.

MODIOLOPSIS, sp. (Page 114.)

7. Left valve, much obscured by matrix, $\times 2$. South Cave, Baggy Point. Museum of Practical Geology.

CTENODONTA? TENSA, n. sp. (Page 104.)

8. Specimen showing the ornament, the subangular posterior side, and signs of the lateral teeth, which seem to have pierced the thin surface, $\times \frac{3}{2}$. Sloly. Barnstaple Athenæum.
9. Cast of a perfect, but very doubtful specimen, showing the teeth, $\times 2$. 9 *a*. Hinge-line, $\times 7$. Barnstaple. Museum of Practical Geology.

CTENODONTA (KOENENIA), cf. OBSOLETA, *Goldfuss*, sp. (Page 106.)

10. Cast, showing the large anterior teeth, but having lost almost all the posterior part of the hinge, $\times 2$. Baggy Point. Museum of Practical Geology.

NUCULITES? LATISSIMUS, *Phillips*, sp.? (Page 107.)

11. Cast of right valve, showing the teeth and the clavicular ridge, $\times 2$. 11 *a*, surface of the same valve drawn from a wax impression of its mould, $\times \frac{3}{2}$. 11 *b*. End view, $\times 2$. Fremington. Barnstaple Athenæum.

CTENODONTA (PALÆONEILO) LIBATA, *Phillips*, sp. (Page 100.)

12. Interior of right valve, showing hinge, $\times 3$. Baggy. Museum of Practical Geology.
13. Right valve, vertically compressed, $\times 2$. 13 *a*. Portion of surface, the longitudinal lines of which are probably induced by pressure, $\times 15$. Barnstaple. Woodwardian Museum.

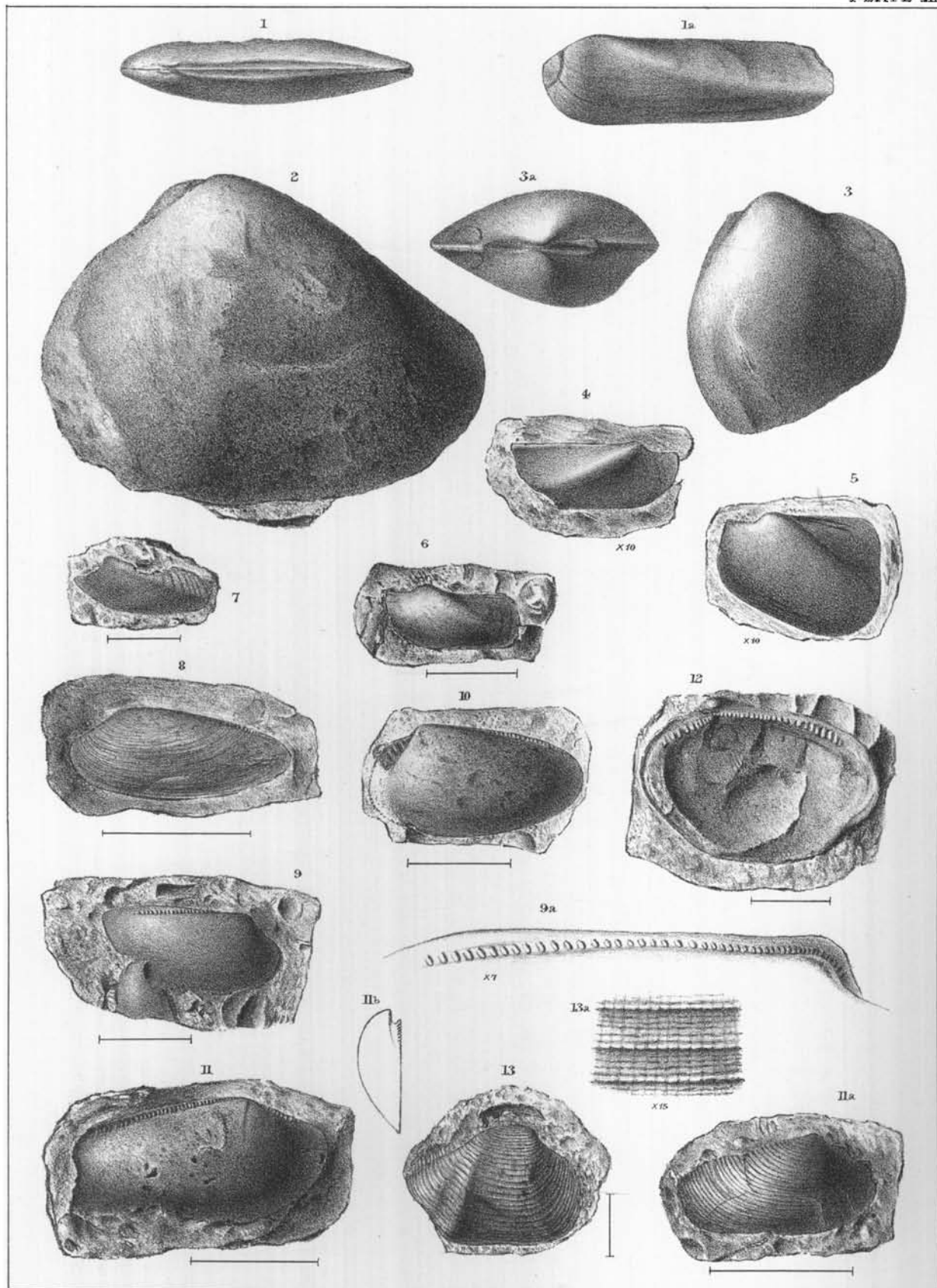


PLATE XIII.

CTENODONTA (PALÆONEILO) LIRATA, *Phillips*, sp. (Page 100.)

FIG.

1. Phillips's type specimen, which is abraded in front and defective behind. Pilton. Museum of Practical Geology.
2. Specimen, showing the posterior ridge and concavity, and with indications of the hinge-teeth, which have partially pierced the shell-surface, $\times 2$. Bradiford. Barnstaple Athenæum.
3. Specimen, very greatly elongated by compression, $\times \frac{2}{3}$. Saunton. Barnstaple Athenæum.
4. Specimen, figured by Phillips as *Pullastra antiqua*, Sowerby. Barnstaple. Museum of Practical Geology.

CTENODONTA ? (PALÆONEILO) ANTIQUA, *Sowerby*, sp. (Page 102.)

5. Sowerby's original type of *Pullastra antiqua*; the figure is drawn from the cast and mould of the specimen combined, $\times 2$. Marwood. Woodwardian Museum.

CTENODONTA ? ELLIPTICA, *Phillips*, sp. (Page 103.)

6. Large specimen, showing the ornament, $\times \frac{2}{3}$. Bradiford. Barnstaple Athenæum.

LEPTODESMA CITIUM, n. sp. (Page 120.)

7. Large specimen, imperfect on the wings. 7 a. Anterior view. Marwood. Museum of Practical Geology.

MYTILARCA ? MODIOLOIDES, n. sp. (Page 117.)

8. Specimen with the margins somewhat obscured by matrix. Braunton. Museum of Practical Geology.

COBRACEPHALUS ANGULOSUS, n. sp. (Page 119.)

9. Specimen of a right valve, showing the angulated character of the contour and the nature of the ornament. $\times 2$. 9 a. Portion of surface, $\times 15$. Top Orchard Quarry. Woodwardian Museum.

CUCULLEA UNILATERALIS, *Sowerby*? (Page 109.)

10. Specimen of a small cast of the closed valves of a very short variety. 10 a. Upper view. Marwood. Museum of Practical Geology.
11. Small and doubtful specimen with strong growth-lines, $\times \frac{4}{3}$. Pilton. Porter Collection.

MODIOLA AMYGDALINA, *Phillips*. (Page 114.)

12. Cast of a left valve, $\times 2$. Fremington. Porter Collection.

DIGONIOMYA ELEGANS, n. sp. (Page 117.)

13. Large specimen of a cast, showing the dorsal depression and the posterior elongation. Croyde. Museum of Practical Geology.

PTYCHOPTERIA DAMNONIENSIS, *Sowerby*, sp. (Page 126.)

14. Large and peculiarly shaped example, somewhat distorted, $\times \frac{4}{3}$. 14 a. Portion of surface, $\times 8$. Barnstaple. Woodwardian Museum.

AVICULOPECTEN GRANULOSUS, *Phillips*, sp. (Page 130.)

15. Specimen of a cast, showing the wings, $\times 2$. Pilton. Porter Collection.

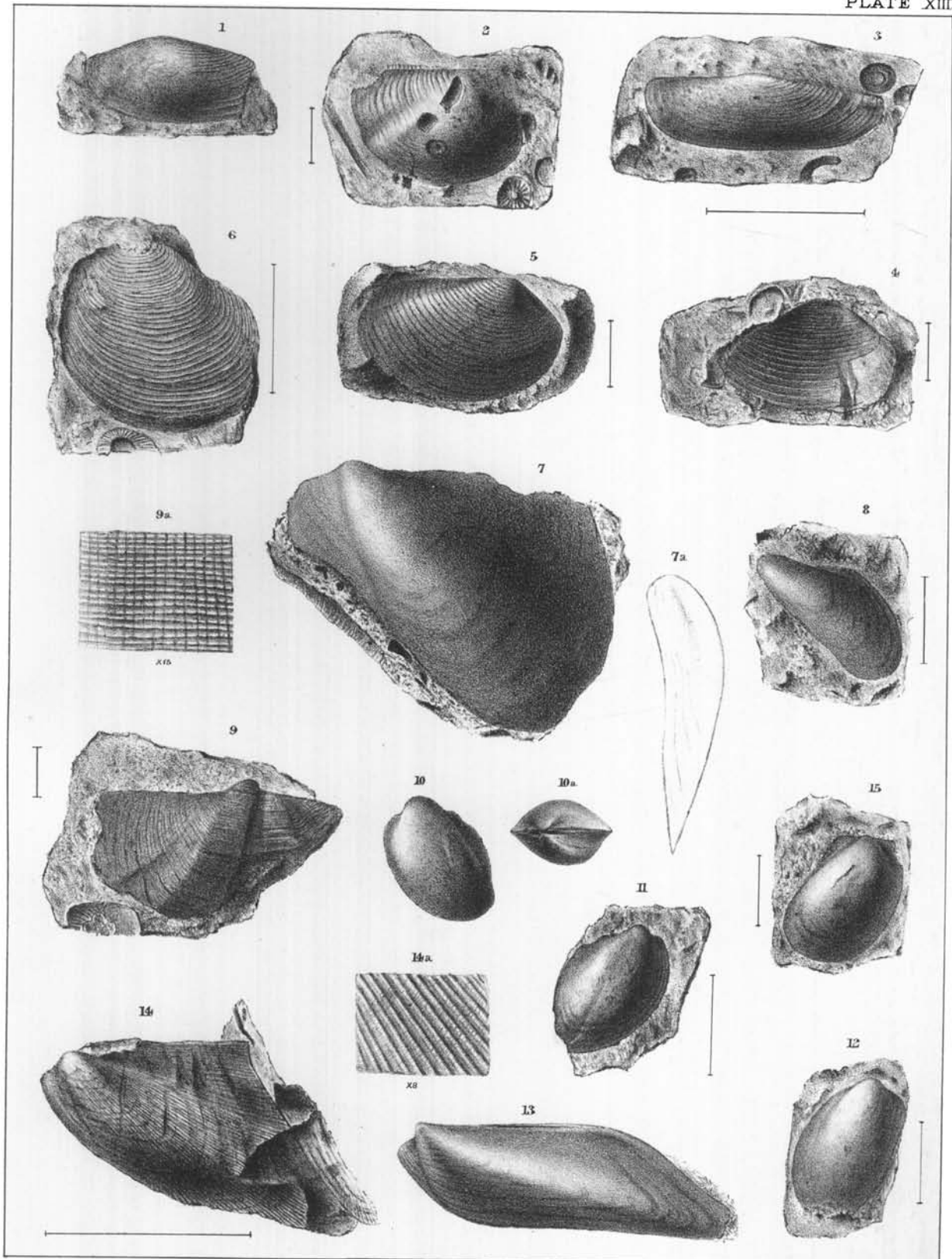


PLATE XIV.

LEPTODESMA, sp. (Page 121.)

FIG.

1. Left valve, imperfect and probably somewhat distorted. Pilton. Barnstaple Athenæum.

LEPTODESMA CULTELLATUM, n. sp. (Page 121.)

2. Left valve, showing the fine striation, $\times 2$. 2a. Corresponding right valve from the same slab, doubtless belonging to the same specimen, showing the fine striation of the surface of the back, and the wings, $\times 2$. Braunton. Museum of Practical Geology.
3. Two valves in contact, lying obliquely in the matrix, and somewhat obscured, $\times 2$. Pilton. Porter Collection.

LEPTODESMA ANATINUM, n. sp. (Page 122.)

4. Cast of a right valve, very imperfect, but showing the umbo, hinge-line, wings, and anterior muscle-scar, $\times 2$. Pilton. Porter Collection.
5. Left valve, injured above, but showing the wings and the character of the surface, $\times 2$. Pilton. Porter Collection.
6. Another imperfect left valve, in which the surface-ornament is obliterated, but the shape partially well shown. Pilton. Porter Collection.

LEIOPTERIA CONRADI, Hall? (Page 124.)

7. Specimen of the left valve, wanting surface, $\times \frac{3}{2}$. Barnstaple. Woodwardian Museum.

LEIOPTERIA MURATA, n. sp. (Page 125.)

8. Specimen of right valve, very defective, but showing the ornament and the general shape of part of the skull, $\times 2$. Barnstaple. Woodwardian Museum.

PTYCHOPTERIA DAMNONIENSIS, Sowerby, sp. (Page 126.)

9. Large specimen, retaining the surface, which shows that the fine radiations on the hind wing are sometimes partially obliterated, and having an angular, but somewhat injured front wing. 9a. Portion of surface, $\times 10$. West Angle Bay, Pembrokeshire. Museum of Practical Geology.
10. Sowerby's original type, which is almost a cast. The marked convexity of the hind wing in the specimen is not shown in the figure. 10a. Upper view. 10b. Anterior view. Marwood. Woodwardian Museum.
11. Cast of a much less oblique and transverse variety. 11a. Upper view. 11b. Anterior view. Marwood. Museum of Practical Geology.
12. Specimen, retaining surface, but obscured by matrix in front, accurately agreeing in character with Phillips's figure of *Avicula cancellata*, $\times 2$. Kingdon's, Shirwell. Barnstaple Athenæum.
13. A similar specimen which more nearly approaches fig. 11 in shape, and in which the minute concentric ornament predominates, $\times 2$. Top Orchard. Barnstaple Athenæum.

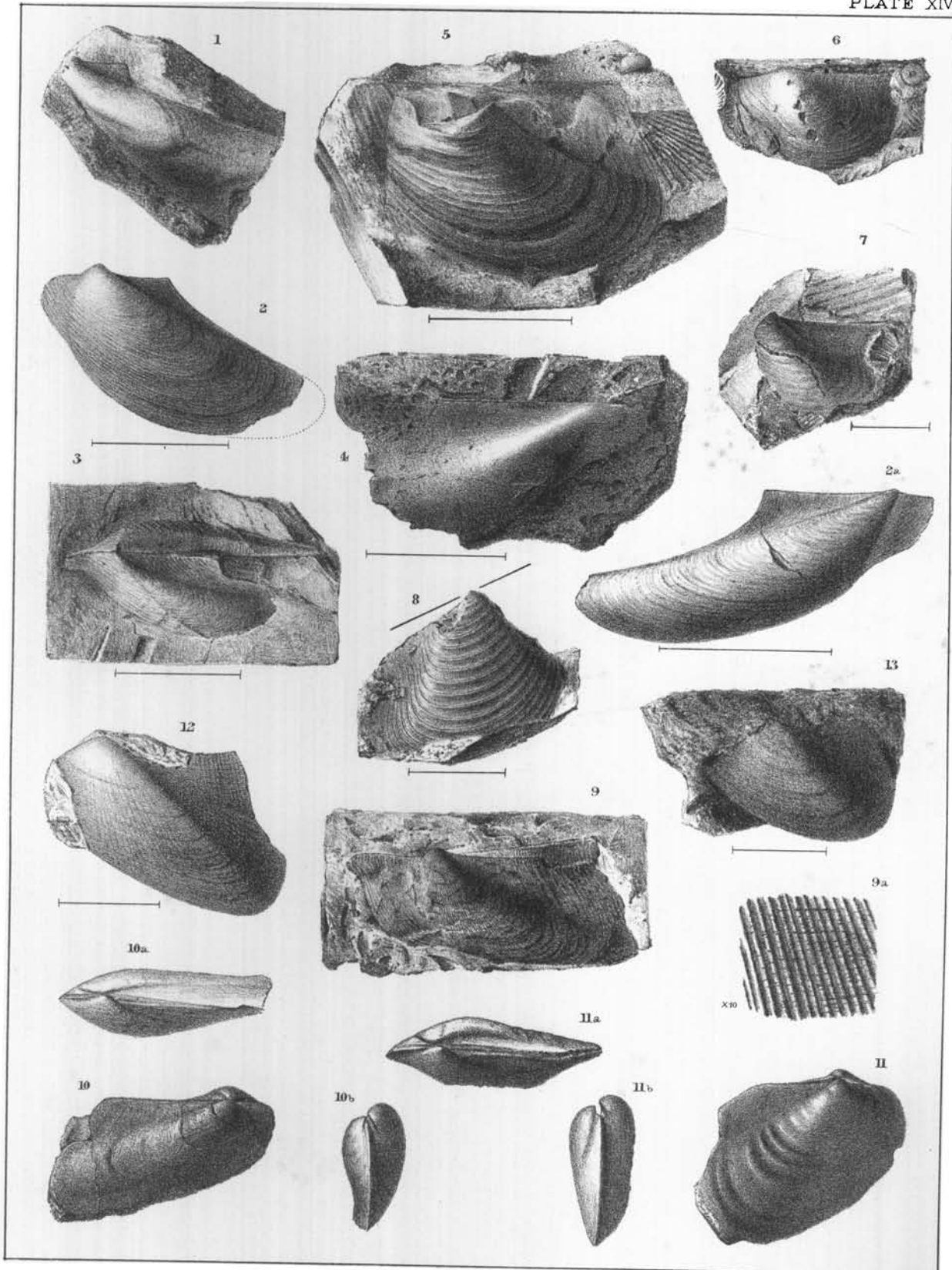


PLATE XV.

PTERINOPECTEN POLYTRICHUS, *Phillips*, sp. (Page 132.)

FIG.

1. Very large but imperfect left valve, showing the radiations and some trace of transverse ornament. Croyde Bay. Museum of Practical Geology.

PTERINOPECTEN HALLII, n. sp. (Page 134).

2. Very perfect left valve, set very slightly obliquely in the matrix, and slightly defective on the anterior wing, $\times 3$. 2 a. Portion of the surface, $\times 5$. Pilton. Porter Collection.
3. Left valve, with a large and undefined hind wing, defective in front, $\times \frac{5}{2}$. Meer Top. Barnstaple Athenæum.
4. Left valve of a large shell, showing the front wing, but defective below, $\times \frac{5}{2}$. Petherwyn. Museum of Practical Geology.
5. Left valve, wanting the wings, $\times \frac{5}{2}$. Top Orchard. Barnstaple Athenæum.
6. Left valve, wanting the wings, but showing the posterior side without rays and with stronger concentric threads, $\times 3$. Top Orchard, Barnstaple Athenæum.

CRENIPECTEN? AURITUS, n. sp.? (Page 139.)

7. Doubtful and indistinct left valve, with small wings and very numerous rays, which do not seem to alternate, but of which every third or fourth seems rather stronger than the rest. The surface is removed except round the edges, $\times 2$. Smoking House Lane. Porter Collection.

PTERINOPECTEN SCABIRADIANS, n. sp. (Page 135.)

8. Doubtful left valve, imperfect in front, and somewhat obscured by vertical crushing and exfoliation of surface, but showing the fine, sharp, and nearly equal distinct ribs and faint signs of transverse threads, $\times 3$. Pilton. Porter Collection.
9. Defective right valve, showing the interrupted radiations and the deeply-notched anterior wing, $\times 3$. Pilton. Porter Collection.

PTERINOPECTEN AUSTENI, *F. A. Römer*, sp. (Page 136.)

10. Very large left valve, showing the wings, the spiny margin, and the peculiar ornament. 10 a. Portion of surface, $\times 3$. Pilton. Porter Collection.
11. Left valve, drawn from a gutta-percha cast, and showing the foliaceous growth-lines, $\times 2$. Barnstaple. Woodwardian Museum.

PTERINOPECTEN MUNDUS, n. sp. (Page 137.)

12. Left valve, showing the hinge-area and front wing. 12 a. Portion of surface, $\times 3$. Barnstaple. Woodwardian Museum.
13. Large but very much distorted specimen. 13 a. Lateral view. Barnstaple. Woodwardian Museum.

ACTINOPTERIA RUDIS, *Phillips*, sp. (Page 131.)

14. Left valve, defective below, and showing a smooth posterior wing, the smoothness of which appears caused by the obliteration of the surface, $\times 2$. Barnstaple. Woodwardian Museum.

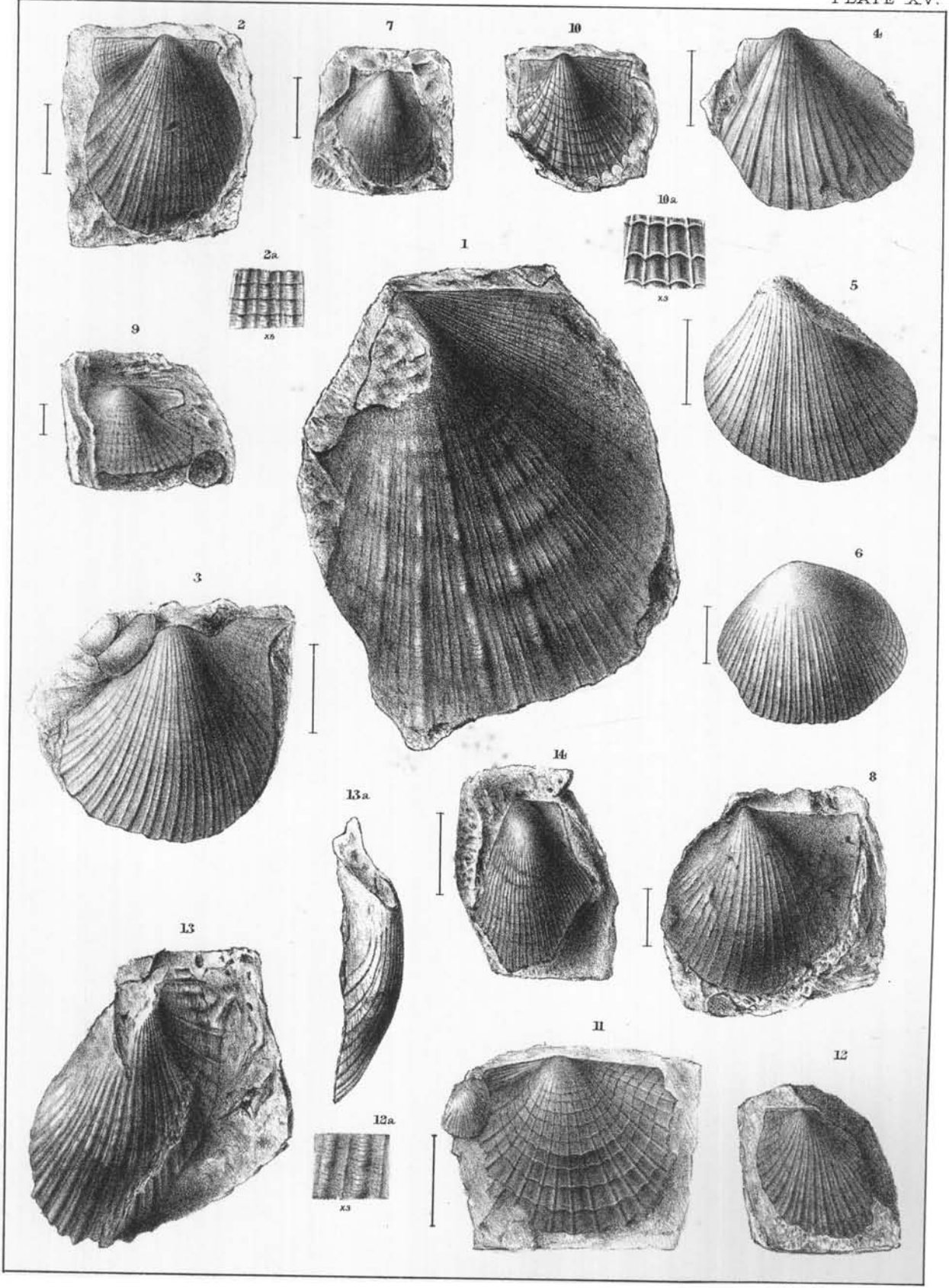


PLATE XVI.

AVICULOPECTEN TRANSVERSUS, *Sowerby*, sp. (Page 127.)

FIG.

1. Specimen of an imperfect left valve, retaining ornament, $\times \frac{7}{4}$. 1 a. Portion of surface, $\times 10$. Barnstaple. Woodwardian Museum.
2. Right valve, figured by Phillips, vertically compressed, but showing wings. Brushford. Museum of Practical Geology.
3. Portion of right valve, showing the ornament and the anterior wing. Pilton. Porter Collection.
4. Right valve, nearly perfect, but vertically compressed, showing the wings. Barnstaple. Woodwardian Museum.

AVICULOPECTEN NEXILIS, *Sowerby*, sp. (Page 129.)

5. Very imperfect specimen of the left valve, $\times 3$. Top Orchard. Barnstaple Athenæum.
6. More perfect, but rather doubtful left valve, defective at the wings, $\times 2$. Braunton. Barnstaple Athenæum.

PLEURONECTITES PILTONENSIS, n. sp. (Page 140.)

7. Nearly perfect right valve, showing the smooth surface, striated wing, and produced anterior margin, $\times 2$. Pilton. Porter Collection.
8. Mould of a very large right valve, showing the posterior wing. Pilton. Porter Collection.
9. Right valve, which is much less oblique, a difference which is probably due to distortion, but if not would be, according to de Koninck, of specific value, $\times \frac{3}{2}$. Top Orchard. Barnstaple Athenæum.
10. Left valve of a specimen, perhaps of the same species, but, if so, much distorted, $\times \frac{3}{2}$. Bradiford. Barnstaple Athenæum.
11. Very similar but shorter left valve, $\times \frac{3}{2}$. Raleigh. Barnstaple Athenæum.

PLEURONECTITES LEPIS, n. sp. (Page 142.)

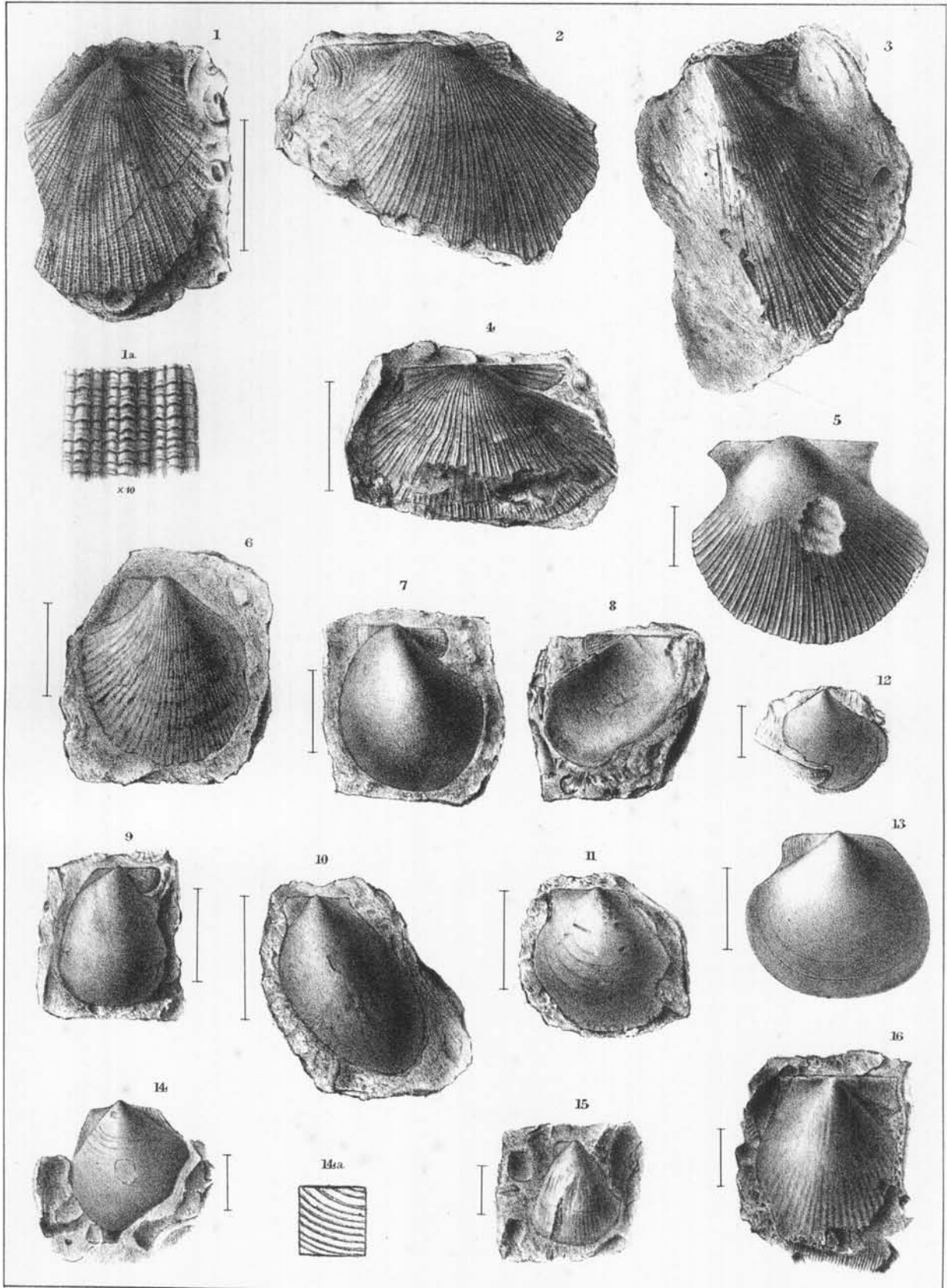
12. Specimen of an imperfect right valve, $\times 2$. Pilton. Porter Collection.
13. Specimen of the left valve, $\times 2$. Top Orchard. Barnstaple Athenæum.

PLEURONECTITES HICKSII, n. sp. (Page 142.)

14. Specimen of the left valve $\times \frac{5}{2}$. Bradiford. Barnstaple Athenæum.

CRENIPECTEN? AURITUS, n. sp. (Page 139.)

15. A very imperfect left valve, $\times 2$. Bradiford. Barnstaple Athenæum.
16. Right valve, imperfect below, but showing the ornament and the wings, $\times 3$. Top Orchard. Barnstaple Athenæum.



A MONOGRAPH
OF THE
DEVONIAN FAUNA
OF THE
SOUTH OF ENGLAND.

BY
G. F. WHIDBORNE, M.A., F.G.S.

VOL. III.—PART II.

THE FAUNA OF THE MARWOOD AND PILTON BEDS
OF
NORTH DEVON AND SOMERSET
(*continued*).

PAGES 113—178; PLATES XVII—XXI.

LONDON:
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1897.

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It closely resembles *P. pygmæus*, Whiteaves, which seems to be equally variable in shape, but it is still smaller, being only about 4 mm. instead of 10 mm. in length. Whiteaves compares his shell with *Macrodon parvus*, White and Whitfield.¹

Affinities.—Our species approaches *Macrodon Hamiltoniæ*, Hall,² in shape, but is a minute instead of being a rather large shell.

Macrodon venustus, Stein.,³ as given by Beushausen,⁴ seems much the same shape, but is very much larger and apparently more trigonal.

2. PARALLELODON PRISCUS, Goldfuss, sp. ? Plate XII, fig. 6.

1834-40. ARCA PRISCA, Goldfuss. Petref. Germ., vol. ii, p. 283, pl. clx, fig. 10.

Description.—Left valve rather small, slightly oblique, very convex, very transverse. Hinge-line as long as the shell, broad behind, where it has several long thin linear horizontal teeth. Umbo very prominent, incurved, tending forward and situated at or about the anterior fourth of the length. Anterior margin broad, slightly convex and oblique, meeting the hinge-line at a somewhat acute angle. Inferior margin very long, nearly straight and direct. Postero-inferior corner slightly produced, rounded. Posterior margin slightly convex and oblique, meeting the hinge at a slightly obtuse angle. Contour of back vertically very convex, horizontally flattened but becoming concave in the supero-lateral parts; with an obtuse ridge or angle running from the umbo to the postero-inferior corner, before which there seems to be a slight dorsal compression. Surface with strong concentric growth-ridges; finer ornament unknown.

Size.—Height 8 mm., length 17 mm., depth of one valve 3 mm.

Locality.—One specimen is in my Collection from Ironpost, near Dulverton.

Remarks.—The only specimen of this shell being a cast with very slight indications of the ornament, it is impossible fully to identify it. All that can be said is that it seems to be exactly like the equally imperfect specimen described by Goldfuss.

Affinities.—*Arca Michelini*, d'Archiac and de Verneuil,⁵ appears to have a straighter, less oblique front margin, and a stronger dorsal constriction.

¹ 1862, White and Whitfield, 'Proc. Boston Soc. Nat. Hist.,' vol. viii, p. 299 (Lower Carb.).

² 1885, Hall, 'Pal. N. Y.,' vol. v, pt. 2, p. 349, pl. li, figs. 1-7, 10, 11.

³ 1853, Steininger, 'Geol. Besch. Eifel,' p. 49, pl. ii, fig. 7.

⁴ 1895, Beushausen, 'Abhandl. k. Preuss. Geol. Landes.,' n. f., pt. 17, p. 39, pl. iv, figs. 3, 4.

⁵ 1842, de Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 373, pl. xxxvi, fig. 6.

3: ORDER—ANISOMYARIA, *Neumayr*, 1883.I. *Family*—MODIOLOPSIDÆ, *Fischer*, 1887.1. *Genus*—MODIOLOPSIS, *Hall*, 1847.

1. MODIOLOPSIS, sp. Plate XII, fig. 7.

Size.—Length 13 mm.

Locality.—One specimen from Baggy Point, South Cave, is in the Museum of Practical Geology.

Remarks.—The specimen here noted is too much obscured by matrix for description, but it appears to belong to this genus, and to be the only evidence of it at present forthcoming from these beds.

It is a long low shell with a very anterior umbo, from which a rather strong angle runs to the postero-inferior corner. The base seems long and straight, and the posterior end short and truncate.

II. *Family*—MYTILIDÆ, *Fleming*, 1828.1. *Genus*—MODIOLA, *Lamarck*, 1801.1. MODIOLA ? AMYGDALINA, *Phillips*. Plate XIII, fig. 12.

1841. MODIOLA AMYGDALINA, *Phillips*. Pal. Foss., p. 38, pl. xvii, figs. 62 a—c.

Description.—Shell small, narrow, oblique, very convex. Hinge-line probably rather short. Umbo large, rounded, prominent, incurved over the hinge-margin, and facing forwards. Anterior side produced, small, very convex. Antero-inferior side very long, straight. Postero-inferior corner large, produced, roundly convex. Posterior side oblique, convex. Contour convex confluent with umbo, becoming concave on the small, undefined rounded wings. Surface with strong growth-lines (not shown in the figure).

Size.—Height 14 mm., width 11 mm.

Locality.—One specimen in the Porter Collection is from Fremington.

Remarks.—This small shell, which is only a cast, is too indistinct for very certain identification. Its most characteristic feature seems the way in which the anterior end is produced just under the hinge, forming above a kind of lunule in front of the umbo, and bounded below by a slight constriction from the umbo,

which perhaps would render the margin a little concave if it were better displayed. In this point it reminds one of the genera *Modiola* and *Cypricardinia*.

Comparing it with the *M. amygdalina* of Phillips, it seems to me to agree remarkably with his description, and on placing it in the oblique positions in which his shell seems to be drawn, it assumes exactly the same form as his figure; in fact the shape of his drawings can only be explained by an anterior contour such as exists in our shell.

It is true that his figure shows much stronger growth-lines, but there is some evidence of this in our shell, considering that it is in the nature of a cast.

Affinities.—*Avicula pusilla*, Barrande,¹ a much smaller and extremely variable shell, occasionally approaches it in shape.

2. Genus—SPATHELLA, Hall, 1885.

“Shell equivalve, very inequilateral, wider behind; anterior end short, narrowly rounded; beaks subanterior, small; umbonal slope rounded or subangular; surface with concentric striæ, sometimes lamellose; probably related to the *Lithophagi*.”

The above are the characters given by Hall; and if, as seems from them and his figures, the following species belongs to it, it may be added that there seems to be an external ligament, a large oval muscle-scar situated in the centre of the anterior end, and a larger circular posterior muscle-scar situated on the upper part of the shell near the posterior end. Along the posterior hinge-line the surface seems concave, bearing two linear transverse ridges, but it does not appear whether they form part of the hinge.

1. SPATHELLA MUNDA, n. sp. Plate IX, figs. 1, 1 a; and Plate XI, figs. 1, 2.

Description.—Shell moderate in size, convex, very oblique and transverse. Hinge-margin very slightly curved, considerably less than the length of the shell, bearing one or two long, linear, horizontal ridges, which seem to bend beneath the umbo with hardly any break. Anterior margin very narrow and doubly convex, almost subangular in front. Inferior margin very long, oblique and nearly straight. Posterior margin very broad, semicircular below, becoming straight and oblique above as it merges into the hinge-margin. Umbo low, wide, flattened, proximate, slightly elevated above the hinge-line, tending forward and

¹ 1881, Barrande, ‘Syst. Sil. Bohême,’ vol. vi, pl. ccv, figs. 1—22, Ét. F, G.

situated at the anterior seventh of the length. Contour gently convex, becoming transversely flat or slightly concave on the back, and sometimes with a slight post-umbonal ridge which vanishes before reaching the postero-inferior corner. Surface with thirty or forty flat, step-like, regular ridges, possibly lamellar, narrow and divaricating in front, becoming gradually larger behind, and indistinct and confused in the postero-superior region, which seems bounded above by a rounded ridge or convexity close to the margin. Cast marked on and near the umbo with regular rows of numerous small rounded tubercles (indicating pits on the inner surface of shell). Anterior muscle-scar apparently shallow, oval, large, situated in the centre of the anterior end; posterior scar larger, situated near the upper part of the posterior end. Umbo in cast preceded by a shallow concave sulcus, running halfway down. Lunule biconcave, undefined. Shell-structure very thin.

Size.—Height 16 mm., length 35 mm., depth of one valve 5 mm.

Localities.—In the Porter Collection is one specimen (cast and mould) from Fremington; and in my Collection four specimens from Frankmarch.

Remarks.—The Fremington specimen is larger and longer than the others, and does not show the pittings, sulcus, and post-umbonal ridge seen in the latter. It seems, however, probable that they all belong to one species, and that the differences are due to their state of preservation. The character of the hinge seems peculiar and difficult to interpret in the different specimens.

Affinities.—It closely resembles the two species of *Spathella* described by Hall,¹ but differs in its more regular ornament, less cylindrical form, and narrower and longer anterior end. It seems to bear the resemblance to *Lithophagi* indicated by Hall.

Pullastra modiolaris, F. A. Römer,² is flatter, with a shorter anterior end, and smaller, less defined umbo.

3. Genus—DIGONIOMYA (Provisional genus).

Shell very inequilateral, angular, transversely rhomboidal, acute behind. Hinge long, straight, thickened. Back depressed centrally, with rounded ridges running from the umbo to the anterior and posterior ends of the base, posteriorly oblique and flattened. Ligament external, situated in a long groove (?). Umbo acute, proximate.

This provisional genus is suggested with the greatest hesitation on account of the extreme poverty of the material; but it seems to be the only course open, as

¹ 1885, Hall, 'Pal. N. Y.,' vol. v, pt. 1, No. 2, pp. 407, 408, pl. lxvi, figs. 36—42.

² 1850, F. A. Römer, 'Beitr. Harzgeb.,' pt. 1, p. 60, pl. ix, figs. 21 a, b.

I have been quite unable to find any genus in which there appears to be the slightest ground for placing the following species.

1. DIGONIOMYA ELEGANS. Plate XIII, fig. 13.

Description.—Left valve large, oblique, lozenge-shaped, very transverse, convex. Umbo small, very sharp, oblique, incurved, and prominent, situate very anteriorly, being only about one-tenth of the length of the shell from the anterior side, and excavated along its back by a concave depression which is continued to the middle of the hind margin. Hinge-line about two-thirds the length of shell, straight. Anterior margin very narrow, subangular. Inferior margin very long and slightly sigmoid, being a little concave towards the rear. Postero-inferior corner very much produced, narrow, and so sharply rounded as to be almost subangular. Posterior side very oblique, long, nearly straight. Contour of surface very convex vertically; the front and back of the umbo being continued in low rounded prominences to the antero-inferior and postero-inferior corners, between and behind which the shell is slightly concave. Surface apparently covered with a few irregular growth-lines.

Size.—Length 60 mm., height 20 mm., depth of one valve 10 mm.

Localities.—In the Museum of Practical Geology is a specimen from Croyde.

Remarks.—I have been unable to refer this shell to any known genus. While remarkable in form, its state of preservation is not such as to give full information as to its nature.

III. *Family*—AVICULIDÆ, d'Orbigny, 1843.

I. *Sub-family*—AMBONYCHINÆ, Miller.

1. *Genus*—MYTILARCA, Hall, 1870.

The following species is provisionally placed under this genus solely on account of its general shape, and probably may have to be transferred elsewhere should clearer specimens be found.

1. MYTILARCA? MODIOLOIDES, n.sp. Plate XIII, fig. 8.

Description.—Left valve of moderate size, very oblique, subtriangular, convex. Anterior side very narrow and convex. Umbo apparently situated at or close to

the anterior point, rounded, proximate. Hinge-margin straight, about two-thirds the length of shell. Margin running from beneath the umbo in a long, oblique, straight or slightly flexuous line to the postero-inferior corner, which it rounds in a broad parabolic sweep, and is continued back obliquely in a gentle convex line to the rear of the hinge-margin. Greatest depth of shell near the umbo, and line of greatest depth running from the umbo close to the front margins. Contour of surface almost perpendicular on the antero-inferior slope, very convex on the back, and gradually becoming slightly concave near the postero-superior corner, so as to form a small undefined wing.

Size.—About 15 mm. long by 12 mm. high.

Locality.—One specimen from Braunton is in the Museum of Practical Geology.

Remarks.—The fossil above described is rendered rather obscure by the encroachment of the matrix over its margins, but it evidently is of a very typical mytiloid shape, and appears to be definitely unlike any other palæozoic species.

Affinities.—*Cardiomorpha mytiloides*, F. A. Römer,¹ seems to be a steeper and differently shaped shell.

Modiomorpha submissa, Barrande,² sp., as given by Barrois,³ seems more transverse, and has a narrower umbo and more dilate front side.

Among other points the obliquity of the posterior side distinguishes it from *Leptodesma citimum*.

Mytilarca inflata, Whiteaves,⁴ is somewhat like in shape and in the bluntness of the umbo, but is shorter and more convex.

Mytilus sabesianus, de Ryckholt,⁵ appears to be shorter and more regularly ovate, with a sharper umbo, and a shorter and more concave antero-inferior margin. *Isocardia contorta*, Barrande,⁶ may also be compared.

II. Sub-family—AVICULINÆ, *Stoliczka*, 1871.

1. Genus—COBRACEPHALUS (Provisional genus).

Shell inequivalve, inequilateral, oblique, with large front wing and dilate hind wing. Umbo extending above the long straight hinge-line, arching forward and, in the right valve, overhanging. Contour divided by five or six radiating angles, spreading from the umbo or its neighbourhood to the margins. Surface marked by crowded squared growth-lines.

¹ 1860, F. A. Römer, 'Beitr. Harzgeb.', pt. 4, p. 163, pl. xxv, fig. 14.

² 1881, Barrande, 'Syst. Sil. Bohême,' vol. vi, pl. cclviii, figs. 4, 1-7, Ét. F.

³ 1889, Barrois, 'Mém. Soc. Géol. Nord,' vol. iii, p. 170, pl. xii, figs. 2-2 c.

⁴ 1891, Whiteaves, 'Cont. Canad. Pal.,' vol. i, pt. 4, p. 293, pl. xxxviii, figs. 5-6 a.

⁵ 1851, de Ryckholt, 'Mélang. Paléont.,' pt. 2, p. 85, pl. xvi, figs. 22, 23.

⁶ 1881, Barrande, 'Syst. Sil. Bohême,' vol. vi, pl. cclx, figs. 1, 1-14, Ét. E.

This suggested genus appears to approach *Cassianella* in shape, but is more oblique, and the right valve is deeply convex, while probably the other valve is much flatter. Many points must for the present remain undefined, and the genus must therefore be regarded as entirely provisional. It seems, however, to be essentially *aviculoid*. Its angularity of contour reminds us of *Conocardium*, but it has a definite wing in place of the tubular projection of that genus.

1. COBRACEPHALUS ANGULOSUS, n. sp. Plate XIII, figs. 9, 9 a.

Description.—Shell small, convex, angulated, very transverse and oblique. Umbo prominent, elevated but flattened, much incurved, arching forward, acute, situated at or about the anterior third of the length, and apparently extending slightly above the hinge-line. Hinge-line equal to the greatest length of shell. Contour of surface vertically convex; horizontally angulated; being (1) flat on a narrow area bounded by rounded angles, which run from the umbo obliquely backward to inferior margin; (2) in front of this, deeply perpendicular, then oblique at the base of front wing, then flat on front wing, and lastly sigmoid at the antero-superior corner; (3) behind the central band, first perpendicular, then oblique, then angulated by a line from behind umbo to the postero-inferior corner, and then oblique and concave, forming a broad hind wing. Anterior wing large, trapezoidal, pointed in front, bounded by an angulated margin. Anterior margin apparently nearly perpendicular below the wing. Inferior margin very short and straight. Posterior margin oblique, convex, angulated. Surface covered by very numerous and crowded, parallel but unequal, sharp, elevated, concentric threads or striæ, separated by deep concavities, which are rather wider than the threads, and crossed by numerous indistinct radiations.

Size.—Height 10 mm., length 14 mm., depth 2·5 mm.

Localities.—There is a single specimen from Top Orchard in the Woodwardian Museum.

Remarks.—I have only seen a single valve of this strange shell.

2. *Genus*—LEPTODESMA, *Hall*, 1883.

The distinguishing mark of this genus, as compared with *Leiopteria*, is its nasute, angulated front wing. It also appears more oblique in general shape, the anterior margin being less protruded. Though some species seem difficult to assign, the two genera appear on the whole to be well characterised.

1. *LEPTODESMA CITIMUM*,¹ n. sp. Plate XIII, figs. 7, 7 a.

Description.—Shell inequivalve. Left valve large, oblique, subtriangular, rather transverse, moderately convex. Umbo small, elevated, oblique, proximate, arching forward, overhanging the hinge-margin, apically acute, and situate at about one-fifth the length of the shell from its anterior end. Hinge-margin long, straight, equal to the greatest length of the shell. Anterior wing rather large, nasute in front, vertically convex, horizontally sloping, bounded by an oblique linear depression, which reaches the margin rather more than halfway down. Front cardinal angle between 60° and 90°. Anterior margin oblique, convex on the higher part of the wing, then slightly concave to the end of the wing, and then slightly convex as it passes into the short inferior margin. Postero-inferior corner broadly and deeply convex. Posterior margin slightly oblique, straight above, and gently convex below. Hind wing large, obliquely flat, with a postero-superior angle of about 100°, and defined by a straight oblique line from behind the umbo meeting the posterior margin not quite halfway down. Contour of surface transversely convex across the line of greatest elevation, which runs near the front side from the apex to the postero-inferior corner in a gently sigmoid sweep, the convexity increasing in front of it and gradually diminishing in rear of it. Shell marked by a few indistinct concentric growth-bulges.

Size of Left Valve.—Height 45 mm., length 57 mm., depth, 7 mm.

Locality.—Two specimens from Marwood and one from Barnstaple are in the Museum of Practical Geology, and one small specimen from Barnstaple in the Woodwardian Museum.

Remarks.—It has the appearance of being decidedly inequivalve. The specimens are almost in the condition of casts, lying in micaceous, ferruginous matrix, and having the surface destroyed. The margin does not lie in one plane, but is inversely sigmoid in front profile. The Woodwardian specimen is very much smaller than the others, but otherwise agrees with them, and shows the front wing to be nasute.

Affinities.—To *Leptodesma potens*, Hall,² it bears some resemblance in general shape, though differing in being more acute below and less concave posteriorly.

¹ Citerior, citimus.

² 1884, Hall, 'Pal. N. Y.,' vol. vi, pt. 1, p. 188, pl. xxi, figs. 21, 30; pl. xxii, figs. 11, 12, 19—21; and pl. lxxxix, fig. 7.

2. LEPTODESMA, sp. Plate XIV, fig. 1, and Plate XVII, fig. 1.

Description.—Left valve large, convex, extremely oblique and transverse. Hinge-line straight, probably very much shorter than the length. Umbo small, acute, very oblique, and situated at or close to the anterior end. Anterior wing apparently very small, oblique and narrow, undefined. Posterior wing narrow, flattish, triangular, with a thickened rounded upper margin over the hinge-line, and apparently with a small rib or bead separating it from the body. Anterior margin very long, oblique, and almost straight. Postero-inferior parts very much produced. Contour of surface convex across the line from umbo to postero-inferior corner, becoming steep near the anterior margin. Surface unknown, but evidently having some growth-ridges which become concave on the hind wing.

Size.—A specimen, defective behind, is 27 mm. high and 40 mm. long.

Localities.—In the Barnstaple Athenæum is a specimen from Pilton; and in Mr. Hamling's Collection another from the beach at Croyde.

Remarks.—Though these specimens are much too defective to enable us to give a full description, they seem to point to a remarkable and very distinct species, which (even allowing for possible distortion) was evidently characterised by its oblique mytiliform shape, though it doubtless belongs to the present genus.

Affinities.—From *Pterinea ventricosa*, as given by Goldfuss,¹ Phillips,² Follman,³ and Frech⁴ (though the versions of these authors do not seem always to agree with each other), it distinctly differs by its great obliquity and length, and by the shape of its wings.

From *A. sublamellosa*, F. A. Römer,⁵ it is distinguished by its length, obliquity, and short front wing.

3. LEPTODESMA CULTELLATUM, n. sp. Plate XIV, figs. 2, 2 a, 3.

Description.—Right valve small, very elongate and oblique, sabre-shaped, gently convex, with small defined wings. Umbo small, acute, prominent, hardly elevated above the hinge, and situated at the anterior one-eighth of the shell. Hinge-line short, straight, about half the length of the shell. Wings flat, sharply defined by impressed bounding lines. Front wing small, long,

¹ 1834-40, Goldfuss, 'Petref. Germ.,' vol. ii, p. 134, pl. cxix, fig. 2.

² 1841, Phillips, 'Pal. Foss.,' p. 49, pl. xxii, fig. 82.

³ 1885, Follman, 'Verh. Nat. Vereins Rheinl.,' Jahr. 44, vol. xliii, p. 191, pl. v, fig. 7.

⁴ 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.,' Band ix, pt. 3, p. 97, pl. x, figs. 1-1 c.

⁵ 1850, F. A. Römer, 'Beitr. Harzgeb.,' pt. 1, p. 13, pl. iii, figs. 4 a, b.

subtrapezoidal or tongue-shaped, bounded by a sigmoidal margin. Hind wing very narrow, triangular, bounded by a concave margin. Front margin very oblique, convex on the wing, concave at the base of the wing, and then gently convex below the wing, passing insensibly into the long, slightly convex, and oblique inferior margin. Postero-inferior corner very greatly produced, narrow and deeply convex. Posterior margin very oblique, slightly concave, with a curvature increasing upwards, meeting the hinge-margin at a right angle. Contour of shell gently convex, but steep posteriorly behind the line from umbo to the postero-inferior corner. Surface of back and wings covered by crowded minute, regular, parallel, distant, sharp concentric lines, and by a few irregular prominent growth-bulges.

Left valve differing from the right by having its sharp umbo rather elevated above the hinge-line, and its anterior wing convex and less defined.

Size.—Height 13 mm., length 30 mm., depth of both valves about 4 mm.

Localities.—In the Museum of Practical Geology is a slab (and its counterpart) containing the two valves in close proximity from Braunton; and in the Porter Collection is a specimen of the joined valves from Pilton, a left valve from Roborough, and another from Poleshill.

Remarks.—While not in actual contact, the two valves from Braunton doubtless belonged to the same animal; though, lying in different directions on a slab that has suffered contortion, their dimensions are rather different. The minute concentric ornament is remarkably regular; over the posterior slope its threads become rather stronger and more distant.

Affinities.—*Avicula innotata*, Barrande,¹ is a shorter shell with a longer hind wing and different ornament.

4. LEPTODESMA ANATINUM, n. sp. Plate XIV, figs. 4—6.

?1889. *AVICULA*, sp., *Kayser*. Abhandl. Konig. Preuss. Geol. Landes., n. s., pt. 1, p. 19, pl. vii, fig. 9.

Description.—Left valve moderate in size, subquadrate, oblique, transverse, moderately convex. Umbo rather prominent, obliquely incurved, proximate, extending slightly above the hinge-line, and situated at the anterior third of its length. Anterior wing large, broad, subtriangular, and defined by a distinct, nearly vertical line from the front of the umbo. Posterior wing large, flattish, triangular, defined, not reaching quite so far back as the postero-inferior point. Anterior margin oblique, slightly incurved under the wing, and fuller below.

¹ 1881, Barrande, 'Syst. Sil. Bohême,' vol. vi, pl. ccxxix, figs. 11, 1—5, Et. E.

Inferior margin gently and evenly convex. Postero-inferior corner broadly rounded. Posterior margin gently concave. Hinge-line straight, and very nearly equal to the greatest length of the shell. Contour of surface convex in the centre, steeper in front, and slightly concave behind the umbo. Surface covered with numerous, very irregular, prominent growth-lines.

Right valve transverse, convex, subtriangular, oblique. Umbo smaller and narrower than that of the left valve, and not reaching above the hinge-line. Anterior wing convex, rather narrow, defined by an indistinct oblique line from the apex. Posterior wing long, narrow, concave, undefined. Anterior margin long, very oblique, slightly and broadly concave under the wing. Postero-inferior margin convex. Posterior margin apparently incurved. Contour of surface steeply convex across line from umbo to postero-inferior corner, being steeper behind than in front. Surface apparently similar to that of the other valve. Hinge-line long, bearing two very long, slight, horizontal lines, like teeth or ligamental grooves, behind the umbo. Anterior muscle-scar large, deep, circular, situated in the centre of the anterior wing, just in front of the umbo.

Size.—Left valve: height 19 mm., length 29 mm., depth about 4 mm. A right valve measures 13 mm. high, 25 mm. long, and about 3 mm. deep.

Locality.—There are two left valves and one right valve from Pilton in the Porter Collection.

Remarks.—Mr. Porter's fossils are in a fair state of preservation for these beds, and seem to be sufficient to define the species. Although the right and left valves are on different slabs, their agreement is such as to leave no doubt that they belong to the same species.

Affinities.—It presents much similarity to *Avicula crenato-lamellosa*, Sandberger,¹ as given by Frech,² but the present evidence points decidedly to its distinctness from it. In our specimens the front wing is much larger, and the posterior side less concave, and there are no signs of the existence of any radiations. *A. pseudo-lævis*, Follman³, and Ehlert⁴, is regarded by Frech as a synonym of Sandberger's shell. It appears to be distinguished from our specimens by its scalloped concentric striæ, by its greater height and more elongate hind wing, and by other points.

Pteronitella venusta, Billings,⁵ of the Upper Silurian seems longer and narrower, with a smaller umbo and a smaller front wing.

The Ludlow shell which Sowerby identifies doubtfully with *Pterinea retroflexa*,

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 288, pl. xxix, fig. 16.

² 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.,' Band ix, pt. 3, p. 49, pl. iv, figs. 5—5 c, and 13—13 b.

³ 1885, Follman, 'Ver. n. Vereins Rheintl.,' vol. 42, p. 199, pl. v, figs. 2, 2 a.

⁴ 1882, Ehlert, 'Mém. Soc. Géol. Fr.,' ser. 3, vol. ii, p. 23, pl. iii, figs. 5, 5 a.

⁵ 1874, Billings, 'Palæoz. Foss. Canada,' vol. ii, pt. 1, p. 142, pl. ix, figs. 5—5 b.

Hisinger, is congeneric, and is evidently closely allied. The specimens of it in the Museum of the Geological Society show great variability, but appear distinguished by their larger hind wing, which extends beyond the postero-inferior corner. As Sowerby points out,¹ it is most improbable that the Silurian species can be the same as Hisinger's form, if it be Jurassic.²

3. Genus—LEIOPTERIA, Hall, 1883.

1. LEIOPTERIA CONRADI, Hall? Plate XIV, fig. 7.

?? 1881. AVICULA (PTERINEA?) SERVIENS, *Barrande*. Syst. Sil. Bohême, vol. vi, pl. ccxxiii, figs. 2, 1-9, Ét. E.

? 1884. LEIOPTERIA CONRADI, *Hall*. Pal. N. Y., vol. v, pt. 1, p. 159, pl. xx, figs. 1, 2, 4; and pl. lxxxviii, figs. 1-4.

Description.—Shell small, oblique, rather transverse. Hinge-line equal to the length of the shell. Umbo small, acute, prominent, slightly elevated, and situated close to the anterior end. Front wing very small, rounded. Hind wing large, long, flat. Anterior and inferior margin long, oblique, gently curved. Posterior margin long, deeply sigmoid. Contour very convex across the line from the umbo to the postero-inferior region, in front of which it arches gently to the margin, and behind which it sinks with a sigmoid curve to the hind wing. Surface covered with rather numerous, concentric, irregular undulations, which appear to have probably been covered by finer striæ.

Size.—Height about 14 mm., length about 16 mm., depth of valve about 5 mm.

Localities.—One specimen is in the Woodwardian Museum from Barnstaple; and another in Mr. Hamling's Collection from near the Old Kiln at Croyde Bay.

Remarks.—These specimens are very imperfect, the first being a cast and defective in front, and the second being compressed in front, and affected by lines of pressure which have obscured the ornament. It appears, however, that they certainly belong to the genus *Leiopteria*; that, though differing considerably in some particulars, they probably belong to the same species; and that they are so very similar to *L. Conradi*, Hall, as probably to be identical with it. If so, the English shells probably belong to a dwarfed variety of that species.

Affinities.—*Leiopteria Dekayi*, Hall,³ is less transverse, and has a much broader wing.

¹ 1839, Sowerby, in Murchison's 'Sil. Syst.' p. 609, pl. v, fig. 9.

² 1826, Hisinger, 'Act. Holm.,' pl. vii, fig. 9; and 'Petr. Suec.,' p. 57, pl. xvii, fig. 12.

³ 1884, Hall, 'Pal. N. Y.,' vol. v, pt. 1, p. 164, pl. xx, figs. 16-18; and pl. lxxxviii, figs. 5-10.

Avicula Bodana, F. A. Römer,¹ appears to be more transverse, with a longer hinge-line, larger wings, and a straighter posterior margin.

Avicula Gervillei, Ehlert,² is a shorter, deeper, and less oblique shell, with a broader and less defined posterior region.

Avicula serviens, Barrande, seems very closely to resemble it; but its hind wing seems generally rather shorter, and its surface sometimes retains fine rays; and it is therefore probable that it is distinct.

2. *LEIOPTERIA?* MURATA, n. sp. Plate XIV, fig. 8.

Description.—Right valve moderately small, flattish, transverse, oblique. Umbo apparently rather acute, elevated. Anterior side rather broad. Antero-inferior corner rather produced, broadly convex. Inferior margin wide, gently and evenly convex. Postero-inferior corner produced, convex. Front wing small, flat. Hind wing apparently large, broad, flat. Contour slightly convex vertically, almost flat on the back horizontally. Surface covered by regular, parallel, very distant, elevated ridges, which seem to incline backwards from the margins, to be truncated by a narrow groove on their summits, and to be separated by very wide and shallow smooth interspaces.

Size.—About 25 mm. high, 33 mm. long.

Locality.—A specimen of the right valve from Barnstaple is in the Woodwardian Museum; and one, which seems to be the mould of a corresponding left valve, is in my Collection from Upcott Arch Quarry.

Remarks.—These fossils evidently appear to belong to a distinct species, but they are unfortunately too imperfect to give a satisfactory conception of it. It bears a curiously strong superficial resemblance to *Otenodonta lirata*, so strong that both specimens were at first mistaken for that shell. The likeness is, of course, entirely deceptive. It is evidently a *Leiopteria*, though both in shape and in ornament it differs distinctly from kindred forms.

4. Genus—PTYCHOPTERIA, Hall, 1883.

It “differs from *Actinopteria* in the nasute anterior extremity, and large, straight wing, marked by a strong longitudinal fold. Hinge-line narrow, linear; furnished with one or two linear, oblique, cardinal and lateral teeth. Surface with fine rays.”

¹ 1860, F. A. Römer, ‘Beitr. Harzgeb.’ pt. 4, p. 162, pl. xxv, fig. 9.

² 1881, Ehlert, ‘Mém. Soc. Géol. Fr.’ ser. 3, vol. ii, p. 22, pl. iii, figs. 5, 5 a.

Hall thus defines his genus, giving *P. Salamanca*, Hall, as an example. It accurately covers the English species.

1. PTYCHOPTERIA DAMNONIENSIS, *Sowerby*, sp. Plate XIII, fig. 14; and Plate XIV, figs. 9—13.

1840. AVICULA DAMNONIENSIS, *Sowerby*. Geol. Trans., ser. 2, vol. v, pt. 3, pl. liii, fig. 22.
1841. — — — *Phillips*. Pal. Foss., p. 51, pl. xxiii, figs. 90—92.
1841. — CANCELLATA, *Phillips*. Ibid., p. 49, pl. xxii, fig. 84.
- ? 1884. PTERINEA, cf. DAMNONIENSIS, *Clarke*. Neues Jahrb. f. Min., Beil.-Band 3, p. 372.
- ? 1884. PTYCHOPTERIA SALAMANCA, *Hall*. Pal. N. Y., vol. v, pt. 1, p. 131, pl. xxiii, figs. 17—20.
- ? 1884. — — — *Sao*, *Hall*. Ibid., p. 132, pl. xxiii, figs. 16, 23.
1893. AVICULA DAMNONIENSIS, *Collins*. Trans. Roy. Geol. Soc. Cornwall, vol. xi, p. 35.

Description.—Shell rather large, convex, inequivalve, subtrigonal, generally very transverse. Hinge nearly as long as shell, straight. Umbo broad, proximate, situated very anteriorly, curving forward, low in the right valve, prominent and overhanging the hinge in the left valve. Anterior wing small, narrow, subtriangular, with an obliquely convex margin below, apparently meeting the hinge-margin at an acute angle. Inferior margin very long, oblique, and slightly convex. Postero-inferior corner much produced and very convex. Posterior margin oblique, straight. Hind wing long, triangular, rather broad, convex along its centre, and separated from the body by a strong linear concavity. Surface covered by very numerous, minute, equal, close, rounded ribs, crossed by a few strong growth-ridges, and by very numerous fine, close, rounded threads. Left valve more convex than the right.

Size.—Three specimens measure 23 mm. high by 40 mm. long, and 13 mm. deep; 14 mm. high by 18 mm. long, and 5 mm. deep; 32 mm. high by 40 mm. long, and 13 mm. deep. A specimen from West Angle is 47 mm. long.

Localities.—In the Barnstaple Athenæum are six specimens from Sloly, five from Marwood, one from Kingdon's, Shirwell, and two from Top Orchard. In the Museum of Practical Geology are eighteen from Marwood, one from Baggy, and eight from West Angle Bay, Pembrokeshire; in the Woodwardian Museum, *Sowerby's* type from Marwood, and six from Barnstaple; in my Collection one from Pouch Bridge. It crowds the surface of a bed just above the *Rh. laticosta* bed at Baggy.

Remarks.—*Avicula Damnoniensis*, Sow., as obtained from Marwood, varies so very much in shape, that it was divided by Phillips into three varieties ; it appears probable, however, that this is in a large degree due to the squeezing of the beds and the decayed state of the specimens, in which the ornament is more or less destroyed. Still it is probable that the species did really vary considerably.

The shells from the Pilton beds were separated as *A. cancellata* by Phillips, but there seems no good reason for this. They are perhaps smaller, more compact in shape, and very regularly ornamented, but these points are probably due to individual accident or to preservation. Sowerby's type seems to agree with a fine specimen from West Angle Bay, which shows from different parts of its surface that, though the hind wing may in some states of preservation seem without radiations, it really possessed them ; but the absence of radiations on the wing is the only character which Phillips mentions as definitely distinguishing Sowerby's species from his own ; while another character (the contour of the hind wing) which Phillips mentioned in *A. cancellata* is equally seen in many Marwood specimens of *A. Damnoniensis*. Probably if the latter specimens were in good preservation the supposed differences would disappear.

It appears probable that *Pt. Salamanca*, Hall, is also identical. In the defective state of our specimens it is difficult to be sure of exact details of shape, but any discrepancies that may be observable are such as might easily be accounted for by incidental causes. Moreover the differences between *Pt. Salamanca*, Hall, and *Pt. Sao*, Hall, seem so slight that they can hardly be more than varietal in a group of shells which we know from other species to be subject to much individual variation.

Affinities.—From the South Devon species of *Actinopteria*, as well as from *Actinopteria intermedia*, Ehlert,¹ sp., it is distinguished by the shape of its wing and the fineness of its ornament.

5. Genus—AVICULOPECTEN, *M'Coy*, 1852.

1. AVICULOPECTEN TRANSVERSUS, *Sowerby*, sp. Plate XVI, figs. 1—4.

1840. PECTEN TRANSVERSUS, *Sowerby*. Geol. Trans., ser. 2, vol. v, pt. 3, pl. liii, fig. 3.
 1841. — — *Phillips*. Pal. Foss., p. 46, pl. xxi. fig. 77.
 1844. — — *M'Coy*. Syn. Carb. Foss. Ireland, p. 101.
 1855. AVICULOPECTEN TRANSVERSUS, *M'Coy*. Brit. Pal. Foss., p. 393.
 1893. — — *Collins*. Trans. Roy. Geol. Soc. Cornwall. vol. xi, p. 36.

¹ 1881, Ehlert, 'Mém. Soc. Géol. Fr.,' ser. 3, vol. ii, p. 21, pl. iii, figs. 1—1 c.

Description.—Right valve large, probably nearly circular, flattish, with small, nearly equal, and well-defined wings. Umbo nearly central, acute, depressed, proximate, not elevated above the hinge-line. Front wing flat, narrow, with an oblique convex margin, meeting the hinge-line at right angles, and defined below by a deep, oblique sinus. Posterior wing narrow, triangular, with a concave margin, meeting the hinge-line at right angles, and defined below by a less definite sinus. Anterior margin deeply notched under the wing, produced centrally, and broadly and evenly convex. Inferior and posterior margins convex. Surface of back ornamented by numerous sharp, triangular rays (divided by deep linear furrows) which are simple near the umbo, but, as they recede from it, develop a smaller similar ray on each side, so that near the margins they form groups of three triangular ridges, of which the central is the highest; the whole surface being crossed by numerous regular, fine, sharp, distant threads or striæ. Surface of front wing with four or five strong, rounded ridges, divided by similar furrows, crossed by numerous fine, rounded striæ. Surface of hind wing with more numerous and indistinct rays, crossed by rather more irregular striæ.

Left valve very similar, but probably rather deeper, and with a larger, broader, and less defined hind wing.

Size.—Phillips's figured specimen is 51 mm. long, but is vertically compressed. Other specimens are still larger, but I have been unable to find any that give the true dimensions, all the specimens having suffered distortion.

Localities.—In the Museum of Practical Geology is Phillips's figured specimen from Brushford, and a second from Braunton. In the Barnstaple Athenæum are two fine specimens from Goodleigh and Pilland, and a poor one from Top Orchard; in the Porter Collection are two specimens from Pilton; and in the Woodwardian Museum are five specimens from Barnstaple and one from South Petherwyn.

Remarks.—Though always distorted, several of the specimens are very fine, and enable us to learn a good deal of the character of the shell.

Phillips, though adopting Sowerby's name, remarks that he has very little doubt that it is the same shell as *Pterinea radiata*, Goldfuss.¹ M'Coy, however, points out that it is distinct from that species. It is distinguished by its radiated wings, and its more numerous and finer ribs of nearly equal size, grouped with remarkable regularity in a different way from those of the German form, which, moreover, has wider interspaces.

¹ 1834-40, Goldfuss, 'Petref. Germ.,' vol. ii, p. 135, pl. cxix, figs. 7a, b; and ? 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.,' Band ix, pt. 3, p. 19, pl. i, fig. 2.

2. AVICULOPECTEN NEXILIS, *Sowerby*, sp. Plate XVI, figs. 5, 6, and Plate XVII, figs. 2, 3.

1840. PECTEN NEXILIS, *Sowerby*. Geol. Trans., ser. 2, vol. v, pt. 3, pl. liii, figs. 1, 2.

1891. AVICULOPECTEN AQUISGRANENSIS, *Frech*. Abhandl. Geol. Specialk. Preuss., Band ix, pt. 3, p. 19, pl. i, figs. 1—1 b.

Description.—Shell small, rather flat (the right valve being apparently almost flat and the left gently convex), subcircular, probably very slightly oblique, nearly equilateral. Wings small, flat, triangular, broad, nearly equal, bounded by sigmoid margins, defined (especially the anterior wing) by strong straight sulci, which reach the margins. Lateral margins, deeply concave under the wings, and then becoming deeply convex in the lower parts, the posterior corner being slightly more produced. Inferior margin nearly semicircular. Hinge-line straight, rather more than half the length of the shell. Umbo of the right valve small, sharp, central, proximate to the hinge-margin; umbo of the left valve rather larger, deeper and more rounded. Contour of back slightly convex, deepest near the umbo, spreading out flatly to the margins. Surface covered with about fifty fine, sharp, minute, elevated, distant, alternating ribs, about half of which have divaricated from the centre; the whole crossed by equally numerous but still finer and smaller parallel concentric threads, which extend also over the wings. Wings with about seven radiating rays similar to those on the body of the valves.

Size.—16 mm. long, 17 mm. high, and 4 mm. deep (left valve).

Localities.—In the Museum of the Geological Society is *Sowerby's* type from Barnstaple; in the Barnstaple Athenæum, two specimens from Top Orchard and one from Braunton; in Miss Partridge's Collection, one from Upcott Arch Quarry; and in my Collection, several specimens from the Ostracod-bed close to the Laticosta bed at Baggy.

Remarks.—For a long time I was only acquainted with very imperfect specimens of this shell; but recently I have found it occurring in abundance in the lower beds of Croyde Bay. There is no doubt of the identity of these fossils with the species as described by *Sowerby*.

Aviculopecten aquisgranensis, *Frech*, appears exactly identical in every respect.

Affinities.—It is distinguished from *A. Hallii* by its very much finer and more numerous ribs.

Pecten subradiatus, F. A. Römer,¹ from the Culm, which is very similar in shape, is described as having numerous finer lines between the major rays.

Avicula Posidonis, F. A. Römer,² is more transverse and squarish, with comparatively larger wings and finer rays, but in other respects is similar. If his specimen had been subject to considerable transverse contortion it might perhaps have approximated our species; but Römer seems to imply that its figure represents its true shape, while specimens show that Sowerby's figure is not much contorted.

Pecten polytrichus, Phillips,³ as given by Römer⁴ and by Frech,⁵ differs in having smaller wings and umbo, broader sides, and a decidedly more rounded form, as well as a few of the rays somewhat greater than the rest. Phillips's own species is still farther removed; it differs from the shell which these German authors have identified with it by the very much greater inequality of its major and minor ribs, and is akin to, if not identical with, the species named *Avicula Ibergensis* by F. A. Römer.⁶

P. Helmerseni, Semenow et Möller,⁷ is similar, but has only transverse striations on its wings.

Crenipecten Winchelli, Meek,⁸ may be compared with it, though probably not congeneric.

Pecten oceani, Goldfuss,⁹ has much coarser ribs.

3. AVICULOPECTEN GRANULOSUS, *Phillips*, sp. Plate XIII, fig. 15.

1841. PECTEN GRANULOSUS, *Phillips*. Pal. Foss., p. 46, pl. xxi, figs. 75 *a, b*.

Description.—Shell small, obliquely ovate, as broad as long. Umbo small, oblique, acute, situated nearly at the anterior third of the length. Hinge-margin straight, about half the length of the shell. Wings small, triangular, broad, flat, very sharply defined, and with gently sigmoid margins; the hind wing being rather larger and longer than the front. Other margins oval, the greatest convexity being in the postero-inferior region. Surface microscopically

¹ 1852, F. A. Römer, 'Beitr. Harzgeb.,' pt. 2, p. 91, pl. xiii, fig. 19.

² 1855, F. A. Römer, *ibid.*, pt. 3, p. 11, pl. iii, fig. 4.

³ 1841, Phillips, 'Pal. Foss.,' p. 46, pl. xxi, fig. 76.

⁴ 1860, F. A. Römer, 'Beitr. Harzgeb.,' pt. 4, p. 161, pl. xxv, fig. 5.

⁵ 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.,' Band ix, pt. 3, p. 16, pl. i, figs. 9—9 *b*.

⁶ 1855, F. A. Römer, 'Beitr. Harzgeb.,' pt. 3, p. 35, pl. vii, fig. 3.

⁷ 1863, Semenow and Möller, 'Mélange Phys. et Chim.,' vol. v, p. 679, pl. iv, figs. 14 *a, b*.

⁸ 1875, Meek, 'Pal. Ohio,' vol. ii, p. 296, pl. xv, figs. 50, 56; and 1884, Hall, 'Pal. N. Y.,' vol. v, pt. 1, p. 89, pl. ix, fig. 1, 2, 4, 25—30.

⁹ 1834—40, Goldfuss, 'Petref. Germ.,' vol. ii, p. 42, pl. lxxxviii, fig. 10.

crenulated by very numerous sharp radiating and concentric lines, which together cover it with a multitude of minute squares; surface of front wing similar but slightly coarser; that of hind wing much coarser, and with the transverse lines dominant. Contour of left valve gently convex.

Size of Right Valve.—Length 14 mm., height 14 mm.

Localities.—There are two specimens from Pilton in the Porter Collection, and one from Landlake in the Museum of Practical Geology.

Remarks.—The two specimens from Pilton closely agree with Phillips's figure of the opposite (?) valve, and are evidently identical though they do not preserve any signs of the ornament except on the hind wing. The ornament on the Landlake specimen is exactly like that in Phillips's figure, except that it is still more minute. That specimen is rather more oblique and transverse, but it is quite possible that (as it is a mould) it might have been the original of his figure in spite of its appearing to represent the opposite valve. It is flatter than the Pilton specimens.

Affinities.—*Pecten linteatus*, Goldfuss,¹ is very similarly ornamented, but appears to be longer and more direct, and to have more rounded rays and considerably larger wings.

Aviculopecten pelmensis, Frech,² more nearly approaches it in shape, but bears much fewer and coarser radiations.

6. Genus—ACTINOPTERIA, Hall, 1883.

1. ACTINOPTERIA RUDIS, Phillips, sp. Plate XV, fig. 14.

1841. AVICULA RUDIS, Phillips. Pal. Foss., p. 50, pl. xxii, figs. 85 a, b.

?1892. ACTINOPTERIA RUDIS, Whidborne. Dev. Faun., vol. ii, p. 73, pl. viii, figs. 4, 6, 6 a.

Description.—Left valve very high, slightly oblique, ovoid. Umbo prominent, extending above the hinge-line, situate anteriorly. Hinge-line short. Hind wing short, triangular, very broad, and clearly defined. Posterior margin forming a slightly obtuse angle with the hinge-margin, straight on the wing, and convex below it. Contour of back convex. Surface with numerous fine, sharp, distant rays, and a few indistinct undulations of growth. "Lower valve: general figure elongate, with a square, short hinge-line and prominent beak near the anterior end; surface covered with flexuous and irregular lines of growth" (Phillips).

Size.—A left valve measures about 15 mm. high.

¹ 1834-40, Goldfuss, 'Petref. Germ.,' vol. ii, p. 78, pl. cxiv, fig. 9; and 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.,' Band ix, pt. 3, p. 17, pl. ii, figs. 3-5.

² 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.,' Band ix, pt. 3, p. 15, pl. i, figs. 7-7 b.

Localities.—A specimen from Barnstaple and two from south-west of Sloly in the Woodwardian Museum, and two very indistinct shells from Sloly in the Barnstaple Athenæum, appear to belong to this species.

Remarks.—Under this heading Phillips has figured two very indistinct valves from Pilton and Bradiford, viz. a left valve which closely resembles our specimens, and a right valve showing the concentric lines described by him.

Our fossils are all too indistinct to throw further light upon the species, or to enable us to be certain whether the Lummaton form is identical. While most of the specimens seem to have a rather large and rayed hind wing, in the specimen here figured it seems short and smooth. Though this certainly throws a little doubt on its identity, I am inclined to regard it as immaterial. The smoothness, at all events, seems simply due to accidental obliteration of ornament.

Affinities.—*A. Jugleri*, F. A. Römer,¹ approaches it most nearly, but is more oblique, and, judging from the figures of it given by various authors, differs in other particulars.

7. Genus or Sub-genus—PTERINOPECTEN, Hall, 1883.

1. PTERINOPECTEN POLYTRICHUS, Phillips, sp. Plate XV, fig. 1.

1841. PECTEN POLYTRICHUS, *Phillips*. Pal. Foss., p. 46, pl. xxi, fig. 76.
 1855. AVICULA IBERGENSIS, *F. A. Römer*. Beitr. Harzgeb., pt. 3, p. 35, pl. vii, fig. 3.
 1884. PTERINEA IBERGENSIS, *Clarke*. Neues Jahrb. f. Min., Beil.-Band iii, p. 370.
 1891. AVICULA IBERGENSIS, *Frech*. Abhandl. Geol. Specialk. Preuss., Band ix, pt. 3, p. 44, pl. iii, fig. 3.

Description.—Left valve very large, nearly flat, rather oblique, higher than long. Umbo probably very small, low, and situate at or about the anterior fourth of the length of the valve. Hinge-line straight, nearly equal to the length. Margins unknown, but probably the inferior short, slightly oblique, and convex, the postero-inferior slightly produced and broadly convex, and the posterior nearly direct and gently sigmoid. Hind wing large, flat, broad, triangular, undefined, and with a nearly perpendicular margin. Contour of back gently convex near umbo, sloping out flatly to margins. Surface with about eight large, rounded, distant, radiating ribs, rapidly decreasing in size laterally, between each of which is an alternating series of seven very much smaller ribs, of which the fourth is the

¹ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 21, pl. vi, fig. 4.

largest and the second and sixth next in size; the whole crossed by seven or eight very low and indistinct undulations, and by very numerous fine concentric striæ. Surface of hind wing with about twenty small, equal, alternating ribs only.

Size of an imperfect valve.—Length 60 mm., height 80 mm., depth 8 mm.

Locality.—One imperfect mould from Croyde Bay is in the Museum of Practical Geology.

Remarks.—The figure of this fossil is given from a wax cast taken from the mould. It is very different in size, shape, and ornament from any of the accompanying fossils, but owing to its own imperfection, and to the unsatisfactory description of the forms with which it may be compared, there is considerable difficulty in deciding its species.

Phillips's figure of *Pecten polytrichus* is similarly ornamented. It appears smaller and more transverse, and its major ribs seem stronger behind than in front, but it has every sign of being taken from a very much compressed and fragmentary specimen, and it is the right or opposite valve to ours. It may be observed that Phillips defines two varieties, one with alternating minor ribs from Brushford, and the other with equal minor ribs from Mudstone Bay. The latter may prove to be a distinct species, but my belief is that the former at all events is identical with ours, and that the differences visible are to be accounted for either by distortion or by his specimen being only the umbonal parts of a larger shell.

Again, *Avicula Ibergensis*, F. A. Römer, appears from its figure to agree with our fossil in shape and character, chiefly differing in being much smaller and in having two major ribs on the hind wing. Frech, who refigures Römer's type, makes it even more like Phillips's specimen than ours. It seems probable that it is only a variety of the English fossil, the differences seen being simply due to age.

Affinities.—The shell identified by Römer¹ and by Frech² with *P. polytrichus* is totally different from Phillips's species, and may be easily distinguished both by its ornamentation and by its very much smaller wings.

Avicula dillensis, Frech,³ has a different and much simpler style of ornament on the left valve; though the right valve is more similar, differing, however, in having more numerous rays and much fewer concentric threads.

A. pectinoides, Sowerby,⁴ approaches it in size and shape, but has many more major ribs, and its ornament is, as is shown by M'Coy,⁵ of an entirely different nature.

¹ 1860, F. A. Römer, 'Beitr. Harzgeb.,' pt. 4, p. 161, pl. xxv, fig. 5.

² 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.,' Band ix, pt. 3, p. 16, pl. i, figs. 9—9 b.

³ Ibid, p. 39, fig. 2, pl. iii, fig. 9, and pl. xiv, fig. 17.

⁴ 1840, Sowerby, 'Geol. Trans.,' ser. 2, vol. v, pt. 3, pl. liv, fig. 2.

⁵ 1855, M'Coy, 'Brit. Pal. Foss.,' p. 393.

Myalinodonta Normaniana, d'Orbigny, sp.,¹ as given by Ehlert,² differs specifically in the absence of major ribs, as well as generically in the absence of an anterior wing.

Aviculopecten transversus is easily distinguished by its obliquity being less, and by its ribs being piled up in groups.

2. PTERINOPECTEN? HALLII, n. sp. Plate XV, figs. 2—6.

? 1887. AVICULOPECTEN, cf. EXACUTUS, *Tschernyschew*. Mém. Com. Géol., vol. iii, pt. 3, p. 45, pl. vii, fig. 7.

Description.—Left valve small, convex, subcircular, not oblique. Umbo large, rounded, rather prominent, subcentral, subacute, proximate, and slightly elevated above the hinge-line. Anterior wing rather large, broad, triangular, slightly convex, sharply defined, with a convex margin meeting the hinge-line at about 100°. Posterior wing large, broad, triangular, undefined, with a concave margin meeting the hinge-line at an acute angle of about 60°. Hinge-line straight, nearly or fully equal to the length of the shell. Contour of back highly and evenly convex, perpendicular by the anterior, and rather steep by the posterior wing. Anterior margin long, convex round the wing, sharply concave at its base, and then broadly convex round the lower part. Inferior margin roundly and evenly convex. Posterior margin broad, sigmoid, nearly vertical. Surface of back covered (1) except on the extreme posterior part, with twenty-five to forty prominent, elevated, rounded, alternating, radiating ribs, becoming smaller rearward, and diminishing in number as they approach the umbo, and (2) on the extreme posterior part by a number of microscopic rays; the whole crossed by twenty or thirty minute, sharp, regular, parallel, very distant threads. Surface of wings with five or six fine, distant radiations, and with rather coarser and closer transverse striæ.

Size of left valve.—Length 15 mm., height 15 mm., depth 5 mm.

Localities.—In the Barnstaple Athenæum are four specimens from Top Orchard, one from Meer Top, and one from Roborough. In the Porter Collection is one from Pilton.

Remarks.—These specimens, though fairly preserved, are all more or less defective, especially about the wings, and all appear to be left valves. There is not, therefore, material fully to describe the shell, and it is of course possible that right valves described under another head really belong to it, though I do not at present know of any which there is any reason to match with it.

¹ 1849, d'Orbigny, 'Prodrôme,' vol. i, p. 87.

² 1882, Ehlert, 'Mém. Soc. Géol. Fr.,' ser. 3, vol. ii, p. 30, pl. v, figs. 1—1 e.

It appears referable to the genus *Pterinopecten*. The front wing is very definite, and the adjacent front boundary of the back is long, straight, and deep; the hind wing is more diffuse and broad. The transverse threads are so delicate that they are only occasionally visible or preserved. The ribs are rather irregular, a few being larger than the rest; toward the rear they become smaller and more even, and then, as a rule, suddenly cease, the last rib reaching the margin above the postero-inferior corner. The space behind this seems smooth, but is really covered with microscopic rays, and upon it the transverse threads become very prominent.

Affinities.—From *Pecten alternatus*, Phillips,¹ it differs by its smaller and more numerous ribs, and by its sharp transverse threads. The latter character may, however, perhaps only be due to a better state of preservation; and the former is weakened by the fact that while our specimens have usually about thirty rays, in one case they are reduced to twenty. Phillips gives the number as about twelve and represents them as very much larger, closer, and rounder; so that there seems sufficient reason to regard his species as distinct.

Aviculopecten (Pterinopecten) dauniensis, Frech,² approximates it, but is more oblique, with a smaller umbo, larger wings, and decidedly fewer and coarser rays and concentric ridges.

3. PTERINOPECTEN SCABRIRADIANS, n. sp. Plate XV, figs. 8, 9; and Plate XVII, fig. 4.

Description.—Right valve small, flat. Umbo small, apparently central, not elevated above the hinge-line. Hinge-line probably as long as the shell. Front wing very long, deeply notched, and extremely narrow, with a long, very oblique, slightly sigmoid margin, and separated from the body by a straight, deep, oblique groove. Lower margins apparently convex. Hind wing undefined. Surface bearing rather numerous, close, strong, rounded, highly nodulated rays, which frequently divaricate, and are separated by linear furrows, sometimes perhaps crossed by undulations. Surface of front wing with two very strong nodulated rays near the hinge, and smooth below.

? Left valve very convex, subcircular. Umbo acute, elevated above the hinge. Hind wing large, very broad, triangular, flat, bounded by a straight margin, and rather well defined by a line from the umbo to the margin. Lower margin apparently almost evenly convex. Surface covered by about twenty very distant, narrow, elevated, sharpish rays, crossed by and nodulated by still more distant, regular, parallel, concentric lines, enclosing with the rays flat oblong interspaces.

¹ 1841, Phillips, 'Pal. Foss.,' p. 47, pl. xxi, fig. 78.

² 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.,' Band ix, pt. 3, p. 22, pl. i, figs. 8—8 b.

Size.—Height 11 mm., length 12 mm.

Localities.—A small distorted right valve, from the lane between Wrafton and Heanton, is in my Collection. A slab containing a similar right valve, together with a left valve which may belong to the same species, is in the Porter Collection from the neighbourhood of Pilton.

Remarks.—Whether these two valves, which are differently ornamented, belong to the same species remains to be proved. It appears safest so to regard them, as they occur together on one block of stone, and each seems quite different from any other Pilton species.

The first figured specimen of the right valve is worn and defective; a specimen found since shows that the rays bear strong transverse tubercles on their summits. What indications there are of transverse lines tend to confirm the identity of the two valves.

Affinities.—The left valve closely approximates *Pterinopecten exfoliatus*, Hall,¹ but appears to have a sharper and less oblique umbo; while the radiations on our right valve are not obsolescent. It is possible that better specimens might prove it identical with one, if not both of our valves.

Pt. undosus, Hall,² though different in ornament, has the front wing as deeply defined and notched as that of the present species.

Some species of *Aviculopecten* given by Hall do not differ very greatly; in fact, *Pterinopecten* and *Aviculopecten* so run into each other that it seems difficult to find a line of demarcation.

Pecten æqualis, M'Coy,³ has fewer rays and a smaller and more definite hind wing than is seen in our left valve.

Aviculopecten Neptuni, Goldfuss,⁴ sp., as given by Frech,⁵ approaches our left valve in shape and general appearance, though not in size, ornament, or convexity; but it differs much from our right valves.

4. PTERINOPECTEN AUSTENI, *F. A. Römer*, sp. Plate XV, figs. 10, 10 a, 11.

1855. AVICULA AUSTENI, *F. A. Römer*. Beitr. Harzgeb., pt. 3, p. 37, pl. vii, fig. 16.

Description.—Left valve rather small, wider than long, flattish, slightly oblique, subcircular. Umbo rounded, prominent, proximate, situated somewhat

¹ 1884, Hall, 'Pal. N. Y.,' vol. v, pt. 1, p. 61, pl. i, figs. 16, 17; and pl. lxxxiii, figs. 6, 7.

² Ibid., p. 72, pl. ii, figs. 10—19; and pl. lxxxii, fig. 7.

³ 1844, M'Coy, 'Syn. Carb. Foss. Ireland,' p. 89, pl. xv, fig. 13.

⁴ 1834—40, Goldfuss, 'Petref. Germ.,' vol. ii, p. 125, pl. cxvi, figs. 4 a, b.

⁵ 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.,' vol. ix, pt. 3, p. 18, pl. ii, figs. 1, 2.

anteriorly, direct and extending slightly above the hinge-margin. Hinge-margin giving the greatest length of the shell, straight behind the umbo, and at rather a lower level and slightly oblique in front of it. Anterior wing rather small, broad, triangular, flat, defined by a depression running obliquely forward from the apex, and marked by two or three linear rays, and by eight or nine sharp, distant, regular, transverse ridges. Hind wing large, flat, broad, undefined. Anterior margin nearly straight and perpendicular above, and becoming obliquely rounded in the lower part, the curve continuing along the inferior margin, and the postero-inferior corner being roundly convex. Posterior margin perpendicular and slightly concave. Surface covered with about eighteen strong, steep, acute, triangular, elevated, very distant ribs, becoming stronger and more distant gradually from the rear forwards, and separated by broad, gently convex intervals; the whole crossed by thirteen or fourteen sharp, regular and regularly distant threads or subfoliaceous ridges, which are slightly concave between the rays. Rays produced into long marginal spines, so that the margin is, in the central parts at least, deeply scalloped. Lateral angles sharp and slightly acute.

Size of Valve.—Height 22 mm., length 23 mm., depth about 4 mm.

Localities.—There are four specimens of the left valve from Pilton in Mr. Porter's Collection, and one from Barnstaple in the Woodwardian Museum. Römer found a specimen in the "first quarry north of Pilton on the way to Marwood."

Remarks.—This species was long ago founded by F. A. Römer on a Devonshire fossil, but it appears to have escaped the notice of English geologists, as I can find no reference to it in either Morris's or Etheridge's Catalogue, or elsewhere. Not having seen Römer's type specimen, I had intended to quote it simply on his authority; but in Mr. Porter's Collection I at once recognised four examples of it, one of which is almost perfect, and agrees in every respect with Römer's figure and description. He remarks that the concentric ribs are strongest on the swollen intervals, while they become small and form no clear knots upon the rays. The species is far removed from any other English Devonian species, and from any foreign species described by Frech, Hall, &c.

5. *PTERINOPECTEN MUNDUS*, n. sp. Plate XV, figs. 12, 12 *a*, 13, 13 *a*.

Description.—Shell large, oblique, convex. Left valve more or less convex, very oblique. Anterior wing small, narrow. Umbo minute, not elevated above the umbo. Hinge-line straight (in front of umbo), lined with three or four minute, parallel, transverse cartilage-furrows. Anterior margin short, convex,

oblique. Inferior margin rather wide, convex, oblique. Postero-inferior margin widely rounded or semicircular. Posterior margin oblique, nearly straight. Surface covered with about twenty-three large, elevated, very rounded ribs, between which is a single similar series of much smaller ribs, separated by concave interspaces equal to the smaller ribs in width; the whole crossed by minute and indistinct close concentric striæ. Contour (in old forms) probably very steep, becoming almost perpendicular in front. Right valve apparently very similar to the other valve, very convex, with a large expanded wing in front.

Size.—A small left valve is 24 mm. high by 20 mm. long. A larger valve is about 38 mm. high by 32 mm. long, and 8 mm. deep.

Locality.—There are two specimens in the Woodwardian Museum from Barnstaple, and another in the Museum of Practical Geology from Croyde.

Remarks.—All these three specimens are defective, and, though they clearly show the general character of this handsome species, are difficult to interpret in detail, and therefore the above description must be regarded as in a measure tentative.

The best specimen is a small, flattish left valve in the Woodwardian. This shows the small anterior wing, above which is seen the straight hinge (about 5 mm. wide), bearing three or four parallel ligamental furrows. With this fossil appears to agree the Croyde specimen, except that it is much more convex, and that the anterior side seems much more rounded, as though the anterior wing, which is gone, were much smaller. The other Woodwardian specimen is so distorted by pressure that it is impossible to make out its original contour; but its general shape and the large size of the ribs on the remaining wing (which is, however, evidently very much distorted) may possibly point to its being the opposite or right valve.

Affinities.—It may be near *Pecten alternatus*, Phillips,¹ from South Petherwyn, but that shell is said to be *not* oblique, and is smaller, and has fewer, more elevated, closer, and more definitely alternating major ribs, while there are no signs of the minor series. Whatever, therefore, may be the shell which Phillips's figure represents, there is at present no sufficient reason to identify it with the present species.

Avicula rudis, Phillips,² widely differs in having a very much more finely radiated left valve and a concentrically marked right valve.

¹ 1841, Phillips, 'Pal. Foss.', p. 47, pl. xxi, fig. 78.

² 1841, *ibid.*, p. 50, pl. xxii, figs. 85 *a*, *b*.

IV. *Family*—PECTINIDÆ, *Fleming*, 1828.1. *Genus*—CRENIPECTEN, *Hall*, 1883.

I have placed the following shell under the present genus because I think I can see faint indications of a crenulated hinge-line, which, however, the roughness of the matrix renders very doubtful.

1. CRENIPECTEN? AURITUS, n. sp. Plate XV, fig. 7? and Plate XVI, figs. 15, 16.

Description.—Right valve small, flat, short, direct. Umbo small, central, direct, acute, flattened, proximate, and not extending above hinge-line. Hinge-line very nearly equal to the greatest length, apparently pitted or dentated. Anterior wing very large, broad, an almost right-angled isosceles triangle in shape, bearing indications of rays, and separated from the body by a deep hollow groove or sinus. Anterior and posterior margins almost straight and direct superiorly, convex inferiorly. Inferior margin short and convex. Contour very flat. Surface of back bearing ten or twenty very low, rounded rays.

Left valve rather more convex. Umbo small, extending slightly above the hinge-line. Anterior wing short, triangular, very broad, bearing a few rays, having a convex margin, and separated from the body by a deep straight groove. Surface (except the wing) covered by low, rounded, distant, irregular ribs, which do not all reach the umbo, and are separated by wider, shallow, concave interspaces.

Size.—Length 8 mm., height 10 mm.

Localities.—In the Barnstaple Athenæum are two specimens of the right valve from Top Orchard, and one of the left valve from Bradiford, and in the Porter Collection one left valve from Pilton, and another, which is doubtful, from Smoking House Lane.

Remarks.—This shell appears to be distinct, and probably rather far removed from the other species occurring in these beds. Owing, however, to the very poor state of preservation of the specimens its description is very difficult; and it has proved impossible to figure it in a satisfactory manner, the critical points being much obscured by the matrix, or by fracture of the shell.

The specimen from Bradiford, though indistinct, appears undoubtedly to be a left valve; and therefore it appears that we can identify the full shell, and may regard it as distinct from any other species which is known by only one of the valves.

2. Genus—PLEURONECTITES, *Schlotheim*, 1820.(STREBLOPTERIA, *M'Coy*, 1851.)

Shell subequivalve, oval or subcircular; anterior side obliquely produced in front; hind wing large, confluent, with a right or obtuse terminal angle; front wings short, in the left valve defined by an oblique groove, and in the right indented by a byssal notch; surface smooth or finely radiated; muscular scar faint and above the centre; hinge with a narrow oblique tooth in front of the umbo; ligamental groove simple and narrow.

The above description is condensed from De Koninck's definition of *Streblopteria*,¹ which is a genus with the Carboniferous *Meleagrina lævigata*, *M'Coy*,² for its type. *Frech*³ points out that it is synonymous with *Pleuronectites*; and *Pl. lævigata*, *Schlotheim*,⁴ of the Trias, which is the type of that genus, though differing specifically, is evidently congeneric with *M'Coy*'s species.

1. PLEURONECTITES PILTONENSIS, n. sp. Plate XVI, figs. 7—9, 10?, 11?

Description.—Right valve small, subovoid, broad, gently convex, more or less oblique. Umbo small, acute, direct, rather flattened, hardly extending above the hinge, and situated rather behind the middle. Hinge-line more than half the length of shell. Anterior wing long, narrow, convex, ovate, marked by four or five coarse low rays and some cross striæ; defined by a deep narrow groove, and bounded by a semicircular margin. Posterior wing short, flat, obtusely triangular, defined by a linear oblique groove. Anterior margin semicircular at the wing, then with a deep, narrow, angular notch, and then spreading out in a broad, bluntly subangular curve, which becomes subcircular below. Inferior margin narrow, convex. Posterior margin neatly convex. Contour of back gently convex, spreading out flatly to the margins. Surface apparently smooth (or only microscopically marked). Muscle-scar very large, central, situated in the upper half of the shell.

? Left valve ovoid, more or less broad and oblique, rather convex. Umbo oblique, acute, reaching slightly above hinge. Anterior wing small, flat, short, equilaterally triangular, and marked with a few radiating and transverse lineations. Posterior wing apparently small, short, flat, and very broad, more or less distinctly defined,

¹ 1885, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. xi, p. 202.

² 1844, *M'Coy*, 'Syn. Carb. Foss. Ireland,' p. 80, pl. xii, fig. 5.

³ 1891, *Frech*, 'Abhandl. Geol. Specialk. Preuss.,' Band ix, pt. 3, p. 12.

⁴ 1820, *Schlotheim*, 'Petref.,' vol. i, p. 217; and 1850-56, *Bronn*, 'Lethæa,' ed. 3, p. 161, pl. xi, fig. 11.

and with its margin confluent with the margin of the body. Margins generally convex, gently concave below the anterior wing. Contour of back gently convex.

Size.—A right valve is 15 mm. long, 16 mm. high, and 3 mm. deep.

Localities.—In the Barnstaple Athenæum are one left and one right valve from Top Orchard, and left valves from Bradiford, Raleigh, and Kingdon's, Shirwell. In the Porter Collection are three or perhaps four right valves and two left valves from Pilton, and two left valves from Roborough. In my Collection is one doubtful right valve from Wrafton Lane.

Remarks.—These specimens are for the most part in a poor state of preservation, and their surface is decayed or gone. They are extremely puzzling from the variety of shapes which they assume, owing probably to the tenuity of the shell. The right valves are, however, easily recognisable by their peculiar convex, radiated, pear-shaped anterior wing. Hence we can identify shells which are inversely oblique with others which are, apparently through squeezing, almost direct. The left valves are sometimes direct, but generally oblique in the opposite direction. It has seemed to me, however, after a careful examination, that this change of shape may be not improbably due to contortion, and therefore I have ventured to place them with these right valves, which otherwise correspond, though I fully realise that the discovery of better preserved specimens may prove them distinct. The figured right valves from Mr. Porter's Collection (Pl. XVI, figs. 7 and 8) should be regarded as the types of the species; that in the Barnstaple Museum would have to be separated if further discoveries were to prove that it is not distorted; while the only left valve that can be certainly referred to it is a very poor specimen of Mr. Porter's, the other left valves being only placed here provisionally until better specimens prove whether they are identical or not.

Affinities.—*Pecten consimilis*, M'Coy,¹ seems closely related, and has a similarly ornamented ear, but it differs in having its umbo larger and more central, and in being less oblique and very much smaller in size.

Pecten perobliquus, F. A. Römer,² seems more oblique and more produced in the postero-inferior part than our right valves, bears no rays on the ear, and has transverse striæ on the other parts.

Crenipecten obsoletus, Hall,³ and *C. glaber*, Hall,⁴ approach in shape, but neither of them appears to have a radiated ear, and they are probably more equilateral.

Streblopteria lateralis, de Koninck,⁵ comes very close, but does not appear to have a radiated ear, and appears more regularly ovoid in outline.

Meleagrina lævigata, M'Coy,⁶ seems decidedly more oblique and transverse.

¹ 1844, M'Coy, 'Syn. Carb. Foss. Ireland,' p. 91, pl. xv, fig. 16.

² 1850, F. A. Römer, 'Beitr. Harzgeb.,' pt. i, p. 48, pl. viii, fig. 4.

³ 1884, Hall, 'Pal. N. Y.,' vol. v, pt. 1, p. 84, pl. ix, figs. 19, 21. ⁴ Ibid., p. 85, pl. ix, figs. 20, 22?

⁵ 1885, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. xi, p. 206, pl. xxxii, fig. 16.

⁶ 1844, M'Coy, 'Syn. Carb. Foss. Ireland,' p. 80, pl. xii, fig. 5.

2. PLEURONECTITES LEPIS, n. sp. Plate XVI, figs. 12, 13.

Description.—Left valve small, flat, circular, slightly transverse. Umbo low, flat, direct, central, acute, small. Hinge-line apparently about half the length. Anterior wing small, flat, triangular, rather narrow, defined by a strong, long, rather concave wall from the umbo. Posterior wing very small, short, undefined. Anterior margin rather concave at the wing, then sloping obliquely forward, and becoming broadly convex round the body of the shell. Inferior margin wide, gently convex. Posterior margin deeply convex below, becoming nearly straight and oblique round the posterior wing. Contour of back nearly flat, perpendicular and steep over the front wing. Surface marked by one or two strong growth-lines, and apparently with very fine and regular concentric striæ. Right valve very similar to the left valve.

Size.—Height 15 mm., length 18 mm., depth of one valve 2 mm.

Localities.—Two, or perhaps three, specimens from Top Orchard are in the Barnstaple Athenæum; and one from Pilton in the Porter Collection.

Remarks.—It is not very certain whether this is a good species. The flattish circular shape and general character appear to give a distinctive appearance; but in a deposit which has suffered so much from distortion it is exceedingly difficult to decide whether an apparent peculiarity of shape may not possibly be due to accident. It appears, however, that there is sufficient reason to assume that it is distinct.

Affinities.—It seems rather similar to *Aviculopecten Schulzi*, Frech,¹ in shape and in the smoothness of the valves, but it differs by having a less defined and angulated posterior wing. The wings in the German species, moreover, of which a right valve only is figured, are strongly radiated.

Streblopteria pullus, de Koninck,² appears more equilateral, and has a more defined hind wing.

3. PLEURONECTITES HICKSHI, n. sp. Plate XVI, figs. 14, 14 a.

Description.—Left valve very small, convex, subcircular, higher than long. Umbo low, sharp, direct, incurved, and extending somewhat above the hinge-line. Hinge-line more than half the length of the shell. Anterior wing (probably short) broad, triangular, defined by a straight, steep, oblique line from the umbo.

¹ 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.,' Band ix, pt. 3, p. 21, pl. i, fig. 10.

² 1885, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. xi, p. 208, pl. xxxii, fig. 13.

Posterior wing apparently obtusely triangular, small. Lower margins probably strongly convex. Contour very gently convex, becoming perpendicular or even rather excavate above the lines which bound the wings. Surface microscopically marked by crowded, regular, elevated, distant concentric threads, and similar but less regular and distinct radiating lines, and with a few transverse striæ on the front wing.

Size.—The specimens are too defective for measurement.

Localities.—A specimen from Bradford is in the Barnstaple Athenæum; and a very doubtful one from Pilton in the Porter Collection. One from the lane between Wrafton and Heanton, and another from Upcott Arch Quarry, are in my Collection.

Remarks.—This is another little species, of the nature of which we have at present very imperfect information. There seems no doubt that it is quite distinguishable from *Pl. Piltonensis*, but I am not so certain whether *Pl. lepis* may not prove to be a synonym of it. The fine concentric ornament is very characteristic, and appears to be different from that on the adjacent species.

Affinities.—The right valve of *Pecten perobliquus*, F. A. Römer,¹ comes very near, but seems to differ in being shorter and much more oblique.

Pleuromectites devonicus, Frech,² is closely approximate, with an exactly similar ornament, but having a smaller and radiated front wing and a rounder umbo. Its front wing seems nearer an equilateral triangle in shape, and the front margin is consequently more indented. It also appears to be a more globose shell.

3. Genus—PERNOPECTEN, Winchell, 1865.

This genus is regarded by Zittel as a section of *Crenipecten*. Hall³ refers to it the Palæozoic (if not also the Jurassic) species of *Entolium*, Meek; and shows that, if identical, it has a priority of a few months over the latter.

Its hinge-line is described as straight, but in the type specimen as figured by Hall the wings protrude upward at least as much as in the shell described below.

1. PERNOPECTEN INSPIRATUS, n. sp. Plate XVII, fig. 5.

Description.—Shell small, flat, nearly equilateral, subcircular; umbo flat, low, slightly anterior, small, rounded. Wings subequal, protruding to a moderate height

¹ 1850, F. A. Römer, 'Beitr. Harzgeb.', pt. i, p. 48, pl. viii, fig. 4.

² 1891, Frech, 'Abhandl. Geol. Specialk. Preuss.', Band ix, pt. 3, p. 13, pl. xvii, figs. 8, 8A.

³ 1885, Hall, 'Pal. N. Y.', vol. v, pt. 1, sect. ii, p. lvii, woodcuts 1—3.

above each side of umbo, subtriangular. Hinge-margin less than half the length of the shell, with two deep internal ridges extending obliquely downwards three quarters of its length. Margins subcircular. Contour flat, the umbonal area being defined in front by a slightly curved line, and behind by a strong straight depression, extending to the centre of the posterior margin. Surface (?).

Size.—Height 16 mm., length 16 mm.

Locality.—One specimen from Top Orchard is in the Barnstaple Athenæum.

Remarks.—The only specimen of this shell with which I am at present acquainted is so indistinct that I at first omitted it from the plates, but further examination convinced me that it has protruding wings in the style of *Amussium*, and is therefore generically distinct from the other specimens with which I supposed it associated. These wings are lower and rounder than is usual in the species that have been referred to the genus *Entolium*, and its slightly inequilateral shape seems to distinguish it from most of the Belgian Carboniferous forms.

I am not aware that any other species of the genus has hitherto been described from Devonian rocks.

4. PROTHYRIS,¹ sp. Plate XVII, fig. 6.

Description.—Shell moderate in size, ensiform, very elongate, its length being about three times its height. Anterior margin apparently rounded and notched. Inferior margin very long and straight, and nearly parallel to the upper margin, the shell being slightly higher in front than behind. Posterior margin apparently gaping. Umbo low, rounded, situated at or about the anterior fifth of the shell. Surface marked with rather few close, low, rounded growth-lines, most visible in the marginal half, and with eight or ten rather strong, unequally distant, linear, oblique, impressed rays running from behind the umbo to the posterior fourth of the inferior margin. Post-cardinal slope apparently narrow, flat, oblique, and marked by a few much stronger radiating ridges.

Size.—Height 10 mm., length 30 mm.

Locality.—Two specimens are in my Collection from Sloly Quarry.

Remarks.—These specimens are interesting from the clearness of their peculiar ornament. They are too imperfect for identification, but one of them appears to show the characteristic notch of the genus, though in a much-injured condition. Both in size, shape, and ornament they seem so different from either of the species described above that I think they will prove distinct from any of them.

¹ See page 86.

MOLLUSCOIDEA.

1. CLASS—BRACHIOPODA, *Duméril*, 1806.

1. ORDER—ARTICULATA, *Deshayes*, 1836.

I. Family—TEREBRATULIDÆ, *King*, 1846.

1. Genus—RENSSELLÆRIA, *Hall*, 1859.

1. RENSSELLÆRIA ? FORMOSA, n. sp. Plate XVII, figs. 7—9.

Description.—Dorsal (?) valve elongate, convex, suboval, without a fold. Surface covered by about twenty low, close-set, flatly rounded ribs, which do not divaricate, but gradually increase in size from the umbo to the margins. Two lofty median septa, continued a short distance forward from the umbo, subparallel and not united, possibly supporting the hinge-plate, and surrounded by a low ovoid ridge, which starts near the umbo, and, passing just in front of them, may perhaps define a muscular area. Dental sockets lateral, triangular. Shell-structure very minutely and regularly punctate.

Size.—A slightly crushed valve is 26 mm. long, by 16 mm. wide, and 7 mm. deep.

Localities.—Four specimens from Ashford Strand are in my Collection, and two from Pilton and Poleshill in the Porter Collection.

Remarks.—These specimens are all more or less imperfect. The first one discovered (fig. 7) had assumed almost the exact shape and appearance of *Tropidoleptus carinatus* (Conrad), and consequently I catalogued it as that shell. Further examination, and comparisons on the one hand with our Ashford specimens, and on the other with Davidson's figured specimens of *T. carinatus*, and with German specimens kindly lent me by Mr. Upfield Green, have proved that its umbonal arrangements agree with the former and not with the latter, and that the specimen owes its peculiar shape to excessive distortion. It therefore is proved not to be *T. carinatus*, and that species does not occur in the Pilton Beds.

The best of my specimens from Ashford appears to afford considerable information about this species, which is evidently beautiful and interesting, but perplexing withal. Externally it might well be referred to *Renssellæria*, but I cannot satisfactorily correlate what is seen of the internal details with those given by Hall for his

genus. The pores of the surface suggest its affinity to the *Terebratulidæ* or to *Retzia*. The cast (fig. 8 a) shows two short, deep, close, but unconnected subparallel fissures; on each side of these are shallow, slightly curved grooves, starting close to the apex, and meeting each other just in front of the fissures, so as to form a small ovoid fossula, which perhaps defines the muscle region; again on each side of this lie rather deep oblique fissures, which seem to be the moulds of the walls of the triangular dental sockets. These features do not tally with those of German specimens of *R. stringiceps* shown me by Mr. Upfield Green, nor do they seem as if they would be consistent with the structures described by Hall, even in an immature state. On the other hand, I am inclined to think that the shell is most likely to be allied to *Renssellæria* or *Trigeria*, which it appears strongly to resemble in outward form and some other points. Consequently, as enough is not yet known about it to give a generic definition, it seems best to leave it provisionally under *Renssellæria*; observing, however, that it appears to me most probable that it will be found to require a new generic name when better specimens have been discovered.

Affinities.—*R. stringiceps*, F. Römer,¹ differs in having much finer and more numerous ribs, *i. e.* forty instead of twenty. The Ilfracombe shell which Davidson² refers to that species is further distinguished by its constant divarication of ribs. Again, the ribs of all the American forms given by Hall and Clarke are much finer and more numerous.

R. crassicosta, Kock,³ appears to have the same number of ribs, but, judging from the figures, the ribs are loftier, and the shell much more globose. There is, perhaps, still greater external resemblance in *Centronella (Trigeria) Guerangeri*, Verneuil, sp.,⁴ but that is a much smaller shell.

II. Family—SPIRIFERIDÆ, King, 1846.

1. Genus—ATHYRIS, M^cCoy, 1841.

1. ATHYRIS? sp. Plate XVII, fig. 10.

Remarks.—A few minute, smooth, flattish, elongate, oval shells were obtained by Mr. Porter from Pilton. In shape they appear to be peculiar, but they do not

¹ 1844, F. Römer, 'Rhein. Uebergangsgeb.,' p. 68, pl. i, figs. 6 a, b.

² 1864, Davidson, 'Brit. Foss. Brach.,' vol. iii, p. 10, pl. iv, figs. 5—7.

³ 1880, Gosselet, 'Esquisse Géol.,' vol. i, pl. i, fig. 20; 1881, Kock, 'Jahrb. f. Min.,' vol. ii, p. 387; and 1883, Kayser, 'Jahrb. Preuss. L. A.,' p. 123, pl. v, figs. 2—5.

⁴ 1883, Ehlert, 'Bull. Soc. Étud. Sci. Angers' (1883), p. 59, pl. i, figs. 1—11; and pl. ii, figs. 1—6.

show sufficient character to enable us to judge whether they are the young of some larger species, or one of those small Brachiopods which cannot be satisfactorily identified without some knowledge of their internal structure.

Sub-genus—SEMINULA, M'Coy, 1844; emend., Hall and Clarke, 1894.

2. ATHYRIS (SEMINULA) OBLONGA, Sowerby, sp. Plate XVII, figs. 11, 11 *a*, 12 ? 12 *a*.

1840. ATRYPA OBLONGA, Sowerby. Geol. Trans., ser. 2, vol. v, pt. 3, pl. liii, fig. 6.

? 1840. — INDENTATA, Sowerby. Ibid., pl. liv, fig. 6.

1864. ATHYRIS ?, Davidson. Brit. Foss. Brach., vol. iii, p. 17, pl. iii, figs. 1, 16.

1896. ATHYRIS ? OBLONGA, Whidborne. Proc. Geol. Assoc., vol. xiv, p. 375.

Description.—Shell slightly pentahedral (or suborbicular), subglobose. Ventral valve the larger; beak prominent, with short dental lamellæ; muscle-scars apparently very short and wide. Dorsal valve with very small dental sockets; muscle-scars short, cylindrical, and very narrow; hinge-plate broad, anteriorly straight. Cast of both valves covered with vascular impressions. Fold and sinus apparently only marginal, low, and not very broad. Surface quite smooth, but with four or five growth-ridges. Margins meeting in an arching line, the ventral valve being thrown back at the shoulders and then advancing to the front.

Size.—Length 19 mm., width 19 mm., depth 10 mm.

Localities.—Ashford Strand, Laticosta Cave Baggy, Saunton, Poleshill, Roborough, &c.

Remarks.—An internal cast with a portion of the mould of the same shell is in my Collection, and from this specimen the above description has been almost entirely taken. Judging from Hall and Clarke's revision of the *Athyridæ* this shell clearly falls within the limits of the sub-genus *Seminula* of M'Coy,¹ of which they² say that its smooth exterior, its subpentahedral form, its sinuate valves, and the peculiar character of its muscle-scars are distinctive features, and that branching vascular sinuses are sometimes retained over the whole pallial area of both valves. In our specimen all these points are observable, though its fold and sinus are very indistinct. Similar specimens seem not uncommon at Ashford, and a bed close to the Laticosta bed at Baggy is paved with valves, which from their shape and smoothness (excepting their few growth-lines) are undoubtedly identical. I have

¹ 1844, M'Coy, 'Synopsis Carb. Foss. Ireland,' p. 158.

² 1894, Hall and Clarke, 'Pal. N. Y.,' vol. viii, pt. 2, p. 93.

also met with about twenty very similar casts in various collections, which appear to be indistinguishable, and which generally show more or less distinctly such points as the vascular sinuses, the subpentahedral shape, and the marginal fold, which rarely seems to be at all strong. With such unsatisfactory material it is of course difficult in many cases to be sure of specific identity; for instance, the type of *Atrypa oblonga*, Sowerby, in the museum of the Geological Society is extremely obscure, and I long hesitated between identifying it with the above specimens, or with those referred below to *Cleiothyris Royssii*. Its oblong shape is, I think, evidently only due to distortion, but the character of the fold and the size of the dental sockets agree best with the present shell. Moreover Sowerby describes it as "smooth," as are also our specimens. But while, therefore, we may conclude that it belongs, and consequently gives its name, to the species now under consideration, we may note that it is not in itself an exponent of its specific value.

For some time it seemed to me possible that our shell might belong to *Athyris concentrica*, von Buch, but having examined some casts from the Lower Devonian of Germany which Mr. Upfield Green informs me belong to that species, I find them to be entirely different and distinct.

The shape of our shell seems different from any of the various English Carboniferous forms of *Seminula*.

Sub-genus—CLEIOTHYRIS, King, 1850; emend., Hall and Clarke, 1894.

3. ATHYRIS (CLEIOTHYRIS) ROYSSII, *Léveillé*. Plate XVII, figs. 13—15a; Plate XVIII, figs. 1—5; and Plate XX, figs. 1, 2.

1835. SPIRIFER DE-ROYSSII, *Léveillé*. Mém. Soc. Géol. Fr., vol. ii, figs. 18—20.
 1840. ATRYPA HISPIDA, *Sowerby*. Geol. Trans., ser. 2, vol. v, pt. 3, pl. liv, fig. 4.
 1840. — DECUSSATA, *Sowerby*. Ibid., pl. liv, fig. 5.
 ? 1841. SPIRIFERA DECUSSATA, *Phillips*. Pal. Foss., p. 70, pl. xxviii, figs. 120 b—e.
 1844. ATHYRIS DECUSSATA, *M'Coy*. Syn. Carb. Foss. Irel., p. 147.
 1844. — DEPRESSA, *M'Coy*. Ibid., p. 147, pl. xviii, fig. 7.
 1844. — HISPIDA, *M'Coy*. Ibid., p. 148.
 1855. — CONCENTRICA, *M'Coy* (pars). Brit. Pal. Foss., p. 378.
 1861. — ROYSSII, *Davidson*. Brit. Foss. Brach., vol. ii, pt. 5, p. 84, pl. xviii, figs. 1—11.
 1864. TEREBRATULA ELONGATA?, *Davidson*. Ibid., vol. iii, p. 8, pl. i, fig. 9.
 1864. ATHYRIS CONCENTRICA, *Davidson* (pars). Ibid., vol. iii, p. 14, pl. iii, figs. 15 (?), 17 (?), 24 (?) (only).
 1864. — sp., *Davidson*. Ibid., pl. iv, figs. 1—3.

1877. SPIRIGERA ROISSYI, *Gosselet*. *Ann. Soc. Géol. Nord*, vol. iv, p. 313.

1896. ATHYRIS? CONCENTRICA and RUGULOSA, *Whidborne*. *Proc. Geol. Assoc.*, vol. xiv, p. 375.

Description.—Shell, in the young state, transverse, flattish, with the ventral valve flattest, without fold or sinus. Ventral valve with small, deep adductor scars, and diffuse diductors. Dorsal valve with a central septum, thickened posteriorly, supporting a broad recurved hinge-plate, which seems to intrude into the beak, and the anterior corners of which support the short crura. Musclescarring paired, each pair being elongate and narrow, while a small internal visceral foramen is seen just in front of the adductors. Spires consisting of about nine whorls, and filling the whole cavity of the shell. Surface covered with very numerous concentric ridges, which are often paired, and appear generally smooth, but sometimes show signs of spiniferous elongations.

Shell, in the older state, becoming large, and sometimes very transverse, with a narrow median septum and strong dental plates. Fold broad, flatly-oval, protruding in front. Surface covered by extremely numerous lamellar striæ, which become more crowded and definitely spiniferous near the margins.

Size.—Large distorted fragments measure 30 mm.

Localities.—Very common in most localities, e. g. Upcott Arch, Croyde Bay, Ashhill Quarry, Braunton Down, Incheldon, Pouch Bridge, Roborough, Poleshill, South Petherwyn.

Specimens figured by Davidson as *Terebratula elongata*, Schlotheim? and as *Athyris concentrica*, von Buch?, are in the Museum of Practical Geology; and others by Sowerby, as *Atrypa hispida* and *A. decussata*, are in the Woodwardian Museum.

Remarks.—Two forms, both of which are not uncommon in the Pilton Beds, appear to be the young and old states of the same species, and are united by some intermediate but less distinct examples.

(1) We have, first, small, flat, transverse casts, which are wide-spread and common (Pl. XVIII, figs. 1—3), and have been figured by Davidson as "*Athyris*, sp. ? supposed to belong to *A. concentrica*." In these many internal details may be seen. In one specimen (Pl. XVII, fig. 15) the beginnings of the crura are preserved. The muscular scars and the spires are occasionally shown, and as the casts often occur in their moulds we can learn also the surface-ornament. This ornament generally seems to consist of smooth concentric ridges, but in some of the specimens these ridges are seen to be spiniferous, exactly corresponding with *A. hispida*, Sowerby, from South Petherwyn, so that there is no doubt that that species is identical with the present. *A. decussata*, Sowerby, is another South Petherwyn shell, which Sowerby also quotes from Barnstaple, and as his figure shows a similar ornament, it is doubtless only another example of the same

species in a rather more advanced stage of growth. It may be compared with Pl. XVII, fig. 15.

With regard to these shells, however, it must be noted that it seems difficult to correlate their internal arrangements with those of *Athyris*. They agree in the small opening of the visceral canal in front of the muscle-scars; but there appear differences in the absence of defined ovoid dental sockets, in the strength of the median septum, and in the hinge-plate being apparently produced and curving forward into the beak. Possibly these structures may be due to the immaturity of the shell. They perhaps agree best with those of the sub-genus *Seminula*, as limited by Hall and Clarke,¹ but according to them that group has a smooth exterior, while judging from the surface the present shell would fall within the sub-genus *Cleiothyris* as defined by them.²

(2) There are also frequently found, though almost always in an extremely crushed and distorted condition, much larger shells, which I formerly believed to belong to a distinct species. These show a broad flattened fold, and a surface of imbricated concentric lines, which appear very similar to those of the smaller form in the central parts, but which become closer and very definitely fringed and spinous marginally (Pl. XX, figs. 1 and 2). In one slab of these moulds in the Barnstaple Athenæum is a cast (the mould of which definitely shows the same surface-ornament) which is identically similar to the cast figured by Davidson as "*Terebratula elongata*, Schlotheim?," and therefore that name must be removed from our Devonian lists, as in them it is evidently only synonymous with that of the present shell. This cast bears much resemblance to the cast of *Athyris lamellosa* figured by Hall and Clarke.³

The question now arises whether this Devonshire species is identical with any previously described form. M'Coy unites it with *A. concentrica*, von Buch, and in this he is in part followed by Davidson. The character of the surface, however, seems clearly to negative this. Very indistinct radiations on the ridges of *A. concentrica* are certainly mentioned by von Buch⁴ and M'Coy, but do not seem to break their continuity; and M'Coy, when identifying Sowerby's shell with it, asserts that "the decussation, to which Sowerby alluded, is only produced by the decomposition of certain of the concentric laminae, according with their original fibrous texture, and is not visible in sound specimens." But the evidence of our larger specimens distinctly disproves this assertion. In several of them the rows of puncta on the ridges (as seen in the mould) are much too definite to be explained in any such way; while in one or two (Pl. XX, fig. 1), where the surface is

¹ 1894, Hall and Clarke, 'Pal. N. Y.', vol. viii, pt. 2, p. 93.

² Ibid., p. 90.

³ Ibid., pl. xlvi, fig. 20.

⁴ 1834, von Buch, 'Über Terebrat.', p. 103.

broken off aslant, rows of fine comb-like spines like those of *Athyris Royssii* are distinctly visible. Now Gosselet and Hall (for instance) distinguish *A. concentrica* by its want of such spines, and that seems to be the general character of the shells that are recognised as belonging to that species. Hence we may certainly conclude that our shell is not *A. concentrica*, but some species of the sub-genus *Cleiothyris* to which *A. Royssii* belongs.

From the great distortion of the specimens, and their preservation only as moulds, it is not easy to compare it with Carboniferous examples of *A. Royssii*. It seems, perhaps, to differ in the spines being generally smaller, and the striæ being more numerous and becoming more crowded marginally; but it evidently itself varies in these points, and *A. Royssii* must have been equally variable, as Davidson says that he has counted eighty striæ on a moderately sized specimen, whereas those he figured must have had fewer. The figure of the Irish *A. depressa*, M'Coy, which Davidson identifies with *A. Royssii*, appears almost exactly like our shells; and Gosselet records *A. Royssii* from the Famennian of Belgium, with which Dr. Barrois, in his visit to Devonshire last summer (1896), classed the Pilton Beds. Therefore, though I formerly thought that the larger specimens of our shells might be distinguished, I feel now no difficulty in regarding them as *A. Royssii*, though possibly they may prove to be a local variety of it.

Affinities.—*Athyris reticulata*, Gosselet,¹ is said to be distinguished from *A. Royssii* by its smaller size, and by its width being greater than its length. In these respects it may not differ from our shell, but it may perhaps have had a stronger and more angular fold.

2. Genus—SPIRIFERA, Sowerby, 1815.

1. SPIRIFERA MICROGEMMA, Phillips. Plate XVIII, figs. 7, 7 a, 8.

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| 1841. | SPIRIFERA MICROGEMMA, Phillips. | Pal. Foss., p. 68, pl. xxvii, figs. 116 a, b. |
| 1864. | — LINEATA ?, Davidson (pars). | Brit. Foss. Brach., vol. iii, p. 43,
pl. iv, fig. 16 (only). |
| 1882. | — — — | Ibid., vol. v, p. 32, pl. ii, figs. 5, 5 a. |
| 1896. | — — — | Whidborne. Proc. Geol. Assoc., vol. xiv, p. 375. |

Localities.—In the Porter Collection are six specimens from Pilton and one from Roborough; in the Barnstaple Athenæum two from Upcott, one from Top Orchard, and one from Vicarage Well; in the Woodwardian Museum one from Barnstaple.

Remarks.—Davidson seemed inclined to regard *Sp. microgemma*, Phillips, as

¹ 1877, Gosselet, 'Ann. Soc. Géol. Nord,' vol. iv, p. 312, pl. iii, fig. 3.

identical with *Sp. lineata*, Martin, sp., but left the question undecided. Under *Sp. lineata* he included as varieties *Sp. elliptica*, Phillips,¹ and *Sp. imbricata*, Sowerby,² sp., but afterwards separated the latter on account of the different shape of its spirals. An examination of a large series of Carboniferous specimens of the above shells shows that in them the fold and sinus are generally absent, are very rarely clearly marked, and never deflect the transverse ridges. Waagen concludes from Davidson's description that dental plates are absent, though they are certainly mentioned by M'Coy.³

Our Pilton specimens are with two exceptions much distorted, and none show the ornament except under the aspect of a mould. They all have definite signs of a fold and sinus, which frequently deflect the transverse striæ; their transverse ridges are few and coarse, being not more than fifteen or twenty; their spines are just visible to the naked eye. One cast shows short but evident arching dental plates. In another the spines are seen to be bicanaliculate (as described by Davidson in a Carboniferous shell). Those specimens which seem to be least distorted are slightly transverse, and the curvature of the front margins somewhat approaches a semicircle. Hence it appears that they constitute a form which does not seem to vary much, and which differs considerably from the general run of Carboniferous forms, but most nearly approaches *Sp. imbricata*. Whether the difference should be regarded as of specific or only varietal value remains yet to be decided; but if *Sp. imbricata* be distinct from *Sp. lineata*, the presumption is that the present form is equally distinguishable from each of them, and therefore it seems preferable to resume, at least provisionally, Phillips's specific name.

2. SPIRIFERA VERNEULLII, *Murchison*. Plate XVIII, figs. 9—13 *a*.

1840. SPIRIFER VERNEULLI, *Murchison*. Bull. Soc. Géol. Fr., vol. xi, p. 252, pl. ii, figs. 3 *a—e*.
 1840. — LONSDALII, *Murchison*. Ibid., p. 251, pl. ii, figs. 2 *a—c*.
 1840. — ARCHIACI, *Murchison*. Ibid., p. 252, pl. ii, figs. 4 *a—c*.
 1858. — — *Pacht*. Baer and Helmeren's Beitr. Russ. Reiches, Band xxi, p. 95.
 1864. SPIRIFERA DISJUNCTA, *Davidson*. Brit. Foss. Brach., vol. iii, p. 23, pl. v, figs. 1—12; and pl. vi, figs. 1—5.
 1868. SPIRIFER DISJUNCTUS, *Dames*. Zeitsch. Deutsch. Geol. Gesell., vol. xx, p. 494.

¹ 1836, Phillips, 'Geol. Yorks.,' pt. 2, p. 219, pl. x, fig. 16.

² 1822, Sowerby, 'Min. Conch.,' vol. iv, pl. cccxxxiv, fig. 3.

³ 1855, M'Coy, 'Brit. Pal. Foss.,' p. 429.

1871. SPIRIFER VERNEULI, *Kayser*. Ibid., vol. xxiii, p. 587.
 1881. SPIRIFERA VERNEULII, *Davidson*. Brit. Foss. Brach., vol. iv, p. 339,
 pl. xxxviii, figs. 9—14.
 1882. — — — — — Ibid., vol. v, p. 35, pl. ii, fig. 1.
 1882. SPIRIFER VERNEULI, *Barrois*. Mém. Soc. Géol. Nord, vol. ii, p. 257, pl. x,
 figs. 7 a—d.
 1886. — DISJUNCTUS,¹ *Wenjukoff*. Fauna Dev. Syst. N.-W. und Cent.
 Russl., p. 64, pl. iii, figs. 1—7;
 and pl. iv, figs. 1—4.
 1894. — VERNEULI, *Gosselet*. Mém. Soc. Géol. Nord, vol. iv, p. 1,
 pls. i—v; pl. vi, figs. 58, 59.
 1894. — DISJUNCTUS, *Hall and Clarke*. Pal. N. Y., vol. viii, pt. 2, p. 24.

Localities.—Pilton, Ashford Strand, Orchard House Pilton, Goodleigh, Top Orchard, Croyde Bay, Tutshill, Roborough, Shirwell, Saunton, Braunton, Bradiford, Hagley Bridge, one mile south of Wiveliscombe, Luscott Barton, Poleshill, Kingdon's Shirwell, Laticosta Cave Croyde, Upcott Arch, Pouch Bridge, Rock Inn Quarry (near Wiveliscombe), Camelford, Tintagel, South Petherwyn. It is one of the most frequent Brachiopods of the Pilton Beds. In the Woodwardian Museum is a specimen from the Lingula-zone of Sloly.

Size.—The largest specimen I have seen is more than eight inches in width.

Remarks.—Davidson regarded all the Spirifers from the Pilton Beds, which have numerous plaits on the fold, as belonging to *Sp. Verneulii*, with which he united *Sp. Archiaci*, *Lonsdalii*, *Murchisoniana*,² and *Barumensis*, as well as the various forms described by Phillips and by Sowerby from these beds. More lately, however, he appears to have expressed an opinion that *Sp. Barumensis* was distinct. It would appear that he was at one time inclined not only to separate *Sp. Murchisoniana* specifically, but to refer it to *Cyrtia*, a genus which afterwards he declined to recognise.

Sp. Verneulii is defined by Gosselet as covered with numerous fine ribs from margin to beak, those of the fold and sinus bifurcating, but those of the wings being always simple (and thereby differing from *Sp. striata*). On the latter character he lays much stress, stating that among Belgian species it is only shared by *Sp. Orbeliana*, which he distinguishes by the slightly convex centre of its sinus and the trapezoidal form of its "languette." *Sp. aperturata*, Schlotheim, he defines as having the lateral ribs narrower than the intervening furrows, and occasionally though rarely bifurcating.

Whether our Pilton fossils all belong to the present species is a question by no means easy to decide. Being almost always distorted and imperfectly preserved, it is most difficult to say whether any lines of distinction can be drawn between

¹ Grouped with *Sp. Verneuli*, *Sp. Archiaci*, *Sp. tenticulum*, and *Sp. Brodi*.

² 1845, Murchison, von Keyserling, and de Verneuil, 'Geol. Russia,' vol. ii, p. 160, pl. 4, figs. 1 a—d.

the multitudinous examples preserved in different collections, though they evidently vary very greatly. Three lines of variation are apparent in them. (1) The area is sometimes narrow and concave, as in the type; and sometimes extremely broad and flat, as in the form *Sp. Barumensis*, Salter, MS., of which examples are found in which the area is much higher than wide, and the umbo hardly if at all incurved. (2) The dental plates are sometimes short and sometimes extremely large and massive, extending almost to the front of the ventral valve. (3) The minute ornament of the shell (which is rarely preserved) is seen sometimes (in specimens from Ashford Strand) to be fine transverse lines, sometimes (in specimens from Ashford Strand) fine longitudinal lines, and sometimes (in specimens from Snapper Quarry) coarse, concentric, irregularly arching rows of pores. It appeared to me at one time that these variations might indicate specific differences, but the examination of foreign specimens does not seem to support this idea.

With regard to the first point, the very numerous figures given by Gosselet show very great variation in the size of the area, though perhaps hardly as great as is seen in the North Devon shells. Moreover in the latter I observe that there does not seem any distinct demarcation to be drawn between shells with narrow areas and those with broad, and that both varieties occur of all sizes. In none of our specimens have I seen any indication of a foramen.

With regard to the second point, the dental plates appear to be most developed in large shells with broad areas, but in smaller specimens with broad areas they are sometimes very short; while Davidson has figured a small specimen with a narrow area from Budleigh Salterton in which these plates are exceedingly developed. It is to be noted that Hall describes them as being inconsiderable in his *Aperturati*-group (which includes *Sp. Verneuilii*) except in a few shells, which he separates from the "*disjunctus*-type" under the name of the "*Hungerfordi*-type." He, however, states them to be very differently developed in shells of adjacent external form.

With regard to the third point, at first sight it appears to be impossible to reconcile the three variations of minute ornament given above. Davidson states that the surface is covered by numerous fine contiguous concentric lines. Gosselet figures one specimen with similar concentric lines, while he figures *Cyrtia Murchisoniana* with fine longitudinal lines. In our specimens I find that these two classes of ornament certainly occur together, though where one is prominent the other is almost obliterated. Few of the Continental specimens I have examined show the minute characters. In specimens of *Sp. Lonsdalii* three coarse longitudinal lines are seen on each rib, as originally described; and in Murchison, von Keyserling, and de Verneuil's 'Russia,' a specimen of *Sp. Archiaci* is figured with an irregular spinous ornament. But in the British Museum is a very large series of Spirifers from China, some of which are referred to *Sp. Verneuilii* (one being so labelled in the Davidson Collection, along with a specimen exactly

similar in ornament from Chimay, in Belgium), while others are referred to *Cyrtia Murchisoniana* (one of these being the figured Chinese specimen¹ of it). While the extreme forms of these shells seem perfectly distinct, I have failed to find any definite line of specific division between them. Though they vary much in shape, some being longer, more ovoid shells, and having a shorter hinge-line than any European forms, they may be traced without break into the ordinary forms of the shell, and even on to those alate forms with produced wings. Their styles of minute ornament, which is often perfectly preserved, are not constant to particular shapes, though in the elongate form, in which a foramen is sometimes seen, this minor ornament generally consists of fine longitudinal threads, and in the broad form generally of transverse lines or of coarser longitudinal threads irregularly broken into spines,—similar, in fact, to the Russian figure,—and thus approaches the texture seen in our specimens from Snapper Quarry. In the Museum of Practical Geology is a specimen from South Petherwyn with the same structure as these Snapper specimens, which have narrow areas. That shell has a large flattish receding area, and a slightly incurved umbo, and evidently falls within the variety *Sp. Barumensis*. Lastly, in the Woodwardian Museum is a slab from South Petherwyn, with three specimens, which show transverse rows of punctations with a tendency to run into longitudinal lines, thus connecting our two figured examples from Ashford and Snapper; and, moreover, the ornament in these three specimens is of three different degrees of coarseness, intermediate between those of the two last-mentioned shells.

It would thus appear—

(1) That the various styles of ornament here described are not inconsistent with each other, and may all belong to *Sp. Verneuilii*, and consequently that *Sp. Verneuilii* is as variable in ornament as in shape.

(2) That though it is still possible that more than one species may be included under this name, there is no evidence of this from our Devonshire specimens; even the form *Sp. Barumensis*, distinctive as it sometimes seems, does not appear to have any definite characters for its separation.

(3) That the variations of *Sp. Verneuilii* are remarkably great. It might possibly be described as “a species in process of solution.” While I venture to think that the difficulties to certain developments of evolutionary theories which are in vogue at present may ultimately be found to be insurmountable, we may say that if species have changed at all it is probable that there were times when the forces of variation were especially active. Every now and then we meet with a species which is so variable that it seems impossible to say whether it is one or a collection of forms. This may be a permanent state, or it may be the crisis in its life-history where it is breaking up into a number of new species. The variations in

¹ Davidson, ‘Quart. Journ. Geol. Soc.’ vol. ix, 1853, p. 355, pl. xv, figs. 6—9.

Sp. Verneuilii are so great and intermingled that it may be in that transition stage.

(4) That some of the shapes of *Sp. Verneuilii* might from external ornament be placed under the genus *Cyrtia*. What is known of the internal arrangements of these shells does not separate them from *Spirifera*, and the size and flatness of their area are certainly not a sufficient reason for doing so. What, therefore, the genus *Cyrtia* may be worth must depend on structures not seen in our English specimens. These shells also resemble some species of *Syringothyris*—e. g. *S. cuspidata*—externally, but distinctly differ from them internally.

3. SPIRIFERA OBLITERATA, *Phillips*. Plate XIX, figs. 1—4*a*.

- ? 1840. SPIRIFER BOUCHARDI, *Murchison*. Bull. Soc. Géol. Fr., vol. xi, p. 253,
pl. ii, figs. 5*a*—*c*.
1841. SPIRIFERA OBLITERATA, *Phillips*. Pal. Foss., p. 78, pl. xxxi, fig. 135.
1896. — — — *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Shell very transverse, fusiform, alate. Hinge-line very long, marked in the cast with crenulations. Cardinal angles very acute. Beak small, incurved. Ventral valve with a narrow sinus, bisected by an elevated line, and dorsal valve with a low narrow fold bisected by a median groove. Dental plates short. Lateral ribs low, rounded, five or more in number (sometimes numerous), gradually decreasing in size, and becoming faint or evanescent on the wings. Ovarian area strongly pitted.

Size.—Height of dorsal valve 9 mm.; width 26 mm.

Localities.—In the Museum of Practical Geology is Phillips's type specimen of *Sp. obliterated* from Brushford; in the Barnstaple Athenæum is a specimen from Top Orchard; in Mr. Hamling's Collection one from Top Orchard; in my Collection four from Ashhill Quarry near Brushford, and two from near the Kiln, Croyde Bay.

Remarks.—Phillips's specimen, being on a slab with other fossils, was unobserved at the time that Davidson described the Devonian Brachiopoda. It has since been recognised, and proves to belong to a definite species of which several other examples have occurred in the Pilton Beds. This specimen is in poor condition, and may perhaps have been slightly shortened by pressure. The usual shape of the species appears to be still more transverse. It seems to be distinguished by its small, narrow, undefined fold and sinus, and by its low rounded ribs, which seem to vary considerably in number, to be broad and prominent near the centre, and to diminish rapidly and regularly toward the sides, so that the wings sometimes appear almost smooth. The fold is very undefined;

it is difficult to say from our specimens how many of the central ribs should be counted as belonging to it.

I am inclined to think it possible that this form may be only a variety of *Sp. Bouchardi*, Murchison. In Murchison's figure the ribs seem stronger and more numerous (those on each side of the sinus being very strong), and the transverse lineation stronger and more regular. These slight differences may, however, partly be explained by the better state of preservation of Murchison's specimen. Moreover our Devonshire shells, none of which are sufficiently well preserved to show the transverse ornament clearly, display much variation in the number of the ribs and other points. On the other hand, specimens of *Sp. Bouchardi* from Ferques in the Davidson Collection are less like them, and all appear to differ in their more angular shape, their definite folds, and their very strong lineations.

Phillips regarded *Sp. obliterated* as allied to *Sp. speciosa*, Schlotheim;¹ but Dr. Barrois, to whom I have shown a photograph of it, sees no reason for supposing it identical. It seems to be distinguished from that species, and from its ally or variety *Sp. paradoxa*, Schlotheim,² by the bifurcation of its fold and sinus, and the more definite grading of its ribs.

Sp. mucronata, Conrad, as given by Sandberger,³ and *Sp. phalæna*, Sandberger,⁴ seem to be less transverse, and to have stronger and more equal ribs.

4. SPIRIFERA (MARTINIA ?) URIL, Fleming. Plate XIX, figs. 5—7.

1828. SPIRIFERA URIL, Fleming. Brit. Anim., p. 376.
 1840. ATRYPA UNGUICULUS, Sowerby. Geol. Trans., ser. 2, vol. v, pt. 3, pl. liv, fig. 8.
 1841. SPIRIFERA UNGUICULUS, Phillips. Pal. Foss., p. 69, pl. xxviii, figs. 119 a—f.
 1864. — URIL, Davidson. Brit. Foss. Brach., vol. iii, p. 41, pl. iv, figs. 25—28.
 1884. — (MARTINIA ?) URIL, Davidson. Brit. Foss. Brach., vol. v, p. 418.

Localities.—Croyde, Braunton, Petherwyn, Top Orchard, Bradiford, Vicarage Well Pilton, Frankmarsh, Upcott Arch Quarry, Ashhill Quarry, Wrafton Lane, &c.

Size.—Height about 9 mm.; width about 13 mm.

Remarks.—This is a very common and characteristic species. From Devon-

¹ 1813, Schlotheim, 'Taschenbuch f. Mineral.,' vol. vii, p. 52, pl. ii, fig. 9.

² Ibid., p. 28, pl. ii, fig. 6.

³ 1889, F. Sandberger, 'Entw. Unter-Abtheil. Dev. Systems Nassau,' p. 104, pl. iii, fig. 2.

⁴ Ibid., p. 105, pl. iii, figs. 3, 3 a.

shire it was first described under the name *Atrypa unguiculus*, Sowerby, but was united to the Carboniferous *Sp. Urvii* by Davidson, and no doubt correctly so.

The muscle-scars seen in some of our specimens are long and very narrow, and there are no dental plates or median septum. Thus they appear to fall within the group *Martinia*, to which Davidson doubtfully referred them, though they certainly bear in some aspects a resemblance to *Ambocœlia*, the value of which cannot be measured until the spires are discovered. None of our specimens show the surface, but Davidson has figured a Carboniferous example with numerous coarse spines.

In size the Devonian fossils somewhat exceed the dimensions of the Carboniferous shell as given by Davidson.

Affinities.—This species seems widely different from the Lummaton *Sp. infima*, mihi,¹ which I suspect belongs to *Ambocœlia*.

I think also that Holzapfel² is right in separating it from *Sp. inflata*, Schnur,³ which was joined with it by Kayser;⁴ though my strong impression is that both the shells he figures under that name should be referred to other species.

5. SPIRIFERA MESOMALA, *Phillips*. Plate XIX, figs, 8, 9 ? 9 a ? 9 b ?

1841. SPIRIFERA MESOMALA, *Phillips*. Pal. Foss., p. 78, pl. xxxi, fig. 137.

Description.—Shell small, moderately transverse, with apparently rounded wings. Beak moderately elevated and incurved. Ventral sinus wide, concave, with two or three indistinct lineations, not breaking its smoothness. Lateral ribs simple, prominent, rounded, distant, about ten on each side; without signs of transverse markings.

Size.—A specimen measures about 6 mm. wide.

Locality.—One specimen is in my Collection from Saunton Hotel, and one or two in Mr. Hamling's Collection from Snapper Quarry. A very imperfect specimen in Mr. Upfield Green's Collection from Sloly may belong to this species, but is perhaps more likely to be a small worn example of *Sp. Verneuilii*, var. *Barumensis*.

Remarks.—Phillips's description of his species is so incomplete that Davidson,

¹ 1893, Whidborne, 'Dev. Fauna,' vol. ii, p. 108, pl. xiii, figs. 1—3.

² 1895, Holzapfel, 'Abh. k. Preuss. Geol. Landes.,' n. s., pt. 16, p. 253, pl. xi, fig. 20 (?); and pl. xvii, fig. 6.

³ 1854, Schnur, 'Palæontographica,' vol. iii, p. 211, pl. xxxvii, fig. 2.

⁴ 1871, Kayser, 'Zeitsch. Deutsch. Geol. Gesell.,' vol. xxiii, p. 584.

not having seen an example of it, simply quoted it on Phillips's authority without expressing an opinion upon its specific value. It may prove to be only the young form of *Sp. Verneuilii*.

I have found two or three small shells which seem likely to be the same species as Phillips's, but they are insufficient to give decided evidence on the question.

The small specimen (fig. 8) from Saunton has certainly a distinctive appearance. It is a ventral valve, and looks as though it would accurately correspond with Phillips's figure of the dorsal valve.

3. Genus—SPIRIFERINA, d'Orbigny, 1847.

1. SPIRIFERINA CRISTATA (*Schlotheim*), var. OCTOPLICATA, *Sowerby*. Plate XIX, figs. 10, 11, 11 a.

1858.	SPIRIFERINA CRISTATA, var. OCTOPLICATA,	<i>Davidson</i> .	Brit. Foss. Brach., vol. ii, pt. 4, p. 38, pl. vii, figs. 37—47.
1864.	—	—	<i>Davidson</i> . ¹ Ibid., vol. iii, p. 46, pl. vi, figs. 11—15.
1895.	--	—	<i>Whidborne</i> . Proc. Geol. Assoc., vol. xiv, p. 376.

Localities.—In the Barnstaple Athenæum are specimens from Ashford Strand; in the Porter Collection from Poleshill and Pilton; in Mr. Hamling's Collection from near the Kiln, Croyde; and in my Collection from East Anstey Station, Ashford Strand, and Pouch Bridge.

Size.—A specimen measures about 21 mm. wide.

Remarks.—This is certainly the species which Davidson figured from Looe and recorded from Pilton, and it has therefore an extensive vertical range in the Devonian rocks. It is a well-characterised form. It is very transverse, with a narrow area, a much incurved beak, numerous (eleven to twenty-one) strong deep ribs, strong, regular, distant transverse lines or flounces, and a very coarsely punctated shell-structure. These puncta seem sometimes to lie in lines corresponding with the transverse lineations. Its fold and sinus are narrow and flattened, and have respectively a very slight median furrow and rib. In the

¹ In the heading of the species Davidson omits the name *octoplicata*, but supplies it at p. 123 and in the plates. Though the same divergence occurs in the lists in his last volume, it seems clear that the omission was purely accidental.

ventral valve there appears to be a median septum, which, taken together with the punctated surface, indicates that it belongs to *Spiriferina*.

The present shell is the Devonian representative of the race which includes the Silurian *Sp. elevata*, Dalman,¹ sp., and the Carboniferous and Permian *Sp. cristata* (and its variety *octoplicata*).

As given by Davidson, *Sp. elevata* has a much wider area and a less incurved beak, *Sp. sulcata*² fewer ribs and sometimes sharper wings, and *Sp. crispa*³ closer transverse lines and fewer ribs. These forms Davidson does not refer to *Spiriferina*, but retains in *Spirifera*.

On the other hand, I can see no differences whatsoever between it and his Carboniferous figures of *Sp. cristata*, var. *octoplicata*, except that the ribs seem slightly less numerous, and a minute median depression is seen on the fold. The small rib on the sinus is equally visible both in the Carboniferous and the Devonian shells. The Permian *Sp. cristata*⁴ itself has fewer ribs and a more lofty umbo. Thus it seems that the present shell is inseparable from the Carboniferous form, whatever may be its relation to the Silurian and the Permian species.

Affinities.—*Sp. Zeilleri*, Barrois,⁵ closely resembles it, and may possibly even prove identical; but its lamellæ seem fewer, and its fold not bicipitated.

In *Sp. aculeata*, Schnur,⁶ the transverse lines seem broken into long fringes instead of simply showing puncta. With regard to that shell it may be noted that Holzapfel⁷ places *Spiriferina insculpta*, Phillips, sp., as a synonym of it, so far as regards the Devonian form described by Davidson⁸ from Lummaton. Whether this Lummaton shell is separable from the Carboniferous type of *Sp. insculpta*, and whether it possesses the distinctive longitudinal lineation which exists on the lamellæ of *Sp. aculeata*, are questions I venture to think are not yet proved in the affirmative; but in any case two points have been overlooked by Herr Holzapfel, viz. (1) that the Lummaton species is a *Spiriferina*, not a *Spirifera*; and (2) that if it is not *Sp. insculpta*, Phillips, it *certainly* is *Sp. pulchella*, Sowerby.⁹ The latter point appears clearly on the examination of Sowerby's type in the museum of the Geological Society. If, therefore, Herr Holzapfel is right in

¹ 1867, Davidson, 'Brit. Foss. Brach.,' vol. iii, pt. 7, p. 95, pl. x, figs. 7—11.

² Ibid., vol. iii, pt. 7, p. 91, pl. x, figs. 4—6.

³ Ibid., vol. iii, pt. 7, p. 97, pl. x, figs. 13—15.

⁴ 1858, *ibid.*, vol. ii, p. 17, pl. i, figs. 37—40, 45, 46; and pl. ii, figs. 43—45.

⁵ 1882, Barrois, 'Mém. Soc. Géol. Nord,' vol. ii, p. 256, figs. 13, 13 a, 13 b.

⁶ 1854, Schnur, 'Palæontographica,' vol. iii, p. 203, pl. xxxiv, figs. 2 a, b.

⁷ 1895, Holzapfel, 'Abhandl. k. Preuss. Geol. Landes.,' n. s., pt. 16, p. 250.

⁸ Holzapfel quotes Davidson thus:—"1864, *Spirifer insculptus*, 'Brit. Dev. Brach.,' Supplement, pl. i, fig. 32." This reference requires to be thus corrected:—"1882, *Spiriferina insculpta*, Brit. Dev. Brach.,' Supplement, pl. i, fig. 32."

⁹ 1840, Sowerby, 'Geol. Trans.,' ser. 2, vol. v, pt. 3, pl. lvii, fig. 8.

this matter, he has unconsciously proved that *Sp. aculeata*, Schnur, is a synonym of *Spiriferina pulchella*, Sowerby, sp.

III. *Family*—RHYNCHONELLIDÆ, *d'Orbigny*, 1847.

1. *Genus*—RHYNCHONELLA, *Fischer de Waldheim*, 1809.

Sub-genus—CAMAROTECHIA, *Hall and Clarke*, 1894.

1. RHYNCHONELLA (CAMAROTECHIA) PARTRIDGII, *Whidborne*. Plate XIX, figs. 12—14.

1841. TEREBRATULA PLEURODON?, *Phillips* (pars). Pal. Foss. (not Geol. Yorks.),
p. 86, pl. xxxv, figs. 155 a, b.
1865. RHYNCHONELLA PLEURODON, *Davidson* (pars). Mon. Brit. Foss. Brach.,
vol. iii, p. 62, pl. xiii, figs. 12, 13.
1896. — PARTRIDGII, *Whidborne*. Proc. Geol. Assoc., vol. xiv,
p. 376.

Description.—Shell generally rather small, transversely oval or sub-pentagonal, apparently becoming more transverse with age. Ribs strong, elevated, acutely triangular, reaching to the umbones, and deeply interlocking at the margins, separated by furrows. Ventral valve with a rather elevated and erect sharp beak, and a sinus which becomes deep in front, so that the “languette” forms a low sub-tetrahedron. Ribs, three on the sinus and about seven on the sides. Lateral ribs with a slightly concave sweep, and terminating marginally with a sharp angle. Dental plates oblique, reaching about one-third down from the beak, their front ends being joined by a low curved ridge which defines the muscular impressions. Dorsal valve with a flat and straight median fold, becoming prominent in front and sharply angulated at the margin, containing almost invariably four ribs. Sides dilate and drooping. Median septum reaching nearly half-way to the front, and having at its posterior end diverging branches which support the dental sockets (?), which are crenulated exteriorly.

Size.—Some specimens are more than 24 mm. wide.

Localities.—Pilton Vicarage Well, Poleshill, Top Orchard, Roborough, Goodleigh, Raleigh, Bradiford, Frankmarsh, Collar Bridge, Kingdon's Shirwell, Saunton, Croyde Bay, Laticosta Cave, Ashford Strand, Upcott Arch Quarry, Ashhill Quarry, Pouch Bridge, Fremington, &c.

Remarks.—This species is abundant and wide-spread in the Pilton Beds, but being usually crushed, contorted, or fragmentary, its exact characters are not easy to define. In writing of it Phillips specially remarks on the difficulty of deciding,

in so complicated a genus, the species of shells which are in such a poor state of preservation, and doubtfully refers them to his Carboniferous *Rh. pleurodon*.¹ In this he has been followed by Davidson and others; but it seems probable that there are sufficient grounds for distinguishing them from the Carboniferous shell, even in their defective state. *Rh. pleurodon* generally has five ribs on the fold, though they may vary from three to nine. From the study of a large number of specimens of our Pilton shell I find that they have almost invariably four ribs on the fold with three on the sinus. Gosselet lays great stress on the number of ribs on the fold, using it as a distinguishing character for his various Upper Devonian species; and, if his view of its importance is correct, we have here a sufficiently definite specific distinction; for, even granting that in many species of *Rhynchonella* the number of ribs on the fold is very various, there seems no reason why in other cases their definite number should not be a point of specific importance. Moreover, the profile of the present shell seems much less rounded than that of *Rh. pleurodon*; the front of the median ribs of the dorsal valve and of the lateral ribs of the ventral valve sweeping definitely outwards till they are abruptly turned in at the margin at a sharp angle, more in the manner of *Rh. anisodonta* than of *Rh. pleurodon*.

Our shells occur as casts, and as I have only seen specimens of the true *Rh. pleurodon* retaining the shell, I have been unable to compare the interior, the arrangements of which are well indicated in our fossils. These arrangements appear exactly the same as those by which Hall and Clarke² define their genus *Camarotoechia*, to which they refer Gosselet's Upper Devonian species, though they do not indicate whether they also include in it *Rh. pleurodon*.

While, however, there seem to be sufficient grounds for distinguishing *Rh. Partridgeiæ* from *Rh. pleurodon*, their relationship is probably very close, the former being apparently somewhat more specialised than the latter. One point of agreement which may be noted is the slight median channeling of the lateral ribs, which is often seen in the Pilton shells, and is mentioned by Davidson as a character of *Rh. pleurodon*.

Affinities.—None of the Upper Devonian *Rhynchonellæ* described by Gosselet³ in 1887 appear to correspond with our species. While several have the same number of median ribs, they all (as well as *Rh. Daleidensis*, F. Römer,⁴ or *Rh. inaurita*, Sandberger⁵) differ in their more rounded profile and the less acutely produced sweep of their medio-dorsal and latero-ventral ribs.

¹ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 222, pl. xii, figs. 25—30.

² 1894, Hall and Clarke, 'Pal. N. Y.,' vol. viii, pt. 2, p. 189.

³ 1887, Gosselet, 'Ann. Soc. Géol. Nord.,' vol. xiv, p. 188.

⁴ 1844, F. Römer, 'Rhein. Uebergangsgeb.,' p. 65, pl. i, figs. 7 a—c.

⁵ 1856, Sandberger, 'Verst. Rhein. Nassau,' p. 337, pl. xxxiii, figs. 5—5 c.

2. RHYNCHONELLA (CAMAROTÆCHIA) TOGATA, n. sp. Plate XIX, figs. 15—18.

?? 1841. SPIRIFER RUDIS, *Phillips*. Pal. Foss., p. 78, pl. xxxi, figs. 136 a—c.

1896. CAMAROTÆCHIA¹ TOGATA, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Shell very large, subtrigonal, hardly (if at all) wider than long. Beak apparently elevated, acute, and only moderately incurved. Ventral valve with a broad subtrigonal sinus, becoming deep in front and bearing two strong median ribs; and with four ribs on each side, of which the first is very strong and the others are successively less distinct. Dental plates (which may be sometimes absorbed?) short, diverging. Muscular area strongly impressed. Dorsal valve with three ribs on the fold, with a short median septum (less than a quarter of the total length) divided into branches posteriorly, supporting an incipient spondylium, and with strongly crenulated outer socket-walls.

Size.—Length and width about 33 mm.

Localities.—In the Porter Collection are two specimens from Pilton and one from Roborough; in the Barnstaple Athenæum one from Pilton; in the Museum of Practical Geology four, labelled North Devon, Marwood, Braunton, and Barnstaple. I have recognised it at Ashhill Quarry.

Remarks.—Though this species appears well characterised, our specimens are all too fragmentary and crushed to permit its full definition. Of them five are ventral and three dorsal valves; and in the latter the indications of lateral ribs are obscure, probably in part on account of the crushing of the shell, whereas in the former they are very strong and definite.

With regard to its generic position, a careful comparison of our specimens with the figures given by Hall² of his group *Camarotæchia* shows that in all points of structure it falls well within its limits.

It is not impossible that this may be the same shell as *Spirifera rudis*, Phillips. His types appear to be lost, and he gives practically no description. His three figures are so "rude" that they may be regarded as unidentifiable, but one of them is very like a dorsal valve of this species. Probably, if our shells were trimmed down, fragmentary specimens could be produced which would agree with all three of his drawings, though possibly the same effect might be produced by trimming other shells in a similar manner. At all events Phillips's species is too ambiguous for any identification with it to be safe.

I have examined the type of *Rh. subdentata*, Sowerby,³ in the Woodwardian

¹ By a clerical error this word was printed *Camarella* in my list.

² 1894, Hall and Clarke, 'Pal. N. Y.,' vol. viii, pt. 2, pl. lvii, figs. 15—32, 49.

³ 1840, Sowerby, 'Geol. Trans.,' ser. 2, vol. v, pt. 3, pl. liv, fig. 7.

Museum. It evidently belongs to the same species as the specimen which Phillips¹ refers to it, but which Davidson² unites with *Rh. reniformis*, Sowerby, only differing from it by the possession of a low arching fold. On the other hand, the second Devonian specimen figured as *Rh. reniformis* by Davidson³ appears more likely to belong to *Rh. Phillipsii*, Davidson.⁴ From the present form all these specimens differ by their wide and nearly straight hinge-lines, and by the character of their folds. Whether, therefore, *Rh. subdentata* be a synonym of *Rh. reniformis* or not, it is certain that the present species is distinct from both.

3. RHYNCHONELLA LATICOSTA, Phillips, sp. Plate XX, figs. 3, 3 a, 4.

1841. TEREBRATULA LATICOSTA, Phillips. Pal. Foss., p. 85, pl. xxxiv, fig. 153.

1865. RHYNCHONELLA LATICOSTA, Davidson. Brit. Foss. Brach., vol. iii, p. 61, pl. xiv, figs. 1—3.

Locality.—It occurs abundantly in a bed about 1 foot thick, which is exposed in a small cave under the cliff near the wall that bounds the south side of Baggy promontory. It is represented in the various collections by specimens which are always defective and contorted.

Size.—A specimen measures 40 mm. wide.

Remarks.—Of this handsome and distinct species I have unfortunately been unable to obtain any specimens that will yield a satisfactory figure. Its beak appears to be prominent and only moderately incurved, and to have long dental plates. The fold and sinus seem low, rounded, and not strongly defined, with five or six ribs on the former, and four or five in the latter. The ribs are strong, and reach quite to the umbo, but appear rounded and not much elevated. In the dorsal valve is a median septum reaching about halfway forwards. The margins of the valves are rounded in.

Affinities.—It appears widely different from our other Devonian species.

Rh. Pengelliana, Davidson,⁵ from Looe, is still larger, and has more ribs on the fold. The Carboniferous *Rh. ? Carringtoniana*, Davidson,⁶ has feebler and more numerous ribs.

¹ 1841, Phillips, 'Pal. Foss.,' p. 90, pl. xxxv, fig. 164.

² 1865, Davidson, 'Brit. Foss. Brach.,' vol. iii, p. 62, pl. xiii, fig. 7.

³ Ibid., fig. 6.

⁴ 1882, Davidson, *ibid.*, vol. v, p. 43, pl. ii, fig. 14.

⁵ 1865, Davidson, *ibid.*, vol. iii, p. 61, pl. xii, figs. 8, 9.

⁶ 1863, *ibid.*, vol. ii, pt. 5, p. 227, pl. xxiii, fig. 22; and pl. liii, figs. 1, 2.

IV. *Family*—STROPHOMENIDÆ, *King*, 1846.1. *Genus*—ORTHIS, *Dalman*, 1828.1. ORTHIS INTERLINEATA, *Sowerby*. Plate XX, figs. 6, 7.

1840. ORTHIS INTERLINEATA, *Sowerby*. Geol. Trans., ser. 2, vol. v, pt. 3, pl. liii, fig. 11; and pl. liv, fig. 14.
1840. — PPLICATA, *Sowerby*. Ibid., pl. liii, fig. 10.
1841. — INTERLINEATA, *Phillips* (pars). Pal. Foss., p. 63, pl. xxvi, figs. 106 a, b (only).
1841. — PARALLELA, *Phillips*. Ibid., p. 64, pl. xxvi, fig. 109 a—d.
1865. — INTERLINEATA, *Davidson*. Brit. Foss. Brach., vol. iii, p. 91, pl. xvii, figs. 18—23.

Localities.—This shell is common and wide-spread. It occurs at Top Orchard, Bradiford, Kingdon's Shirwell, Upcott, Braunton, Pilton, Wrafton Lane, Saunton Point, Frankmarsh, Ashhill Quarry, Croyde, Petherwyn, and Landlake.

Size.—Height 12 mm., width 16 mm.

Remarks.—The types of *O. interlineata* and *O. plicata*, *Sowerby*, which are in the museum of the Geological Society, evidently belong to the same species. *Davidson* also reunites with it *Orthis parallela*, *Phillips*, which *Phillips* had separated from it. *Orthis orbicularis*, var., *Murchison*¹ (which *Davidson* seems to refer to in his description of this species), does not seem distinguishable from it. *Murchison*, himself, regarded his shell as distinct from the *Orthis orbicularis*² of the Silurian System, which is united to *O. lunata*, *Sowerby*,³ by *Davidson*.

2. ORTHIS, sp. Plate XX, figs. 8, 8 a, 9.

1841. ORTHIS INTERLINEATA, *Phillips* (pars). Pal. Foss., p. 63, pl. xxvi, figs. 106 c, d (only).
- ? 1841. — PPLICATA, *Phillips* (not *Sowerby*) (pars). Ibid., p. 64, pl. xxvi, fig. 108 e (only).

Description.—Shell minute, flat. Umbo elevated, prominent, rounded. Hinge-line much shorter than the width of the shell. Lateral margins semicircular.

¹ 1840, *Murchison*, 'Bull. Soc. Géol. Fr.,' vol. xi, p. 255, pl. ii, figs. 8 a—c.

² 1839, *Sowerby*, in *Murchison*, 'Sil. Syst.,' p. 611, pl. v, fig. 16.

³ Ibid., p. 611, pl. v, fig. 15.

Front margin gently convex. Valve with a median depression. Surface covered with about twenty strong, distant, alternating ribs, which have the appearance of being microscopically lineated and granulated.

Size.—Height 4 mm., width 5 mm.

Localities.—Two or three specimens are on a slab from Saunton in Miss Partridge's Collection, and its reverse in the Porter Collection. I have, I believe, observed two or three better specimens of this tiny shell, but, failing to take note of them at the time, am now unable to find them.

Remarks.—Phillips figured a specimen which is almost identical with ours, both in size, shape, and ornament. This he referred to *O. interlineata*, but it seems to me questionable if our shell be the young of that species, as it seems distinguished not only by the fewness of its ribs, but by the size of its umbo and by several other points. We have not, however, sufficient evidence to enable us to arrive at its true character.

2. Genus—ORTHOTETES,¹ Fischer de Waldheim, 1830.

1. ORTHOTETES CRENISTRIA (*Phillips*), var. ARACHNOIDEA, *Phillips*. Plate XX, figs. 10, 11.

1836. SPIRIFER ARACHNOIDEUS, *Phillips*. Geol. Yorks., vol. ii, p. 220, pl. xi, fig. 4.
- ? 1841. ORTHIS SEMICIRCULARIS, *Phillips*. Pal. Foss., p. 65, pl. lviii, fig. 112*.
1865. STREPTORHYNCHUS CRENISTRIA et var. ARACHNOIDEUS, *Davidson*. Brit. Foss. Brach., vol. iii, pt. 5, p. 81, pl. xviii, figs. 4, 7.
1896. ORTHOTETES CRENISTRIA, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

¹ I have to thank Professor Rupert Jones for the trouble he has taken in deciding the orthography of this name. It was originated in 1829 by Fischer de Waldheim (not by Evans) ('Bull. Imp. Soc. Nat. Moscou,' p. 375) for a shell found by Mr. Evans at Pakhrino, which he (*i. e.* Fischer) believed to be of a new genus, and named *Orthotetes*, deriving it from ὀρθωτής (*i. e.* ὀρθότης), "straightness," because "at the hinge is a transverse impression straight and linear." In 1837 ('Oryct. Gouv. Moscou,' p. 133) he repeats the same spelling and derivation, and figures the shell. In 1850 ('Bull. Imp. Soc. Nat. Moscou,' p. 491) he describes and figures it under the same name, and distinguishes it from *Orthis*.

Professor Rupert Jones writes, "Orthotetes was made wilfully from ὀρθωτής, and, though irregular, must be accepted as an intended name." Bronn and Davidson wrote it thus; but later authors, *e. g.* Zittel, Ehlert (deriving it from ὀρθός), and Hall, changed it to *Orthothetes*. *Orthothetes* might be derived from ὀρθός and θέτης, but that would mean "the adoptive father of straight things" (or ? of an *Orthis*), and would be (even on evolutionary principles) hardly an improvement on Fischer's original malformed word. If altered at all it should have been changed to *Orthotes*.

Localities.—Croyde Bay, Saunton Point, Saunton Hotel, Ashford Strand, Upcott Arch Quarry, Bradiford, Poleshill, Kingdon's Shirwell, Paper Mills Ilfracombe Road, Goodleigh, Top Orchard, Pouch Bridge, Rock Inn Quarry near Wiveliscombe, Petherwyn. Only moderately common.

Size.—One specimen is more than 50 mm. long and wide.

Remarks.—Davidson considers that our Pilton fossils show no difference from the Carboniferous species, *O. crenistria*. It is to be observed, however, that in the typical form of this species three or four smaller ribs often occur between two of the larger, whereas in our specimens the larger and smaller ribs always alternate regularly. Our ventral valves, moreover, appear to be usually flat rather than concave. Hence they appear to fall within the variety *arachnoidea* as given by Davidson, who indeed seems to refer them to that form.

A comparison of our shells with Lummaton specimens of *O. umbraculum* seems to show that the distinction made between them by Davidson can most probably be sustained. While both species are very variable, their ornament seems to differ in character, the ribs of *O. umbraculum* being relatively closer and sometimes differently grouped, while the transverse threads in *O. crenistria* are stronger. I have not, however, seen any Lummaton specimens with the surface sufficiently well preserved to show the minute ornament which Davidson describes as characterising Eifel specimens of that species.

Davidson¹ regards *Orthotetes pecten*, Linné, sp., as closely resembling in size and striation some shapes of *O. umbraculum*. These two certainly seem more like each other than they are to *O. crenistria*.

Ehlert,² in a lucid and elaborate dissertation on *O. hipponyx*, Schnur, sp.,³ refers that shell to the Lower Devonian, *O. umbraculum* to the Middle Devonian, *O. crenistria*, var. *devonica*, Keyserling, sp.,⁴ to the Upper Devonian, and *O. crenistria* to the Carboniferous, as cognate forms. From his description, however, Keyserling's shell does not seem to agree with the Pilton form. Davidson states that it has been sometimes referred to *O. crenistria*, var. *senilis*.⁵

The Pilton shell is in itself very variable in the number and strength of its ribs. A very large variety occasionally occurs (Pl. XX, fig. 10) in which they are very much finer and more numerous than usual (being sometimes more than 200), and in which the ventral valve is definitely concave. This multiplication of ribs may be partly but not entirely due to age. It is interesting to

¹ 1865, Davidson, 'Brit. Foss. Brach.,' vol. iii, p. 78; and 1871, *ibid.*, pt. 7, p. 306.

² 1897, Ehlert, 'Bull. Soc. Géol. Fr.,' ser. 3, vol. xxiv, p. 856, pl. xxvii, figs. 12—16.

³ 1851, Schnur, 'Progr. d. h. Bugersch.,' p. 4.

⁴ 1846, Keyserling, "Reise Petschora-Land, Geol. Beobacht.," p. 221, pl. vii, figs. 7—7 c.

⁵ 1865, Davidson, 'Brit. Foss. Brach.,' vol. iii, p. 80.

compare this form with Ehlert's figures of *O. hipponyx*, which lies between it and *O. umbraculum*.

3. Genus—STROPHOMENA, de Blainville, 1825.

1. STROPHOMENA RHOMBOIDALIS, Wilckens, sp. Plate XX, fig. 5.

1865. STROPHOMENA RHOMBOIDALIS, var. ANALOGA, Davidson. Brit. Foss. Brach.,
vol. iii, p. 76, pl. xv, figs. 15—17.
1884. — — — Davidson. Ibid., vol. v, p. 467.
1893. — — — var. ANALOGA, Whidborne. Dev. Fauna,
vol. ii, p. 149.

Localities.—This is a moderately common shell in the Pilton Beds, and is represented in most museums. Among the localities are Top Orchard, Pilton, Braunton, Goodleigh Road, Croyde, Poleshill, Pottington, Fremington, Upcott Arch Quarry, Wrafton Lane. It is also found in the Ilfracombe Beds.

Remarks.—Our specimens are often excellently preserved, and include the interiors of both valves as well as the exterior. I can see nothing to distinguish them as a variety; if anything, they are more like the Silurian than the Carboniferous shells. Davidson, in fact, adopted for the typical Silurian form the description he had before given for his Carboniferous variety, and he ultimately dropped the varietal name *analoga* from the Devonian and Carboniferous shells. Our North Devon specimens certainly support this view.

V. Family—PRODUCTIDÆ, King, 1846.

1. Genus—PRODUCTUS, Sowerby, 1812.

1. PRODUCTUS PRÆLONGUS, Sowerby, sp. Plate XX, figs. 12, 12 a, 13, 13 a.

1840. LEPTÆNA PRÆLONGA, Sowerby. Geol. Trans., ser. 2, vol. v, pt. 3, pl. liii,
fig. 29.
1855. PRODUCTA PRÆLONGA, M' Coy. Brit. Pal. Foss., p. 390.
1865. PRODUCTUS PRÆLONGUS, Davidson. Brit. Foss. Brach., vol. iii, p. 102,
pl. xix, figs. 22—25.

Description.—Ventral valve very elongate, suboval, evenly convex. Hinge-line nearly, if not quite, as long as the width of the shell. Umbo extremely large, extending very greatly beyond the hinge, and recurved upon it so that its apex is in its close proximity. Surface with a very narrow, shallow, irregular,

sinus from the level of the hinge-line to the margin, bearing a longitudinal row of four or five very large spines. Cast ornamented with very numerous, reticulating, longitudinal threads, which show a tendency to group themselves into more or less incipient ribs. Wings with a few coarse tubercles (spines) near the corners.

Dorsal valve transverse, geniculated, with a minute umbo; having (as seen from within) a large elevated triangular ridge down the centre, and seven or eight smaller broken ridges on each side, which increase in size as they cross the flat part of the shell, and extend to the margins; the whole nodulated by rugose transverse undulations, which are minute near the umbo, but soon become very coarse. Ears convex, prominent, marked only with transverse ridges.

Size.—About 35 mm. long and wide.

Localities.—Croyde, Braunton, Saunton, Top Orchard, Kingdon's Shirwell, Ashford Strand, Upcott Arch Quarry, Wrafton Lane, Rock Inn Quarry, Pouch Bridge. It is very abundant, generally gregarious; but it seems local, probably being confined to limited beds, which in the disturbed condition of the Pilton Series it is not easy definitely to trace.

Remarks.—The external surface of this shell does not appear to be known. The ventral valve occurs in a state that shows a coarse ramifying fibrous texture, which has the appearance of having originally been covered by an additional layer of shell. This valve is remarkable for the incipient central keel in the midst of a rather definite shallow groove or sinus, which bears a row of very large and probably long, cylindrical, or slightly clavate spines. There are also a few coarse spines on the ears. The ribs are rounded and more or less indistinct, and there seem no signs of spines upon them.

The dorsal valve is so dissimilar from the ventral valve in shape and markings that it was regarded by my friend Mr. Townshend Hall as a distinct species; but Sowerby's type, which is in the Woodwardian Museum, preserves both valves in contact, as pointed out by M'Coy, and thus proves their true relationship. On account of its geniculate form it is always its inner face which is exposed, and I have therefore described it from that point of view. If it were seen from the outside its characters would probably be almost exactly reversed.

2. PRODUCTUS PRÆLONGUS, *Sowerby?* var. SIMPLICIOR, n. var. Plate XX, figs. 14, 14 a, 15, 15 a.

1865. PRODUCTUS LONGISPINUS?, *Davidson*. Brit. Foss. Brach., vol. iii, p. 103, pl. xx, fig. 7.

1896. — — *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Ventral valve usually rather small, elongate, gibbose, but flattened on the marginal half of the centre of the valve. Umbo more or less elevated, recurved upon the hinge. Hinge-line shorter than the width of the shell. Surface having (1) from fifteen to twenty-five rather irregular, rounded rays, rising some distance in front of the umbo, and bearing some large, long spines, which tend to arrange themselves in transverse rows; (2) exceedingly minute fibrous markings; and (3) a few irregular transverse undulations on the wings and umbonal parts.

Size.—An unusually large specimen measures 33 mm. long, 20 mm. wide, and 10 mm. deep; its umbo extends about 8 mm. behind the hinge-line.

Localities.—In the Woodwardian Museum are eight specimens from Croyde and three from Top Orchard; in the Museum of Practical Geology one from Braunton; in the Porter Collection five from Pilton and one from Poleshill; and in the Barnstaple Athenæum a slab containing specimens mentioned and figured by Davidson as “*P. longispinus*, Sowerby?”

Remarks.—The specimens in the Barnstaple Athenæum, which Davidson referred somewhat doubtfully to *P. longispinus*, are very imperfect and indistinct; but they are evidently identical with the other specimens mentioned above, which are most of them in a better state of preservation, and afford clear proof that they do not belong to the same species as Sowerby’s Carboniferous *P. longispinus*. They have much stronger and fewer ribs, and none of them show any signs whatever of an angular median sinus.

From the typical form of *P. prælongus* they usually differ by (1) their smaller size; (2) the absence of a sinus bearing a vertical row of very long spines; (3) the presence of spines on other parts of the body, which are often arranged in concentric rows; and (4) their very much more definite and regular ribs.

On the other hand, these points of difference are not constant. One or two of the specimens show a distinct tendency to a slight median groove or concavity, and have median spines arranged longitudinally. It appears to me that it will therefore be best to regard them as a variety of *P. prælongus*, as it may prove to be only an immature or stunted form of that shell.

3. *PRODUCTUS SCABRICULUS*, *Martin*, sp. Plate XX, figs. 16—18, and Plate XXI, fig. 12.

1809. *ANOMITES SCABRICULUS*, *Martin*. *Petrif. Derb.*, p. 8, pl. xxxvi, fig. 5.

1841. *LEPTENA SCABRICULA*, *Phillips*. *Pal. Foss.*, p. 58, pl. xxiv, figs. 97 *a*, *b*.

1861. *PRODUCTUS SCABRICULUS*, *Davidson*. Brit. Foss. Brach., vol. ii, pt. 5,
p. 169, pl. xliii, figs. 5—8.
1865. — — — — — Ibid., vol. iii, p. 103, pl. xx, figs.
3 (?), 4—6.

Description.—Ventral valve convex, gibbose, transverse or occasionally slightly elongate. Umbo flattened, moderately elevated, recurved over the hinge-line. Sinus low, broad, undefined. Surface marked on the umbo and wings with coarse concentric ridges, which vanish in front; and also covered by about fifty coarse, close, rounded, irregularly alternating and occasionally discontinuous ribs, occasionally carrying spines (which in some specimens appear to be set forward and in others backwards). Wings with a few large spines in their corners.

Dorsal valve strongly geniculated, marked on the flat portion with coarse, rounded, divaricating ribs, which are crossed and nodulated by closer concentric ridges; these ribs alone being continued over the elbow, in front of which they are very irregular.

Size.—About 28 mm. long by 34 mm. wide.

Localities.—In the Woodwardian Museum is a ventral valve from Croyde and two dorsal valves. In the Porter Collection is a ventral valve from Smoking House Lane, and two from Pilton, and eight dorsal valves from Pilton, Roborough, and Poleshill.

Remarks.—I have been unable to recognise the Devonshire examples which Phillips and Davidson figured. Their figures of the dorsal valves with their corded ornament and internal markings are clear. Phillips's figure of the ventral valve is certainly very vague in itself, but in conjunction with his description it may be taken to represent a small specimen of this species. Davidson's figure is covered with spines, and it appears very difficult indeed to distinguish it from some of the figures which he gives of *Strophalosia productoides*, while in a slab in the Davidson Collection labelled by him "*St. productoides* and *P. scabriculus*" I have been able to discover only specimens of the former species.

At the same time some ventral valves have been found, which, though generally distorted, appear to present all the characters of this species. Having compared them with numerous Carboniferous specimens, and especially with those in the Bristol Museum, to which Phillips himself likened his Pilton specimens, I see no reason for hesitating to refer them to this Carboniferous form. These specimens correspond, moreover, with a number of dorsal valves from the Pilton beds, of some of which there can be no doubt that they belong to *P. scabriculus*, though it is difficult to be certain whether others can be distinguished from *Str. productoides*.

4. *PRODUCTUS INTERRUPTUS*, Sowerby, sp. ? Plate XXII, figs. 1—3.

- ? 1840. *LEPTÆNA INTERRUPTA*, Sowerby. Geol. Trans., ser. 2, vol. v, pt. 3, pl. lvi, fig. 7.
 ? 1841. — n. sp.? Phillips. Pal. Foss., p. 229, pl. lviii, fig. 98.
 ? 1844. *PRODUCTA INTERRUPTA*, M'Coy. Synops. Carb. Foss. Irel., p. 110.
 ? 1865. *PRODUCTUS*, sp., Davidson. Brit. Foss. Brach., vol. iii, p. 103, pl. xx, fig. 8.

Description.—Ventral valve small, very gibbose, approximately hemispherical. Umbo small, flattened, not prominent, incurving to the hinge-line. Ears apparently small. Ribs numerous, low, rounded, more or less distinct, occasionally divaricating, much interrupted in the umbonal region by a number of deep irregular concentric grooves (which are bounded by ridges) and crossed, especially in the marginal parts, by very numerous, regular, minute, impressed threads. Dorsal valve apparently concave, following the contour of the ventral valve, indistinctly ribbed, and transversely ridged or wrinkled throughout.

Size.—Length 13 mm., width 11 mm.

Localities.—Six slabs (three of which are from Fremington) containing several specimens are in the Porter Collection. Two specimens from Ashford Strand, one from Fremington and one from Newport near Barnstaple, are in Mr. E. F. G. Bryan's Collection.

Remarks.—This small species has the appearance of being very distinct, but our specimens are all more or less imperfect and in poor condition. The shell seems to be papyraceous. The strong irregular grooves, followed by blunt ridges, which are chiefly seen in the central portions of the shell, break up the ribs into short series in a manner which presents great likeness to *P. fimbriatus*, Martin,¹ so that it is not impossible that it may prove to be an extreme variety of that species. At the same time in our shells these grooves seem much narrower, so as to cause less extensive interruption to the ribs, and at least in the ventral valve they are only seen in the posterior part of the shell, the ribs being continuous for the marginal half of their length. The umbo, moreover, seems much smaller and depressed, and no spines are now visible upon the ribs. It is probable, therefore, that they are distinct.

Leptæna interrupta, Sowerby, is a shell from the Limestone of Plymouth. Its type is in the Museum of the Geological Society. It was said by Davidson to "appear exceedingly like a small example of the Carboniferous *P. fimbriatus*, Sowerby, or *P. laxispinus* (*i. e.* *P. laciniatus* ?), M'Coy, which may have got accidentally mixed up among Rev. W. Y. Hennah's Plymouth specimens." Its only

¹ 1861, Davidson, 'Brit. Foss. Brach.,' vol. ii, pt. 5, p. 171, pl. xxxiii, figs. 12—15; and pl. xliv, fig. 15.

difference, however, from our specimens is that the ribs may be rather more numerous, and that the interruptions extend to the marginal parts; and it appears to me most probable that they both belong to the same species, and therefore that Mr. Hennah's specimen is a Devonian fossil.

The figure of *Producta laciniata*, M'Coy,¹ from the Middle Carboniferous of Ireland, which is very like the figure given by Sowerby of his species, but has much finer and more spinous ribs, is regarded by Davidson as possibly a variety of *P. fimbriatus*, though separated from it by M'Coy.

5. PRODUCTUS CORRUGATUS, M'Coy. Plate XXI, figs. 4, 5.

1844. PRODUCTA CORRUGATA, M'Coy. Synops. Carb. Foss. Ireland, p. 107, pl. xx, fig. 13.
1845. PRODUCTUS TENUISTRIATUS, Verneuil. Pal. Russia, vol. ii, p. 266, pl. xvi, fig. 6.
1855. PRODUCTA CORRUGATA, M'Coy. Brit. Pal. Foss., p. 459.
1861. PRODUCTUS CORA, Davidson (? not *d'Orbigny*). Brit. Foss. Brach., vol. ii, pt. 5, p. 148, pl. xxxvi, fig. 4; and pl. xlii, fig. 9.
1896. — TENUISTRIATUS, Whidborne. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Ventral valve large, subglobose, rounded or perhaps sometimes slightly depressed along the centre of the back. Ears small and undefined. Beak wide, convex, incurved, overhanging the hinge-line, and having a few strong foldings or rounded wrinklins on its sides and on the ears. Ribs extremely numerous, minute, rounded, irregularly flexuous, sometimes alternating, divided by similar furrows, and very occasionally bearing minute spines; remaining of a uniform size over the whole valve, and sometimes splitting into two or three and again reuniting. Surface crossed by close, regular, microscopic transverse striæ.

Localities.—In the Porter Collection are nine or ten specimens from Fremington and one from Kingdon's Shirwell; in Miss Partridge's Collection is one from Fremington.

Size.—The specimens are all crushed or imperfect; one is 38 mm. long by 25 mm. wide; others were evidently larger.

Remarks.—Our shells are rounded or perhaps sometimes flattened on the back, but I have not seen anything in them that amounts to a sinus. The ribs, though always minute, seem to vary in size and number in different specimens, as also do their flexuosity and their habit of division and reunion, which are some-

¹ 1844, M'Coy, 'Synops. Carb. Foss. Irel.,' p. 110, pl. xx, fig. 12.

times excessive. Davidson's figures show still finer and more numerous ribs than do our shells.

Our shells are so exceedingly like M'Coy's *P. corrugatus* from the Yellow Sandstone and Carboniferous Limestone of Ireland as to be certainly identical with it; for, though M'Coy says it had no spines, his figure seems to show indications of minute rare spines such as are evident in our specimens. Davidson, following de Koninck, who had examined d'Orbigny's types, united M'Coy's species with the South American *P. Cora*, d'Orbigny. On the other hand, d'Orbigny's original figure of *P. Cora*¹ looks totally different. Its spines are much coarser and more frequent, and it has a row of large hinge-spines. Waagen, who figures an Indian example which bears out at least the first two of these distinctions, sides with M'Coy in denying its identity with the English, Irish, and Belgian shell. He divides his section *Lineata* into two groups: (1) those with a sinus, as *P. Neffidievi*, Verneuil² (which Davidson united to *P. Cora*), and *P. lineatus*, Waagen;³ and (2) those without a sinus, as *P. Cora*, d'Orbigny, and ? *P. semireticulatus*, Martin. Again, Tschernyschew distinguishes the Permian-Carboniferous *P. tenuistriatus*, Verneuil, from *P. corrugatus*, M'Coy (which M'Coy had united with it), by the irregularity of the fission and reunion of the ribs, and both these forms from *P. Cora*, d'Orbigny, by the absence of spines on the middle parts of the shell, and by the fineness of the ribs. But our Devonshire specimens are accurately identical with *P. tenuistriatus* in every respect, and in some of them the irregularity and flexuosity of the ribs and the paucity of the spines are fully as great as in the Russian shell which Tschernyschew figures, while in others the ribs seem as straight and the spines as imperceptible as described by M'Coy.

It seems, therefore, best to place our shells with *P. corrugatus* and *P. tenuistriatus*, which they prove to be mutually identical, and to leave the disputed question of the identity of *P. Cora*, d'Orbigny, in abeyance.

6. PRODUCTUS, cf. *P. SUBACULEATUS*, *Murchison*. Plate XXI, figs. 1—3.

Localities.—Two fragmentary specimens from Fremington and one from Pilton are in the Porter Collection. One from Saunton is in the Barnstaple Athenæum.

Size.—Width about 30 mm. Length of a spine more than 44 mm.

¹ 1842, d'Orbigny, 'Paléont. Voyage Amér. Mérid.', p. 55, pl. v, figs. 8—10.

² 1845, Murchison, Verneuil, and Keyserling, 'Russia,' vol. ii, p. 259, pl. xviii, fig. 2.

³ 1884, Waagen, 'Salt Range Brach.,' p. 673, pl. lxvi, figs. 1, 2; and pl. lxvii, fig. 3.

Remarks.—The above-named specimens, which are too imperfect to admit of specific determination, belong to some species of *Productus* which was covered by numerous, but not crowded, coarse and very long spines, arranged more or less regularly in transverse rows, and apparently most developed in the marginal parts; its umbo appears to be rather small and not very prominent; its ears are small, and bear a few very strong spines; its shape is gibbose and rather transverse; its ventral valve has a small sinus down the back; its dorsal valve is geniculated, and crossed in the flat portion by rather numerous corrugations.

To whatever species these shells belong, they appear to be distinct from the species described above. Their surface may perhaps have been something like *P. spinulosus*, Sowerby,¹ but they are distinguished from that shell by their sinus, their larger size, and the much greater length of their spines. Not one of the specimens is sufficiently good to enable us to ascertain its true shape or the details of its surface-ornament. It is probably related to or even a variety of *Productus* (or *Productella*) *subaculeatus*, Murchison,² but its spines seem more numerous than is usual in that species.

2. Genus—STROPHALOSIA, King, 1844.

1. STROPHALOSIA PRODUCTOIDES, Murchison, sp. Plate XXI, figs. 6—11.

1840. ORTHIS PRODUCTOIDES, *Murchison*. Bull. Soc. Géol. Fr., vol. xi, p. 254, pl. ii, figs. 7 a—c.
1840. LEPTENA CAPERATA, *Sowerby*. Geol. Trans., ser. 2, vol. v, p. 3, pl. liii, fig. 4.
1865. STROPHALOSIA PRODUCTOIDES, *Davidson* (pars). Brit. Foss. Brach., vol. iii, p. 97, pl. xix, figs. 13, 14 (only ?).
1871. — — — *Kayser*. Zeitsch. Deutsch. Geol. Gesell., vol. xxiii, p. 638.

Localities.—Baggy Point, Laticosta Cave, Croyde, Saunton, Braunton, Poleshill, Ashford Strand, Frankmarsh, Top Orchard, Roborough, Ashhill Quarry, Pouch Bridge, South Petherwyn. It is abundant and often gregarious, but rather local, being probably confined to particular zones in the Pilton series.

Size.—A specimen measures about 50 mm. long by 55 mm. wide.

¹ 1861, Davidson, 'Brit. Foss. Brach.,' vol. ii, pt. 5, p. 175, pl. xxxiv, figs. 18—21; and 1880, *ibid.*, vol. iv, p. 299, pl. xxxvi, fig. 11.

² 1865, Davidson, 'Brit. Foss. Brach.,' vol. iii, p. 99, pl. xx, figs. 1, 2; and 1882, *ibid.*, vol. v, p. 54, pl. iii, fig. 22; and 1893, Whidborne, 'Dev. Fauna,' vol. ii, p. 154; see also p. 156, pl. xvii, fig. 12.

Remarks.—There is some difficulty in defining the specific limits of this abundant shell on account of its variability, and the likeness of some of its shapes to species of *Productus*.

Its typical form has nearly circular margins and fairly numerous small spinous markings; it is well represented by Murchison's original figure, and by those of Sowerby's *Leptæna caperata*. Specimens which are rather more transverse than this, and have rather more numerous spinous markings, occur commonly at Pilton (Pl. XXI, fig. 10). In another variety the thorn-like spinous markings are replaced by strong and more or less continuous ribs, and the transverse wrinkles are confined to the posterior half (Pl. XXI, fig. 8); these shells seem in their usual imperfect condition sometimes so similar to *P. scabriculus* that it is not easy to draw the line between them, but they appear distinguishable by their smaller umbones, their broad hinge-lines, and their long hinge-spines. Again, on the other side of the typical form we find one of the commonest variations presented by large elongate flattish shells, in which the umbones are very small, and the spinous markings are minute, short, multitudinous and quincuncially arranged (Pl. XXI, figs. 7, 9); in these the transverse wrinkles are very numerous and prominent, and sometimes produce with the spinous markings a zigzag appearance. At first sight this variety has a distinct appearance, but it is most probably only an aged or extreme form of the present shell. Lastly, in a few small shells we find the spinous markings very few, acicular, and confined to the more central parts of the shell, and the transverse ridges prominent and straight (Pl. XXI, fig. 11); these may be regarded as immature shells. While, however, the above variations may be noted, it must be added that they are not constant, as they are united by intermediate forms, and few shells are exactly alike. There seems, therefore, every reason to believe that they all belong to a single species.

The strong erect spines of the hinge of both valves sometimes reach a length of more than 10 mm. (Pl. XXI, fig. 9). Specimens occasionally occur in which the body-spines are seen to be elongate, crowded, and hair-like over the whole surface. A decayed specimen from Baggy retains them wherever the shell is not obliterated, both on the shoulders and the front portion of the valve (Pl. XXI, fig. 6). While the extreme elongation in shape of some specimens is largely due to contortion, it is probably not to be wholly accounted for by this cause.

Two other variations not occurring in the Barnstaple area must be noticed. At South Petherwyn the shells called by Phillips *Leptæna membranacea*,¹ but united by Davidson to this species, are common. These are small and flat; their spinous markings are very few and blunt, while their wrinkles are numerous, prominent, and zigzagged. All the specimens I have noticed are dorsal valves, but a ventral valve is figured by Davidson. Again, in the same beds occur equally

¹ 1841, Phillips, 'Pal. Foss.,' p. 60, pl. xxv, fig. 101.

small, rounded, ventral valves, with somewhat larger, scattered, blunt tubercles or spinous markings. These seem to have been referred by Phillips¹ to his *P. laxispina*,² but are included in this species by Davidson: *St. productoides*, Wenjukoff,³ and *St. calvus*, Wenjukoff,⁴ appear closely to correspond with them. It is remarkable that amid the numerous specimens from the Pilton Beds nothing like either of these two forms should have come under my notice, and I reserve for the present my opinion as to their specific identity.

3. Genus—CHONETES, *Fischer de Waldheim*, 1837.

1. CHONETES HARDRENSIS, *Phillips*, sp. ? Plate XXII, fig. 4.

- ? 1841. ORTHIS HARDRENSIS, *Phillips*. Pal. Foss., p. 138, pl. lviii, figs. 104 a—d;
and pl. lx, fig. 104*.
- ? 1855. LEPTÆNA (CHONETES) HARDRENSIS, *M'Coy*. Brit. Pal. Foss., p. 454.
- ? 1861. CHONETES HARDRENSIS, *Davidson*. Brit. Foss. Brach., vol. ii, p. 186,
pl. xlvii, figs. 12—18, 25 ?.
1865. — — — Ibid., vol. iii, p. 94, pl. xix, figs. 6—9.
- ? 1880. — LAQUESSIANA, *Davidson*. Ibid., vol. iv, p. 312, pl. xxxiv,
fig. 18.
1882. — HARDRENSIS, *Davidson*. Ibid., vol. v, p. 54, pl. iii, fig. 24.
- ? 1884. — LAQUESSIANA, *Davidson*. Ibid., vol. v, p. 280, pl. xx, figs.
20—21 a.

Description.—Ventral valve small, moderately transverse, suboval. Hinge-line straight, as long as the width of the shell, bearing several obliquely-set spines. Umbo small, incurved, not extending above the hinge. Contour very gently convex. Front margin long, slightly convex. Side margins obliquely convex. Lateral angles rather less than right angles. Surface covered with very numerous, straight, divaricating rays, which are more or less nodulous. Dorsal valve concave; interior radially pitted.

Size.—Length 6 mm., width 9 mm.

Localities.—Top Orchard, Ashford Strand, Mainstone, Bradiford, Kingdon's Shirwell, Croyde, Laticosta Cave, Baggy, Upcott Arch Quarry, Wrafton Lane, Rock Hill Quarry, Ashhill Quarry.

¹ 1841, Phillips, 'Pal. Foss.', p. 59, pl. xxv, fig. 99.

² 1861, Davidson, 'Brit. Foss. Brach.', vol. ii, pt. 5, p. 166, pl. xxxiii, fig. 18 (under *P. aculeatus*).

³ 1886, Wenjukoff, 'Faun. Dev. Syst. Russl.', p. 45, pl. ii, figs. 5, 6.

⁴ Ibid., p. 47, figs. 8—10.

Remarks.—This is undoubtedly the shell to which Davidson ultimately restricted the name *Ch. Hardrensis*; but its title to that name seems rather faulty.

Ch. Hardrensis, though described in Phillips's Devonian work, seems primarily to be a Carboniferous species, his two first and best figures being from Westleigh (Culm) and Yorkshire, though he also quotes it from Berry Pomeroy and Meadfoot. In 1852 M'Coy limited the name to the Carboniferous form, referring the Devonian shells to *Ch. sarcinulata* (Schlotheim). Davidson, in 1865, united under it both the Carboniferous and Devonian shells, quoting it as especially abundant from near Barnstaple, figuring "one of Phillips's original specimens" from North Devon, and uniting with it *Leptæna sordida*, Sowerby. In 1880, however, in deference to the opinion of de Koninck, he reluctantly separated the Carboniferous shell under the name *Ch. Laquessiana*, de Koninck, remarking at the same time that the Rev. W. Downes had found two good examples of *Ch. Laquessiana* at Westleigh, which is Phillips's first locality for his *Ch. Hardrensis*. In face of the latter fact, can Phillips's be superseded by a later name for the Carboniferous shell, if it is distinct from the Devonian form? But further, though possibly Davidson may have included more than one species among the numerous Carboniferous varieties which he records, some of them, including the typical Carboniferous shape, seem impossible to be distinguished from our Pilton shells (at all events in their present state of preservation). Lastly, it is also to be noted that the shell which in 1882 he figures from Hope's Nose seems also to coincide with them. On the whole it seems best to retain Phillips's name for these common Pilton shells, only remembering that, if the Carboniferous shell be ultimately proved distinct, it has a strong claim to retain the name *Hardrensis* for itself.

As seen in the Pilton Beds our species is very variable. Its diversity in shape is doubtless exaggerated by distortion, but its fine divaricating rays vary considerably in size and number, while they have a granular appearance, and sometimes show the characteristic arrangement of minute regular and close concentric striæ. The hinge-spines are only very imperfectly seen in any of our specimens, but the slight indications of them occasionally visible seem to have the same obliquity as in Phillips's type.

PLATE XVII.

LEPTODESMA, sp. (Page 121.)

FIG.

1. Specimen defective, but showing portions of the wings. Saunton Point (in a pebble). Hamling Collection.

AVICULOPECTEN NEXILIS, *Sowerby*, sp. (Page 129.)

2. Portion of the surface of a specimen, $\times 15$. Laticosta Cave, Baggy. My Collection.
3. Slab, with moulds of the opposite valves, apparently of a single shell, $\times 3$. Laticosta Cave, Baggy. My Collection.

PTERINOPECTEN SCABRIRADIANS, n. sp. (Page 135.)

4. Specimen of a right valve, showing ornament and anterior wing clearly, but defective below, $\times 3$. Wrafton Lane. My Collection.

PERNOPECTEN INSPIRATUS, n. sp. (Page 143.)

5. Specimen, showing the projecting wings, $\times \frac{3}{2}$. Top Orchard. Barnstaple Athenæum.

PROTHYRIS, sp. (Page 144.)

6. Left valve, showing the anterior notch (which is fractured) and the radiating and transverse markings, $\times \frac{3}{2}$. Sloly Quarry. My Collection.

RENSELLERIA? FORMOSA, n. sp. (Page 145.)

7. Specimen, showing umbonal arrangements and texture, but so much distorted as to simulate *Leptæna laticosta* in shape, $\times \frac{3}{2}$. 7 a. Portion of surface, $\times 40$. Poleshill. Porter Collection.
8. Large specimen, showing the cast of the dental plates, &c., and the rounded shape of the ribs, $\times \frac{3}{2}$. 8 a. Umbonal portion, $\times 3$. Ashford Strand. My Collection.
9. Portion of the surface of a fragmental specimen, $\times 40$, showing the pores and the shape of the ribs. Ashford Strand. My Collection.

ATHYRIS? sp. (Page 146.)

- 10, 10 a. Dorsal and lateral views of a minute undetermined species, $\times 6$. Pilton. Porter Collection.

ATHYRIS (SEMINULA) OBLONGA, *Sowerby*, sp. (Page 147.)

11. Cast of the closed valves, showing the slight marginal fold and indications of the marks left by the vascular sinuses, $\times 2$. 11 a. Portion of the mould of the same individual, showing its smooth surface, $\times 3$. Ashford Strand. My Collection.
12. Cast of the dorsal valve of rather doubtful specimen, which has a stronger and wider fold than usual, $\times \frac{3}{2}$. 12 a, umbonal part, $\times 3$. Barnstaple. Woodwardian Museum.

ATHYRIS (CLEIOTHYRIS) ROYSSII, *Léveillé*, sp. (Page 148.)

13. Specimen figured by Davidson as *Terebratulula elongata*, Schlotheim (?), but exactly corresponding with casts of this species, $\times \frac{3}{2}$. Braunton. Museum of Practical Geology.
14. Cast of the ventral valve of a rather doubtful specimen, $\times 2$. Roborough. Porter Collection.
15. Mould of the ventral valve of a small specimen, showing the surface and the beginnings of the crura, $\times 2$. 15 a, Umbonal part, $\times 5$. Pilton. Porter Collection.

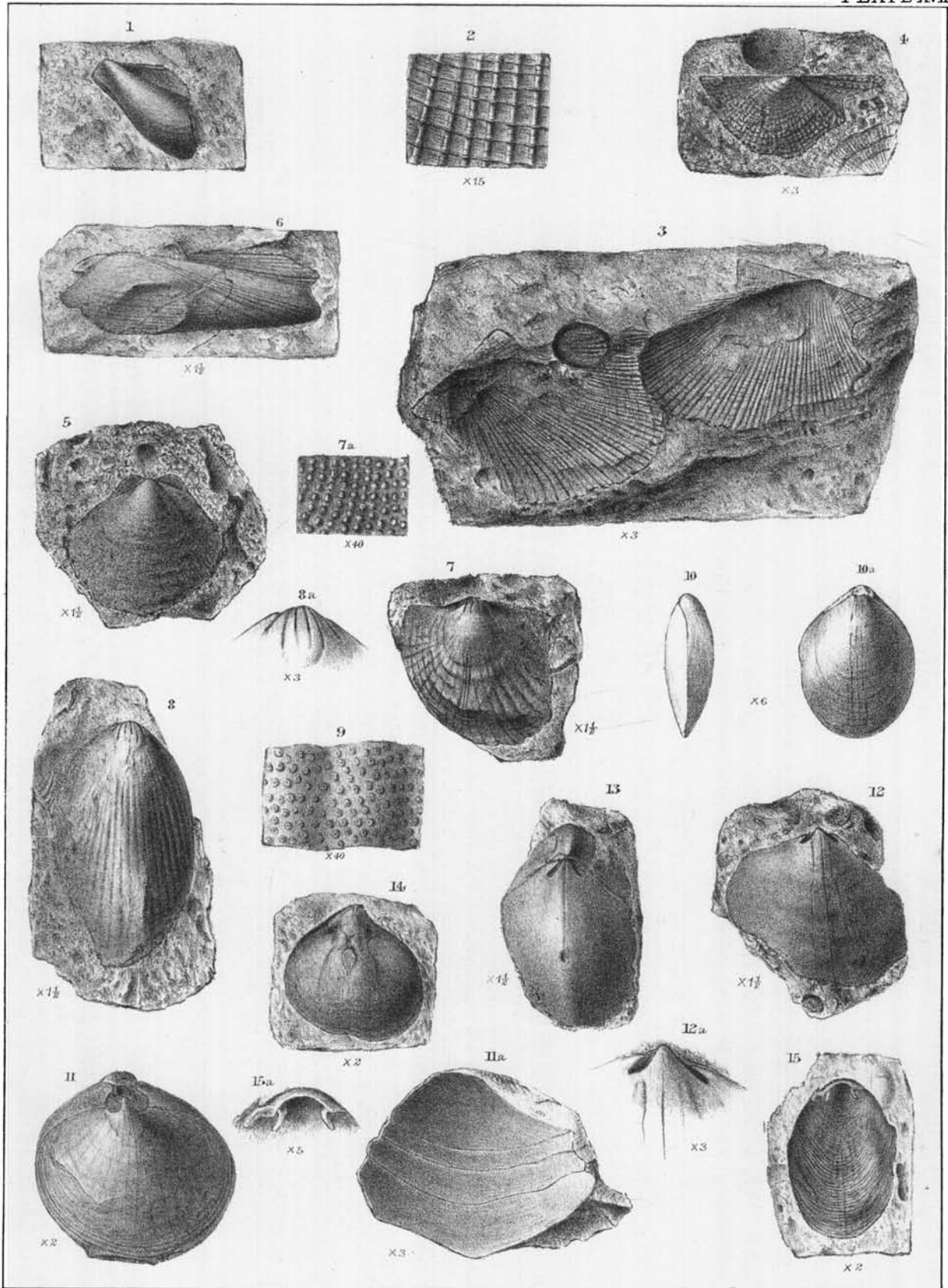


PLATE XVIII.

ATHYRIS (CLEIOTHYRIS) ROYSSII, *Léveillé*, sp. (Page 148.)

FIG.

1. Dorsal view of the cast of a young specimen, showing the central septum and the muscle-scars, $\times 3$. Croyde. Museum of Practical Geology.
2. Dorsal view of a similar specimen, showing the spire, $\times 3$. 2 *a*, posterior view, showing the opening of the visceral canal, $\times 3$. Croyde. Museum of Practical Geology.
3. Mould of another young specimen, showing the ornament, $\times 3$. (*This figure is drawn out of the perpendicular.*) Poleshill. Porter Collection.
4. Mould of a large distorted specimen, showing the fold and the ornament, which becomes closer and more spiniferous near the margins, $\times 2$. Pouch Bridge. Barnstaple Athenæum.
5. Distorted mould of another large specimen, with unusually numerous striæ, $\times 2$. Pilton. Porter Collection.

SPECIES INDETER.

6. Cast of a ventral valve, showing muscular marks and signs of probable ribs, $\times 2$. Poleshill. Porter Collection.

SPIRIFERA MICROGEMMA, *Phillips*. (Page 151.)

7. Cast taken from the mould of a valve, showing ornament, but distorted in the region of the sinus, $\times 2$. 7 *a*. Portion, $\times 5$. Pilton. Porter Collection.
8. A distorted dorsal valve, showing the fold, $\times \frac{3}{2}$. Top Orchard. Barnstaple Athenæum.

SPIRIFERA VERNEUILII, *Murchison*. (Page 152.)

9. A crushed individual, showing the hinge, $\times \frac{3}{2}$. Pilton. Porter Collection.
10. Portion of the cast of a specimen of the variety *Sp. Barumensis*, showing the spires.
11. Portion of the surface of a large specimen, showing the minor longitudinal ornament, $\times 10$. Ashford Strand. Barnstaple Athenæum.
12. Portion of another specimen, in which the transverse ornament is strong and the minor longitudinal ornament invisible, $\times 10$. Ashford Strand. Barnstaple Athenæum.
13. Ventral valve, seen from within, $\times \frac{3}{2}$. 13 *a*, portion of surface, $\times 15$, showing the arching lines of pores. Snapper Quarry. My Collection.

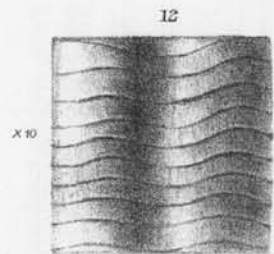
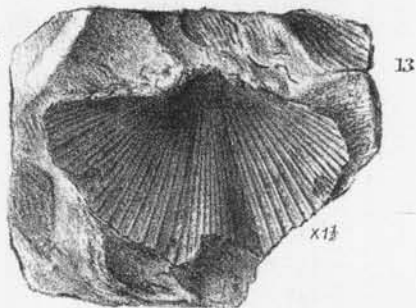
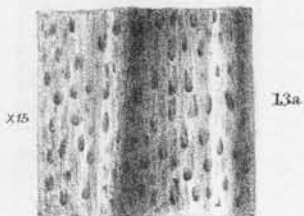
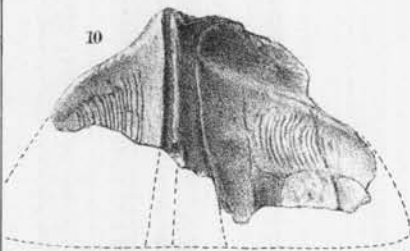
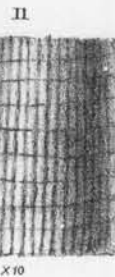
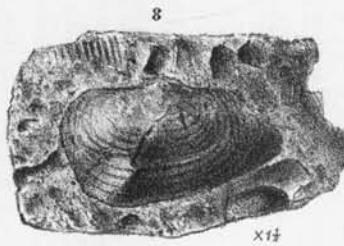
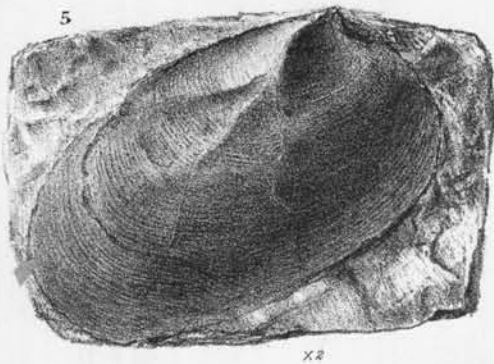
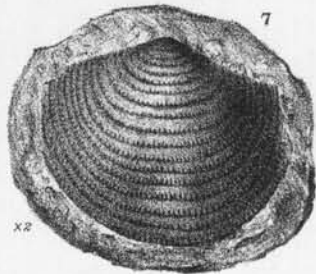
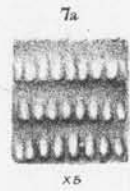
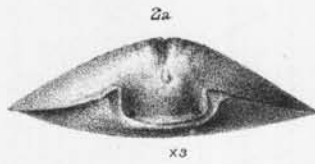
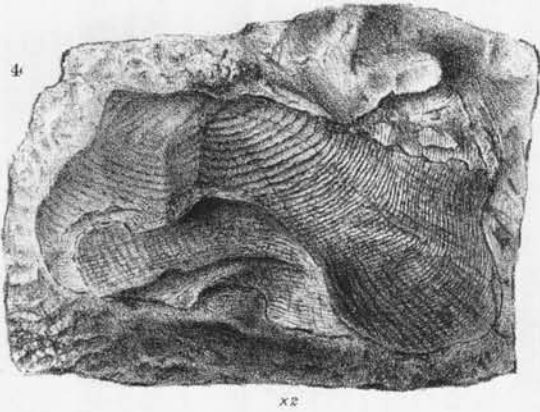
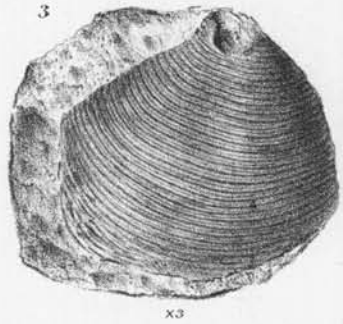
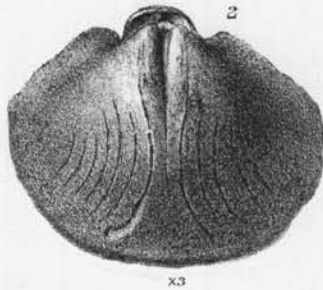
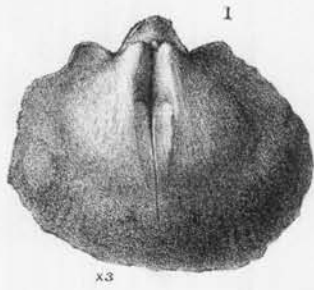


PLATE XIX.

SPIRIFERA OBLITERATA, *Phillips*. (Page 156.)

FIG.

1. Phillips's type specimen, being a ventral valve, $\times \frac{3}{2}$. Brushford. Museum of Practical Geology.
2. Specimen of a dorsal valve, $\times \frac{3}{2}$. Top Orchard. Hamling Collection.
3. Another specimen with numerous ribs, $\times \frac{3}{2}$. Ashhill Quarry. My Collection.
4. A small specimen of the umbonal part of a dorsal valve, $\times 3$. 4 *a*, umbo, $\times 6$. Frankmarsh. My Collection.

SPIRIFERA URUI, *Fleming*. (Page 157.)

5. An unusually large specimen of the ventral valve, $\times \frac{3}{2}$. Roborough. Porter Collection.
6. A ventral valve, apparently of a variety of this species, with an unusually small beak and a very deep angular sinus, $\times 2$. Barnstaple. Woodwardian Museum.
7. A small specimen of the dorsal valve, $\times 3$. Ashhill Quarry. My Collection.

SPIRIFERA MESOMALA, *Phillips*. (Page 158.)

8. A small defective ventral valve with well-preserved surface, showing the smooth median sinus, $\times 5$. Saunton Hotel. My Collection.
9. A small and very badly preserved ventral valve, either of this species, or, more probably, of *Sp. Verneuilii*, $\times \frac{3}{2}$. 9 *a*, view of area. 9 *b*, side view. Sloy Quarry. Mr. Upfield Green's Collection.

SPIRIFERINA CRISTATA (*Schlotheim*), var. OCTOPLICATA, *Sowerby*. (Page 159.)

10. Specimen of a ventral valve, showing the plaited surface, $\times 3$. Poleshill. Porter Collection.
11. A small ventral valve in the state of a cast, $\times 2$. 11 *a*, portion, $\times 15$, showing the puncta of the surface. Poleshill. Porter Collection.

RHYNCHONELLA PARTRIDGÆ, *Whidborne*. (Page 161.)

12. Cast of dorsal valve, showing the fold with four ribs, $\times \frac{3}{2}$. 12 *a*, umbonal portion, $\times 4$, showing the hinge arrangement. Pilton. Porter Collection.
13. Ventral valve, showing the sinus with three ribs, the ridge bounding the muscular area, and the apical grooving of the ribs, $\times 2$. Pilton. Porter Collection.
14. Another specimen, $\times \frac{3}{2}$. Roborough. Porter Collection.

RHYNCHONELLA TOGATA, n. sp. (Page 163.)

15. Ventral valve, showing the two ribs on the sinus, $\times \frac{3}{2}$. "North Devon." Museum of Practical Geology.
16. Another ventral valve, showing the coarse distant ribs and the muscular area. Marwood. Museum of Practical Geology.
17. Umbonal portion of another dorsal valve (which has three ribs on the fold). Pilton. Barnstaple Athenæum.
18. A very defective dorsal valve, with no indication of lateral ribs, $\times \frac{3}{2}$. Barnstaple. Museum of Practical Geology.

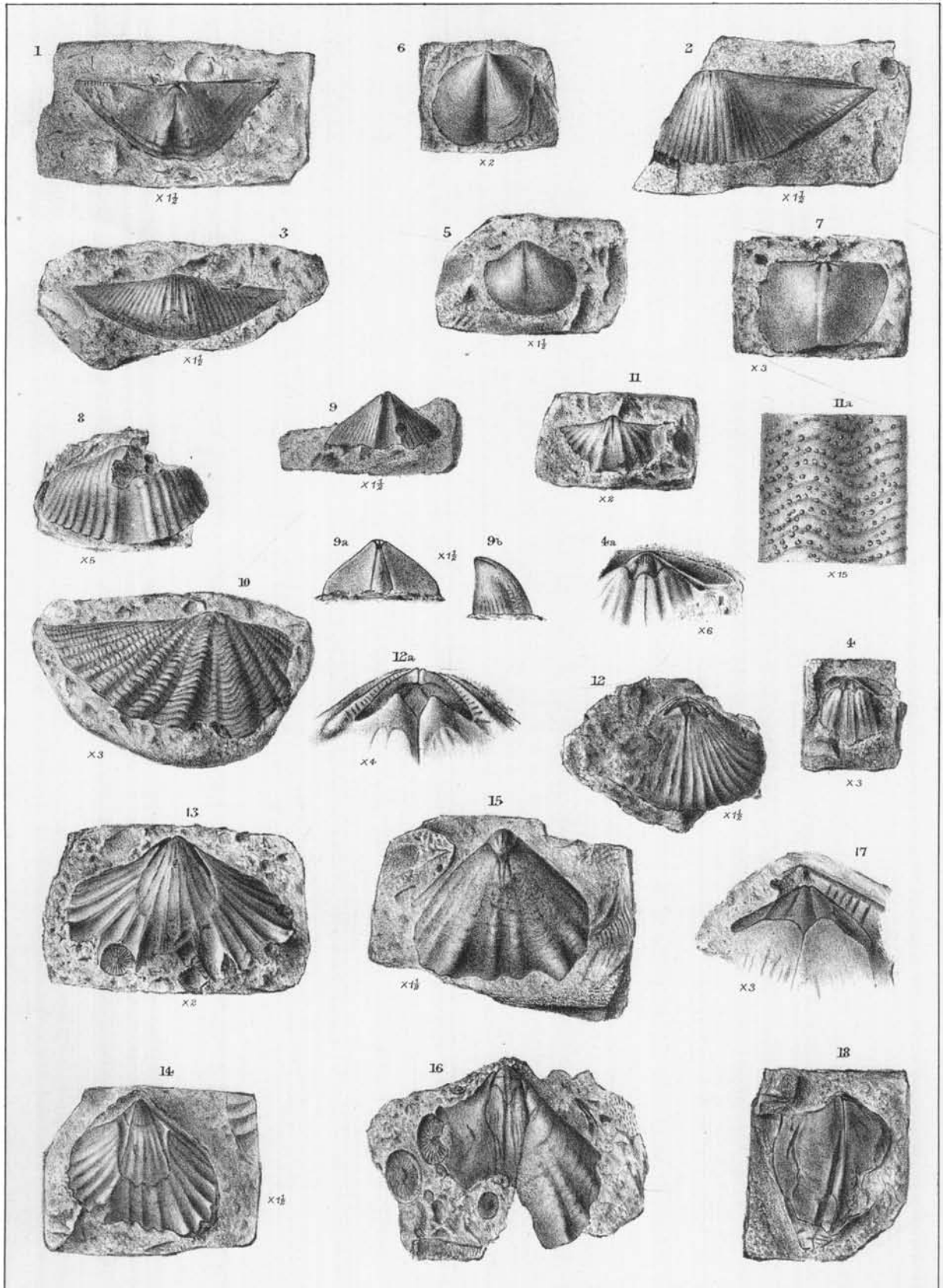


PLATE XX.

ATHRYS (CLEIOTHYRIS) ROYSSII, *Léveillé*, sp. (Page 148.)

FIG.

1. Portion of the mould of a specimen, showing the spines, $\times 8$. Poleshill? Porter Collection.
2. Portion of the mould of another specimen, showing the transverse ridges and the commencement of the spines, $\times 8$. Pilton. Porter Collection.

RHYNCHONELLA LATICOSTA, *Phillips*, sp. (Page 164.)

3. Large obliquely distorted specimen. 3 a. Another view. Laticosta Cave, Baggy. My Collection.
4. Cast of a smaller dorsal valve, showing the median septum. Laticosta Cave, Baggy. My Collection.

STROPHOMENA RHOMBOIDALIS, *Wilckens*, sp. (Page 168.)

5. Interior of a dorsal valve. Pilton. Porter Collection.

ORTHIS INTERLINEATA, *Sowerby*. (Page 165.)

6. Cast of a dorsal valve, $\times 2$. Pilton. Porter Collection.
7. Cast of a ventral valve, $\times 2$. Pilton. Porter Collection.

ORTHIS, sp. (Page 165.)

8. Specimen, drawn from a wax cast of a mould, $\times 6$. 8 a, Portion of shell, $\times 30$, showing markings, which may, however, be partly due to weathering. Saunton? Porter Collection.
9. Specimen, $\times 6$. Saunton? Miss Partridge's Collection. (The slab on which this lies proves to be the reverse of the slab in the Porter Collection; it contains several small specimens, and the artist appears to have chosen the cast of the same shell as that in the last figure.)

ORTHOTETES CRENISTRIA (*Phillips*), var. ARACHNOIDEA, *Phillips*. (Page 166.)

10. Portion of a large variety, with very fine and numerous ribs, $\times 2$. "Blagiford Paper Mills," Ilfracombe Road. Porter Collection.
11. Portion of another specimen, with few and coarse ribs, $\times 2$. Saunton Down, south end of Croyde Bay. Hamling Collection.

PRODUCTUS PRÆLONGUS, *Sowerby*, sp. (Page 168.)

12. Dorsal valve, showing the median rib and the ears, $\times \frac{3}{2}$. 12 a, side view, $\times \frac{3}{2}$. Top Orchard, Barnstaple Athenæum.
13. Small ventral valve, showing the scars of spines in the sinus and on the ears, $\times 2$. 13 a, side view, $\times 2$. Pilton. Porter Collection.

PRODUCTUS PRÆLONGUS, var. SIMPLICIOR, n. var. (Page 169.)

14. Specimen partially hid by matrix, showing the absence of a median sinus, and the presence of short scattered spines, $\times 2$. 14 a, portion of shell enlarged. Poleshill. Porter Collection.
15. Another specimen, with smaller umbo, $\times 2$. 15 a, side view, $\times 2$. Barnstaple. Woodwardian Museum.

PRODUCTUS SCABRICULUS, *Martin*, sp. (Page 170.)

16. A transverse ventral valve, nat. size. Smoking House Lane. Porter Collection.
17. Another distorted specimen, with scars of spines on the ears. Woodwardian Museum.
18. Portion of mould of dorsal valve, $\times 10$. Pilton. Porter Collection.

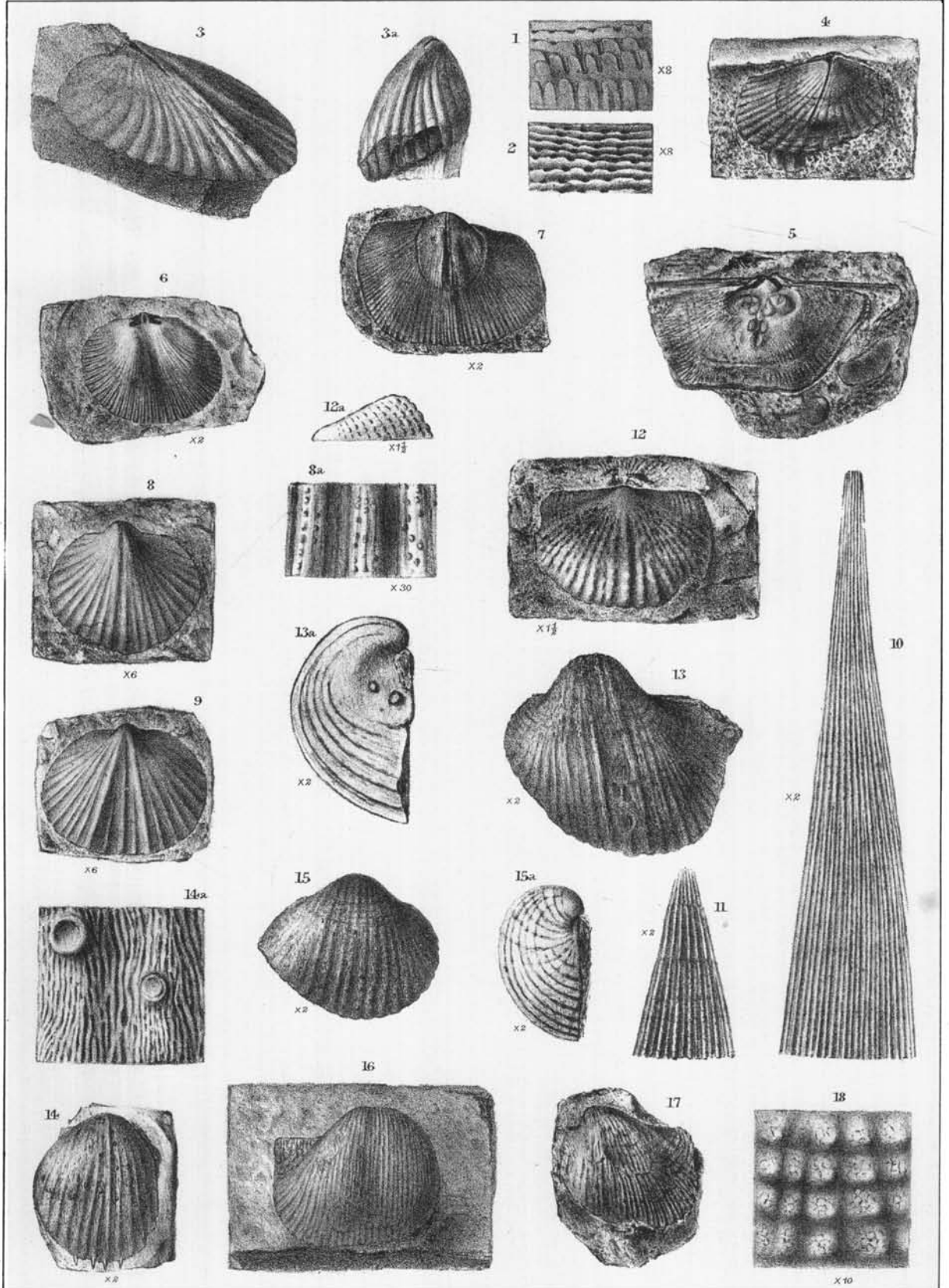


PLATE XXI.

PRODUCTUS cf. P. SUBACULEATUS, *Murchison*. (Page 174.)

FIG.

1. Imperfect dorsal valve, with the casts of long spines of the ventral valve. Pilton. Porter Collection.
2. Fragment of the mould of a ventral valve, showing casts of long spines, $\times \frac{3}{2}$. Fremington. Porter Collection.
3. Worn cast of a valve, showing the scars of spines in transverse rows, $\times \frac{3}{2}$. Fremington. Porter Collection.

PRODUCTUS CORRUGATUS, *M'Coy*. (Page 173.)

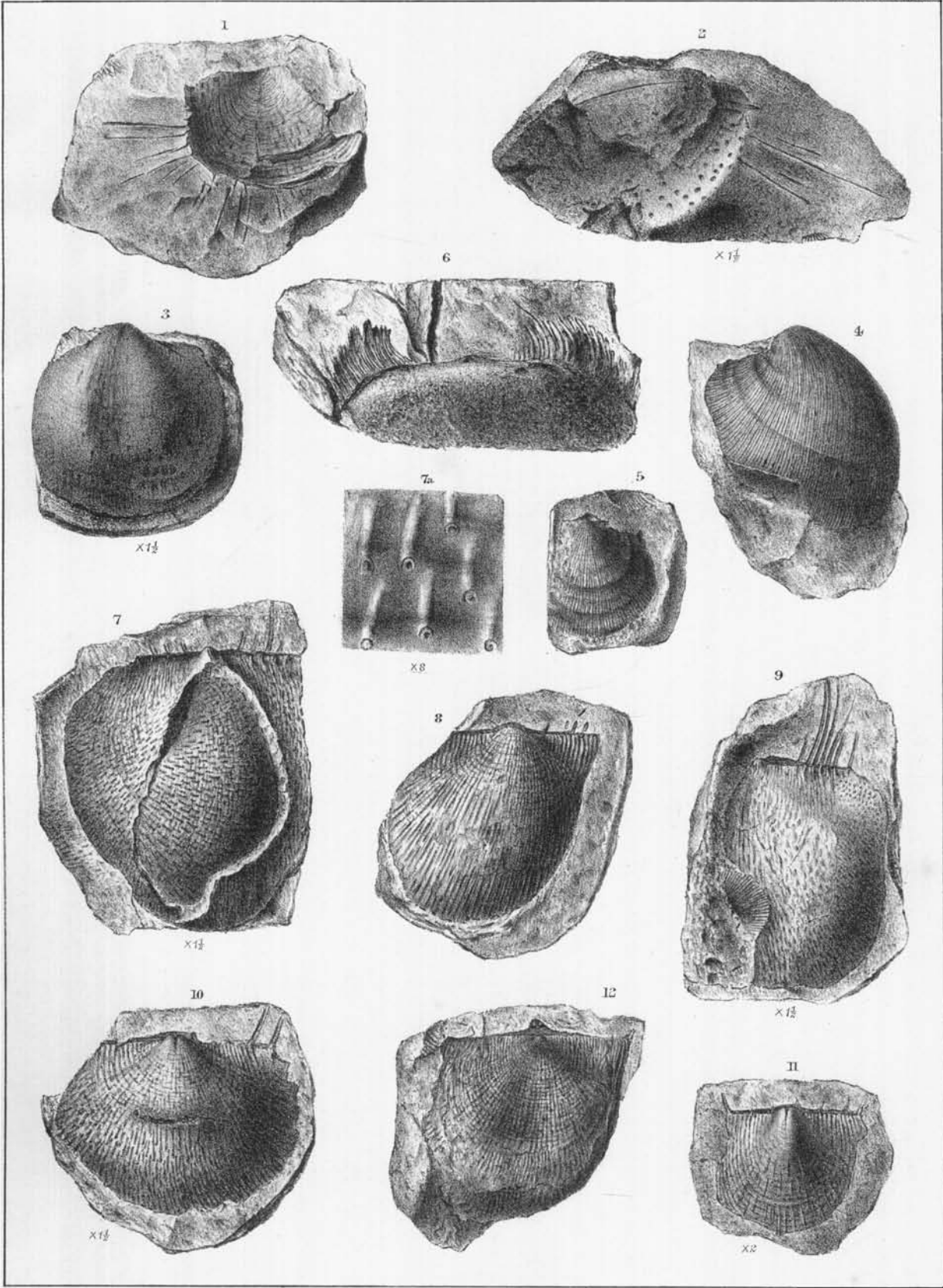
4. Oblique view of a worn specimen, with less flexuous ribs than usual. Fremington. Porter Collection.
5. Dorsal valve, most probably of this species, seen from within. Fremington. Porter Collection.

STROPHALOSIA PRODUCTOIDES, *Murchison*, sp. (Page 175.)

6. Posterior part of a decayed specimen, which is covered (wherever the surface is not totally obliterated) by crowded hair-like spines. Laticosta Cave, Baggy. My Collection.
7. Dorsal valve, showing hinge-area and hinge-spines; part of the centre being broken away, another specimen is disclosed, which shows the attachment of the spines, $\times \frac{3}{2}$. 7 a. Portion of the latter specimen, $\times 8$. Poleshill. Porter Collection.
8. Ventral valve, with very long ribs and hardly any signs of spines, except on the hinge. Poleshill. Porter Collection.
9. Specimen, showing the length of the hinge-spines, $\times \frac{3}{2}$. Pilton. Porter Collection.
10. Transverse specimen, with short ribs, $\times \frac{3}{2}$. Poleshill. Porter Collection.
11. Young specimen, with very few short ribs in the median parts, $\times 2$. Poleshill. Porter Collection.

PRODUCTUS SCABRICULUS, *Martin*, sp. (Page 170.)

12. Large elongate dorsal valve, showing the hinge-area. Pilton. Porter Collection.



A MONOGRAPH
OF THE
DEVONIAN FAUNA
OF THE
SOUTH OF ENGLAND.

BY
G. F. WHIDBORNE, M.A., F.G.S.

VOL. III.—PART III.

THE FAUNA OF THE MARWOOD AND PILTON BEDS

OF
NORTH DEVON AND SOMERSET
(*continued*).

PAGES 179—236; PLATES XXII—XXXVIII.

LONDON:
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1898.

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2. CHONETES MARGARITACEA, *Whidborne*. Plate XXII, figs. 5, 5 a, 6.

1896. CHONETES MARGARITACEA, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Ventral valve small, very transverse, semi-oval. Umbo low, rounded, very slightly extending over hinge. Hinge-line straight, equal to the width of the shell in length, bearing three (or four) nearly perpendicular spines. Margins very gently curved in front, gradually increasing in curvature laterally, and meeting the hinge-line at nearly right angles. Contour of surface moderately convex, becoming flatter on the wings. Ribs about thirty, low, rounded, divided by narrower concave furrows, vanishing on the wings, and crossed by minute regular sharp distant concentric threads, which are twice as close as the ribs.

Size.—Length 7 mm., width 15 mm.

Localities.—In the Porter Collection are six specimens from Roborough, Poleshill, and Pilton; in the Barnstaple Athenæum one from Bradiford; in the Museum of Practical Geology one from Braunton; and in my Collection one from Croyde.

Remarks.—This beautiful shell is distinguishable from *Ch. Hardrensis*, with which it occurs, by its somewhat larger size, its more transverse and oval shape, and its much larger, fewer, and more simple ribs, as well as by its pronounced concentric ornament.

From *Ch. Phillipsii*, Davidson,¹ it differs in its more oval and transverse shape and its considerably finer ornament.

Ch. plebeia, Schnur,² appears to be less transverse, and to have less simple ribs and more oblique hinge-spines.

3. CHONETES ILLINOISENSIS, *Worthen?* Plate XXII, figs. 7, 8.

- ? 1858. CHONETES LOGANI, *Hall* (not *Norwood and Pratten*). Geol. Rep. Iowa, vol. i, pt. 2, p. 598, pl. xii, figs. 1 a—e, 2.
 ? 1860. — ILLINOISENSIS, *Worthen*. Trans. St. Louis Acad. Sci., vol. i, p. 571.
 ? 1868. — — *Meek and Worthen*. Geol. Surv. Illin., vol. iii, p. 505, pl. xv, figs. 8 a, b.
 1896. — — *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Shell rather small, transverse. Hinge-line straight, nearly as long as the width of the shell. Margins moderately convex in front, their

¹ 1882, Davidson, 'Brit. Foss. Brach.', vol. v, p. 54, pl. iii, figs. 23, 23 a.

² 1897, Whidborne, 'Quart. Journ. Geol. Soc.', vol. liii, p. 454, pl. xxxiii, figs. 1, 2.

convexity gradually increasing on the sides, the extremities of which meet the hinge-line at an obtuse angle. Ventral valve moderately convex. Dorsal valve flat, becoming concave near the margins. Hinge-line with (at least) two very long, thin, slightly oblique spines on each side in the ventral valve. Surface covered with multitudinous elevated, rounded, divaricating and sometimes rather flexuous, minute radiations (probably about 150).

Size.—A distorted specimen is 8 mm. long by 15 mm. wide.

Locality.—In the Porter Collection are two slabs, containing several specimens from Pilton or Fremington.

Remarks.—These fossils appear distinguished by the very great number of the ribs, as well as by the flexuosity of these ribs, which seems to be caused by their frequent divarication at irregular intervals.

They are very similar to *Chonetes Dalmaniana*, de Koninck,¹ as given by M'Coy² and Davidson,³ but appear to differ by their longer, less oblique, and (apparently) fewer hinge-spines, and their rounded cardinal angles.

As far as can be judged from Meek and Worthen's figure, they do not appear distinguishable from *Ch. Illinoisensis*, though in that figure the length of the spines is not shown, and the sides of the shell seem rather straighter.

2. ORDER—INARTICULATA, *Deshayes*, 1836.

I. Family—CRANIIDÆ, *d'Orbigny*, 1847.

1. Genus—CRANIELLA, *Æhlert*, 1888.

1. CRANIA INSECURA, n. sp. Plate XXII, fig. 9.

Description.—Cast of dorsal or upper valve irregularly quadrate with rounded angles, rather longer than broad, and widest at or about one-third the diameter from the front. Apex small and sharp, slightly in front of the centre. Contour broadly conical, but having two large indistinct swellings before the apex, one on each side, in front of which the surface sinks steeply to the margin. Anterior margin almost straight; lateral margins oblique and slightly arching; posterior margin straight, and only half the width of the anterior. Margins (in cast) with a broad concave border. Occlusor muscle-marks two, concave, ovoid

¹ 1843, de Koninck, 'Discr. Anim. Foss. Terrain Carb. Belg.,' p. 210, pl. xiii, fig. 3; and pl. xiii *bis*, fig. 2.

² 1844, M'Coy, 'Synops. Carb. Foss. Irel.,' p. 119, pl. xx, fig. 7. Mons. Æhlert informs me that he questions the identity of M'Coy's and de Koninck's species.

³ 1861, Davidson, 'Brit. Foss. Brach.,' vol. ii, pt. 5, p. 183, pl. xlvi, figs. 7—7 b.

or pear-shaped, adjacent in front and slanting outwards, situate immediately behind the apex, and one-seventh of the shell in length. Divaricator scars rather larger and more oval than the oclusors, concave, elongate, not slanting, apparently bisected longitudinally, situate at the postero-lateral corners, and touching the inner edge of the marginal rim. Surface (of cast) traversed by an irregular transverse ornament, reproduced from the organism to which it was attached.

Size.—Length 13 mm., width 12 mm., depth 7 mm.

Localities.—In the Barnstaple Athenæum is a specimen on a slab with *Productus prælongus*, *Rhynchonella Partridgiæ*, &c. Though its locality is not stated, it is clearly from the equivalent to the Top Orchard beds. A doubtful specimen is in the Porter Collection from Pilton, and another in my Collection from Ashhill Quarry.

Remarks.—The figured specimen is indistinct, especially in consequence of its having irregular ridges assumed from some other organism on which it was parasitic. Davidson¹ notes that the free valves of the Carboniferous *Cranixæ* are sometimes similarly marked. The broad marginal concavity seems to indicate a massive shell, and the concave marks in the cast show that in the shell the muscle-scars were very convex.

In 1896 I referred this shell to *Craniella Meduanensis*, Ehlert;² I am inclined now to think that there are probably not sufficient grounds for this identification; the muscular impressions appear to be smaller and differently shaped, and there appears something in the nature of a border. Moreover, Mons. Ehlert, judging from a photograph submitted to him, regards it as a *Craniella* of the group of *Meduanensis*, but distinguishable by its contour, the situation of the muscles, and the position of the summit.

To the Carboniferous *Crania quadrata*, M'Coy, sp.,³ it also appears somewhat similar; but it is distinguished by the anterior position of its vertex and its oclusor scars, and by the more transverse shape of its divaricator scars.

Of *Crania proavia*, Goldfuss,⁴ I have only been able to find figures and descriptions of the lower or fixed valve, and have therefore been unable to compare it. In shape it would seem to have been more rectangular and transverse.

¹ 1861, Davidson, 'Brit. Foss. Brach.,' vol. ii, pt. 5, p. 195.

² 1888, Ehlert, 'Bull. Soc. Etud. Sci. Angers,' (1887), p. 38, pl. x, figs. 1—1g.

³ 1844, M'Coy, 'Synops. Carb. Foss. Irel.,' p. 104, pl. xx, fig. 1.

⁴ 1853, Schnur, 'Palæontographica,' vol. iii, p. 230, pl. xliii, figs. 9a, b; and 1871, Kayser, 'Zeitsch. Deutsch. Geol. Gesell.,' vol. xxiii, p. 641, pl. xiv, fig. 6.

2. Genus—CRANIA, Retzius, 1781.

1. CRANIA? RICTA, n. sp. Plate XXII, figs. 10, 10 a.

1896. CRANIA RINGENS, *Whidborne* (not *Höninghaus*). Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Ventral valve flattish, transversely oval. Divaricator scars rather small, transversely oval, slightly convex, strongly defined, crossed by strong oblique ridges, and situated very near each other and near the centre of the posterior margin. Occlusor scars confluent, forming apparently a long transverse oval prominence, covered with transverse ridges, and situate at about the posterior fourth of the median line. Ventral adjustor (?) scars very small, obliquely oval, situate at the antero-lateral margins of the occlusor scars. Inner surface covered by minute closely-arranged tubercles or granules.

Size.—Length about 14 mm., width about 19 mm.

Localities.—A single specimen from Pilton is in the Porter Collection.

Remarks.—I am very doubtful about the generic position of this curious fossil, and only place it provisionally in this genus as its muscle-marks appear not unlike those of some species of *Crania*. In many ways it seems to be remarkable. The specimen, which is almost flat, and may, I think, be regarded pretty confidently as a ventral valve, shows no signs of having been attached to any other organism. The striation of the muscle-scars is very strong and acute; the divaricator scars are unusually proximate to each other, being less than their own width apart; and the width across the pair is less than one-third the width of the whole shell. The surface at the centre of the occlusor scars is blurred, so that it cannot be seen whether they are fully or only partially confluent. At their anterior corners may be seen two much smaller and less distinct scars, which may perhaps belong to ventral adjustors. The most striking feature of the fossil, however, is the coarse tuberculation of its inner surface, which conveys the idea, not of being the casts of pores left in a decayed shell-structure,¹ but of being the original internal face of the shell. This is, perhaps, analogous to the tuberculated border of some species of *Crania*.

I have been unable to find the description of any species at all approaching this shell; and, though its general resemblance to some more recent *Cranix* makes it just possible that it may be included within the limits of the genus, it is far more likely that further specimens will prove the existence of generic or even greater distinctions.

¹ But compare 1892, Hall and Clarke, 'Pal. N. Y.,' vol. viii, pt. 1, pl. iv H, fig. 7.

II. *Family*—DISCINIDÆ, *Gray*, 1848.I. *Genus*—DISCINA, *Lamarck*, 1819.1. DISCINA NITIDA, *Phillips*, sp. Plate XXII, figs. 11, 11 *a*, 12.

1836. ORBICULA NITIDA, *Phillips*. Geol. Yorks., vol. ii, p. 221, pl. ix, figs. 10—13.
1865. DISCINA NITIDA, *Davidson*. Brit. Foss. Brach., vol. iii, p. 104, pl. xx, figs. 9—10 *a*.
1871. — — ? *Kayser*. Zeitsch. Deutsch. Geol. Gesell., vol. xxiii, p. 640.

Size.—Length 23 mm., width 18 mm.

Localities.—In the Museum of Practical Geology is a lower valve from Barnstaple, and two upper valves (the smaller of which was figured by Davidson) from West Angle (Pembrokeshire). In Miss Partridge's Collection is a specimen of each valve from Saunton. I have obtained specimens from Saunton Hotel and the "Laticosta Cave,"¹ Baggy.

Remarks.—The comparison of our specimens with a large series of Carboniferous specimens leaves no doubt of their specific identity. The only differences observable are that the Devonian specimens sometimes are slightly larger and sometimes more elongate and oval, and that the foramen of the lower valve, as seen internally in them, is much smaller than it is as seen externally in the Carboniferous examples, which difference probably is simply due to its character.

In Miss Partridge's specimen of the upper valve, the strong median longitudinal thickening under the apex is more evident than it is in the Yorkshire shells, in several of which, however, it is observable.

III. *Family*—LINGULIDÆ, *King*, 1850.I. *Genus*—LINGULA, *Bruguère*, 1792.1. LINGULA SQUAMIFORMIS, *Phillips*. Plate XXII, fig. 13.

1836. LINGULA SQUAMIFORMIS, *Phillips*. Geol. Yorks., vol. ii, p. 221, pl. xi, fig. 14.
1865. — — *Davidson*. Brit. Foss. Brach., vol. iii, p. 105, pl. xx, figs. 11, 12.

¹ "Laticosta Cave" is, of course, not a local name in ordinary use. It is as well to remark again that I have simply used it as an abbreviation to indicate the one spot where (in company with numerous other species) *Rh. laticosta* has hitherto been found.

Size.—Length 19 mm., width 14 mm.

Localities.—Very abundant at Sloly Quarries. Specimens have been found near Baggy Point by Mr. Townshend Hall. A single fine specimen from Saunton is in Miss Partridge's Collection.

Remarks.—The specimens from Sloly sometimes occur in beautiful states of preservation, but are almost always more or less distorted. Occasionally they appear almost circular in shape, and these my friend Mr. Townshend Hall was inclined to separate under the manuscript name *L. circularis*; but, having examined his specimens, I believe that their shape is entirely due to pressure, and that there is no reason to regard them even as a variety of the common form.

On the other hand, I am more doubtful as to the identity of the fine dorsal valve (Pl. XXII, fig. 13) found by Miss Partridge in the Pilton Beds of Saunton. Its almost oblong shape, almost horizontal posterior margin unbroken by the apex, its very convex shoulders, its thin shell, and the five or six radiating lines on the cast in front, seem to indicate that it is at least a marked variation from the form of the species occurring at Sloly.

2. CLASS—BRYOZOA, *Ehrenberg*, 1832.

1. ORDER—GYMNOLÆMATA, *Allman*, 1856.

1. SUB-ORDER—CRYPTOSTOMATA, *Vine*, 1883.

Fenestellids are very abundant in the Pilton Beds; but, as usual, their state of preservation is such as not to lend itself to their easy determination. They can in general only be obtained in fragments, crushed and drawn out in different directions, so as to mask their relative dimensions. From the pressure which the fronds have undergone it can rarely be said whether they were originally fan-shaped or conical. From the nature of the rock it is impossible to obtain sections. They occur for the most part either (1) in the condition of internal casts when the cells are visible, but too frequently the dissepiments have disappeared, or (2) in that of external moulds, in which case sometimes the cell-mouths may be recognised, but the dissepiments are frequently blurred by the matrix or missing.

Hence specific determination can only be very tentative. There appears to be sufficiently clear evidence of the existence of at least three or four species, but to define them so as to show their differences or their identity with fossils occurring in other localities is almost impossible; and it is not unlikely that if better specimens were obtainable, differences would be found to exist between some specimens which, under present circumstances, it is necessary to place together.

I. *Family*—FENESTELLIDÆ, *King*, 1849.

1. *Genus*—FENESTELLA, *Lonsdale*, 1839.

1. FENESTELLA PLEBEIA, *M'Coy*. Plate XXII, figs. 14—15 *a*; and Plate XXIII, figs. 1, 1 *a*.

1841. FENESTELLA ANTIQUA? vars. β ? and γ , *Phillips*. Pal. Foss., p. 24, pl. xii, figs. 35 (*d, e?*) *f, g*.
1844. — PLEBEIA, *M'Coy*. Synops. Carb. Foss. Irel., p. 203, pl. xxix, fig. 3.
1855. — — — Brit. Pal. Foss., p. 76.
1879. — — — *Shrubsole*. Quart. Journ. Geol. Soc., vol. xxxv, p. 278.
1881. — — — Ibid., vol. xxxvii, p. 179.

Description.—Zoarium apparently flabelliform, large. Fenestrules about nine or ten in the length of 10 mm., and thirteen in the width of 10 mm., elongate, oblong. Branches stout, undulating near the base, almost straight in the distal parts, about the width of the fenestrules, and divaricating at first irregularly and farther from the base at very regular distances. Dissepiments apparently small and narrow. Non-poriferous surface ornamented with a few strong longitudinal ridges. Mode of increase sometimes near the base by one or two new branches rising from the closed head of a fenestrule, but generally by the simple fission of the branches, which appears to occur at the rate of once in about ten fenestrules, and at the same level in groups of adjoining fenestrules. Cells arranged in two alternating rows, sometimes with a third cell intercalated at the commencement of a branch, pentagonal in longitudinal section, numbering from four to six, generally five, in the length of a fenestrule.

Size.—A fragmentary specimen is 50 mm. long.

Localities.—Poleshill, Wrafton Lane, Pilton, Ashford Strand, Snapper Quarry, Kingscote (near Brushford), Croyde, &c. It is an abundant species, and is found at most of the Pilton localities, though it is not so frequent in beds where large Brachiopods predominate.

Remarks.—This appears to be the species described by Phillips from North Devon under the name "*Fenestella antiqua*, (β), Lonsdale, var. β and γ ," though under these varieties he also included the South Devon form, which I have called *F. fanata*,¹ and from which it differs in its less rapid branching, the larger number of cells to a fenestrule, and other points. M'Coy, in 1855, separated the form found at Petherwyn from the Middle Devonian species, and referred it to his pre-

¹ 1895, Whidborne, 'Dev. Fauna,' vol. ii, p. 165, pl. xviii, figs. 6—10; and pl. xix, figs. 3, 4.

viously described *F. plebeia*, and it appears to me that with that species these Pilton fossils are identical.

The only point in which Phillips's description does not agree with our fossils is that he figures and describes the non-poriferous face as granular, whereas they show it to be striated. A free specimen, however, from Ironpost has it tuberculated, and though the fossil is obscure, it seems most likely that that feature is due to mineral change acting perhaps on a finely granulated matrix, and may have obliterated the original striation.

2. FENESTELLA? UMBROSA, n. sp. Plate XXII, figs. 16, 16 a; and Plate XXIII, figs. 2, 2 a, 3, 3 a.

Description.—Zoarium large, convex, infundibuliform. Branches undulating, stout, broader than the fenestrules, poriferous on the external face, which is obliquely flattened, and appears to bear a thin sharp median keel. Non-poriferous face with a few very strong longitudinal striæ, of which the central seems strongest, and perhaps forms an incipient keel. Cells two or three (or occasionally even four) to a fenestrule, projecting (?) so as to cause indentations on the sides of the branches. Fenestrules twelve to seventeen in the length of 10 mm., and about twenty-two in the width of 10 mm. Rate of branching about one in seven.

Size.—A doubtful crushed specimen is more than 80 mm. long.

Localities.—In the Barnstaple Athenæum is one specimen from Roborough; in the Woodwardian Museum two from Barnstaple; in the Museum of Practical Geology one from Croyde and one from the Pilton Beds; in the Porter Collection six from Roborough, Poleshill, and Pilton; and in my Collection one from Croyde Rocks.

Remarks.—These specimens appear clearly to indicate a species distinct from the common Pilton *Fenestella plebeia* both in general appearance and detail, and distinguished from it by its stouter, more undulating branches, its smaller and narrower fenestrules, its more rapid branching, its cup-like shape, and other points. At the same time the imperfect state of our specimens, which are almost all moulds or casts, makes it hard to say how much weight may be placed on characters and measurements observable in them, and there are some inconsistencies noticeable in them, rendering it not impossible that they include two similar species, which cannot be separated without better material. Thus—

(1) A specimen in the Woodwardian Museum, another in the Museum of Practical Geology, and another in the Barnstaple Athenæum show that the

zoarium was infundibuliform, either from its developing from a central base or from its sides overlapping each other. In these fossils the poriferous face of the branches is external, and in one of them it appears to show a thin keel.

(2) In a second specimen in the Museum of Practical Geology, however, the poriferous face appears to be upon the concave (or internal) side of the zoarium. This fossil is a mould, and is remarkable for having circular cavities, not quite as numerous as the fenestrules, irregularly placed on its branches, which they equal in width. Whether these cavities indicate spines, as in *F. Lyelli*, Dawson,¹ or ovarian capsules or nodes such as are described in the very similar *F. vera*, Ulrich,² does not appear. The specific identity of this specimen must evidently be at present doubtful, unless the appearance of the inner face being poriferous is deceptive.

In the other specimens the number of cells to a fenestrule is sometimes two, sometimes three, while sometimes (unless a dissepiment has been obliterated) it is four. In one or two specimens which seem to belong to the same species, but which are in a different state of preservation, and perhaps more nearly resemble *F. plebeia* in some points, their number is clearly three or four.

Affinities.—*F. nodulosa*, Phillips,³ appears to be a closely allied form, resembling our typical specimens in the prominence of the cell-mouths, which nodulate the sides of the branches. Possibly its cells were as a rule slightly more numerous, and its fenestrules wider. Among numerous examples of it in the Woodwardian Museum are two which show its frond to be flabellate, as described by M'Coy⁴ (though Phillips called it "radiating," and so figured it). For this reason it seems safer to regard it as distinct.

F. oculata, M'Coy,⁵ also is very similar, but appears to branch more rarely, to have no keel on the poriferous face, and to be smooth on the reverse. In these points, perhaps, *F. flabellata*, Phillips,⁶ is still nearer, but its branches seem to be slighter, and its fenestrules more regular; it was regarded by Shrubsole as synonymous with *F. membranacea*, Phillips (*i. e.* *Hemitrypa hibernica*, M'Coy).

M'Coy mentions that in *H. hibernica* there are large irregular spines on the inner face. The fact that the external face is poriferous, and other resemblances, may possibly indicate that our species is really a *Hemitrypa*, but at present there is no direct proof that it is so. The prominence of the pores, at all events, distinguish it from *H. hibernica* as well as from *H. oculata*, Phillips.

¹ 1879, Nicholson, 'Manual Palæont.,' vol. i, p. 420, fig. 262.

² 1890, Ulrich, 'Geol. Surv. Illinois,' vol. viii, p. 535, pl. xlv, figs. 1, 1 a; and pl. liv, fig. 3.

³ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 199, pl. i, figs. 31—33; and 1881, Shrubsole, 'Quart. Journ. Geol. Soc.,' vol. xxxvii, p. 183.

⁴ 1844, M'Coy, 'Synops. Carb. Foss. Ireland,' p. 203.

⁵ *Ibid.*, p. 203, pl. xxviii, fig. 15.

⁶ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 198, pl. i, figs. 7—10.

3. FENESTELLA LAXA, *Phillips*.

1836.	FENESTELLA LAXA, <i>Phillips</i> .	Geol. Yorks., vol. ii, p. 199, pl. i, figs. 26—30.
1841.	— — —	Pal. Foss., p. 23, pl. xii, figs. 34 <i>a</i> , <i>b</i> .
1879.	— CRASSA, <i>Shrubsole</i> .	Quart. Journ. Geol. Soc., vol. xxxv, p. 280.
1881.	— — —	Ibid., vol. xxxvii, p. 186.

Remarks.—Under this name Phillips identifies fossils from Petherwyn and Croyde with those he had before described from the Carboniferous of Yorkshire. His Devonian figure shows fenestrules about 10 mm. long by 5 mm. wide.

I have met with no specimens of any *Fenestella* at all approaching these dimensions.

4. FENESTELLA POLYPORATA, *Phillips*. Plate XXIII, figs. 4, 4 *a*, 5, 5 *a*.

1836.	FENESTELLA POLYPORATA, <i>Phillips</i> .	Geol. Yorks., vol. ii, p. 199, pl. i, figs. 19, 20.
? 1844.	— MULTIPORATA, <i>M'Coy</i> .	Synopsis Carb. Foss. Irel., p. 203, pl. xxviii, fig. 9.
1879.	— POLYPORATA, <i>Shrubsole</i> .	Quart. Journ. Geol. Soc., vol. xxxv, p. 280.
1881.	— — —	Ibid., vol. xxxvii, p. 185.

Description.—Zoarium composed of very large network, very irregular near the base, but more regular (and rather smaller?) in the upper parts. Branches much narrower than the fenestrules, sometimes dividing at the same levels. Poriferous face with a blunt angle or keel, and with obliquely flattened (or excavated?) sides, bearing (close to, but not protruding over, the margin) a row of elevated, elongate, oval cell-mouths, separated by intervals of about half their length. Non-poriferous face rounded (or bluntly keeled?), roughly granulated (?). Fenestrules oblong, 2 to 4 mm. in length, and about 1 mm. wide; but near the base irregularly ovoid, and sometimes still longer. About eight cells to a fenestrule.

Localities.—A fragmentary specimen, showing the cell-mouths, from the Pilton beds is in Mr. Hamling's Collection, one from Pilton in the Porter Collection, and three from Kingscote, Pouch Bridge, and East Anstey in my Collection.

Remarks.—Carboniferous specimens of *F. polyporata* in the Woodwardian Museum from Hook Head and from Settle are evidently identical with our Pilton examples. In both these cases the stems seem slightly stouter and the fenestrules

more oval, but probably our specimens might more resemble them if they were not so cloaked by the matrix, which often almost or entirely covers the dissepiments. *F. multiporata*, M'Coy, is united by Shrubsole with this species, and there certainly seems nothing to distinguish it; the Pilton fossils seem midway between them.

Affinities.—*F. quadridecimalis*, M'Coy,¹ would appear to branch more rapidly, and to have thinner branches and much more numerous pores.

Whatever the specimens from Pilton referred by Phillips to his *F. laxa* may be, their reticulation (as in the Carboniferous type) was very much larger than that of the present species, *e. g.* in his figure (said to be natural size) it is more than twice the length of that of our fossils, and the stems are wider than the width of our stems and fenestrules together. It could not, therefore, be reasonably regarded as the same species.

II. *Family*—ACANTHOCLADIIDÆ, Zittel, 1880.

I. *Genus*—PENNIRETIPORA, d'Orbigny, 1849.

Goldfuss defined his genus *Glaucaneme*² for four of Münster's species belonging to or in the style of *Vincularia*, and afterwards added a fifth species, *G. disticha*,³ from the Eifel or from Dudley, to which his generic definition was not applicable. The latter species, according to his figure, seems probably congeneric with *G. bipinnata*, Phillips. In 1839 *G. disticha* was described from Dudley by Lonsdale⁴ in 'Siluria,' but in terms which imply that the Dudley fossil was more akin to *Ptilopora* than to *G. bipinnata*, which Phillips in 1841 described from the Pilton beds. In 1849 d'Orbigny⁵ formed the genus *Penniretipora*, and defined it in terms which, though slight, are consistent with the characters of the present genus. He enumerated eight species, of which probably the first two do not belong to the present genus, and the next four do. Curiously enough he omits *G. bipinnata*, and places it under M'Coy's genus *Ichthyorachis*, having possibly mistaken Phillips's drawing of the reverse side for the obverse. In 1884 Vine⁶ formed a new genus, *Pinnatopora*, with *G. bipinnata* for its type, and restricted *Glaucaneme* to *G. disticha*, Lonsdale. In 1890 Ulrich⁷ followed Vine as to

¹ 1844, M'Coy, 'Synopsis Carb. Foss. Irel.,' p. 204, pl. xxviii, fig. 13.

² 1830, Goldfuss, 'Petref. Germ.,' vol. i, p. 100, and p. 101, note on *Vincularia*.

³ *Ibid.*, p. 217, pl. lxiv, fig. 15.

⁴ 1839, Murchison, 'Sil. Syst.,' p. 677, pl. xv, figs. 12—12 d.

⁵ 1849, d'Orbigny, 'Prodrome,' vol. i, p. 45.

⁶ 1884, Vine, 'Report Brit. Assoc.,' 1883 (Southport), pp. 191 and 192 (woodcut).

⁷ 1890, Ulrich, 'Geol. Surv. Illinois,' vol. viii, p. 614.

Pinnatopora, but considered that *G. disticha*, Lonsdale, should perhaps be called *Penniretipora*.

Dr. Gregory informed me in 1895 that he considered *Pinnatopora* a synonym of *Penniretipora*, and following him I described two doubtful Lummaton species under the latter name.

It is clear from the above that our fossils cannot be called *Glaucaneme*, and that they can be called *Pinnatopora*.

It seems rather doubtful whether *Penniretipora* is sufficiently defined to be valid. D'Orbigny's definition is "Two rows of cells on one side; the whole pinniform, with a stem and free lateral branches." It is perhaps allowable to discard the doubtful species he enumerates, and to restrict the genus to those congeneric with *G. bipinnata*, Phillips; in fact, to treat it as identical with *Pinnatopora*, and therefore on the score of priority regretfully to regard the latter and neater name as a synonym.

1. PENNIRETIPORA BIPINNATA, *Phillips*, sp. Plate XXIII, figs. 6—8.

1841. GLAUCONEME BIPINNATA, *Phillips*. Pal. Foss., p. 21, pl. xi, figs. 33 a—g.
 1844. — — — *M'Coy*. Synopsis Carb. Foss. Irel., p. 199.

Description.—Zoarium pinnate, elongate, generally curved and rambling, sometimes sending forth a second midrib at an acute angle to the original one. Midrib about .5 mm. wide near the base, decreasing very slowly in width, striated and perhaps granulated on the reverse side, which appears rounded and possibly rather flattened. Poriferous side with a strong (perhaps nodulated?) keel, and with obliquely flattened sides, each of which has a row of small rounded cell-mouths, which appear to project rather forward, and to be thickened internally. Cells oblong and elongate longitudinally, with thin walls, numbering two on the midrib to each branch. Lateral branches starting from the centre of the sides of the cells, set at an angle of about 70° to the midrib, free, straight, subcylindrical, sometimes 3 mm. long, about half the width of the midrib and about two-thirds the width of the intervals between them, with rounded extremities, and containing two rows of from six to ten alternating cells; from fourteen to eighteen branches occupying a length of 10 mm. on the midrib.

Size.—A defective but longitudinally stretched specimen is 35 mm. long.

Localities.—Saunton Point, Croyde, Upcot Arch Quarry, Poleshill, Bradiford, Frankmarsh, Top Orchard, Brushford. It appears to be of frequent occurrence.

Remarks.—Though from the state of preservation it is hard to be sure of its exact character and dimensions, this species seems to have abundant distinguishing

marks, *e. g.* the regularity with which the branches start from the centre of every second cell on the midrib, their angle and length, and the serpentine general form. The divarication of the main stem itself is rare, and I have not observed any specimen in which it occurs more than once. The angle thus formed is curvilinear, and is generally much less than that of the secondary branches; while the new midrib immediately bears similar lateral branches, though probably at first they are not so long as those on the old. The secondary branches alternate with each other, though they sometimes seem nearly level. The dimensions seem to vary a good deal in different specimens.

Affinities.—*Glaucaneme pluma*, Phillips, sp.,¹ appears from the figures to have longer and slighter branches, and more cells on the midrib between them.

In *G. pulcherrima*, M'Coy,² the habit seems very different, the cell-mouths more central, and the lateral branches "regularly attenuate." In *G. gracilis*, M'Coy,³ the cell-mouths are much larger and nodulate the sides, and the branches are much broader than the intervals, but in some respects it bears much likeness to our species. None of the American species described by Ulrich in the eighth volume of the 'Geol. Surv. Illinois' at all resemble it.

G. stellipora, Young and Young,⁴ is much more irregular, and has stellate cell-mouths; nor do any of the other species described by those authors⁵ appear to approach the present form.

2. PENNIRETIPORA VIRGATA, n. sp. Plate XXIII, figs. 9, 9 a.

Description.—Zoarium small (?), slight, loosely ramose, consisting of a midrib, from which occasional lateral branches start at an angle of about 50°, which in their turn appear to bear similar and similarly set minor branches. Midrib slight, about .25 mm. wide, straight, slightly tapering. Reverse face rounded, smooth or minutely striated (?). Poriferous face sharply keeled, obliquely flattened on the sides. Cells in two rows, triangular in longitudinal section. Lateral branches few, unequally distant, slight, sometimes about 4 mm. long, with central keel and two rows of cells, and apparently tapering to a subacute point. Numerous (from five to ten?) cells on the midrib in the intervals between the lateral branches. Intervals unequal, and frequently about 2 mm. in length.

Size.—A specimen (which is probably a fragment) measures 6 mm. long.

¹ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 199, pl. i, figs. 13—15.

² 1844, M'Coy, 'Synops. Carb. Foss. Irel.,' p. 199, pl. xxviii, fig. 4.

³ Ibid., p. 199, pl. xxviii, fig. 5.

⁴ 1874, Young and Young, 'Quart. Journ. Geol. Soc.,' vol. xxx, p. 682, pl. xl, figs. 5—11.

⁵ 1876, *Iidem*, 'Proc. Nat. Hist. Soc. Glasgow,' vol. ii, pt. 2, p. 325; and 1879? vol. iv, p. 354.

Localities.—There is a specimen from Croyde Bay in my Collection, and three slabs containing several specimens from Top Orchard in the Woodwardian Museum.

Remarks.—This little species seems rare, but from its slightness it may easily have been overlooked. It is very different from *P. bipinnata*, and I am not aware of any species which it at all resembles. The very large and variable number of cells between adjacent branches, the acuteness of the angle at which the branches are set, the repetition of branching in the lateral branches, and the greatness of the width of the intervals compared with the width of the branches, as well as possibly the shape of the cells, appear to be distinguishing features.

The pieces I have seen are very small, but it is possible that they are only fragments from larger specimens.

III. *Family*—STREBLOTRYPIDÆ, *Ulrich*, 1890.

“Zoaria variable. Zoœcia with primitive portion subtubular or tubular; apertures subcircular, often truncated posteriorly, surrounded by a slightly elevated rim. Front or outer portion of cell, back of the aperture, simply depressed, or with from two to twelve or more small pits. Diaphragms wanting” (*Ulrich*).¹

1. *Genus*—STREBLOTRYPA, *Ulrich*, 1890.

“Zoaria ramose, slender, solid. Zoœcia radiating from an imaginary axis, with primitive portion long, tubular; or from a linear axis, when they are somewhat shorter. . . . Apertures regularly elliptic or truncated at the posterior margin, surrounded by a slight peristome, and within this sometimes a narrow sloping area; arranged usually in rather regular longitudinal series. Just back of the aperture, occupying the depressed front of the cell, are from one to twelve small pits, which, when numerous, are arranged in two or three rows. Very small acanthopores occasionally present” (*Ulrich*,² *abbreviated*).

1. STREBLOTRYPA GREGORII, *Whidborne*. Plate XXIII, figs. 10, 10 a.

1896. STREBLOTRYPA GREGORII, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Zoarium cylindrical, small, with strong, acute, elevated, undulating, longitudinal ridges dividing the cell-areas. Areas elongate, irregularly

¹ 1890, *Ulrich*, ‘Geol. Surv. Illin.’ vol. viii, p. 402.

² *Ibid.*, p. 403.

fusiform, concave, with a large, probably circular cell-mouth, behind which are three or four smaller pits or mesopores.

Size.—Length of fragmentary specimen 9 mm. ; breadth about 1 mm.

Locality.—A slab containing two specimens from the Pilton beds is in Mr. Hamling's Collection.

Remarks.—The specimens, though in many respects good, are rather difficult to make out in exact detail. As far as can be judged from external appearance, they belong undoubtedly to *Streblotrypa*, but it is not easy to say whether the smaller pores are only situated on one side of the aperture or on both.

As both our specimens are broken pieces, it cannot be seen whether it is, as most species described by Ulrich, a branching form.

IV. Family—RHABDOMESONTIDÆ, Vine, 1883.¹

1. Genus—RHABDOMESON, Young and Young, 1874.

Of this genus Ulrich² says that it only differs from *Rhombopora* in having a solid axial tube. *Rhombopora* he thus defines (*abbreviated*):—"Zoaria slender, ramose, solid. Zoecia with thick-walled vestibules. Apertures in diagonally intersecting or longitudinal lines. Strong acanthopores at angles of junction, and more numerous smaller spines generally occupying the summit of the ridge-like interspaces between the subelliptical apertures. Diaphragms sometimes present in the axial regions."

Elsewhere Ulrich notes the close resemblance between the *Rhabdomesontidæ* and the *Batostomellidæ*, tracing passages through kindred species in both families.

I feel in great doubt as to which of these two families the species described below—the *Millepora gracilis*, Phillips—belongs.

It appears (as far as can be seen without the aid of sections) exactly to agree with the above definition of *Rhabdomeson*, except that it seems clearly to possess mesopores. In one of the specimens three or four subsidiary cells, chiefly at the corners, are distinctly seen, and these must, I think, be probably regarded as mesopores, and not as acanthopores, while less clear indications of them are visible in one or two other specimens. In the latter, again, are seen prominences which appear in every way identical with the acanthopores and spines described by Ulrich in *Rhombopora*. Besides Phillips's species we find a second form of

¹ Ulrich (*loc. cit. infra*) states that the primitive cell is tubular, that hemisepta are usually present, and that there are no mesopores.

² 1890, Ulrich, 'Geol. Surv. Illin.,' vol. viii, pp. 401, 402.

Polyzoa whose exterior is distinguished by the much greater distance of its cell-mouths. Belonging to one of these two species (it is not easy to say which) are sometimes found natural casts and sections. In a few instances the latter are along the centre, and these show clearly a strong cylindrical central tube or axis from which the cells arise—that is, have the distinguishing mark of *Rhabdomeson*.

The history of the genus *Rhabdomeson* is as follows:—Young and Young¹ described a Carboniferous species which they referred (with one expression of uncertainty) to Phillips's *M. gracilis* thus (*abbreviated*): “Stem slender, cylindrical, branching perpendicularly, having a hollow axis or thin calcareous tube with cells ranged round. Apertures oval in funnel-shaped depressions, divided by tuberculated ridges. Tubercles (or in good specimens spines) four, situated at the angles, with sometimes smaller between. Cells conical, turning upwards and outwards, separated at their apex by a thin wall which thickens outwardly, so that the mouths are separated by one-third the diameter of the cell-cavity. Spines solid, but showing a central pit when worn.” They name the genus, but leave its characters to be inferred from the species.

That the pits in this description correspond with the subsidiary cells seen in our specimens is possible, but, it seems to me, doubtful. Unless they do, Young and Young's Carboniferous species cannot be congeneric with ours, and in any case can only retain its specific name, if ours, which is Phillips's original species, proves to belong to a different genus.

For the present it seems best to refer the Pilton species provisionally to *Rhabdomeson*, as, with the exception of this difficulty of the character of the minute pores, it is probable that it fulfils the requirements of that genus.

1. RHABDOMESON ? GRACILE, *Phillips*, sp. Plate XXIII, figs. 11—15 *a*.

- | | | | |
|---------|----------------------|--------------------------|---|
| 1841. | MILLEPORA GRACILIS, | <i>Phillips</i> . | Pal. Foss., p. 20, pl. xi, figs. 31 <i>a</i> , <i>b</i> . |
| ? 1874. | RHABDOMESON GRACILE, | <i>Young and Young</i> . | Ann. Mag. Nat. Hist., ser. 4,
vol. xiii, p. 335, pl. xvi, figs. B 1—6. |
| ? 1875. | — | — | <i>Young and Young</i> . Ibid., vol. xv, p. 333. |
| ? 1884. | — | — | <i>Vine</i> . Report Brit. Assoc., 1883, p. 205. |

Description.—Zoarium small, straight, cylindrical. Axis strong, cylindrical, about one-eighth the width of the zoarium. Cells elongate, tubular, rising obliquely from the branches at a greater or less angle, and with their vestibules recurved, so as to become approximately horizontal. Interior of cells unknown.

¹ 1874, Young and Young, 'Ann. Mag. Nat. Hist.,' ser. 4, vol. xiii, p. 335.

Surface with circular or longitudinally oval cell-mouths set in quincunx, separated from each other by intervals less than their diameters. Interspaces elevated, ridge-like, bearing nodes or acanthopores on their summits, and three or four mesopores (?) situated generally at the corners of the apertures. About three cell-mouths to 1 mm.

Size.—A specimen measures 20 mm. long and 1 mm. wide.

Localities.—Top Orchard Quarry, East Anstey, Ironpost.

Remarks.—The difficulties in describing this and the following species have been stated above, and the descriptions must be taken as tentative in some respects.

There is, I think, no doubt that this species is the original *Millepora gracilis* of Phillips. His enlarged figure accurately represents the appearance that rather worn specimens retaining the surface assume.

If the Carboniferous *Rh. gracile* of Young and Young is congeneric, that form would require a new specific name, as it is certainly not identical.

To the above description it may be added that in some of the natural cylindrical sections showing the central tube there seems a point at which the cells become horizontal, and beyond which they are set obliquely with a slope in the opposite direction to that upon the other side of it. This would appear to be a point of origin, and if so the organism would probably be free. In these specimens I have not seen any signs of branching.

Affinities.—Carboniferous specimens of "*Rhabdomeson gracile*" in the Woodwardian Museum, from Hook Head and other localities, appear to me to be totally unlike our fossils; their cells are in perpendicular ranges, their acanthopores are very prominent and bead-like, and I can see no trace of anything like mesopores. *Rhombopora dichotoma*, M'Coy, sp.,¹ and *Rhabdomeson rhombiferum*, Phillips, sp.,² as represented by specimens in the same Museum, seem quite different in structure from the present fossils. On the other hand, *Rhabdomeson interporosum*, Phillips, sp.,³ appears, from its specimens, to be very much more like them; it seems to have mesopores, or at least subsidiary cells or pits of the same character as those in our fossils, and may certainly be regarded as belonging to the same genus.

¹ 1844, M'Coy, 'Synopsis Carb. Foss. Irel.,' p. 198, pl. xxvii, fig. 15.

² 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 199, pl. i, figs. 34, 35.

³ Ibid., p. 199, pl. i, figs. 36—39.

2. SUB-ORDER—TREPOSTOMATA, *Ulrich*, 1882.I. Family—BATOSTOMELLIDÆ, *Ulrich*, 1890.1. Genus—LEIOCLEMA, *Ulrich*, 1882.1. LEIOCLEMA? DISTANS, *Whidborne*. Plate XXIII, figs. 16, 16 a.

1896. RHABDOMESON? DISTANS, *Whidborne*. *Proceed. Geol. Assoc.*, vol. xiv, p. 376.

Description.—Zoarium small, ramose, cylindrical. Zoecia small, elongate, oval, separated from each other by interspaces considerably greater than their diameters. Interspaces apparently flat, and occupied by numerous thin-walled mesopores (?) Cell-mouths possibly covered with convex opercula (?).

Size.—A specimen measures 11 mm. long, and 1 mm. in the width of the branch.

Localities.—In the Woodwardian Museum are two slabs containing two specimens from Top Orchard, and in Mr. Hamling's Collection two slabs with two or three specimens from rocks to the north-west of the "Laticosta Cave," Croyde.

Remarks.—This species is similar in habit to *R. gracile*, but is clearly distinguished from it by its smaller and much more distant cell-mouths, and by the existence of numerous small mesopores round the larger cells, evidence of which is seen in the Woodwardian specimens, which are in the form of moulds, and which also show slight ridges dividing the cell-areas.

In the Croyde specimens, on the other hand, which retain the surface, though probably worn, the cell-mouths form small convex projections, which may perhaps mean that they were covered by opercula. In parts of the latter specimens which are worn to form rough natural sections the cells appear to be short conical tubes, rapidly curved, and enlarged in the mature part or vestibule.

In this species (assuming that sections like that shown on Pl. XXIII, fig. 15, do not belong to it) we do not appear to have any approach to *Rhabdomeson*, while it presents a general likeness to *Batostomella*; its external resemblance to *Leioclema gracillimum*, *Ulrich*,¹ is so strong, that it seems advisable to refer it provisionally to that genus.

The genus *Hyphasmopora*, *Etheridge*,² certainly appears to have much in common with it. Its cells are in vertical lines, separated by a cancellated network

¹ 1890, *Ulrich*, 'Geol. Surv. Illinois,' vol. viii, p. 429, pl. lxxv, figs. 6—6 b.

² 1875, *J. Etheridge*, jun., 'Ann. Mag. Nat. Hist.,' ser. 4, vol. xv, p. 43, pl. xiv, figs. B 1—4.

of irregularly formed pores, but cell-mouths are almost entirely absent from the reverse side,—a feature which does not appear from our specimens, though it is quite possible that it may exist.

II. *Family*—FISTULIPORIDÆ, *Ulrich*, 1882.

I. *Genus*—FISTULIPORA, *M'Coy*, 1849.

1. FISTULIPORA? sp. Plate XXIII, figs. 17, 17 a.

? 1841. MANON CRIBOSUM, *Phillips*. Pal. Foss., p. 17, pl. ix, fig. 26.

1896. BERENICEA IRREGULARIS?, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Zoarium forming a very thin expansive layer, in which no signs of attachment to other organisms have been discerned. Zoœcia short, stout, cylindrical, set perpendicularly to the face of the layer, divided by walls which, though appreciably thick, are much thinner than the diameter of the cells, and crowded together in such a way that irregular circular patterns may frequently be traced in the mass. Ten zoœcia occupying a distance of about 5 mm. Cell-mouths possibly contracted.

Size.—A specimen is 40 mm. long and more than 10 mm. wide; it seems about 1 mm. thick.

Localities.—There is a specimen in the Porter Collection from Poleshill, and another in my Collection from Saunton Hotel.

Remarks.—Of these fossils little can be said, except that they appear to be so similar in pattern to *Berenicea irregularis*, *Lonsdale*,¹ that it is possible that they may prove to be akin. The same irregular arrangement appears to be observable in the Silurian species. I have observed a very similar fossil in the Ilfracombe beds.

Whether they are the same as the very similar fossil which *Phillips* described from these beds as *Manon cribosum*, *Goldfuss*,² I am uncertain, as his figure shows a texture which, though much finer than that in *Goldfuss*'s figure, is much coarser than that of our specimens. As I have only seen these little fossils in the condition of casts it has been quite impossible to arrive at their true character, and it therefore seems best to leave them for the present in the genus *Fistulipora*, which was formed by *M'Coy* "to include *Manon cribosum*, *Goldfuss*, and some new species."³ One of our specimens shows vacant spots, which may, or may not, represent monticules.

¹ 1839, *Murchison*, 'Sil. Syst.,' p. 679, pl. xv, figs. 20, 20 a.

² 1826, *Goldfuss*, 'Petref. Germ.,' vol. i, p. 3, pl. i, figs. 10 a, b.

³ 1855, *M'Coy*, 'Brit. Pal. Foss.,' p. 11.

2. FISTULIPORA? sp. Plate XXIII, figs. 18, 19.

Description.—Zoarium formed of a very thin layer encrusting crinoid stems and other organisms. About twenty-five cells in a distance of 5 mm. Cells probably opening obliquely.

Size.—A specimen measures about 20 mm. long and 10 mm. wide.

Localities.—A specimen from Frankmarsh is in the Barnstaple Athenæum, one from Barnstaple in the Woodwardian Museum, and one from Saunton Hotel in my Collection. I have observed other specimens, and it does not appear to be uncommon.

Remarks.—Whether this is more than a young stage or dwarfed encrusting variety of the last species I am unable to say. In the specimens before me the cells seem distinctly smaller and more oblique near the margins of the layer, and it therefore seems better to keep them apart, at least for the present.

ANNULOSA.

1. ORDER—TUBICOLA, *Cuvier* (?).1. *Genus*—CORNULITES, *Schlotheim*, 1820.

Without expressing an opinion as to the systematic position of these fossils, except offering the remark that their resemblance to *Spirorbis*, as may be seen by the figures given by Hall, seems favorable to their being placed among the Tubicolous Annelids, it may be observed that their presence in the Pilton Beds is not favorable to theory that they are “horns of Cystideans,” as no Cystideans occur in these beds.

1. CORNULITES DEVONIANUS, *Whidborne*. Plate XXXVII, figs. 1—3.

1896. CORNULITES DEVONIANUS, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 377

Description.—Tubes conical, solitary, straight curved or irregularly flexuous, generally elongate, but occasionally short and rapidly increasing; apparently unattached. Surface (of cast) crossed by very strong annulations, which usually are broad (about three in a length equal to the width), nearly regular and in the form of consecutively truncated inverted cones, but sometimes are very irregular, close and confluent.

Size.—Length from 3 to 12 mm.

Localities.—In the Barnstaple Athenæum is a specimen from Top Orchard; in the Porter Collection five from Pilton, one from Roborough, and one from Poleshill; and in my Collection one from Pouch Bridge, one from Kingdon's Shirwell, and one from Laticosta Cave, Baggy.

Remarks.—Our specimens being chiefly casts do not show any cellular structure, and only in two cases faint signs of longitudinal striation. From their form and general character, however, there can be no doubt that they belong to the genus *Cornulites*. In the smaller specimens the annulations are, as a rule, fairly regular (though occasionally they appear to vanish over a portion of the circumference) and the shape is a very elongate cone, sometimes straight, sometimes recurved. In one or two specimens, which are larger, the annulations have become very irregular and confused, the shape is a broader cone, and there is a more rapid expansion near the mouth or broader end. I have not observed any signs of their being attached to other bodies, but it is most likely that they were so attached by the apex.

From the Silurian *C. serpularius*, Schlotheim,¹ our fossils are widely different in size and the width of their annuli, and they also appear to differ in the same respects, though in a less degree, from *C. proprius*, Hall,² and the other species described by him. A comparison of Hall's figures³ is interesting, as they show that the same variations with age occurred in his species as in ours.

ECHINODERMATA.

1. CLASS—ECHINOIDEA, *Breyn*, 1732.

1. SUB-CLASS—PALECHINOIDEA, *Zittel*, 1890.

1. ORDER—PERISCHOËCHINIDÆ, *M'Coy*, 1849.

I. *Family*—MELONITIDÆ, *Zittel*, 1890.

1. *Genus*—LEPIDESTHES, *Meek and Worthen*, 1868.

“Subspheroidal; interambulacral areas narrow, with plates imbricating from below upwards, and from the middle outwards; ambulacral areas very wide, composed of numerous small pieces scarcely differing in form, and all imbricating from above downwards, the lower edges of each lapping upon the next series

¹ 1820, Schlotheim, 'Petrefact.,' p. 378, pl. xxix, fig. 7.

² 1888, Hall, 'Pal. New York,' vol. v, pt. 2, Suppt., p. 19, pl. cxvi, figs. 1—21.

³ Ibid., pls. cxv, cxvi, cxvi a.

below; ambulacral pores two in each piece, and nearly central. Anal opening and apical disc unknown. Jaws well developed. Entire surface ornamented with numerous very small granules of uniform size, probably for the articulation of minute spines, as in *Palæchinus*.¹

The species described below seems so nearly to fall within the limits of the above description that in the crushed condition of our fossils it hardly seems safe to form a new genus for it at present, especially as the generic definition gathered from a single specimen of a single species may perhaps require some modification.

The chief particulars in which our species disagrees are—(1) that the interambulacral plates bear six or eight irregular small tubercles of different sizes; (2) that the ambulacral plates seem smooth; and (3) that there seem to be very numerous minute acicular spines, mixed with a comparatively few larger ones. It must here be distinctly observed that it fails to meet *accurately* the requirements, not only of the genus, but of the family.

Its imbricated plates, together with their large numbers in both areas, separate it from all the other genera of this order mentioned by Zittel except *Pholidocidaris*,² which differs among other things in the much larger comparative size of the adambulacral plates, and in many of the interambulacral plates bearing a large central tubercle.

*Perischodomus*³ has only two rows of ambulacral plates in each area.

Hybechinus, of Meek and Worthen,⁴ chiefly differs from *Lepidesthes* in having the imbrication exactly opposite, *i. e.* from above downwards in the interambulacral zones, and from below upwards in the ambulacral (so that their lower part is covered). Its interambulacral plates are rhombic instead of being hexagonal, as in our species. The granules seem very much more minute; they are not visible in the drawing of *H. spectabilis*, Worthen and Miller,⁵ the type species.

1. LEPIDESTHES? DEVONICANS, *Whidborne*. Plate XXIV, figs. 1—2; and Plate XXV, figs. 3 *a—f*.

1896. LEPIDESTHES? DEVONICANS, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Test very large, regular, composed of very numerous plates, which are approximately equal in height and breadth. Interambulacral areas with

¹ 1868, Meek and Worthen, 'Geol. Surv. Illinois,' vol. iii, p. 522 (slightly abbreviated).

² 1873, *Ibid.*, vol. v, p. 510.

³ 1849, M'Coy, 'Ann. Mag. Nat. Hist.,' ser. 2, vol. iii, p. 254.

⁴ 1883, Worthen and Miller, 'Geol. Surv. Illinois,' vol. vii, p. 331.

1883, *ibid.*, p. 332, pl. xxxi, figs. 5 *a—d*.

about seven rows of subhexagonal plates, which appear to be of uniform size in all the rows at the same level, and to be imbricated from below upwards. Interambulacral plates about 2 mm. in diameter, minutely granulated over their whole surface, and ornamented by (1) an irregular circle of five small unequal tubercles or warts, which have a minute perforated mamelon on a sloping elevated boss, and are bordered by a minute linear furrow or areola, and (2) several much smaller warts of various sizes. Spines very numerous (or crowded), acicular, sometimes 5 mm. long, covered with microscopic longitudinal grooves, and slightly expanded at the base, which seems to be concave with a slight median projection. Ambulacral areas with numerous (probably about seven) rows of rather smaller and narrower plates (apparently of a rather wide curvilinear polygonal shape), each of which bears close-set twin ambulacra, and which generally seem smooth, though small tubercles are observable upon a few of them. Lantern-apparatus composed of very large, smooth, wedge-shaped bones, some of which are 12 or 15 mm. long.

Size.—A flattened distorted specimen is about 120 mm. long and 55 mm. wide.

Localities.—A large flattened example (on two slabs split horizontally) from "the Pilton Beds, North Devon," is in the Museum of Practical Geology, and another (almost entirely hidden by the matrix), from Croyde, is in my Collection.

Remarks.—The best of these specimens appears to be an almost complete test, but, having been flattened and then split through the centre, the plates have become so confused that it is almost impossible to decipher it accurately, though most of its characters may be said to be nearly clear. Occasionally the hexagonal form of an interambulacral plate is evident; and their imbricating character is undoubted, though it is not so easy to be sure of the direction of the imbrication. These interambulacral plates do not all seem tuberculated, but all are granulated. Their tubercles are clear and vary in size, but they are always small: though irregularly placed, a roughly circular arrangement of the five largest may often be traced. In one part seven plates at least may be counted across the area. The ambulacral plates, again, are obscure in shape, but they appear sometimes rather broader than high, and irregularly polygonal or pentagonal, with some concave sides. They do not, as a rule, show any ornament or granulation, but in one or two cases spiniferous tubercles can be seen upon them. They evidently imbricate, and the imbrication seems probably to be in the opposite direction to that of the interambulacral plates. The ambulacra are large and very distinct, and perhaps are obliquely arranged, but this is not certain. Judging from the casts of the ambulacra, the test must have been thin. The spines, though always very small, seem to vary in length and thickness.

From the present dimensions of our crushed specimens we may conclude that

the test in its original shape could hardly have been less than three inches in diameter, and possibly was considerably larger.

Affinities.—*Lepidesthes Coreyi*, Meek and Worthen,¹ differs in having much smaller and more numerous (eighteen to twenty-five) warts, which are all equal in size, both on the interambulacral and ambulacral plates. Its test also appears to have been much smaller.

II. *Family*—ARCHÆOCIDARIDÆ, M^cCoy, 1855.

I. *Genus*—PROTODIDARIS, gen. nov.

Interambulacral plates with a small central perforated tubercle, consisting of a minute mamelon on a base without a distinct areola or bounding ring round the base, and with five or six minute subsidiary tubercles. Spines acicular, finely striated.

The central perforated tubercles show that the species described below may be regarded as belonging to the family *Archæocidaridæ*, but the absence of a "ring or slight projection round their base" excludes it from the genus *Archæocidaris*, in which genus, moreover, the spines are (with very rare exceptions) covered with thorny points.

Neither does it appear referable to *Eocidaris*, Desor,² though it agrees with it in the absence of the bounding ring or slight projection. In that genus as described by Hall,³ and in *E. Drydenensis*, Vanuxem, sp.,⁴ it is stated that there is only one spine to each plate, whereas our species would seem to have had several subsidiary spines. Desor, moreover, in his original description, states the spines to be spinuliferous, whereas ours are simply striated.

In *Lepidocidaris*,⁵ which appears to be a genus founded by Meek and Worthen for their *Eocidaris? squamosus*,⁶ the central tubercles appear very much larger, bordered by a groove, though without a bounding rim, and surrounded on the margins of the plate by crowded granules; its spines, however, are similar in shape to ours.

There seems, therefore, only to remain the genus *Lepidechinus*,⁷ with which

¹ 1868, Meek and Worthen, 'Geol. Surv. Illinois,' vol. iii, p. 525, woodcut A.

² 1858, Desor, 'Synopsis des Échinides Fossiles,' p. 155.

³ 1867, Hall, 'Twentieth Rept. Regent's Univ. N. Y.,' p. 297.

⁴ *Ibid.*, p. 298.

⁵ 1873, Meek and Worthen, 'Geol. Surv. Illinois,' vol. v, explan. of pl. ix.

⁶ *Ibid.*, p. 478, pl. ix, figs. 15 a—g.

⁷ 1861, Hall, 'Desc. N. Sp. Crinoidea,' Preliminary Notice, p. 18.

our species may be compared. In Hall's definition of the genus and of the type species (*L. imbricatus*) no tubercles are mentioned. In his second species, *L. vari-spinus*,¹ a few of the interambulacral plates bear very much elevated tubercles. The characters of these tubercles are not very evident from the description of the species, but judging from the figure it seems extremely unlikely that they tally with ours.

It therefore is most probable that its genus is distinct, although at present this can be only very imperfectly defined.

1. PROTODIDARIS ACUARIA, *Whidborne*, sp. Plate XXV, figs. 1—2 a.

1896. EOCIDARIS? ACUARIA, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Interambulacral plates large, 4 or 5 mm. in diameter (probably sometimes hexagonal in shape), bearing a small central perforated tubercle consisting of a mamelon surmounting a boss, but without any distinct areola, and surrounded by an irregular circle of five or six minute granules or warts. Spines cylindrical, of various sizes, sometimes being more than 11 mm. long, finely striated longitudinally, but without lateral spicules, and slightly constricted above the base, which is expanded in the shape of an inverted truncated cone. Dental apparatus large, apparently more than 30 mm. in size, some of its ossicles being covered on one side with transverse, and on another with obliquely rugose, markings.

Size.—The test was probably very large, a fragmentary specimen, which shows comparatively few plates, being about 65 mm. in length.

Locality.—In the Museum of Practical Geology are three fragmentary specimens, all probably portions of a single animal, from "East of Barnstaple."

Remarks.—The only specimens of this species with which I am acquainted yield but very imperfect information about its characters. They consist of the casts of confused groups of plates and spines, the latter having helped to obscure the shape of the former. I have not recognised any ambulacral plates among them, and it is therefore probable that the ambulacral areas occupied a comparatively small portion of the test. Though the margins of the plates are for the most part obliterated, their general size and character are clear, and, with the following exception, I have not been able to recognise anything very similar to them in the descriptions of recorded species.

Cidaris lævispina, Sandberger,² which Desor³ refers to *Eocidaris*, though

¹ 1867, Hall, 'Twentieth Report Regents Univ. N. Y.,' p. 295, pl. ix, fig. 10.

² 1856, Sandberger, 'Verst. Rhein. Nassau,' p. 382, pl. xxxv, figs. 2—2 b.

³ 1858, Desor, 'Synopsis Échinides Fossiles,' p. 156, pl. xxi, figs. 18—22.

remarking that it perhaps differs generically from another species which he places beside it, seems very nearly akin to the present form, but its subsidiary tubercles are very much larger and more regularly placed.

2. CLASS—ASTEROIDEA, *Grey*, 1840.

1. ORDER—ENCRINASTERIÆ, *Bronn*, 1860.

1. *Genus*—PALÆASTER, *Hall*, 1852.

1. PALÆASTER LONGIMANUS, *Whidborne*. Plate XXVI, figs. 1—4; and Plate XXIX, fig. 3.

1896. PALÆASTER LONGIMANUS, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 376.

Description.—Upper surface of body of medium size, convex, without any expanded disc, and with five very long slightly tapering arms. (Madriporiform tubercle unobserved.) Surface covered with polygonal or subquadrate tessellated plates, each bearing a large rounded central tubercle. Plates arranged in from seven to five longitudinal rows on the arms, the central row being the largest, and the lateral rows smaller, the plates gradually diminishing from the centre.

Under surface having narrow transverse ambulacral plates with large grooves, bounded by a row of large transverse adambulacral plates which alternate with a row of smaller marginal plates.

Oral plates small, triangular. Arm-plates in more than fifty transverse rings.

Size.—Length of a single arm about 20 mm.; hence the animal, if regularly expanded, would measure about 35 mm.

Localities.—In the Museum of Practical Geology are four specimens labelled “Park, near Braunton,” “Braunton Down,” “Baggy Point,” and “North Devon.” In the Woodwardian Museum are two specimens from Top Orchard; in the Porter Collection one from Pilton; and in my Collection one from Top Orchard.

Remarks.—I have repeatedly searched these specimens, which are all casts, for a madriporiform body, but, probably from their state of preservation, have not been able to discover anything resembling one. The external skeleton of the arms seems generally to consist of a large central plate, having on each side a smaller proximate plate, three very small lateral plates, a larger marginal plate, and a still larger transverse adambulacral plate, so that the ring is composed normally of thirteen rows, but occasionally an additional row seems to be present. The shape of the plates of the body and back, their bevelled margins, flat surfaces,

and large central oval bead-like tubercles are well shown in one of the specimens in the Museum of Practical Geology. The oral plates are not distinct; they are probably either very small, or have their surface divided by a depression. The arms seem unusually long for this genus; in two of the specimens (Pl. XXVI, fig. 4, and Pl. XXIX, fig. 3) the arms appeared at first sight shorter and more conical, but a slight development of the specimens (after they had been drawn) showed that their arms were really longer than at first appeared, and there seems little doubt that their semblance of shortness is due to their being twisted and covered with matrix.

Affinities.—The length of the arms and the much fewer number and larger size of the rows of plates appear to distinguish this species from *P. asperrimus*, Salter.¹ From *P. coronella*, Salter,² it seems separated by the absence of a corona, and from *P. obtusus*, Forbes, sp.,³ and *P. Ruthveni*, Forbes, sp.,⁴ by the character of the ornament. Most if not all of the species of *Palæaster* described by Hall⁵ in his Twentieth Annual Report are distinguished by the much greater shortness of the arms.

Asterias asperula, Ferd. Römer,⁶ seems, on the other hand, to be still slighter in shape, and to have relatively longer arms. From its state of preservation the figures are not easily compared with ours, but the description indicates that there were two alternating central rows of plates instead of a single large central row, as in the present species.

The arms of *P. Caractaci*, Salter, are much shorter, and the surface arrangement quite different.

2. ORDER—EUASTERIÆ, Zittel, 1895 (= ASTERIÆ VERÆ, Bronn).

1. Genus—MEDUSASTER, Stürtz, 1890.

1. MEDUSASTER PARVUS, n. sp. Plate XXXVII, fig. 4.

Description.—Animal minute, with a large round disc and sixteen arms. Disc rather thick, flatly cushion-shaped, and apparently covered by numerous large nodular plates. Angle-ossicula apparently very large and long, leaving in the cast long triangular ridges, which extend from the point of junction of the bases

¹ 1857, Salter, 'Ann. Mag. Nat. Hist.,' ser. 2, vol. xx, p. 325, pl. ix, fig. 1.

² Ibid., p. 326.

³ 1849, E. Forbes, 'Mem. Geol. Surv.,' Decade 1, p. 2, pl. i, fig. 3.

⁴ Ibid., p. 1, pl. i, fig. 1.

⁵ 1867, Hall, 'Twentieth Ann. Report Regents Univers. N. Y.,' p. 283, pl. ix, figs. 1—4.

⁶ 1863, Ferd. Römer, 'Palæontographica,' vol. ix, p. 146, pl. xxiv, figs. 1—5; pl. xxvi, fig. 6; and pl. xxvii, fig. 1.

of the arms almost half-way to the centre of the disc. Arms rather longer than the width of the disc, slight, composed of rows of few long and level ossicula, bearing on each side at long regular intervals a single large, long, thorn-like spine (which in the fossil is occasionally bent, possibly from accidental causes).

Size.—Total width of specimen 8 mm. (If perfect and untwisted it probably would measure 9 or 10 mm.) Disc 2.5 mm. Arms between 3 and 4 mm. long.

Locality.—A single specimen from north-east of Harford Landkey is in Mr. Hamling's Collection.

Remarks.—It was only after the description of the last species was in print that I found this interesting little fossil in a slab sent to me by my friend Mr. Hamling. Though minute, and in such defective preservation that it is impossible to make out the arrangements of its plates, it is sufficiently clear to leave no doubt whatever as to its general character. Its sixteen arms can be definitely counted, and the few long distant spines that margin them are evident, though sometimes they seem curiously bent. The plates of the arms have the appearance of being remarkably long.

Affinities.—This species appears to be congeneric with *M. Rhenanus*, Stürtz,¹ but is distinguished from it by its small size, its much larger disc, its more numerous arms, and several other particulars.

Helianthaster Rhenanus, Ferd. Römer,² is very much larger, its disc is relatively smaller, the plates of its sixteen arms more numerous and differently arranged, and the spines much more numerous.

3. CLASS—OPHIUROIDEA, *Wright*, 1857.

1. ORDER—OPHIUREA, *Zittel*, 1879.

I. *Family*—OPHIO-ENOBINASTERIÆ, *Stürtz*, 1886.

1. *Genus*—PROTASTER, *Forbes*, 1849.

Stürtz³ and Dr. Gregory⁴ have both pointed out that various species, differing in important particulars from each other, have been referred to this genus, and that it greatly needs revision. While, therefore, until this be done, it may be necessary still to refer species of unlike aspect to it, it is best to remember that neither *P. Miltonii*, Salter, nor *P. Forbesii*, Hall, nor *P. brisingoides*, Gregory,⁴ but

¹ 1890, Stürtz, 'Palæontographica,' vol. xxxvi, p. 229, pl. xxxi, figs. 34, 35.

² 1868, Ferd. Römer, 'Palæontographica,' vol. ix, p. 147, pl. xxviii, fig. 1.

³ 1886, Stürtz, 'Palæontographica,' vol. xxxii, p. 79.

⁴ 1889, Gregory, 'Geol. Mag.,' Decade 3, vol. vi, p. 24, woodcuts 1—4.

P. Sedgwickii, Forbes, is the type of the true genus *Protaster*, from which the superfluties will have to be removed.

1. PROTASTER GRANIFER, *Whidborne*, sp. Plate XXVI, figs. 5, 5 a, 6, 6 a.

1896. EUGASTER GRANIFER, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 377.

Description.—Animal with a moderately large pentagonal disc, and rather long arms, which are slightly fusiform at first, and then taper very slowly to a distant extremity. Upper surface of disc marked by a large impressed stellate corona, which is bounded by elevated sides, and is about half the width of the disc in diameter. Upper and lower surface of disc and upper surface of arms covered with an integument composed of minute convex scales, irregularly scattered among still more numerous and minute granules. Mouth apparently small and central. Oral or buccal plates apparently large, deep, and elongate. Upper surface of arms having (1) two central alternating rows of transverse sub-hexagonal plates, divided transversely by a linear groove, and (2) an alternating lateral row of slightly convex squamose or imbricating plates, at the lower margins of each of which are situated one or more short, broad, ovate, slightly curved spines. Under surface of arms with two alternating rows of narrow ambulacral plates, excavated on their outer margins by pores, which are outwardly enclosed by a row of obliquely protruding adambulacral plates, at the outer or lower extremities of which the spines are situated.

Size.—A nearly perfect, but perhaps slightly elongated, arm measures 50 mm. The size of the expanded animal was therefore probably about 90 mm.

Localities.—In the Museum of Practical Geology is a very fine specimen (seen as casts of the upper and lower surfaces) from “the Pilton Beds of North Devon.”

Remarks.—Casts taken from the under surface of this specimen and from the under surface of specimens of *Protaster Sedgwickii*, Forbes,¹ in the same Museum appear accurately to agree in all points of the arrangement of the arms and plates. The arrangement of the buccal plates appears also to be similar. Hence, as *P. Sedgwickii* is the type of the genus, it appears that this is a species of *Protaster*, in spite of the disc having a pentagonal form more in the shape of that of the genus *Eugaster*, Hall.²

From *P. Sedgwickii* it differs in the large size of the corona and many other minor particulars.

¹ 1849, Forbes, ‘Geol. Surv.’ Decade 1, p. i, pl. iv, figs. 1—4.

² 1867, Hall, ‘Twentieth Report Regents University, N. Y.’ p. 290.

2. PROTASTER? (DREPANASTER) SCABROSUS, *Whidborne*. Plate XXIX, figs. 1—2 *a*.

1896. PROTASTER SCABROSUS, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 377.

Description.—Animal small, with long, narrow, regularly tapering arms. Disc probably one-fourth or one-fifth the width of the expanded animal, subcircular, covered on its dorsal surface with comparatively large squamiform overlapping plates, which appear to be subquadrate in shape. Dorsal surface of arms covered with similar, but smaller, squamiform plates. Ventral surface of arms with (1) a double median row of ambulacral plates, excavated at their outer ends by moderately large pores, and (2) a marginal row of elongate arching adambulacral plates, whose proximal ends in part bound these pores, and each of which bears a group of two or three spines. Buccal plates (ten? paired) apparently rather large, giving, in the cast, the appearance of a short-rayed star on the under side.

Size.—A specimen with twisted arms measures 22 mm. One of the arms is about 20 mm. long, so that the expanded animal probably measured about 37 mm. across.

Localities.—There is a good specimen from Croyde in the Barnstaple Athenæum, and another from Braunton Down in the Museum of Practical Geology.

Remarks.—It is to be observed that the ambulacral plates in this species distinctly alternate. This appears to be consistent with Forbes's original definition of the genus *Protaster*; though, from Salter¹ having described them in *P. Miltonii* as level (by way of exception), Hall and others seem to have come to regard this as a generic character—Hall, however, questioning it, as in *P. Forbesii*, Hall,² they slightly alternate. It appears to me, however, that for various other reasons, *P. scabrosus*, together with *P. Forbesii*, with which it appears to be congeneric, will have to be separated from the genus *Protaster* as defined by Forbes; from the shape of its adambulacral plates it might perhaps bear the name of *Drepanaster*.³

3. PROTASTER? (DREPANASTER) SCABROSUS, var. Plate XXVII, figs. 1—3; and Plate XXVIII, figs. 1—2 *b*.

Description.—Animal small, five-rayed. Disc large, circular, covered with very small plates. Rosette large, subpentagonal. Arms long, rather stout at the base, regularly and rather rapidly tapering, and having on their under side a double alter-

¹ 1857, Salter, 'Ann. Mag. Nat. Hist.,' ser. 2, vol. xx, p. 330, pl. x, figs. 4—4 *c* (cf. p. 325, where "*Protaster*, nov. gen.," is evidently a misprint).

² 1867, Hall, 'Twentieth Report Regents University, N.Y.,' p. 293, pl. ix, figs. 5, 6.

³ Δρέπανον, a sickle.

nating row of stout ambulacral plates (probably thirty in number) excavated on their outer margins by large round pores, which are bounded outside by elongate, curving or bent, adambulacral plates. Surface of plates minutely granulated. Oral plates large, wedge-shaped, paired into close connection at their apices.

Size.—An arm measures 28 mm., so that the expanded animal must have measured about 50 mm.

Localities.—In the Museum of Practical Geology are three specimens from Croyde, and one (cast and reverse) from North Devon; in Mr. Hamling's Collection one (cast and reverse) from Top Orchard Quarry; and in the Porter Collection an indistinct specimen from Fremington.

Remarks.—While these specimens have much resemblance to those last described, several dissimilarities are to be noted in them. Thus the disc (usually very indistinctly seen) appears much larger and covered by much smaller plates, the rosette seems larger, the arms stouter and more quickly tapering, and the ambulacral plates much broader. In some of the specimens the adambulacral plates appear to have been pushed out of place. At the same time it does not seem certain, in the defective state of our specimens, how much real value these dissimilarities have,—whether they are partly caused by their imperfection, or are indicative of a specific difference. It has seemed advisable, therefore, to keep them separate for the present, as an unnamed variety of the former species.

2. Genus—EUGASTER, Hall.

1. EUGASTER ? PERARMATUS, *Whidborne*, sp. Plate XXVII, figs. 4—6 a.

1896. PROTASTER PERARMATUS, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 377.

Description.—Animal large. Upper surface of the plates of the disc and arms minutely granulated. Arms very stout, rather rapidly tapering, covered on the upper surface by a median row of broad, convex, subhexagonal plates (which seem slightly to imbricate inwardly) alternating on each side with a row of still wider subpentagonal plates, which in their turn are followed by a row of smaller plates on the perpendicular sides, bearing at their lower extremities long lateral spines at the rate of two or three to each plate. Spines thorn-like and probably about the width of the arms in length. Under side with a double row of level ambulacral plates, succeeded on each side by a row of narrow adambulacral plates, which are separated from the former by very large transverse hexagonal excavations, of which probably only the outer portions are occupied by the pores themselves.

Size.—A small portion of an arm is 30 mm. long; another is 10 mm. across. Though the specimens are too fragmentary to convey much idea of the size of the animal, it is clear that it must have been considerably larger than any of the accompanying species.

Localities.—In the Museum of Practical Geology are confused masses of the arms of two animals (in three specimens) from Braunton Down. In the Porter Collection are two fragmentary portions of another animal and a third specimen from Pilton.

Remarks.—Though these specimens are too fragmentary or confused for full description, their very large size, the stoutness of the arms, and the shape and arrangements of the plates, both above and below, show that they belong to a species quite distinct from the other star-fishes of these beds—so distinct, indeed, that it must probably be removed from the genus *Protaster*. The arrangement of the lower side of their rays appears, as far as can be seen, to have much in common with that of Hall's genus *Eugaster*, but the plates appear not to alternate but to be perfectly level.

II. *Family*—OPHIURIDÆ, *Agassiz*, 1835.

I. *Genus*—OPHIURELLA, *Agassiz*, 1835.

1. OPHIURELLA ? GREGARIA, *Whidborne*, sp. Plate XXVIII, fig. 3.

1896. PROTASTER GREGARIUS, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 377.

Description.—Animal small, with five very long slight arms, which taper very slowly to a very acute termination. Disc circular? with a finely granulated surface, occupied almost entirely by ten very large, curved, paired, radial plates, which form a prominent petalloid corona. Arms composed of about forty rings of squamose plates in distinctly level rows; these rows consisting on the dorsal face of a prominent, apparently indented median row, and a row on each side, the plates of which appear to have a triangular depression and to bear a series of four or five small obliquely set comb-like spines. Ambulacral plates large, level, margined by a large circular pore.

Size.—An arm (probably wanting a few terminal joints) is more than 25 mm. long.

Locality.—In the Museum of Practical Geology is a slab, containing the remains of numerous specimens, from Braunton Down.

Remarks.—This species is distinguished from the accompanying forms by its prominent corona, the character of its plates, the absence of alternation in the

rows of plates, and the extreme length and tenuity of its arms. From the mode of their occurrence, however, the specimens may possibly be the immature state of some other form known or unknown. It has been very difficult to distinguish between the upper and lower faces of the arms, which probably very closely resemble each other in general appearance.

Among British Palæozoic starfish this species seems most nearly to resemble *Protaster leptosoma*, Salter,¹ both on its upper and under surfaces, but in that species the central pentagon is smaller and the shape still slighter. Comparing these two species with *Furcaster palæozoicus*, Stürtz,² it seems probable that they may be members of the same group. Moreover, Mesozoic species referred by Wright³ to *Ophiurella* seem sufficiently similar to make it possible they may be congeneric, while a Devonian species *O. primigenia* is referred to *Ophiurella* by Stürtz.⁴ Again, the figures of *Ophiura rhenana*, Stürtz,⁵ show details which might correspond with the indications seen in our less well-preserved fossil. On the whole it may be well to leave it temporarily in the genus *Ophiurella*, to which, even if not actually belonging, it probably is nearly allied. It certainly has nothing to do with *Protaster*.

4. CLASS—BLASTOIDEA, Say, 1825.

1. ORDER—REGULARES, Etheridge and Carpenter, 1886.

I. Family—PENTREMITIDÆ, d'Orbigny, 1852.

The species described below appears to fall within this family (as amended by Etheridge and Carpenter) from (1) possessing, as far as can be judged, minute irregularly rhombic deltoids, which occupy the extreme summits of the inter-radial sinuses, and (2) the spiracles being apparently situated in the oral space beyond the deltoids and not within their margins, the ambulacra being rather broad, and hydrospire-slits not being exposed outside them.

With regard to its generic position, it may be noted that its ambulacra are very long and are broader than the intervening sinuses. Its shape too, as far as can be seen, is more or less a prolate spheroid; but in none of our specimens

¹ 1857, Salter, 'Ann. Mag. Nat. Hist.,' ser. 2, vol. xx, p. 331, pl. ix, fig. 5.

² 1886, Stürtz, 'Palæontographica,' vol. xxxii, pl. viii, p. 79, figs. 4—5 a; and 1890, *ibid.*, vol. xxxvi, p. 214, pl. xxxi, figs. 40, 40 a.

³ 1866, Wright, 'Brit. Foss. Echinod. Oolitic Form.,' vol. ii, p. 154, pl. xviii, figs. 3 a, d; and p. 154, woodcut 40.

⁴ 1886, Stürtz, 'Palæontographica,' vol. xxxii, p. 77, pl. viii, figs. 1—2 a.

⁵ 1893, Stürtz, 'Verh. n. h. Vereins Preuss. Rheinl.,' vol. l, p. 7, pl. i, figs. 1—3.

is the base visible, though enough of the radial plate is seen to show that the basal parts were probably at least slightly extended beyond the extremities of the arms.

It seems to differ from most species of *Pentremites* by the narrowness and arrangements of its arms; from most species of *Pentremitidea* by the length of its sinuses, and from most species of *Mesoblastus* by the width of its arms, the apparent shape of its spiracles, and the probable presence of an under-lancet-plate. On the whole there seems to be least difficulty in assigning it for the present to the genus *Pentremitidea*, but this must only be regarded as a provisional arrangement until the discovery of specimens sufficiently perfect to decide the point.

1. Genus—PENTREMITIDEA, *d'Orbigny*, 1849.

1. PENTREMITIDEA PHILLIPSII, n. sp. Plate XXIX, figs. 5, 5 a, 6.

1841. PENTREMITES OVALIS, *Phillips* (not *Goldfuss*). Pal. Foss., p. 29, pl. xiv
figs. 40 a, b.

1886. *Etheridge and Carpenter*. Catal. Blast. Brit. Mus., p. 129.

Description.—Calix probably more or less prolately spheroidal; summit flatly convex, broad; base unknown. Ambulacra (*i. e.* ambulacral areas) moderately broad, rather rapidly tapering, extending very far down the calix. Radial plates very large; bodies convex, much shorter than the limbs. Limbs very long. Interradial sinuses elongate, lanceolate, with sharp raised margins, not reaching far into the summit, and slightly narrower on the whole than the ambulacra. Deltoids indistinctly seen, very small, apparently irregularly rhombic. Spiracles apparently subcentral, undivided by septa, situate above the tops of the deltoids. Lancet-plate exposed, with a central groove and with rather distant branches, both being margined with long and coarse crenulations (which seem also to extend to the side-plates). Side-plates squarish.

Three or four hydrospire-folds seen at the distal extremity of one of the ambulacra, probably exposed by the breaking off of part of the under-lancet-plate, which appears to cover all the area between the side-plates. Radials marked with microscopic rounded lineations, slightly radiating towards the sides of the interradian sinus.

Size.—A specimen appears to be about 7 mm. long.

Localities.—In the Barnstaple Athenæum is a specimen from Strand, Ashford, and another from Bradiford; and in my Collection is one from Wrafton Lane.

Remarks.—These specimens are all fragmentary, and consequently it is very

difficult to make out the character of the species from them, or from the figure of Phillips's equally defective specimen, the original of which appears now to be lost. At the same time their resemblances to each other are so close that there can be no doubt that all four fossils belong to the same species.

(1) The Strand specimen is the largest. It is an inside cast. It appears to show a radial with the included ambulacrum, and (?) a deltoid (the division, however, of which from the radial is very indistinct) and the beginning of an adjoining ambulacrum. The hollows for the side-plates (and casts of the pores?) are visible.

(2) The Bradiford specimen is the cast of a single ambulacrum. It shows the median food-groove and its side-branches; the coarse crenulations upon them are very evident; the shape of the lancet-plate is perhaps discernible.

(3) The Wrafton Lane specimen is the mould of parts of the summit, of three ambulacra and of two radials. There seem to be signs of two spiracles. The impressions of the ambulacra seem very perfect, and show their median groove and branches, the side-plates (the marks on which are not easy to decipher), and the hydrospire pores. There are also seen two deltoids (very indistinctly) and one interradian sinus, the surface-ornament and the raised sides of which are very evident.

(4) Phillips's specimen appears to be lost. In his figure the ambulacra seem slightly broader and more triangular. The structure shown in his enlarged drawing may be either a deformity or an indication of the appearance which, in some lights, the ambulacra from our Wrafton Lane specimen assume. He describes "the general figure" as "oval, attenuated at the base," but does not show the shape of the base in his drawing.

Phillips identified his specimen with *Pentremites ovalis*, Goldfuss.¹ The resemblance, as far as the figures can be compared, is certainly considerable. In the German figure, however, the ambulacra are broader and slightly more petaloid, the side-branches are longer, narrower, and much more numerous, the interambulacral areas are more triangular and acute, and do not extend quite so high, and the ornament of these areas, though similar, is coarser. Thus Goldfuss's fossil comes nearer to Etheridge and Carpenter's definition of the genus *Pentremites* as restricted by them, and though it is not absolutely proved to be different from our English species, there is the greatest probability that it is so, not only specifically but generically. Moreover it is said to have come from a Carboniferous quarry, though from beds in it which Professor Ferdinand Römer thought might possibly be Devonian. Under these circumstances it does not seem desirable to retain the German name for our Pilton fossil.

¹ 1826-33, Goldfuss, 'Petref. Germ.,' vol. i, p. 161, pl. 1, fig. 1 a-c.

II. *Family*—CODONASTERIDÆ, *Etheridge and Carpenter*, 1886.

1. *Genus*—CODONASTER, *M'Coy*, 1849.

1. CODONASTER CONICUS, n. sp. Plate XXIX, figs. 4, 4 a.

Description.—Calix very elongate, subfusiform. Base apparently trilobate. Summit very gently convex. Radial plates nearly half as long again as the basal, and separated from them by a slightly zigzag suture. Section of upper parts of the calix distinctly pentagonal, apparently becoming slightly stellate at the summit. Upper margins of the interradial sinus forming a very low triangle. (Shape of deltoid plates unobserved.) Ambulacra apparently moderately narrow, short, curving gently downwards near their distal ends. Deltoid plates apparently bearing a strong ridge along their centre. Anus semicircular, situated very near the centre? Hydrospire-slits few and coarse.

Size.—Length about 6 mm., width about 3 mm.

Locality.—A single specimen (with part of its mould) from Top Orchard Quarry is in the Woodwardian Museum.

Remarks.—This little specimen is crushed, and being in the state of preservation usual in these beds its details are indistinct. This is especially the case at its summit, where not only is it squeezed together but its surface has been mostly carried away with the mould. From its general shape, however, and what indications of its structure remain, there seems no reason for doubt that it belongs to the genus *Codonaster*. The spaces in the ambulacra seem very few and coarse, indications of three or four of them being seen. Three or four ridges (more or less parallel) outside some of the ambulacra, where the surface is broken away, appear to be the upper part of the hydrospire-slits. Remains are seen of a circular or semicircular wall round the central area, and there is a round pit, which may be the anus. The upper margins of the interradial sinuses are defective, but they appear to have been elevated into low triangles and probably to have been bent obliquely inward at the summit. Five short coarse radii, dividing the interradial areas on the summit, appear to be the ridges on the deltoid plates.

Affinities.—From the Carboniferous *C. trilobatus*, M'Coy¹ (which, including *C. acutus*, M'Coy,¹ is the only described English species), our Pilton form is totally different in shape; but to the Upper Devonian *C. Hindii*, Etheridge and Carpenter,²

¹ 1849, M'Coy, 'Ann. Mag. Nat. Hist.,' vol. iii, p. 251.

² 1886, Etheridge and Carpenter, 'Catal. Blastoid. Brit. Mus.,' pp. *passim*, pl. xii, figs. 4—7.

its likeness is very great indeed, both in general appearance and as far as can be seen in the arrangement of the ambulacra. In form, however, it distinctly differs in being still more elongate; while (though it is not possible to speak positively) it also appears more stellate in the shape of its summit and has wider ambulacra.

Its similarity to an American species of equivalent age is interesting.

5. CLASS—CRINOIDEA, *J. S. Miller*, 1821.

1. ORDER—FLEXIBILIA, *Zittel*, 1895.¹

I. Family—ICHTHYOCRINIDÆ, *Wachsmuth and Springer*, 1879.

1. Genus—TAXOCRINUS, *Phillips* (apud *Morris*), 1843.²

1. TAXOCRINUS MACRODACTYLUS, *Phillips*, sp. Plate XXXIII, figs. 2—4 a.

1841. CYATHOCRINUS? (ISOCHRINUS) MACRODACTYLUS, *Phillips*. Pal. Foss., pp. 29, 30, pl. xv, figs. 41 a—g.

1843. TAXOCRINUS MACRODACTYLUS, *Morris*. Catal. Brit. Foss., p. 90.

1879. — — — *Wachsmuth and Springer*. Proc. Acad. Nat. Sci. Philad., 1879, p. 272.

Description.—Column cylindrical, expanding considerably in the immediate proximity of the cup. Columnars rather short, alternating, becoming gradually very short as their diameter increases, having milled faces, and, as a rule, flat lateral margins, though occasionally at some distance from the cup some joints occur with convex margins. (Under basals unobserved). Basals five, very narrow, triangular. Radials five, very large, transversely quadrate. Primibrachs 5×3 (or sometimes 2?), similar to the radials except the uppermost, which is pentagonal and axillary. Secundibrachs 10×5 , similar to the primibrachs but smaller. Succeeding series of brachials similar but progressively smaller and slightly more numerous in their rows, there being five or six series of brachials in all. Arms uniserial, sometimes curling in at their extremities. No interradians visible.

Size.—Phillips's type specimen measures 88 mm. from the bottom of the cup to the curled extremities of the arms.

Localities.—In the Museum of Practical Geology are one of Phillips's type specimens from Pilton and five other specimens from North Devon; in my

¹ Cf. 1898, F. A. Bather, 'Geol. Mag.,' Decade 4, vol. v, p. 324.

² Cf. 1879, Wachsmuth and Springer, 'Proc. Acad. Nat. Sci. Philad.,' 1879, p. 270.

Collection is a specimen of the stem, showing its expanded proximal end, from Ashhill Quarry; and in the Porter Collection are two specimens from Fremington.

Remarks.—The specimens are all obscure about the base of the dorsal cup. The shape of the basals is clearly seen from the mould, though their number is only gathered by inference.

It seems probable that Phillips's figure, 41 *c*, does not belong to this species.

Affinities.—*Taxocrinus nobilis*, Phillips, sp.,¹ seems remarkably similar. Its arms appear relatively stouter, and Phillips² distinguishes it by the fewer rows of plates in its upper series of brachials (*i. e.* by the more rapid branching of the arms). It also shows interradials, of which our specimens give no sign.

2. TAXOCRINUS STULTUS, *Whidborne*. Plate XXXIV, figs. 1—3.

1896. TAXOCRINUS? STULTUS, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 377.

Description.—Stem rather stout, cylindrical, not perceptibly expanding near the cup. Columnars with convex or bead-shaped outer margins, arranged, at some distance from the body, in an alternating series of long and medium-sized, between very short, segments, but becoming uniform and increasingly short in the proximity of the cup. Edges crenulated, especially near the cup. Under basals (apparently) three, very narrow, flatly pentagonal, visible externally. Basals five, small, transverse, and pentagonal, except the one on the anal side, which appears to be considerably larger and higher than the rest, intruding between the radials and truncated on the top, and followed by a longitudinal row of two or three small anal plates. Radials large, squarish or inversely pentagonal, in contact, except, perhaps, at their upper corners and on the anal side. Primibrachs 5 × 3, similar in size and shape to the radials except the uppermost plate, which is pentagonal. Secundibrachs rather smaller but similar to the primibrachs, and in rows of five or six. Upper series of brachials indistinctly seen in the specimens, but possibly short and few, and inclined to curl inwards. Under side of arms perhaps rather convex, with a very small concave groove.

Size.—A specimen of the cup and arms (their extremities perhaps unseen) is 20 mm. high.

Localities.—In the Porter Collection is a specimen (obverse and reverse) from Pilton, and another from Poleshill. In the Barnstaple Athenæum is another from Roborough.

¹ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 205, pl. iii, fig. 40.

² 1841, Phillips, 'Pal. Foss.,' p. 30.

Remarks.—This little species appears to fall well within the limits of the genus *Taxocrinus* as restricted by Wachsmuth and Springer. It is distinguished from *T. macrodactylus* by various points, among others by the proximate columnars being much higher and being uniform in diameter. The arms also seem relatively much stouter.

Close examination has proved the short synopsis of the species which I originally gave to be incorrect; the plates in the best of the specimens are very difficult to distinguish, and it was only by tracing them out plate by plate that their true relationship, as seen in the opposite halves of the fossil, could be ascertained.

2. ORDER—CAMERATA, *Wachsmuth and Springer*, 1885.

I. *Family*—RHODOCRINIDÆ, *F. Römer*, 1855.

1. *Genus*—RHODOCRINUS, *J. S. Miller*, 1821.

1. RHODOCRINUS?, ? sp. Plate XXXI, figs. 3—3 *d.*

Size.—A distorted cup measures 25 mm. by 12 mm. in transverse sections, and the accompanying arm is 60 mm. long.

Localities.—In the Museum of Practical Geology is a specimen (with its reverse) from North Devon of a flattened dorsal cup with some expanded arms; and in the Woodwardian Museum from south-west of Sloly is the broken base of another cup, which may, from its somewhat similar ornamentation, possibly belong to the same species.

Remarks.—Though the first of these specimens is not in a condition to permit its identification, it appears distinct from any of the accompanying Crinoids. The dorsal cup is large, and was probably deeply conical or subglobose, and composed in large part of hexagonal plates arranged something in the style of *Actinocrinus*; but it is now so much flattened and cloaked by matrix that few of its plates can be seen, and their exact arrangement cannot be traced. The plates that are visible seem small and numerous, and they are marked with coarse nodules having a stellate arrangement. From the margins of the cup a number of very slender and long arms take their rise. Signs of only eight or ten of these arms remain, but it appears probable that there were originally twenty, of which ten were small and did not bifurcate, and ten were larger. These larger arms have more than five rather narrow uniserial plates before their first bifurcation, after which the plates

become cuneate, and at last definitely biserial, and the arms do not appear to branch again. The greatest portion of these longer arms is clothed by exceedingly fine and elongate, close-set, hair-like pinnules, with ten or fifteen long segments, so that they have much the appearance of a feather from a bird's tail. These arms are totally different in general aspect from those of *Actinocrinus Porteri*.

Mr. Bather, who has kindly examined the specimen, expresses the arm-formula thus :

$$\overline{\text{I Br.}}-\text{II Br.}-\left\{\begin{array}{l} \text{thick III Br.}-\text{IV B. (F.)}-\text{pinnules.} \\ \text{thin III Br. (F.)}-? \text{pinnules.} \end{array}\right.$$

To what genus this fossil belongs is most uncertain. There seem some slight grounds for supposing that it might belong to *Rhodocrinus*, and therefore with much hesitation I have placed it tentatively there.

II. Family—BATOCRINIDÆ, Wachsmuth and Springer, 1897.

1. Genus—MEGISTOCRINUS, Owen and Shumard, 1852.

1. MEGISTOCRINUS ?, sp. Plate XXXVII, fig. 5.

Remarks.—In the Woodwardian Museum, from Barnstaple, is the imperfect cast of the dorsal cup of a Camarate Crinoid which measures about 10 mm. wide, and which appears to be distinguished from *Actinocrinus Porteri* by the much more uniform size of its plates.

In this specimen (taking a single ray) the lowest plate seen appears to be a radial, which, however, is almost destroyed; this is followed by a small hexagonal first primibrach, and this by a similar sized, polygonal, axillary primibrach. This, again, is followed by two pairs of hardly smaller secundibrachs, the first hexagonal, the second axillary; and between these are three or four small inter-axillary plates. The interambulacral plates in the adjoining area (which may be an anal area?) are very numerous; there seem three in the second row, and four in the third and fourth rows.

It seems, as far as can be judged, sufficiently like a *Megistocrinus* to be placed tentatively in that genus.

III. *Family*—MELOCRINIDÆ, Zittel, 1880.1. *Genus*—MARIOCRINUS, Hall, 1859.

To what genus the following species belongs seems very doubtful. Being monocyclic with four basals and *presumably* without an anal in the radial ring, it is however, excluded from *Melocrinus* by its uniserial arms, and their mode of branching.

The Silurian genus *Mariocrinus*¹ perhaps presents the least difficulty. According to Wachsmuth and Springer it differs from *Melocrinus* in having uniserial arm-plates. Some of its arms, however, are stated to be simple, whereas those of our fossils probably all fork once a long way up. The number of plates, moreover, which are contained in the cup in our species seems very much fewer.

1. MARIOCRINUS ? MUNDUS, n. sp. Plate XXXIV, fig. 5 ? and Plate XXXVII, figs. 6, 7.

Description.—Stem round, very long, consisting of rather long, uniform, rather convex columnars in the lower parts, which become very short and more convex near the cup, the uppermost joint being apparently formed only halfway round. Margins of columnars very strongly crenulated. Dorsal cup elongate, vasiform. Basals four, about as long as their width. Radials five, very large, hexagonal or heptagonal, longer than wide, with flat upper margins. First primibrachs much smaller than the radials, pentagonal, axillary. Secundibrachs slightly smaller than the primibrachs, pentagonal, included within the cup, bearing two arms. Interambulacral plates (in one observed area), one resting on the shoulders of two radials, and about the same size as and at rather a lower level than the first primibrachs, hexagonal, bearing on its shoulders two much smaller interambulacrals of the second row. Anal side unobserved. Arms twenty ? uniserial, apparently short (about one and a half times the length of calix), tapering, composed of alternating wedge-shaped plates, bifurcating at about the fifteenth joint, and without any visible signs of pinnules.

Size.—A specimen with stem and arms measures about 110 mm., the cup being about 7 mm., and the arms 14 mm.

Localities.—A single specimen from Croyde Rocks is in my Collection; and in the Barnstaple Athenæum is a doubtful specimen from Braunton (Pl. XXXIV, fig. 5) showing a few plates of the cup and parts of the stem and arms, which possibly may belong to the same species.

¹ 1881, Wachsmuth and Springer, 'Proc. Acad. Nat. Sci. Philad.', 1881, p. 288.

Remarks.—The Croyde specimen possesses the customary indistinctness of our fossils, for though both sides of the mould and the central cast are preserved, the cup is much distorted, and each side of it is obliterated. Hence its plates cannot be perfectly traced; and, particularly, it seems a little doubtful whether the first primibrachs are axillary, so as to produce twenty arms instead of ten; *i. e.* whether the following series of plates are second primibrachs or secundibrachs. The exposed face shows five arms, but their junction with the cup is obscure.

In the Athenæum specimen the stem is slight and round, and apparently bears a few fine cirrhi, and (some distance from the cup) every eighth columnar seems enlarged. In the cup a vertical row of five or six small polygonal plates may be traced, which may be a basal, a radial, and one or two primibrachs and secundibrachs, but there are too few plates shown to make their characters clear. The arms are comparatively much larger and more massive, uniserial, formed of rather long plates, clothed with rather sparse pinnules, and bifurcating some six or eight plates up. Its identity with the former specimen is very doubtful.

IV. *Family*—ACTINOCRINIDÆ, *F. Römer*, 1855.

1. *Genus*—ACTINOCRINUS, *J. S. Miller*, 1821.

1. ACTINOCRINUS PORTERI, *Whidborne*. Plate V, fig. 21; Plate XXX, fig. 8; Plate XXXI, figs. 1, 1*a*, 2, 5; and Plate XXXII, fig. 1.

1896. ACTINOCRINUS PORTERI, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 377.

Description.—Column long, round, with short alternating or doubly alternating segments. Larger columnars with a large prominent squared central band occupying more than half of their flat peripheries, and with about thirty-five rather stout submarginal radiations on their articulating surfaces. Central canal petaliform in section, dumb-bell-shaped between the sutures.

Calix large. Basals three (?), very narrow, hexagonal. Radials five, moderate in size, hexagonal. First primibrachs similar to the radials, but rather smaller. Second primibrachs rather smaller than the first, pentagonal. Secundibrachs 10 × 1, smaller than the primibrachs, pentagonal. Arms probably twenty, with short plates, uniserial for the first two or three plates (which are included in the cup), then biserial with alternating plates, branching at somewhat uneven heights from thirteen to twenty plates up, and again at still more uneven heights higher up.

Interradials (in one interradial area)—in the first row, one plate intercalated between, and of the same size as, the first primibrachs—in the second row two, smaller, and situated between the first and second primibrachs—in the third row

three, situated on the level of the second primibrach—in the fourth row three which are very small. Anal area (Pl. V, fig. 21) with—in the first row, an anal plate equal to and intercalated between the radials—in the second row, three plates arching over the former, and more or less level with the first primibrachs (the two lateral of these being of the same size as the primibrachs, and the central smaller)—in the third row four (or five?) smaller plates—in the fourth row five smaller plates rather irregularly placed, and above these several more small irregularly placed plates. (The only specimen showing the anal area is, however, too obscure to permit certainty as to the above numbers.)

Plates of the dome small and bearing central bosses, but in the condition of the specimens not individually decipherable. Arms thickly clothed with long and large, close-set tapering pinnules, having six or seven joints. Ornament of body-plates nodular-radiate.

Size.—A specimen of a portion of a dorsal cup is about 35 mm. across at the base of the arms.

Localities.—In the Museum of Practical Geology are two slabs containing portions of two very large specimens from Braunton, half a calix with stem from Barnstaple, another calix with arms from Barnstaple, and another specimen showing the arms and part of the dome, and another of a calix divided transversely from North Devon. In the Woodwardian Museum are two specimens of the dorsal cup, and two of the arms from Barnstaple. In the Porter Collection is a specimen of the dorsal cup, and two of portions of the arms from Pilton.

Remarks.—Although several of these fossils are much finer as specimens than are often found in the Pilton Beds, none of them show the entire cup, and therefore it is not easy to judge of the value of their individual plates without some uncertainty. The plates of the dorsal cup are ornamented by coarse radiating ridges, and the starting of the arms form clustered projections from the side of the cup, after the manner of typical forms of *Actinocrinus*, with which genus it appears to agree generally, unless it be in the mode of branching of its arms.

A curious case of deformity occurs in one of the specimens (Pl. XXXI, figs. 1, 1 a, 2). One of its arms, instead of simply bifurcating at the thirteenth joint, divides into three branches at once. These three new arms go off as nearly as possible at the same level; the regular biserial arrangement of the back of the arm is broken at the beginning of the division by several small plates, mostly pentagonal in shape, but it is at once resumed as soon as the division is completed.

Another specimen of a dorsal cup in the Porter Collection (Pl. V, fig. 21) is interesting as having had its dome covered by a *Capulus* (*Orthonychia*).

2. ACTINOCRINUS ? BATHERI, *Whidborne*. Plate XXXII, figs. 2—3*b*.

1896. ACTINOCRINUS BATHERI, *Whidborne*.¹ Proc. Geol. Assoc., vol. xiv, p. 377.

Description.—Dorsal cup rather shallow, conical, apparently considerably wider than high. Basals three, apparently wide and very short, with convex surfaces forming a kind of rim or bead round the base. Radials and first and second primibrachs very indistinctly seen, apparently small, subhexagonal, wider than high, and regularly decreasing in size. Secundibrachs very large, pentagonal, axillary. Arms twenty, uniserial for the first seven or eight joints, and then becoming biserial, clothed with strong, close, tapering pinnules. Interambulacral plates of the first row apparently large and hexagonal, and of succeeding rows much smaller and narrower. One (or two) interaxillary plates between each pair of secundibrachs. Dome apparently not quite as high as the cup, composed of very numerous plates, each bearing a very large globular boss. Surface of dorsal cup covered with extremely strong ridges, forming a coarse stellate pattern.

Size.—Height of dorsal cup about 7 mm., width about 13 mm.

Locality.—A specimen of the dorsal cup and arms, on two slabs obliquely divided, is in the Museum of Practical Geology from Braunton; and a doubtful specimen of the base of a cup is in the Woodwardian Museum from south-west of Sloly.

Remarks.—The very strong ornament, together with the poorly preserved surface of this fossil, which is in the condition of a mould, has rendered it quite impossible to trace more than a very few of the plates in the lower part of the cup. Those that can be traced appear on the whole to have the characters and arrangement of *Actinocrinus*, the basals being evidently very short, the radials and primibrachs probably rather wider than high. They all seem relatively small compared to the secundibrachs, which are large, convex, and smooth, and in this respect the fossil differs so remarkably from *A. Porteri* that there seems no doubt that it belongs to a distinct species, if not genus.

¹ By thus naming this species I had meant to express my gratitude to my friend Mr. F. A. Bather for some kind help in regard to it. I was unaware at the time that he preferred that species should not bear personal names.

V. *Family*—PLATYCRINIDÆ, *F. Römer*, 1855.

1. *Genus*—PLATYCRINUS, *J. S. Miller*, 1821.

1. PLATYCRINUS ? ANGULIFERUS, n. sp. Plate XXXVII, figs. 8—12.

Description.—Cup probably elongate. Basal disc nearly horizontal? Radials large, upright, suboblong, higher than wide, with a low excavation above, and ornamented by two or three central perpendicular ridges, from which four or five horizontal ridges start to the sides. Second primibrach axillary. Arms uniserial, with very low alternating cuneate plates (not quite reaching the sides), very long and moderately slender, sending out branches some distance up, and bearing close-set pinnules. Some small interradians on the shoulders of the radials.

Size.—Radials 8 or 10 mm. high.

Localities.—A crushed specimen from Saunton Hotel, consisting of parts of four radials with arms attached, is in Mr. Coomara Swamy's Collection; three detached radials from Top Orchard, Roborough, and Pilton are in the Porter Collection; and one from Ashhill Quarry and another from Croyde are in my Collection. A detached columnar of a *Platycrinus* from Vicarage Lane, Pilton, in the Barnstaple Athenæum, may perhaps belong to this species.

Remarks.—These specimens appear to be the remains of a fine species, the full characters of which cannot at present be ascertained. I have long been acquainted with the scattered plates, which are very similar in shape to those of *Platycrinus* or *Hexacrinus*, and are curiously ornamented with strong ridges which do not radiate, but form a succession of right angles on their surface. Recently Mr. Swamy has lent me a specimen showing part of the cup and arms, but these are unfortunately somewhat obscured by crushing. I have not observed any anal plate among the specimens, and though it is possible that one may have existed in the cup, it seems rather more probable that it was wanting. If it is a *Platycrinus* it is quite possible that the highly nodulate segment of a *Platycrinus* stem in the Barnstaple Athenæum may have belonged to it.

VI. *Family*—HEXACRINIDÆ, *Wachsmuth and Springer*, 1885.

1. *Genus*—ADELOCRINUS, *Phillips*, 1841.

So little appears to be known about the single species on which Phillips founded it, that the validity of this genus must remain for the present entirely in doubt. It has of late been sometimes treated as a synonym of *Platycrinus*.

The occurrence, however, of a small detached plate (Pl. XXX, fig. 2), suspiciously like the anal of *Hexacrinus*, makes it more likely that it was related to that genus. But its style of ornament so closely resembles that of *Arthracantha* as to suggest its identity with it. However, though the little tubercles which cover the body-plates are so elongate that they may be probably regarded as spines, I have been unable to trace their full length or their shape, and am not quite certain that they are moveable. Hence, while this view may ultimately be found correct, it certainly cannot as yet be asserted positively. It seems therefore best to retain for the present Phillips's existing name for whatever it may be worth, rather than to unite it with any genus from which it might again have to be separated.

1. ADELOCRINUS HYSTRIX, *Phillips*. Plate XXX, figs. 1—7 *a*.

1841. ADELOCRINUS HYSTRIX, *Phillips*. Pal. Foss., p. 30, pl. xvi, fig. 42 *a, b*.

Description.—Dorsal cup large, deep, apparently obconical, composed of large plates, which seem to be thin, covered with more or less numerous small elongate tubercles or spines, and so closely united that signs of the sutures are rarely discernible. Basal plates three, forming a shallow cone. Radials large, higher than wide, subpentagonal, with a small excavation above. Anal plate? narrow, subquadrate. No other plates of the calix decipherable except a few small polygonal plates (apparently of the dome), each of which bears a large rounded central tubercle. Arms stout, probably not very long, about ten in number, and not branching; biserial, composed of rather high joints, and clothed with long stout pinnules.

Size.—A specimen of the cup with closed arms (perhaps not fully shown) is about 40 mm. long.

Localities.—In the Museum of Practical Geology are a dorsal cup (*Phillips's* type) from Brushford, a portion of another cup and some arms from Branton, and two detached plates from Barnstaple. In the Barnstaple Athenæum are a cup with arms (mould and reverse) and a plate of the calix with some arms from Top Orchard, and portions of two other cups from Branton. In the Porter Collection are portions of three cups and two detached plates from Pilton. Fragments of the dorsal cup do not appear to be rare.

Remarks.—Although several specimens have been found, we are unable to carry the description of this species very much further than where *Phillips* left it. Repeated examination of the specimens has only resulted in showing indistinct signs of the division of the lower part of the cup into three unequal plates; and the shape of the radials is only known from detached plates. The plates appear to

have been very thin and very intimately united, consequently it is quite impossible to trace the divisions of the upper parts of the calix, which are, moreover, in many of the specimens wanting. Some of the arms are, however, occasionally clearly shown, and a few scattered plates of the dome are seen in one of the specimens.

The tubercles on the plates of the cup seem to vary very considerably in number and size. They appear to be conical, and higher than wide, and may be in the shape of small spines.

Affinities.—The basal disc is remarkably like that of *Arthracantha Ithacensis*, Williams,¹ as figured by Wachsmuth and Springer;² but, if it had spines, they were probably very much smaller and more like those of *A. punctobrachiata*, Hall, sp.³ The ornament of *Hexacrinus interscapularis*, Phillips, sp.,⁴ may also be compared.

The fossil doubtfully described by Römer⁵ as *Cerriopora? patina* certainly presents much superficial resemblance in general shape to some of our specimens, though the ornament seems closer and more regular. Römer himself notes its likeness to a Crinoid.

3. ORDER—INADUNATA, *Wachsmuth and Springer*, 1885.

In the maze of this order it almost requires a necromancer to bring down a species to its rightful place amid the kaleidoscopic genera that appear, change, and vanish with the progress of science. With such obscure data as our Pilton fossils the results must necessarily be highly problematical.

I. *Family*—POTERIOCRINIDÆ, *Austin*, 1850? (emend. *Wachsmuth and Springer*, 1886).

1. *Genus*—POTERIOCRINUS, *J. S. Miller*, 1821.

Wachsmuth and Springer,⁶ finding difficulties in reference to Miller's type species *P. crassus*,⁷ propose *P. notabilis*, Meek and Worthen, as "a new, or at

¹ 1883, H. S. Williams, 'Proceed. Amer. Philos. Soc.,' p. 85, plate.

² 1897, Wachsmuth and Springer, 'N. Amer. Crinoid. Amer.,' vol. ii, p. 749, pl. lxxvi, figs. 1 a—c.

³ Ibid., p. 750, pl. lxxvi, figs. 2 a, b.

⁴ 1895, Whidborne, 'Dev. Fauna,' vol. ii, p. 190, pl. xxi, figs. 1—4, and pl. xxii, figs. 1—2 a.

⁵ 1850, F. A. Römer, 'Beitr. Harzgeb.,' pt. 1, p. 8, pl. ii, figs. 3 a, b.

⁶ 1879, Wachsmuth and Springer, 'Proc. Acad. Nat. Sci. Philad.,' 1879, p. 327.

⁷ 1821, J. S. Miller, 'Nat. Hist. Crinoid.,' p. 68, pl. xxiii, figs. 1—17.

least an additional type." The latter might perhaps have value as an explanatory species, but it is evident that to raise it to equal rank with *P. crassus*, Miller, may only make confusion worse confused. The true remedy would be a re-description of *P. crassus* from the original figured type (now in the Bristol Museum), and other carefully identified specimens of it from the same beds. As a matter of fact, it is very questionable whether Wachsmuth and Springer are even right in supposing that *P. notabilis* belongs to the same group of species. I have not been able as yet to examine closely the specimens in the Bristol Museum, but from what I am able to see of them I am inclined to think *P. crassus* may be found to have several rows of primibrachs in at least one of its arms, as stated by Austin,¹ and therefore that the primibrachs are variable in the genus, as stated by Sladen,² whereas *P. notabilis* (and therefore, according to Wachsmuth and Springer, the genus *Poteriocrinus*³) has one row only.

1. POTERIOCRINUS TENSUS, *Whidborne*. Plate XXXV, figs. 1—2; Plate XXXVIII, fig. 1.

1896. POTERIOCRINUS TENSUS, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 377.

Description.—Columnars very short, with smooth peripheries. Dorsal cup high, conical. Infra-basals five, large, pentagonal, as high as wide. Basals five, hexagonal?, very high. Radials rather shorter than basals, inversely pentagonal, with excavated upper margins. First primibrachs sometimes axillary? Arms very long, uniserial, bifurcating twice, composed of truncate cuneate plates. Pinnules rather few, slight, extremely elongate, with ten or twelve distant joints. Anal plates three. Ventral sac large, cylindrical, very long, with regular longitudinal undulations, and composed of about six rows of very numerous, subquadrate, slightly transverse plates with linear slits and lateral perforations.

Size.—A cup with portions of the arms is 80 mm. long.

Localities.—In the Woodwardian Museum is a specimen of the cup and arms, and another of a detached ventral sac from Barnstaple; in Miss Partridge's Collection a specimen of the cup and expanded arms from Saunton Hotel; and in the Porter Collection a ventral sac from Pilton.

Remarks.—Our specimens do not show the characters very clearly; but on the whole, taking the Woodwardian specimen as the type, the species seems to

¹ 1850? Austin, 'Mon. Rec. Foss. Crinoid.,' p. 71.

² 1877, Sladen, 'Proc. W. Rid. Yorks. Geol. Polyt. Soc.,' n. s., vol. i, p. (3).

³ 1886, Wachsmuth and Springer, 'Proc. Acad. Nat. Sci. Philad.,' 1886, p. 158; but see 1897, Wachsmuth and Springer, 'N. Amer. Crinoid. Amer.,' vol. i, pp. 78, 154.

approach *P. crassus*, and is therefore probably a typical *Poteriocrinus*. That specimen is accompanied by three gutta-percha casts, which appear to have brought away portions of the cup as they were taken, so as to enable the plates to be counted, though in one their interior, and in the others their exterior, casts are seen. Part of its ventral sac is exposed. Two bifurcations may be traced in the arms, but whether the plates below the first of these are primibrachs or secundibrachs is not clear; the arms seem hardly sufficiently numerous for the latter. No pinnules are visible.

In Miss Partridge's fine fossil, on the other hand, no bifurcation of the arms is observable, and this must throw some doubt on its identity with the other specimen. The arms appear ten in number (eight are seen), and they bear remarkably long and slight distant pinnules, having ten or twelve distant joints.

2. POTERIOCRINUS BARUMENSIS, *Whidborne*, sp. Plate XXXIV, fig. 6; and Plate XXXV, fig. 3.

1896. CYATHOCRINUS BARUMENSIS, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 377.

Description.—Rather small. Stem cylindrical?, composed of short alternating columnars. Cup short, obconical. Infra-basals five, pentagonal, as high as wide. Basals small, hexagonal, as high as wide. Radials five, large, pentagonal, truncated above, as high as wide. Primibrachs five, large, pentagonal, as long or longer than the radials, axillary. Arms stout, very long, uniserial with truncated cuneate plates, and bearing very long close pinnules. Anal side unknown. Ventral sac large, long, composed of slightly transverse pieces with stellate marks.

Size.—A cup measures 7 mm. wide and 6 mm. high.

Localities.—There are two specimens (from Top Orchard Quarry and from Barnstaple) in the Woodwardian Museum. An indistinct specimen from Fremington is in the Porter Collection, and its reverse in Miss Partridge's Collection.

Remarks.—At first I supposed these fossils to be specimens of *P. tensus*, but further examination convinces me that they cannot be included in that species. The cup is much shorter and more globose, the basals smaller and primibrachs larger and single, and the columnars circular.

The stem in one of the specimens (Pl. XXXV, fig. 3) shows a curious deformity. Across one (and perhaps a second) longitudinal line the columnars are not continuous, but meet alternately, their line of junction being marked by a zigzag suture.

3. *POTERIOCRINUS*, sp. Plate XXXV, figs. 4—5 *a*, and Plate XXXVI, figs. 9, 9 *a*.

Description.—Large. Stem angular near dorsal cup. Columnars short, alternating. Proximal columnar curvilinear. Dorsal cup rather high, conical. Infra-basals five, pentagonal, wider than high. Basals five. Radials rather shorter than basals, with truncated upper sides. Primibrachs 5×2 or 3. Arms stout, uniserial, occasionally bifurcating, and composed of truncated cuneate plates, which in the lower parts (at least) bear stout short pinnules or armlets. Anal plates? Ventral sac extremely large, cylindrical, elongated, with longitudinal undulations, and composed of exceedingly short transverse pieces with long linear slits.

Size.—A dorsal cup is about 12 mm. high. The sac of another specimen is 100 mm. high.

Localities.—In the Museum of Practical Geology is a specimen on two slabs as well as two detached ventral sacs from Braunton Down, and another ? from Braunton; in the Woodwardian Museum is a specimen from Barnstaple; and in the Porter Collection a ventral sac from Pilton.

Remarks.—I first supposed these might be large specimens of *Poteriocrinus tensus*; but, though the specimens are imperfect, they reveal several points of difference, *e. g.* the character of the ventral sac is very different, the arm-plates seem shorter, and the arms more rapidly branching. A pinnule or armlet very near the cup (Pl. XXXV, fig. 5 *a*) is noteworthy, as it has the appearance of bearing shorter pinnules on its side; its true character is therefore obscure.

2. *Genus*—*SCAPHIOCRINUS*, Hall, 1858.

S. dichotomus is the second of the two species described by Hall¹ in 1858; but Wachsmuth and Springer select it as the type of the genus as revised by them, because, they state, the first species belongs to the genus *Graphiocrinus*, de Koninck and le Hon, 1853.

1. *SCAPHIOCRINUS* ? *PLUMIFER*, n. sp. Plate XXXI, figs. 4—4 *c*; Plate XXXIII, fig. 1; Plate XXXVI, figs. 1, 1 *a*; and Plate XXXVIII, fig. 2.

Description.—Stem becoming acutely pentagonal near the base of the cup, composed of short columnars in a doubly alternating series, having convex peri-

¹ 1858, Hall, 'Report Geol. Surv. Iowa,' vol. i, pt. 2, p. 553, woodcut 72.

pheres. Dorsal cup basin-shaped, wider than high. Infra-basals five ? short. Basals five, almost regularly hexagonal in shape, as wide as high. Radials five, wider than high, pentagonal ? convex, and with wide horizontal upper margins. Surface of plates of the cup marked with strong (sometimes intermittent) ridges, radiating from the centres of the basals and other points. Primibrachs five, in from one to six rows, the first, the second, and the sixth primibrachs appearing to be axillary in different arms. Arms elongate, branching two or three times at rather regular distances so as to become about twenty-eight in all. Brachials rugose, uniserial, cuneate, bearing numerous slight, close-set, elongate pinnules of six or eight plates. Ventral sac probably (as seen in another specimen) long and narrow, and composed of small subhexagonal pieces marked with stellate ridges. Anal apparently situated on the horizontal top of a basal, and bearing on its shoulder a second anal, above which seem to be other interambulacral plates.

Size.—A cup with the greatest portion of the arms hitherto found measures about 60 mm. in length.

Localities.—In the Woodwardian Museum are six fine specimens of parts of the dorsal cup and arms from Barnstaple (on seven slabs); in the Barnstaple Athenæum a specimen of the extended head, and another (on two slabs) of the closed head from Braunton; in the Museum of Practical Geology a specimen from Braunton, and in Mr. Coomara Swamy's Collection one from the Pilton Beds.

Remarks.—It appears to me that these specimens give evidence of a well-marked species, though in spite of the excellence of several of the specimens it seems impossible to be certain about some of its most important characters.

The elaborate ornamentation of the dorsal cup, and the ridges or rugosities on the larger arm-plates, are of some assistance in identifying the specimens; but the plates of the cup, and especially the arrangement of the anals, are not well shown in any of the specimens, none of which enable us to trace the plates all round. One of the Woodwardian specimens shows short stout armlets of three segments upon the secundibrachs, which seem, however, only modifications of the pinnules of the higher branches.

I have found very great difficulty in locating this species in any of the genera allowed by Wachsmuth and Springer. While the ornate surface of its body-plates would approach their definition of their restricted *Poteriocrinus*, the shape of the dorsal cup is quite different, as also is the arrangement of the primibrachs. While perhaps not quite falling within the limits of their emended definition of *Scaphiocrinus*, Hall, it certainly bears sufficient likeness to several species referred by them to that genus to be imagined congeneric.

2. SCAPHIOCRINUS TRANSCISUS, n. sp. Plate XXXVIII, fig. 3.

Description.—Column at the base of the cup pentagonal, with very short columnars. Dorsal cup conical, rather short, apparently consisting of five rather large infra-basals, five large subhexagonal basals, five rather short radials, and three anal plates, all very strongly ornamented by large, smooth, rounded ridges, which radiate from the centres of the plates. Primibrachs 5×2 (at least in one ray), short. Arms uniserial, with cuneate plates, bifurcating again a few plates up. Ventral sac exceedingly large and heavy, composed of rather large and high pieces.

Size.—Height of dorsal cup about 25 mm.

Localities.—A fragmentary portion of a calix and of the ventral sac from Barnstaple is in the Woodwardian Museum; and another similar specimen from Pilton is in the Porter Collection.

Remarks.—These specimens are too imperfect for anything like a full specific description. They appear most nearly to resemble *S. plumifer*, and I am not certain whether they may prove to be more than a variety of it. As far, however, as can be seen at present they seem to differ from it by their very much larger size, and their much less elaborate ornamentation. The ventral sac is exceedingly wide and massive. The individual plates are ornamented with five or six large bars or costæ radiating from their centres, without tubercles, in a way very like some of the plates of *Poteriocrinus crassus*, figured by J. S. Miller.

3. SCAPHIOCRINUS ? INORDINATUS, n. sp. Plate XXXIV, fig. 7 ?; Plate XXXV, fig. 6, 6 a; Plate XXXVIII, fig. 4.

Description.—Stem pentagonal near the cup. Columnars short, alternating, with a central raised and perhaps nodulated band round their peripheries. Dorsal cup probably bowl-shaped and rather shallow. Infra-basals indistinctly seen, probably five, short. Basals five, small, polygonal. Radials five, large, convex, truncated above. Primibrachs large, convex, the first (at least in four of the rays) quadrate, the second pentagonal and axillary. Anal plates—one in the first row, large, elongate, apparently squeezed in between the basals, but prolonged above them, bearing in the second row a large plate resting on its upper margin, and a third above that. Surface coarsely rugose. Arms composed of elongate quadrate plates, and bearing very long pinnules.

Size.—A flattened cup is about 7 mm. wide.

Localities.—In my Collection is a flattened specimen from Upcott Arch (on the

two faces of a slab divided horizontally). As far as can be seen, a specimen (on the two faces of a slab divided longitudinally) from Barnstaple in the Woodwardian Museum belongs to the same species; as perhaps does also a fine but obscure specimen (divided longitudinally) from Poleshill, in the Porter Collection, and a specimen from Braunton in the Museum of Practical Geology.

Remarks.—I have drawn up the above description from the specimen from Upcott Arch. While the Woodwardian specimen from its corrugated surface and its general appearance seems probably identical, its plates are not sufficiently clear to make this certain. Its cup is of a low vasiform shape, the large radials bending outwards and being convex, so that a section across them would be petaloid. In most of the rays the second primibrach is axillary, but in one (the right anterior?) the first primibrach seems axillary, or at least it is shorter than the corresponding pairs, and no suture can be traced across it. Its arms appear to be ten in number, and clothed with strong pinnules.

To what genus this species (with the Upcott Arch specimen for its type) may belong is a perplexing question. It appears to me clear that the first anal is included in the basal ring, and is level with the basals; but, according to Wachsmuth and Springer, this arrangement exists in none of the *Inadunata*, though Bather¹ has since proved it to occur in *Thenariocrinus* and one or two other genera, to neither of which, however, our species in other respects approximates. This position of the azygous plate would probably be a character of generic importance, but our specimens are not sufficiently good and indubitable to form the type of a new genus. The only course, therefore, is to leave them for the present in *Scaphiocrinus*, and await the evidence of further finds.

4. SCAPHIOCRINUS, sp. Plate XXXIV, fig. 8.

Description.—Stem circular, with very unequal alternating columnars which have convex peripheries. Dorsal cup very shallow, bowl-shaped. Infra-basals pentagonal, very short. Basals about as high as wide. Radials large. First primibrachs very large and long, axillary. Arms large and very long, composed of rather short cuneate plates, bifurcating at about the sixth plate, and clothed with large and stout pinnules. Anal side unknown.

Size.—A cup is about 4 mm. wide.

Localities.—In the Museum of Practical Geology is one specimen from Barnstaple and one from Braunton Down; in the Woodwardian Museum one (on two slabs) from Barnstaple; in the Porter Collection one from Poleshill; and in my Collection one from Top Orchard.

¹ 1890, Bather, 'Ann. Mag. Nat. Hist.,' ser. vi, vol. vi, p. 222.

Remarks.—All these specimens are imperfect and indistinct. They seem to agree as far as can be made out, but whether they belong to a new form or to one of the accompanying species is uncertain.

5. SCAPHIOCRINUS? SALEBROSUS, n. sp. Plate XXXVII, fig. 13.

Description.—Stem pentagonal, composed near the cup of short alternate columnars with a raised central band round their peripheries. Dorsal cup rather shallow, bowl-shaped (nearly hemispherical), composed of tumid plates. Infra-basals very indistinctly seen. Basals large, convex, apparently hexagonal. Radials convex, pentagonal, truncated above, and with a linear articulating ridge. Azygous plate pentagonal, situated on the shoulders of two basals, and bearing an anal piece on its left shoulder, and another on its truncated summit. First primibrach in some of the arms axillary? Arms stout, uniserial, bifurcating (in one instance six plates up), composed of somewhat cuneate plates; (arm-furrows wide, with ligamental fossæ?). Pinnules strong, with rather short plates. Ventral sac probably large, and covered by ridged, polygonal plates. Surface of body and arm-plates covered with a minute irregularly corrugated ornament.

Size.—A dorsal cup measures about 6 mm. high and 9 mm. wide.

Localities.—A specimen from Pilton is in the Porter Collection; another from Barnstaple in the Woodwardian Museum; a third from Upcott in the Barnstaple Athenæum.

Remarks.—Of these specimens the first is exposed longitudinally, the second horizontally, while the third is only a most obscure and doubtful basal part of a cup. They seem sufficient to show the distinctness of the species, but not to give a clear conception of its characters. The bowl-shaped cup with tumid plates covered with a minute ornament gives distinguishing characters. The ventral sac is not itself seen, but the occurrence of numerous peculiar plates indicates something of its size and character. It seems to differ from *Poteriocrinus Barumensis* by having larger basals and smaller infra-basals and by the greater tumidity of its plates.

It appears to come very near to the characters given by Wachsmuth and Springer¹ for *Cromyocrinus*, a genus which they first unite with and then separate from *Eupachyocrinus*, Meek and Worthen.² It may be compared with *C. globosus*, Worthen, sp.,³ and *C. papillatus*, Worthen, sp.⁴

¹ 1879, Wachsmuth and Springer, 'Proc. Nat. Sci. Philad.,' 1879, p. 356.

² 1886, *ibid.*, 1886, p. 170.

³ 1873, Meek and Worthen, 'Geol. Surv. Illin.,' vol. v, p. 557, pl. xxi, fig. 12.

⁴ 1883, Worthen, *ibid.*, vol. vii, p. 315, pl. xxix, fig. 17.

3. *Genus*—SCYTALOCRINUS, *Wachsmuth and Springer*, 1886.

Sladen¹ founded the genus *Dactylocrinus* for the *Poteriocrinus tenuis* of Austin² (not Miller³); and the species *S. stadiodactylus* described below, which is very similar to that species, seems quite agreeable to his definition. Wachsmuth and Springer, however, stating that his name had been preoccupied by Quenstedt in 1876 for another form, merge Sladen's genus into their own *Scytalocrinus*,⁴ to which they refer a large number of American fossils. How far our species is congeneric with some or all of these may be doubtful, though in many points it corresponds. It differs from most if not all of them in the very great length and quadrate shape of its arm-joints, and this feature was made by Sladen one of the important characters of his genus. Wachsmuth and Springer explain this away by saying that it simply betokened a young animal. In our case, however, their remark hardly appears applicable; several of our specimens show the arms, and these are of very great length, and seem to be of sufficiently mature character.

1. SCYTALOCRINUS STADIODACTYLUS, *Whidborne*, sp. Plate XXXVI, figs. 2—6, 8, and Plate XXXVII, fig. 14.

1886. POTERIOCRINUS STADIODACTYLUS, *Whidborne*. Proc. Geol. Assoc., vol. xiv, p. 377.

1886. — BATHERI, *ibid.*, p. 377.

Description.—Stem apparently long and slender, composed of moderately high, equal or nearly equal columnars. Dorsal cup conical or slightly obconical, moderately deep. Infra-basals five, small, slightly higher than wide, pentagonal. Basals five, apparently large, higher than wide, hexagonal. Radials five? moderately short, truncate above. Primibrachs 5 × 2. Arms ten, very long and slender, composed of very long, narrow, subquadrate plates, and sending out occasionally long slight armlets or pinnules. Anal side with a pentagonal azygous plate, resting on the shoulders of two basals, and bearing an anal piece on its left shoulder level with the radials, and another hexagonal anal on its summit; the last two supporting further similar plates, which appear to clothe the lower parts

¹ 1877, Sladen, 'Proc. W. Rid. Yorks. Geol. and Polyt. Soc.,' n. s., vol. i, p. (4), pl. x, fig. 2.

² 1850? Austin, 'Monog. Rec. and Foss. Crinoid.,' p. 83, pl. x, figs. 5 a, b.

³ 1821, J. S. Miller, 'Nat. Hist. Crinoid.,' p. 71, pl. xxii, fig. 2, and pl. xxiv, figs. 1—25.

⁴ 1879, Wachsmuth and Springer, 'Proc. Acad. Nat. Sci. Philad.,' 1879, p. 339; and 1886, *ibid.*, 1886, pp. 157, 161.

of the greatly elongated ventral sac, which in its higher parts is covered by slightly transverse quadrate plates, and swells out into a slightly clavate form.

Size.—A calix is 3 mm. high; another 6 mm. high. The arm of a similarly sized specimen appears to be more than 50 mm. long.

Localities.—In the Barnstaple Athenæum are one specimen from Braunton and two from Roborough; in the Woodwardian Museum are five (on four slabs) from Barnstaple; and in the Porter Collection two from Pilton.

Remarks.—The great slighthness and elongation of its arm-plates and the length and mode of branching of the arms easily distinguish this form from the accompanying Crinoids. The arms do not appear to exceed ten, and are composed of alternately long and shorter quadrate plates, only the longer of which appear to bear long and relatively strong pinnules, which, therefore, do not produce the usual plumose aspect. The arms do not seem straight, but slightly waved or zigzagged, the pinnules starting from the outer angles thus formed. Possibly the pinnules themselves sometimes have a slightly waving shape, and hence they may be of rather doubtful nature, and possibly have to be reckoned as armlets, but I have not been able to recognise any branching in them.

The anal side of the cup is seen in a small specimen (Pl. XXXVI, figs. 2, 2 *a*, which I should regard as the type) which retains the arms; but there it is rather distorted by accident. This specimen also shows the ventral sac, which is seen to rise from the anal plates of the cup for some distance as a narrow tube covered with elongate hexagonal plates, and then to swell out into an elongate inflated shape, when it is covered by short quadrate pieces in probably ten or twelve rows. How high it extends cannot be seen. The height of the cup being about 4 mm., the neck of the sac is 10 mm. long, and the inflated part more than 10 mm.; while the width of the neck is 1 mm., and of the inflated part 3 mm.

The arm-plates are sometimes three times as long as their width.

Two specimens (Pl. XXXVI, figs. 6, 8) were regarded by me in 1896 as a distinct species, which I named *Poteriocrinus Batheri*. They seemed to differ from the type by the greater size and length of their basals, shorter columnars, and some other points. Further examination makes me very doubtful whether any of the supposed distinctions hold good, or may not have been really caused by the imperfect preservation of our specimens—the appearance of the column especially being due to decay, and the portion of an arm (fig. 7) on the same slab as fig. 6 evidently belonging to another animal of a different species. They must therefore, I think, be united with the present species.

Affinities.—*Sc. loreus*, Sladen, sp.¹ (= *Poteriocrinus tenuis*, Austin), is very similar, and seems evidently congeneric, but its dorsal cup is more elongate and

¹ 1877, Sladen, 'Proc. W. Rid. Yorks. Geol. and Polyt. Soc.,' n. s., vol. i, p. (5), pl. x, fig. 2.

conical, its arm-plates seem all equal, and it appears to differ in having only one row of primibrachs.

Sc. Vanhornei, Worthen,¹ is also very like, both as to its dorsal cup and its ventral sac, but its arm-plates are much shorter and more cuneate. Its second primibrach is axillary.

2. SCYTALOCRINUS ARACHNOIDEUS, n. sp. Plate XXXVIII, figs. 5, 6.

Description.—Stem round, with alternate very long and moderate columnars (near the cup), which have gently convex peripheries. Dorsal cup small, apparently semi-globose (bowl-shaped). Infra-basals elongate, pentagonal? longer than wide. Basals subhexagonal, equal to the infra-basals in height but broader. Radials pentagonal, about the same size as basals, convex laterally, and with horizontal upper margins. First primibrachs large, square; second primibrachs pentagonal, axillary. Arms very long, simple, not perceptibly tapering, composed of equal plates, which are rather higher than wide, have almost horizontal sutures, and bear very long pinnules with numerous joints. Azygous plate very similar to the radials, bearing apparently another very small anal on its left shoulder, and a third on its truncated upper margin; these being followed by numerous rows of subhexagonal pieces forming a long narrow neck to the sac, which is longer than the height of the cup, the sac then expanding and forming a long reticulate bag four or five times the height of the cup.

Size.—Height of a cup 5 mm., length of ventral sac about 40 mm.

Localities.—There are three specimens from Barnstaple in the Woodwardian Museum.

Remarks.—These specimens appear to have very much the same characters as *Sc. stadiodactylus*, but to differ distinctly from it in the structure of their arms, which are much stouter, and composed of comparatively short equal joints. The ventral sac seems also very similar. The defective state of our specimens leaves of course many of the characters indistinct and doubtful, but as their size does not seem to exceed that of the former species, they could hardly be supposed to be its adult condition, and must therefore, I think, be regarded as a new form.

¹ 1875, Worthen, 'Geol. Surv. Illin.,' vol. vi, p. 517, pl. xxxi, figs. 2, 3.

4. Genus—CÆLIOCRINUS, White, 1863.

1. CÆLIOCRINUS, n. sp. Plate XXXVIII, fig. 7.

Description.—Dorsal cup unseen. Arms stout, slowly diminishing in size bifurcating at nearly level distances, the ramifications occurring only on the two outer arms of the rays, and the branches being given off toward the inner side of the ray, and remaining single throughout. Arm-plates extremely short, uniserial, cuneate. Pinnules large and long. About five plates between the first divarication seen and the second; about seven between the second and third; and about eleven between the third and fourth. Anal sac long.

Size.—A specimen with parts of the arms is 22 mm. long.

Localities.—A single defective specimen from Barnstaple is in the Woodwardian Museum.

Remarks.—This specimen being a mass of arms with only indistinct indications of the dorsal cup is insufficient for full determination, but at the same time is distinctly different from any other Pilton Crinoid.

As far as can be seen, it has great resemblance to such forms as *Zeacrinus cariniferus*, Worthen,¹ and *Z. lyra*, Meek and Worthen,² which Wachsmuth and Springer refer to *Cæliocrinus*,³ a genus with a "balloon-shaped" dorsal sac, and for one of the species of which they somewhat rapaciously claim⁴ the well-known *Echinosphærites tessellatus*, Phillips, sp.,⁵ regardless of its structure! A small portion of the ventral sac, seen in our specimen, proves it to have been large and possibly wide, but its shape is unknown, so that it is not certain whether our species belongs to this or some kindred genus. The cuneate plates of the arms, however, appear, according to Wachsmuth and Springer, to separate it from *Zeacrinus*, and from such species as *Zeacrinus ramosus*, Hall,⁶ or *Scaphiocrinus subæqualis*, Wachsmuth and Springer,⁷ which, after having placed in a new genus *Pachylocrinus*, they afterwards referred to *Woodocrinus*, de Koninck,⁸ from the type form of which, *W. macrodactylus*, these species certainly have a very different aspect, though they may be more like *W. expansus*, de Koninck.⁹

¹ 1873, Meek and Worthen, 'Geol. Surv. Illin.,' vol. v, p. 535, pl. xx, fig. 4.

² Ibid., p. 432, pl. i, fig. 11.

³ 1879, Wachsmuth and Springer, 'Proc. Acad. Nat. Sci. Philad.,' 1879, p. 354.

⁴ 1886, *ibid.*, p. 168.

⁵ 1841, Phillips, 'Pal. Foss.,' p. 135, pl. lix, figs. 49^{xx} a, b.

⁶ 1858, Hall, 'Report Geol. Surv. Iowa,' vol. i, pt. 2, p. 548, pl. ix, fig. 3.

⁷ 1873, Meek and Worthen, 'Geol. Surv. Illin.,' vol. v, p. 494, pl. xv, fig. 6 (this figure, however, has cuneate plates); and 1879, Wachsmuth and Springer, 'Proc. Acad. Nat. Sci. Philad.,' 1879, p. 339.

⁸ 1854, de Koninck et le Hon, 'Recherches Crinoid. Terr. Carb. Belg.,' p. 212, pl. viii, figs. 1 a—e.

⁹ 1858, de Koninck, 'The Geologist,' vol. i, p. 13, pl. ii, fig. 1.

PLATE XXII.

PRODUCTUS INTERRUPTUS, *Sowerby* (?). (Page 172.)

FIG.

1. Ventral valve, lying obliquely in the matrix, showing the ribs and the interrupting grooves and ridges in the posterior parts, $\times 3$. Pilton. Porter Collection.
2. Dorsal? valve, somewhat worn, showing the transverse ridges over the whole surface, $\times 2$. Fremington. Porter Collection.
3. Portion of a crushed specimen, showing ornament, $\times 8$. Pilton. Porter Collection.

CHONETES HARDRENSIS, *Phillips*, sp. (Page 177.)

4. Cast of dorsal valve, showing the areas of the dorsal and ventral valves, and the divaricating ribs, $\times 8$. Saunton Hotel. My Collection.

CHONETES MARGARITACEA, *Whidborne*. (Page 179.)

5. Ventral valve, showing the shape and the simple ribs, $\times 3$. 5 a. Portion of surface, showing the shape of the ribs and the transverse ornament, $\times 10$. Roborough. Porter Collection.
6. Another specimen, much crushed, showing two of the hinge-spines, $\times 3$. Braunton. Museum of Practical Geology.

CHONETES ILLINOISENSIS, *Worthen* (?). (Page 179.)

7. Dorsal valve, showing the crowded divaricating and slightly waved striæ and the slight geniculation, $\times 3$. Fremington (?). Porter Collection.
8. Ventral valve, much crushed, showing one of the long oblique hinge-spines, $\times 3$. Fremington (?). Porter Collection.

CRANIELLA INSECURA, n. sp. (Page 180.)

9. Cast of dorsal valve, showing the apex, the casts of the muscle-scars, and the ornament assumed from the organism to which the other valve was attached, $\times 2$. Pilton Beds. Barnstaple Athenæum.

CRANIA? BICTA, n. sp. (Page 182.)

10. Ventral valve, showing the divaricator, the ocluclosor, and the ventral adjuster (?) muscle-scars, $\times 3$. 10 a. Portion, showing the minutely tuberculated inner surface, $\times 10$. Pilton. Porter Collection.

DISCINA NITIDA, *Phillips*, sp. (Page 183.)

11. Upper valve, which is a cast in the central part, but retains the surface near the margins, the front part of which is covered by matrix, $\times \frac{2}{3}$. 11 a. Lateral view, $\times \frac{2}{3}$. Saunton Hotel. Miss Partridge's Collection.
12. Lower valve, $\times \frac{2}{3}$. West Angle Bay, Pembrokeshire. Museum of Practical Geology.

LINGULA SQUMIFORMIS, *Phillips*. (Page 183.)

13. Dorsal valve, showing the radiations on the surface, $\times 2$. Saunton Hotel. Miss Partridge's Collection.

FENESTELLA PLEBEIA, *M'Coy*. (Page 185.)

14. Part of a large frond. 14 a. A fenestrule, showing the non-poriferous surface, $\times 20$. 14 b. A fenestrule, which is a natural section, showing five or six cells between the dissepiments, $\times 20$. Snapper Quarry. Hamling Collection.
15. Fragment of a frond. 15 a. Portion, showing a nodulated surface, and the section of some cells, $\times 20$. Ironpost. My Collection.

FENESTELLA? UMBROSA, n. sp. (Page 186.)

16. Wax impression of the natural cast of a frond. 16 a. A portion of the surface showing the blunt central keel, the shape of the fenestrules, and three or four cell-mouths to a fenestrule, $\times 20$. Roborough. Barnstaple Athenæum.

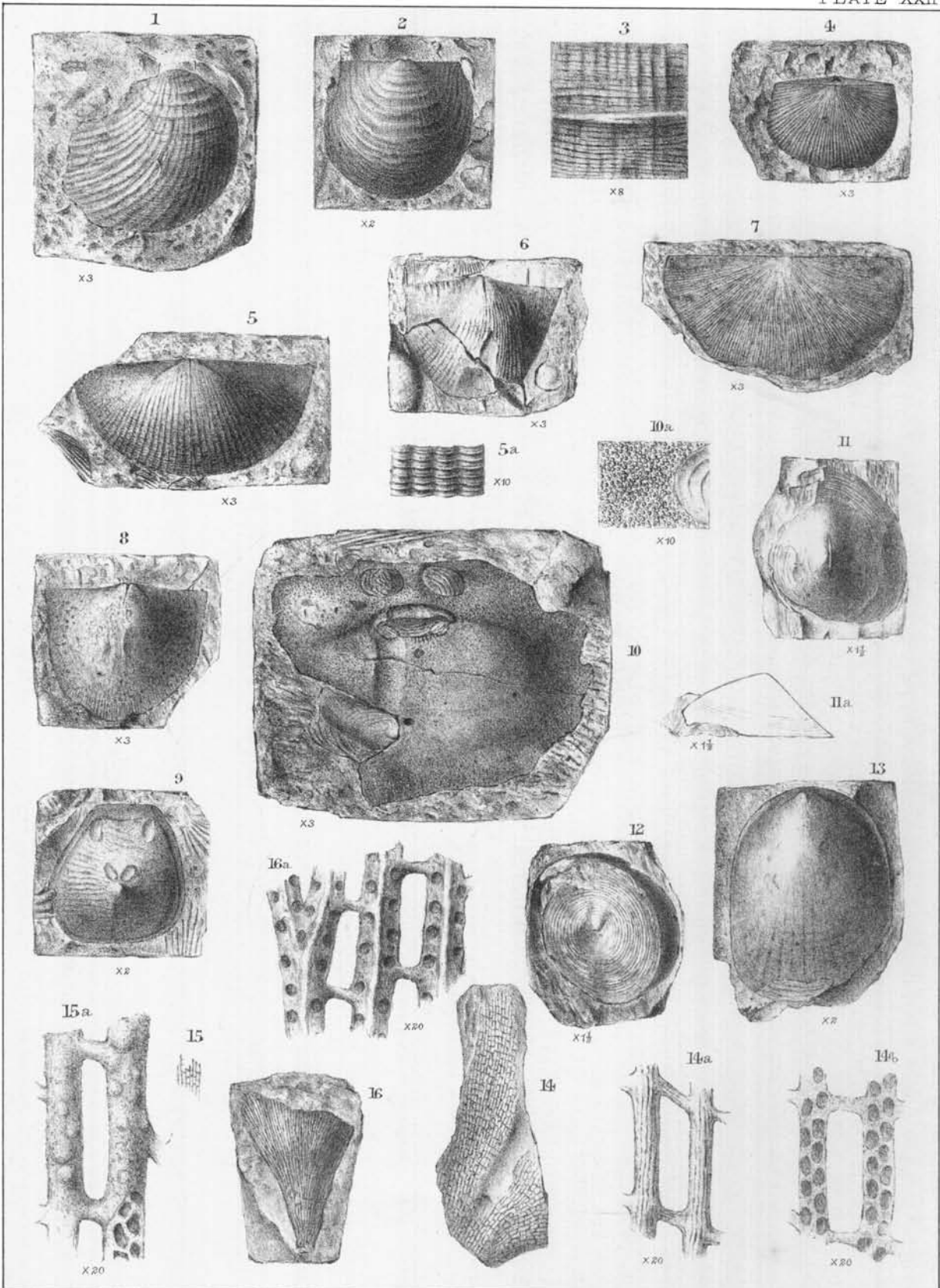


PLATE XXIII.

FENESTELLA PLEBEIA, *M. Coy.* (Page 185.)

FIG.

1. Fragmentary specimen. 1 *a.* Portion, showing the striated non-poriferous side, and the section with four or six cells to a fenestrule (slightly restored), $\times 20$. Pilton Beds. Porter Collection.

FENESTELLA ? UMBROSA, n. sp. (Page 186.)

2. Fragmentary specimen in the condition of a cast, probably belonging to this species, but with very small fenestrules. 2 *a.* Portion, showing two cells to a fenestrule, $\times 20$. Roborough. Porter Collection.
3. Fragmentary specimen of the radical portion of a frond. 3 *a.* Portion, showing the keeled and striated non-poriferous side, which sometimes appears to have two cells to a fenestrule, $\times 20$. Poleshill. Porter Collection.

FENESTELLA POLYPORATA, *Phillips.* (Page 188.)

4. Fragmentary specimen of the poriferous face. 4 *a.* Portion, showing six cells to a fenestrule, the median keel, and the elevated cell-mouths, $\times 20$. Pilton Beds. Hamling Collection.
5. Fragmentary specimen of the radical portion of a frond. 5 *a.* Portion, showing the mode of branching, the cells, the cell-mouths, and the median keel, $\times 20$. Pilton. Porter Collection.

PENNIRETIPORA BIPINNATA, *Phillips,* sp. (Page 190.)

6. Portion of a large cast, showing mouths of cells. 6 *a.* Portion, showing two cells on the central stem between each two of the branches, $\times 20$. Poleshill. Porter Collection.
7. Slab with several specimens retaining surface. 7 *a.* Portion of a frond, showing the central keels and the cell-mouths, $\times 20$. Barnstaple. Woodwardian Museum.
8. Specimen, showing the mode of branching. Pilton. Porter Collection.

PENNIRETIPORA VIRGATA, n. sp. (Page 191.)

9. Fragmentary specimen. 9 *a.* Portion, showing the numerous cells between the subsidiary branches, $\times 20$. Croyde Bay. My Collection.

STREBLOTRYPA GREGORII, *Whidborne.* (Page 192.)

10. Portion of a zoarium. 10 *a.* Portion of surface, showing the acute undulating ridges, the mouths of the zoecia and the mesopores, $\times 20$. Pilton Beds. Hamling Collection.

RHABDOMESON ? GRACILE, *Phillips,* sp. (Page 194.)

11. Portion of a zoarium. 11 *a.* Portion of surface, showing cell-mouths, $\times 20$. Barnstaple. Woodwardian Museum (on a slab from which Sowerby's figure in 'Geol. Trans.,' ser. 2, vol. v, pt. 3, pl. liii, fig. 17, was taken).
12. Portion of a zoarium. 12 *a.* Portion of surface, showing cell-mouths and acanthopores, $\times 20$. Ironpost. My Collection.
13. Portion of the zoarium of a variety with larger cell-mouths. 13 *a.* Portion of surface, showing the long, oval cell-mouths and pores, $\times 20$. East Anstey. My Collection.
14. Cast of a zoarium, probably belonging to this species. 14 *a.* Portion, showing the form of the cells, $\times 20$. Pilton. Porter Collection.
15. Portion of the natural section of a zoarium, probably belonging to this species. 15 *a.* Portion, showing the shape of the cells and the central axis, $\times 20$. Pilton. Porter Collection.

LEIOCLEMA ? DISTANS, *Whidborne,* sp. (Page 196.)

16. Portion of a zoarium. 16 *a.* Portion, showing the small, distant, oval cell-mouths and the scattered mesopores, $\times 20$. Laticosta Cave, Baggy. Hamling Collection.

FISTULIPORA ? sp. (Page 197.)

17. Specimen of a free zoarium. 17 *a.* Portion, showing the cells, $\times 15$. Pilton. Porter Collection.

FISTULIPORA (?), sp. (Page 198.)

18. Specimen encrusting a coral, $\times 2$. Frankmarsh. Barnstaple Athenæum.
19. Wax cast of the portion of another specimen, encrusting a crinoid stem, $\times 20$. Barnstaple. Woodwardian Museum.

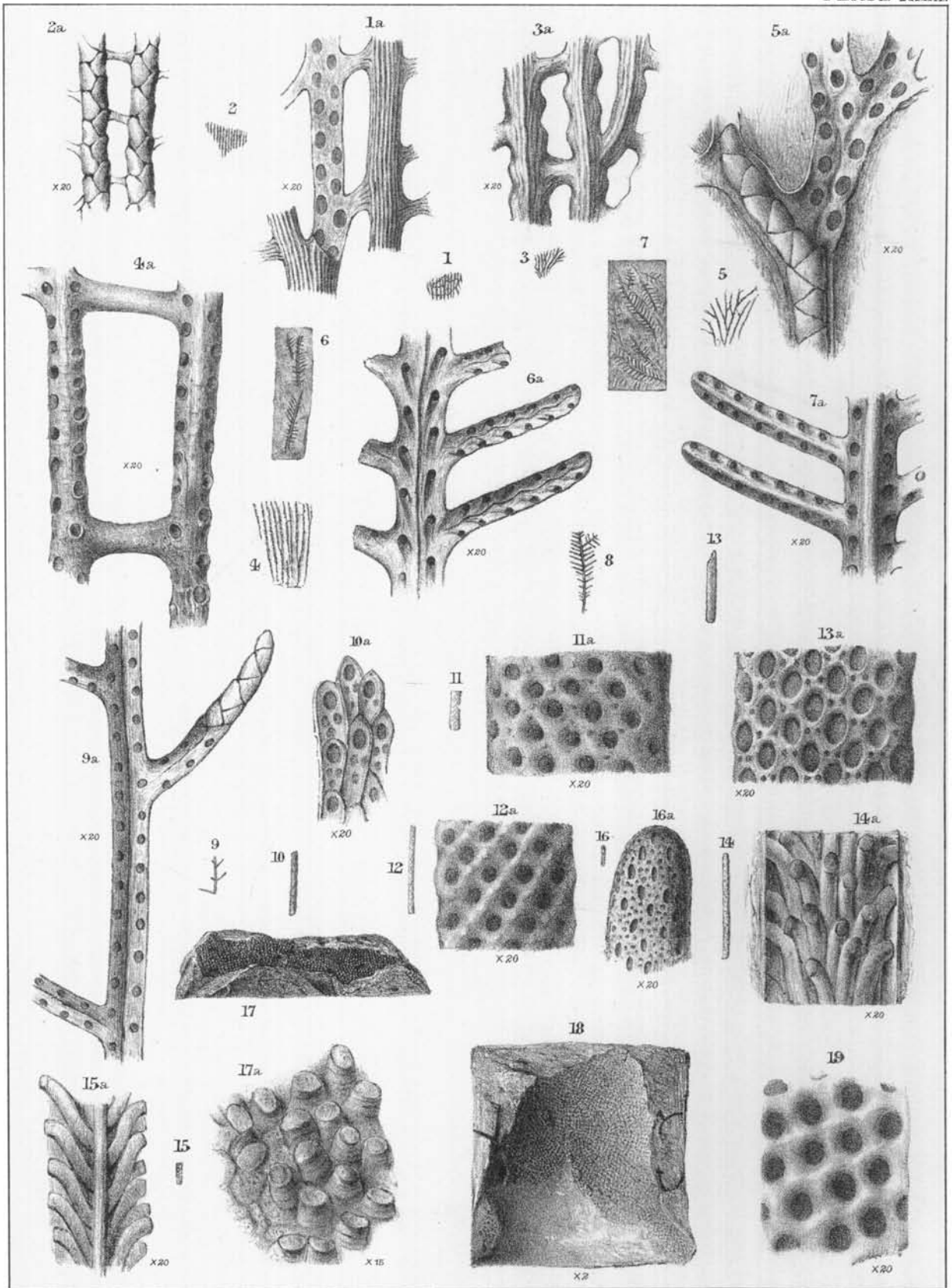


PLATE XXIV.

LEPIDESTHES ? DEVONICANS, *Whidborne*. (Page 260.)

FIG.

1. One side of the mould of a nearly perfect but flattened and compressed specimen, in which the remains of the lantern are seen, and the ten areas may be roughly traced, nat. size. Pilton Beds, North Devon. Museum of Practical Geology.
2. Portion of the opposite face of the same specimen, showing numerous spines and interambulacral and ambulacral plates, $\times 2$. Pilton Beds, North Devon. Museum of Practical Geology.

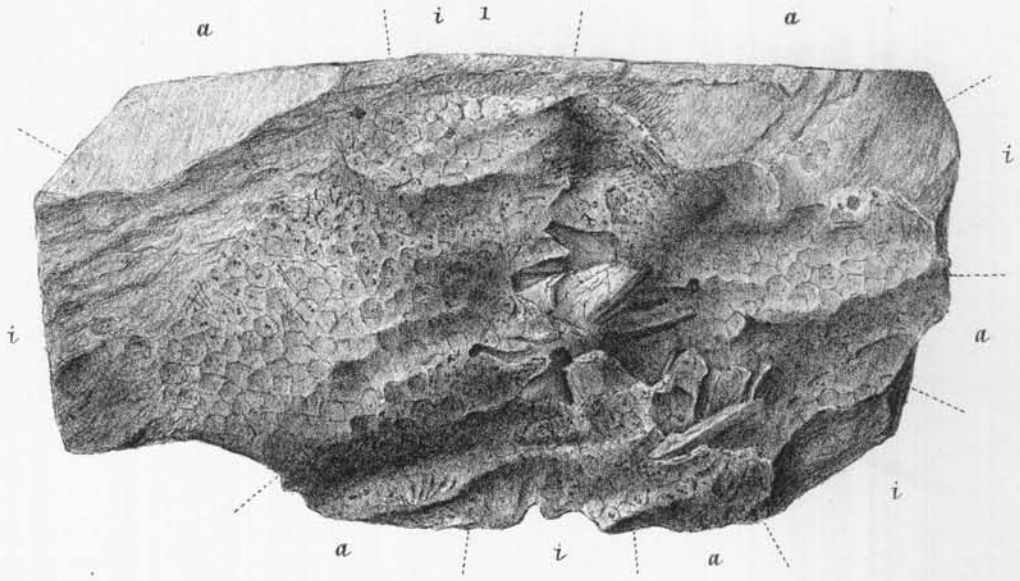


PLATE XXV.

PROTODIDARIS ACUARIA, n. sp. (Page 203.)

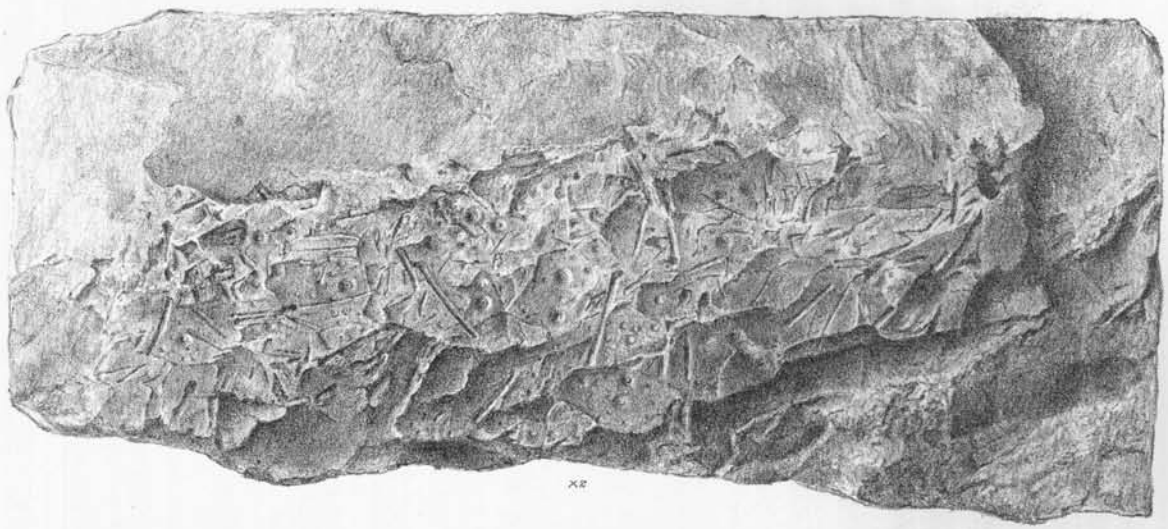
FIG.

1. Mould of a portion of a crushed test, showing numerous interambulacral plates and spines, $\times 2$. 1 *a*. Portion of the same, showing a tubercle and parts of two spines, $\times 25$. 1 *b*. Portion of the same, showing several plates and large and small spines, $\times 5$. East of Barnstaple. Museum of Practical Geology.
2. Another specimen, probably belonging to the same test, showing remains of the lantern-apparatus, nat. size. 2 *a*. Portion of one of the bones of the lantern, $\times 10$. East of Barnstaple. Museum of Practical Geology.

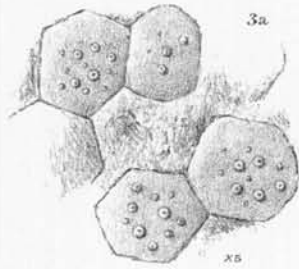
LEPIDESTHES? DEVONICANS, *Whidborne*. (Page 200.)

- 3 *a*. Wax cast of some interambulacral plates from the test figured on Pl. XXIV, showing their shape and ornamentation, $\times 5$. 3 *b*. Wax cast of some ambulacral plates, $\times 5$. 3 *c*. Portion of an interambulacral plate, showing a tubercle, $\times 25$. 3 *d*. Portion of a spine, $\times 25$. 3 *e*. Another spine, $\times 10$. 3 *f*. An ambulacral plate, showing its thickness, $\times 10$. Pilton Beds, North Devon. Museum of Practical Geology.

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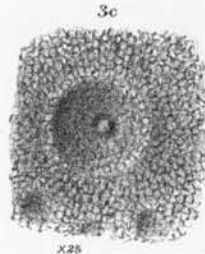


x2



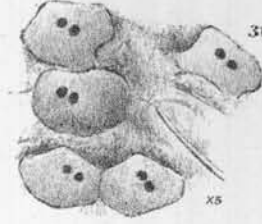
3a

x5



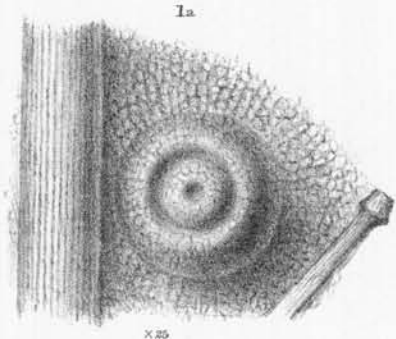
3c

x25



3b

x5



1a

x25



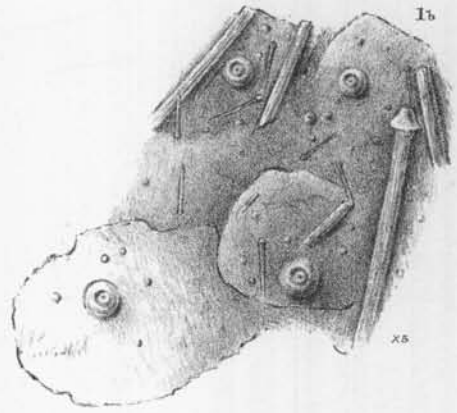
3d

x25



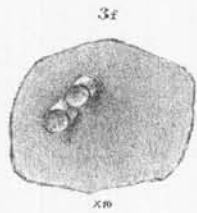
3e

x10



1b

x5

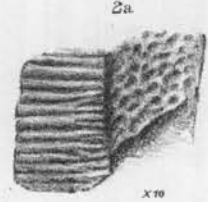


3f

x10



2



2a

x10

PLATE XXVI.

PALÆASTER LONGIMANUS, *Whidborne*. (Page 204.)

FIG.

1. Mould of the upper surface of a specimen, $\times 3$. 1 *a*. Wax impression of a portion of the same, showing the arrangement of the plates, $\times 5$. Park, near Braunton. Museum of Practical Geology.
2. Mould of the under surface of the same animal, $\times 3$. Park, near Braunton. Museum of Practical Geology.
3. Mould of the under surface of another specimen, showing the length of the arms, $\times 3$. 3 *a*. Wax impression, showing the mouth, $\times 5$. 3 *b*. Wax impression of an arm, which has been twisted so as to show its upper side, $\times 8$. Baggy Point. Museum of Practical Geology.
4. Wax impression from another specimen, showing the mouth and parts of the arms, $\times 6$. Pilton. Porter Collection.

PROTASTER GRANIFER, *Whidborne*, sp. (Page 207.)

5. Mould of the lower surface, $\times \frac{3}{2}$. 5 *a*. Wax impression from a portion of one of the arms showing (indistinctly) the arrangement of the plates, $\times 3$. Pilton Beds, North Devon. Museum of Practical Geology.
6. Mould of the upper surface of the same animal, $\times \frac{3}{2}$. 6 *a*. Wax impression of a portion of the surface, $\times 15$. Pilton Beds, North Devon. Museum of Practical Geology.

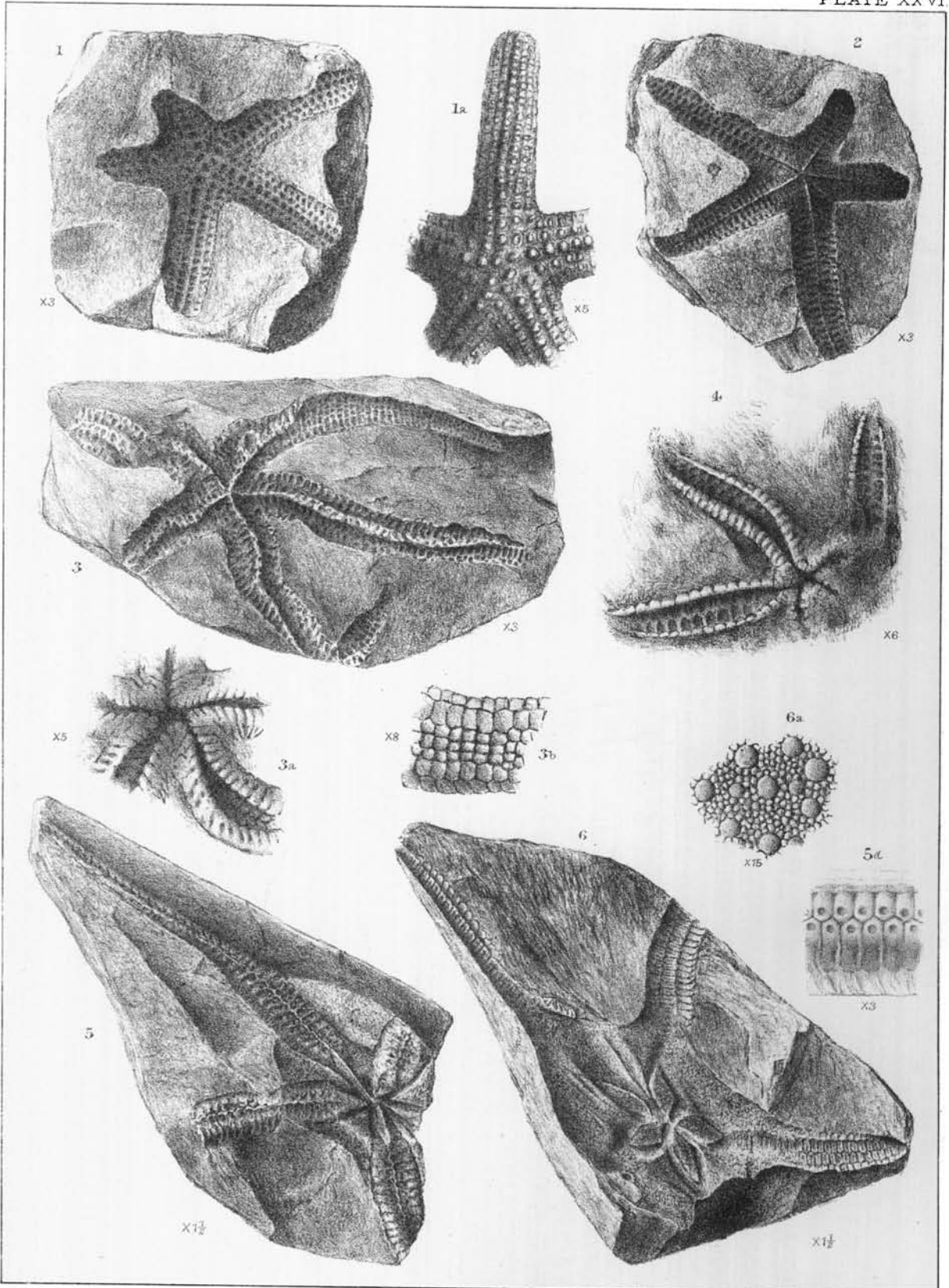


PLATE XXVII.

PROTASTER? (DREPANASTER) SCABROSUS, *Whidborne*, var. (Page 208.)

FIG.

1. Under surface of an indistinct specimen, $\times 2$. 1 *a*. Wax impression of a portion of one of the arms, $\times 4$. Top Orchard Quarry. Hamling Collection.
2. Upper surface of the same animal, $\times 2$. 2 *a*. Wax impression of a portion of one of the arms, $\times 4$. 2 *b*, Side view of the same, $\times 2$. 2 *c*. Wax impression of a portion of the surface, $\times 10$. Top Orchard Quarry, Hamling Collection.
3. Another specimen in a very poor state of preservation, $\times 3$. Fremington. Porter Collection.

EUGASTER? PERARMATUS, *Whidborne*, sp. (Page 209.)

4. Wax impression from the mould of the lower side of an arm, $\times \frac{7}{2}$. Poleshill. Porter Collection.
5. Wax impression from the mould of portions of the upper sides of three arms, $\times 2$. Poleshill. Porter Collection.
6. A confused group of arms from another animal. 6 *a*. Wax impression of one of the arms, $\times 4$. Braunton Down. Museum of Practical Geology.

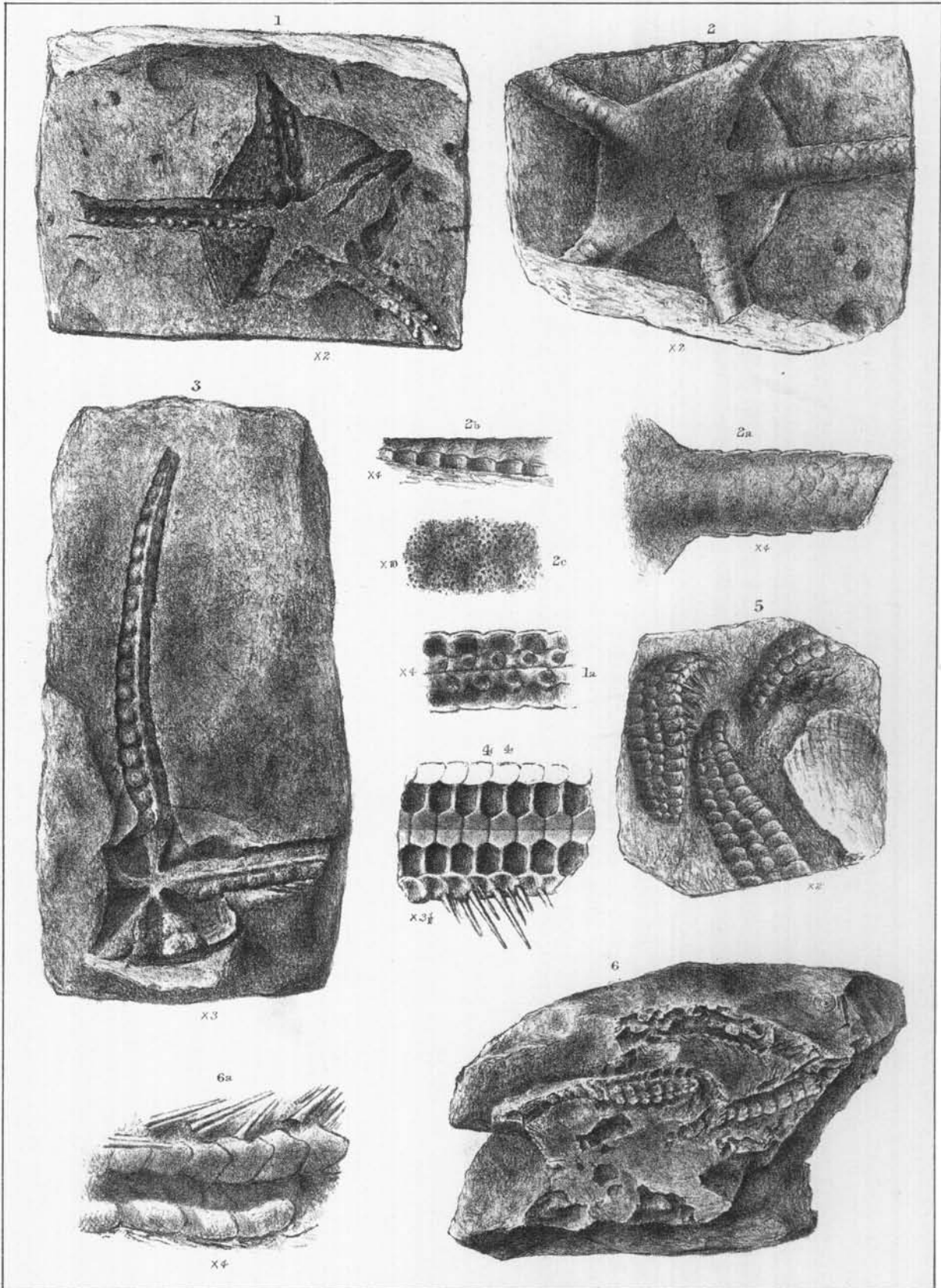


PLATE XXVIII.

PROTASTER ? (DREPANASTER) SCABROSUS, *Whidborne*, var. (Page 208.)

FIG.

1. Under side of a specimen, $\times 3$. 1 *a*. Wax impression, showing the oral arrangement, $\times 5$. 1 *b*. Wax impression of a portion of the arms, $\times 7$. Croyde. Museum of Practical Geology.
2. Under side of another specimen, $\times 3$. 2 *a*. Wax impression of a portion of one of the arms, $\times 10$. 2 *b*. A small portion of the surface of the same, $\times 70$. Croyde. Museum of Practical Geology.

OPHIURELLA ? GREGARIA, *Whidborne*, sp. (Page 210.)

3. Wax impression of a portion of the mould of a specimen, $\times 5$. (The longest portion of arm here shown is only three fifths of its full length.) Braunton Down. Museum of Practical Geology.

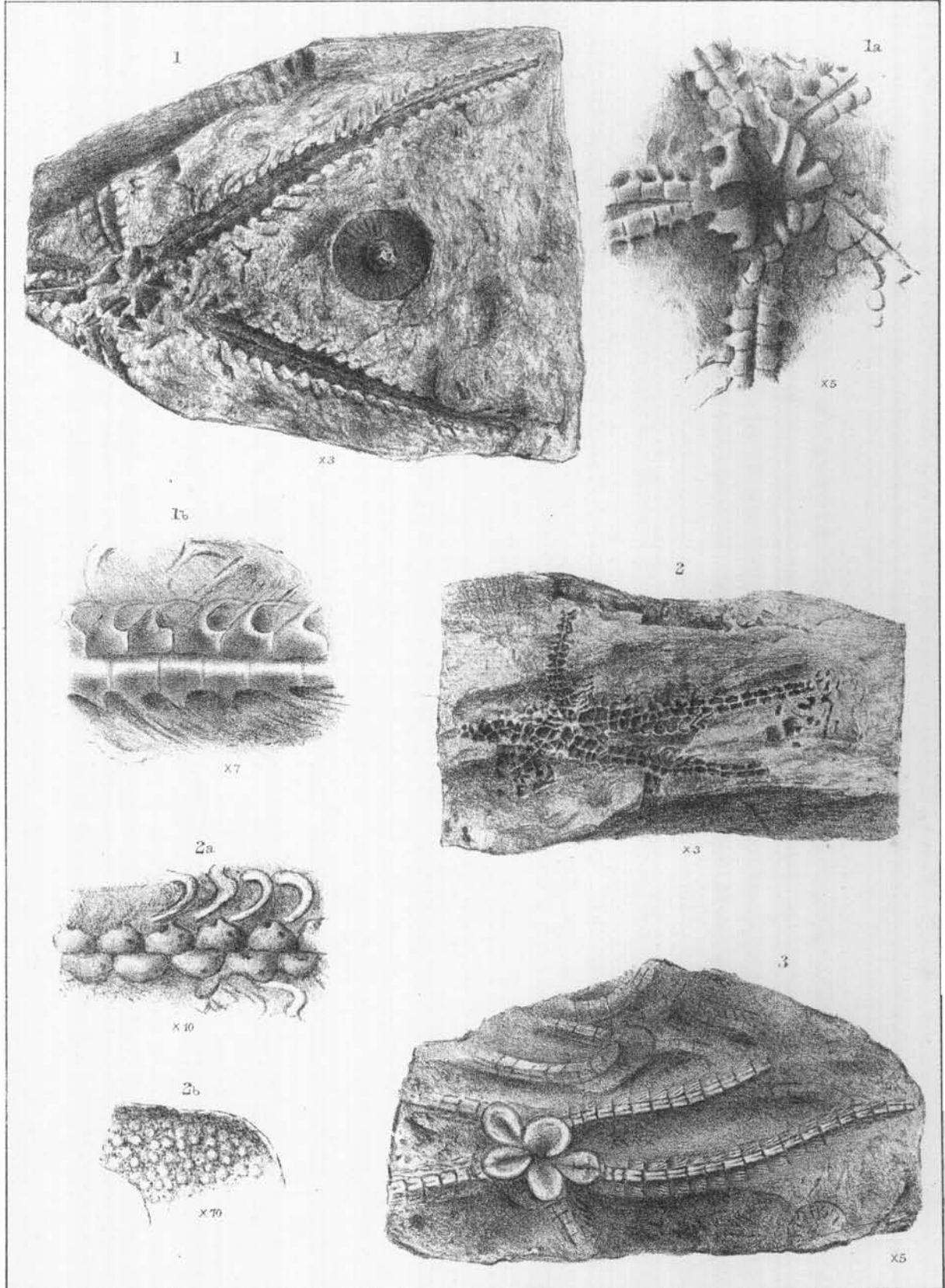


PLATE XXIX.

PROTASTER ? (DREPANASTER) SCABROSUS, *Whidborne*. (Page 208.)

FIG.

1. Specimen showing the small plates of the dorsal surface of the disc and portions of the arms, and the lateral spines, $\times 5$. 1 *a*, 1 *b*. Wax impressions of two portions of the arms, $\times 10$. Croyde Bay. Barnstaple Athenæum.
2. Another specimen, showing the lower side of an animal, $\times 3$. 2 *a*. Wax impression of a portion of one of the arms, $\times 10$. Braunton Down. Museum of Practical Geology.

PALÆASTER LONGIMANUS, *Whidborne*. (Page 204.)

3. Wax impression from the mould of the upper surface of a small specimen, the arms of which are really longer than here visible, $\times 4$. Top Orchard Quarry. My Collection.

CODONASTER CONICUS, n. sp. (Page 214.)

4. Small specimen, showing the sutures, $\times 6$. 4 *a*. Upper view showing the disc, the surface of which is partly destroyed, $\times 12$. Top Orchard Quarry. Woodwardian Museum.

PENTREMITIDEA PHILLIPSII, n. sp. (Page 212.)

5. Mould of a specimen, showing two ambulacra and an interradius, $\times 10$. 5 *a*. Wax impression of a portion of one of the ambulacra, showing the food-grooves and the plates, $\times 20$. Wrafton Lane. My Collection.
6. Cast of a radial plate with an ambulacra, $\times 3$. Ashford Strand. Barnstaple Athenæum.

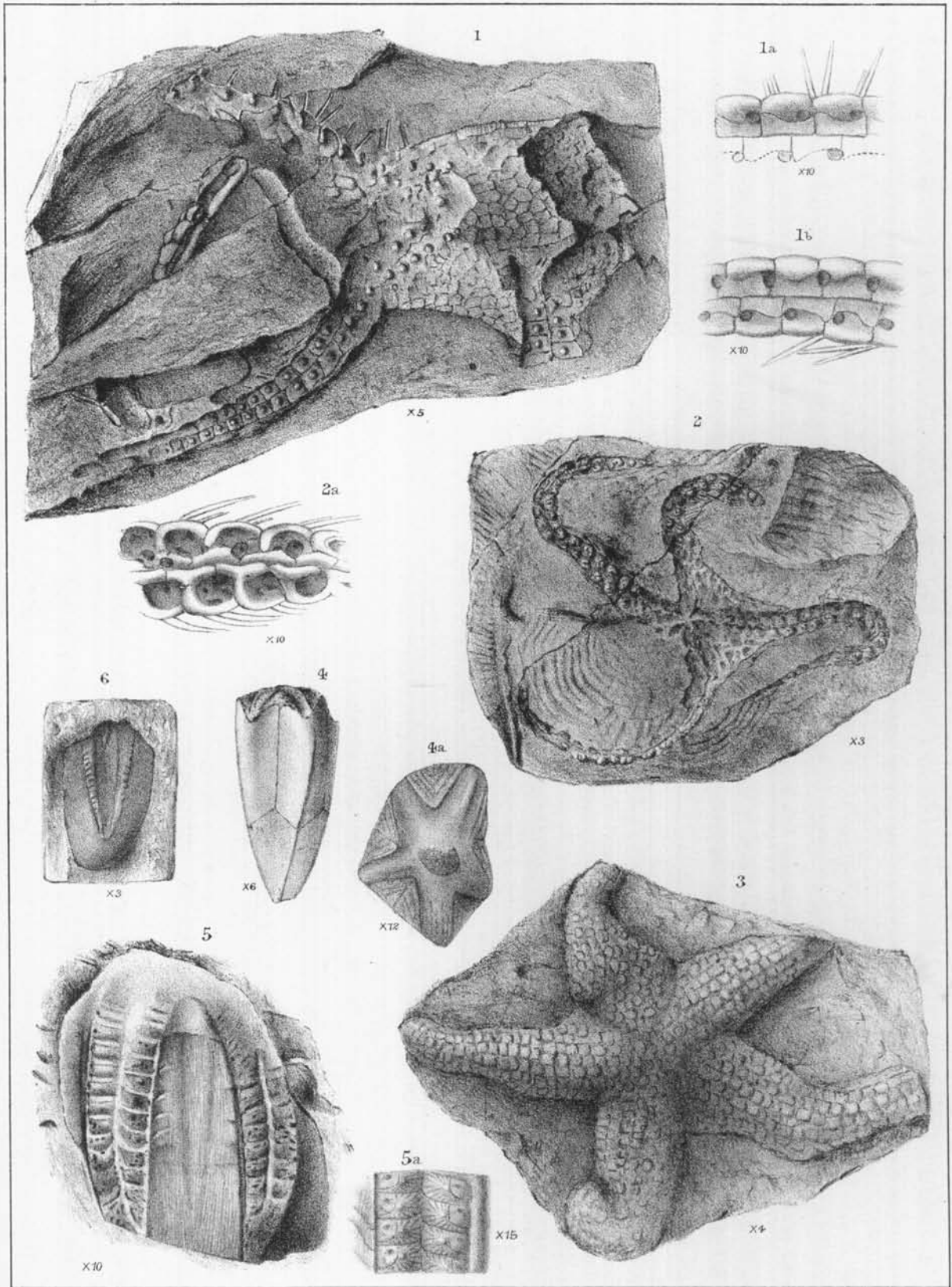


PLATE XXX.

ADELOCRINUS HYSTRIX, *Phillips*. (Page 224.)

FIG.

1. Basal view of the wax impression of a mould of part of a dorsal cup, $\times 2$. Pilton. Porter Collection.
2. A single concave plate of another cup (possibly an anal plate?), $\times 4$. Pilton. Porter Collection.
3. Wax impression of part of another cup, having larger and more numerous tubercles, and being quadrate in horizontal section, $\times 2$. Bradford. Barnstaple Athenæum.
4. Wax impression from Phillips's type specimen, having few and small tubercles, $\times \frac{3}{2}$. Brushford. Museum of Practical Geology.
5. Specimen of a calix with arms attached, $\times 2$. Top Orchard. Barnstaple Athenæum.
6. The other side of the same animal, showing the arms, $\times 2$. 6 a. Wax impression of a portion of one of the arms, showing the plates and pinnules, $\times 7$. Top Orchard. Barnstaple Athenæum.
7. Specimen, showing parts of five arms with their pinnules *in situ*, and part of the calix of the same or another animal, $\times \frac{3}{2}$. 7 a. Wax impression of one of the arms, $\times 7$. Braunton. Museum of Practical Geology.

ACTINOCRINUS PORTERI, *Whidborne*. (Page 220.)

8. Gutta-percha cast of a specimen, $\times 2$. Barnstaple. Woodwardian Museum.

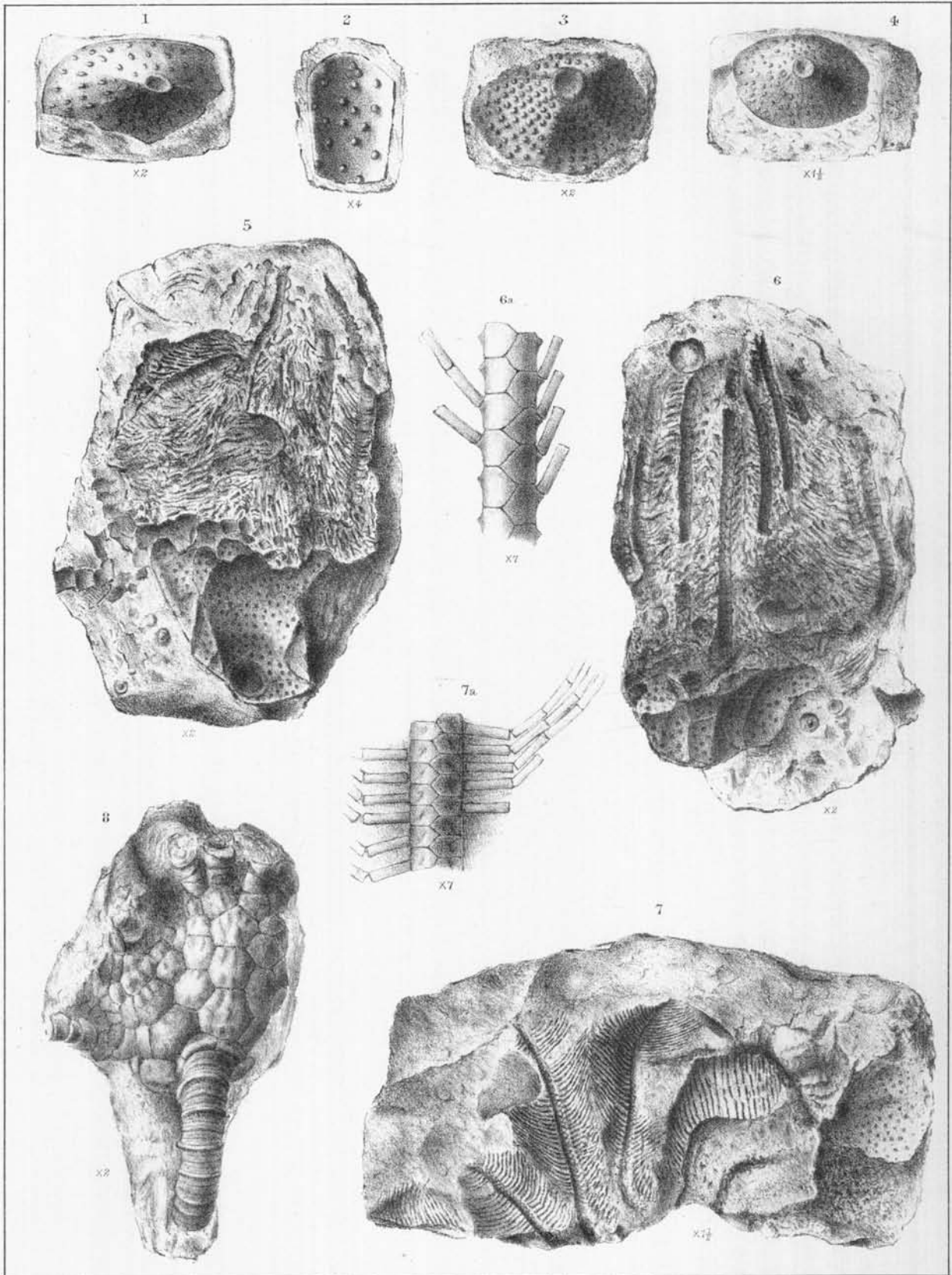


PLATE XXXI.

ACTINOCRINUS PORTERI, *Whidborne*. (Page 220.)

FIG.

1. Mould of part of a calix with arms and pinnules, nat. size. 1 *a*, wax cast of a portion of one of the arms, showing a curious triple branching, $\times 2$. North Devon. Museum of Practical Geology.
2. Mould of the opposite side of the same animal as fig. 1, showing part of the dome. North Devon. Museum of Practical Geology.

RHODOCRINUS? sp. (Page 217.)

3. Specimen showing a defective dorsal cup with armlets and long arms clothed with fine pinnules, nat. size. 3 *a*, a plate of the cup, $\times 7$. 3 *b*, a portion of an arm, showing the arrangement of the plates, $\times 10$. 3 *c*, impression of the inner surface of one of the pinnules, $\times 25$. 3 *d*, portion of the outer surface of one of the arms, $\times 5$. North Devon. Museum of Practical Geology.

SCAPHIOCRINUS? PLUMIFER, n. sp. (Page 228.)

4. Gutta-percha cast of a specimen, nat. size. 4 *a*, anal side of the dorsal cup, $\times 6$. 4 *b*, one of the arms, $\times 5$. 4 *c*, impression of one of the pinnules, $\times 25$. Barnstaple. Woodwardian Museum.

ACTINOCRINUS PORTERI, *Whidborne*. (Page 220.)

5. Part of the dorsal cup and arms of a large specimen, nat. size. Braunton. Museum of Practical Geology.

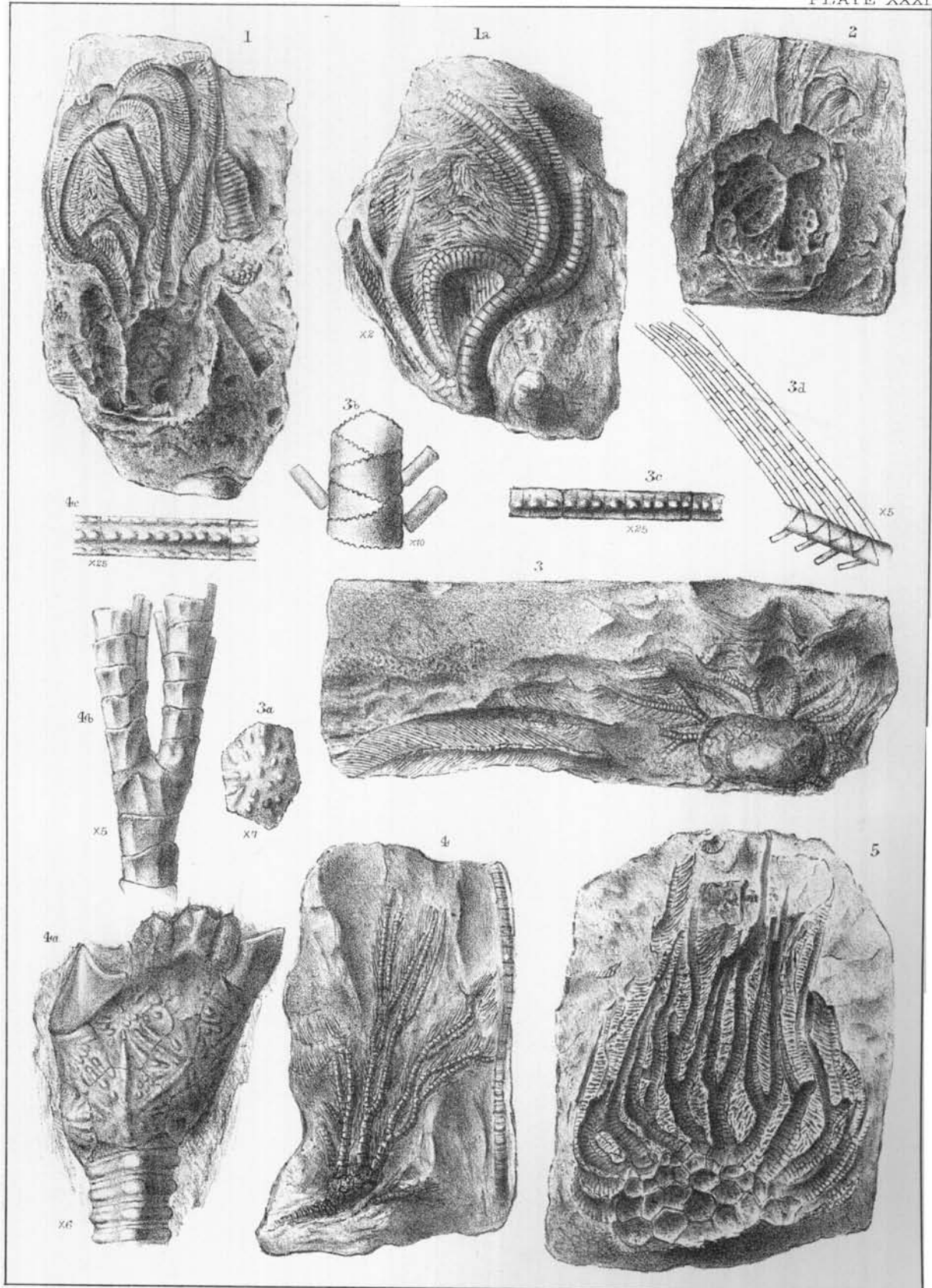


PLATE XXXII.

ACTINOCRINUS PORTERI, *Whidborne*. (Page 220.)

FIG.

1. Specimen, containing the opposite side of the dorsal cup figured on Pl. XXXI, fig. 5, together with the stems of several other individuals. Braunton. Museum of Practical Geology.

ACTINOCRINUS ? BATHERI, *Whidborne*. (Page 222.)

2. Mould of the dome and inner side of the arms, $\times \frac{3}{2}$. 2 *a*, wax cast of part of the dome, showing some of the plates, $\times 3$. 2 *b*, three plates, $\times 10$. Braunton. Museum of Practical Geology.
3. Mould of the dorsal cup of the same individual, $\times \frac{3}{2}$. 3 *a*, wax cast of the dorsal cup, slightly restored, $\times 3$. 3 *b*, lateral view, $\times 3$. Braunton. Museum of Practical Geology.

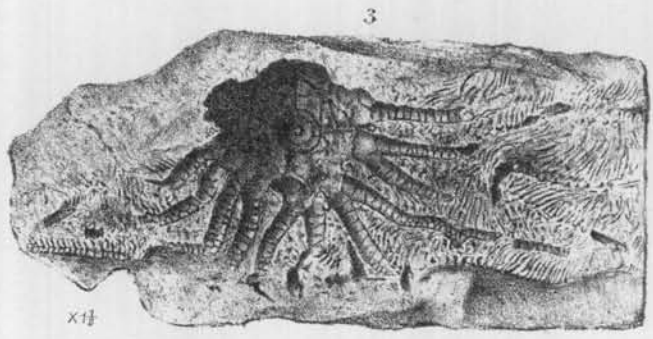
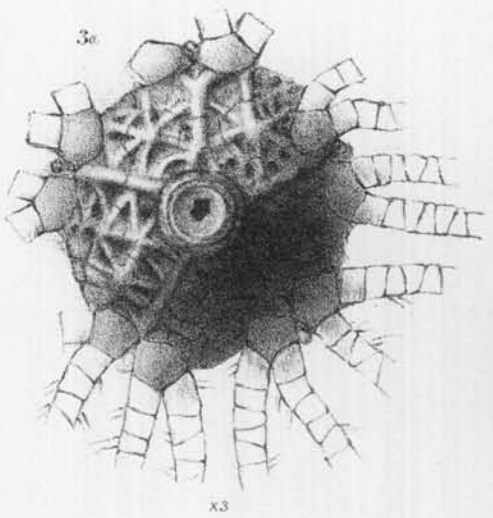
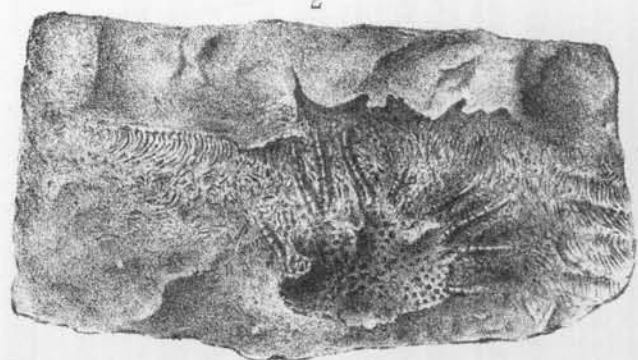
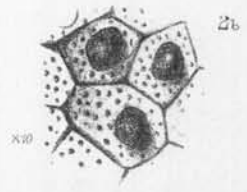
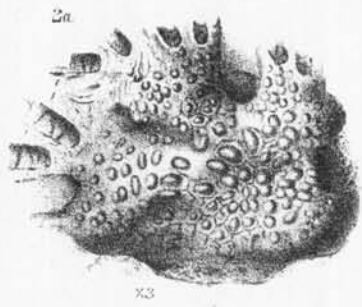
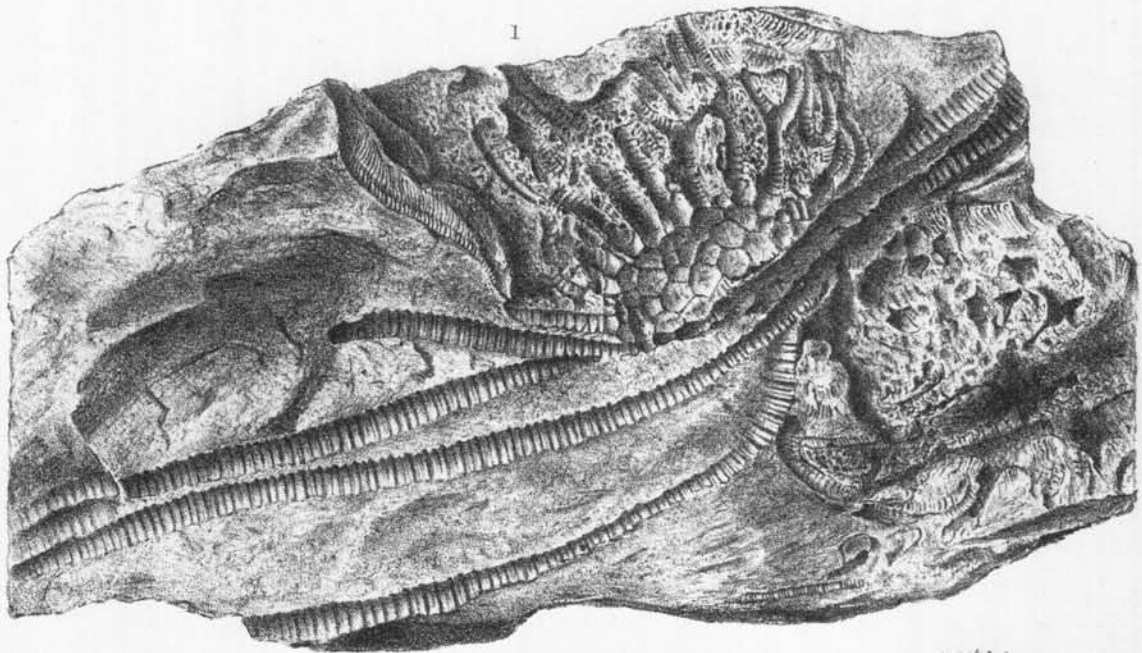


PLATE XXXIII.

SCAPHIOCRINUS? PLUMIFER, n. sp. (Page 228.)

FIG.

1. Gutta-percha cast of a large specimen, in which the plates of the dorsal cup are broken away, $\times 2$. Barnstaple. Woodwardian Museum.

TAXOCRINUS MACRODACTYLUS, *Phillips*. (Page 215.)

2. The only remaining specimen of Phillips's types of this species known, nat. size. Pilton. Museum of Practical Geology.
3. Another specimen, showing the bifurcations of the arms, $\times \frac{3}{2}$. 3 a, wax cast of the inner side of one of the arms, $\times 3$. North Devon. Museum of Practical Geology.
4. Another specimen, being a cast in the upper part and a mould in the lower, nat. size. 4 a, wax cast of the top of the stem and lower part of the dorsal cup, restored above the dotted line from the arms seen in the specimen, $\times 2$. North Devon. Museum of Practical Geology.

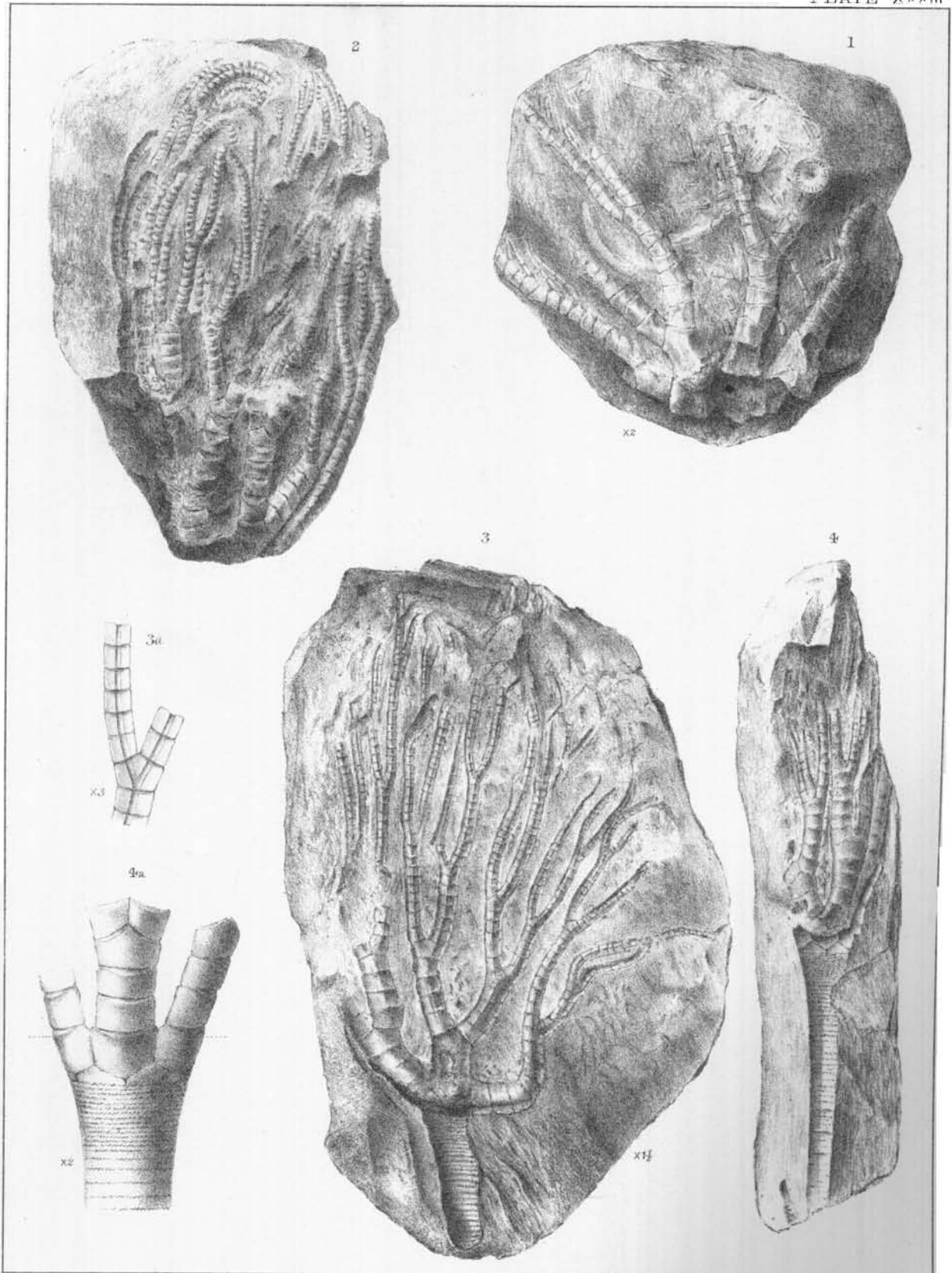


PLATE XXXIV.

TAXOCRINUS STULTUS, *Whidborne.* (Page 216.)

Fig.

1. Wax cast of a specimen, showing the top of the stem, the dorsal cup, and the beginnings of the arms, one of which has three primibrachs and five and six secundibrachs respectively, $\times 3$. (*The little plates seen between the arms have been drawn too regularly, and are probably not pinnules, but scattered plates from the infolded extremities of the arms.*) Pilton. Porter Collection.
2. Mould of the opposite side of the same individual, $\times 2$. 2 a, wax cast, showing anal plates, $\times 3$. Pilton. Porter Collection.
3. Another specimen, showing the character of the stem, $\times 2$. Pilton. Porter Collection.

SP. INDET.

4. Terminal portion of an arm with stout short pinnules, $\times 4$. 4 a, portion, $\times 10$. Pilton. Porter Collection.

MARIOCRINUS ? sp. (Page 219.)

5. Doubtful specimen, showing the arms and a few plates of the dorsal cup, $\times 2$. Braunton. Barnstaple Athenæum.

POTERIOCRINUS BARUMENSIS, *Whidborne.* (Page 227.)

6. Gutta-percha cast of a specimen showing the plates of the dorsal cup, the first primibrachs axillary, and nine secundibrachs in one of the arms, $\times 2$. Barnstaple. Woodwardian Museum.

SCAPHIOCRINUS ? INORDINATUS ? n. sp. (Page 230.)

7. Mould of a specimen, very doubtfully referred to this species, $\times \frac{3}{2}$. Braunton. Museum of Practical Geology.

SCAPHIOCRINUS ? sp. (Page 231.)

8. Mould of a specimen, showing the very shallow dorsal cup and the large primibrachs, $\times \frac{3}{2}$. 8 a, portion of an arm, showing the pinnules, $\times 5$. Braunton. Museum of Practical Geology.

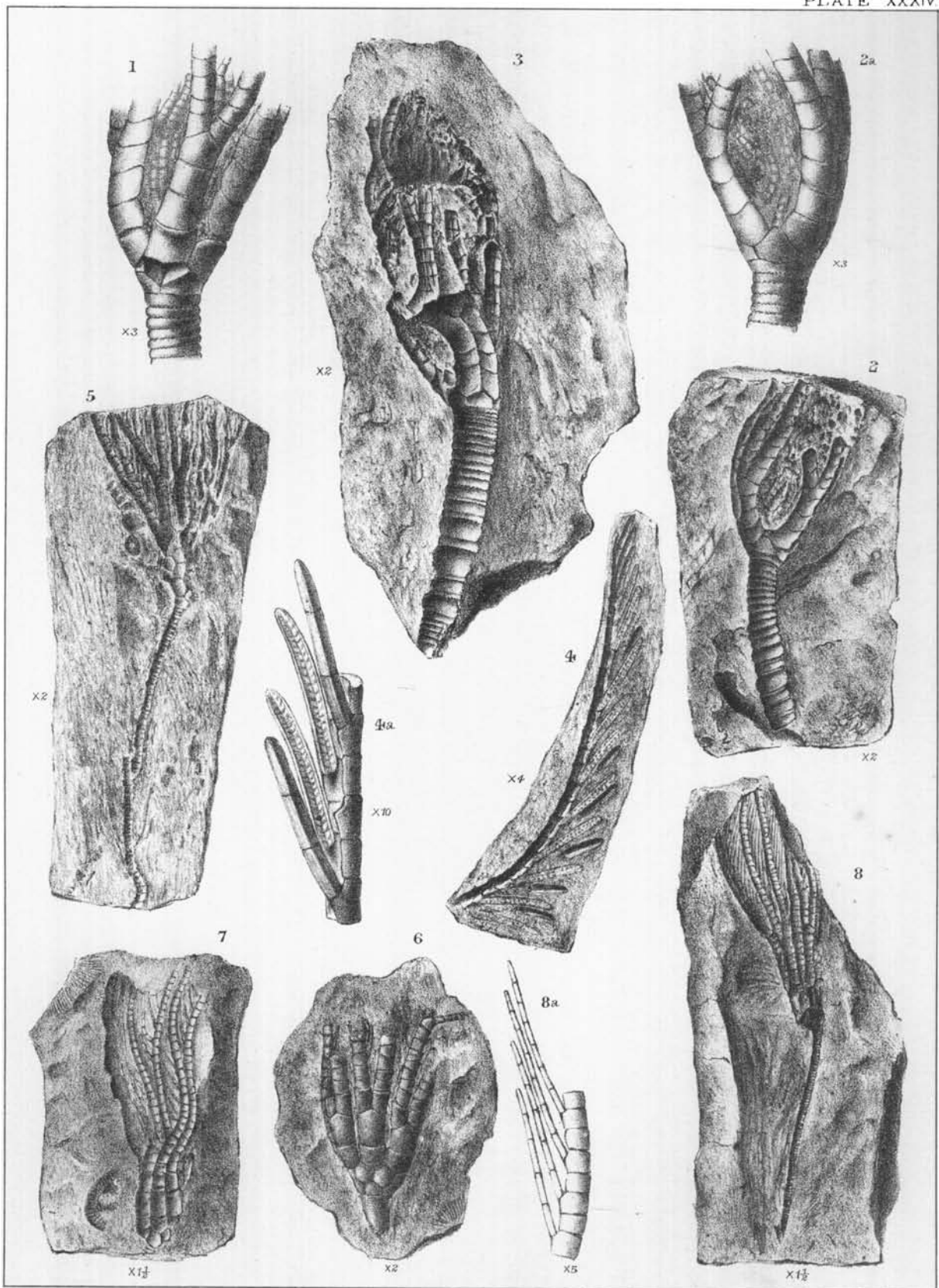


PLATE XXXV.

POTERIOCRINUS TENSUS, *Whidborne*. (Page 226.)

FIG.

1. Gutta-percha cast of a specimen, showing the dorsal cup (much injured), the branching of the arms, and fragments of the anal tube, $\times 2$. (*The plates between the cup and the first bifurcations of the arms have been restored in this figure, and perhaps incorrectly.*) 1 a, portion of one of the arms, $\times 5$. Barnstaple. Woodwardian Museum.
2. Another gutta-percha cast, taken subsequently from the same specimen, showing the opposite side of the dorsal cup, $\times 2$. Barnstaple. Woodwardian Museum.

POTERIOCRINUS BARUMENSIS, *Whidborne*. (Page 227.)

3. Specimen, showing the plates of the dorsal cup and the arms, and having a curious deformity in the stem, $\times 2$. Top Orchard Quarry. Woodwardian Museum.

POTERIOCRINUS, sp. (Page 228.)

4. A large detached ventral sac, nat. size. Braunton. Museum of Practical Geology.
5. Specimen, showing one arm, part of the ventral sac, and some plates of the dorsal cup, nat. size. 5 a, portion of the arm, showing an armlet which appears to bear pinnules, $\times 5$. Barnstaple. Woodwardian Museum.

SCAPHIOCRINUS ? INORDINATUS, n. sp. (Page 230.)

6. Specimen, showing the dorsal cup and arms, $\times 2$. 6 a, portion of one of the arms, showing the pinnules, $\times 7$. Barnstaple. Woodwardian Museum.

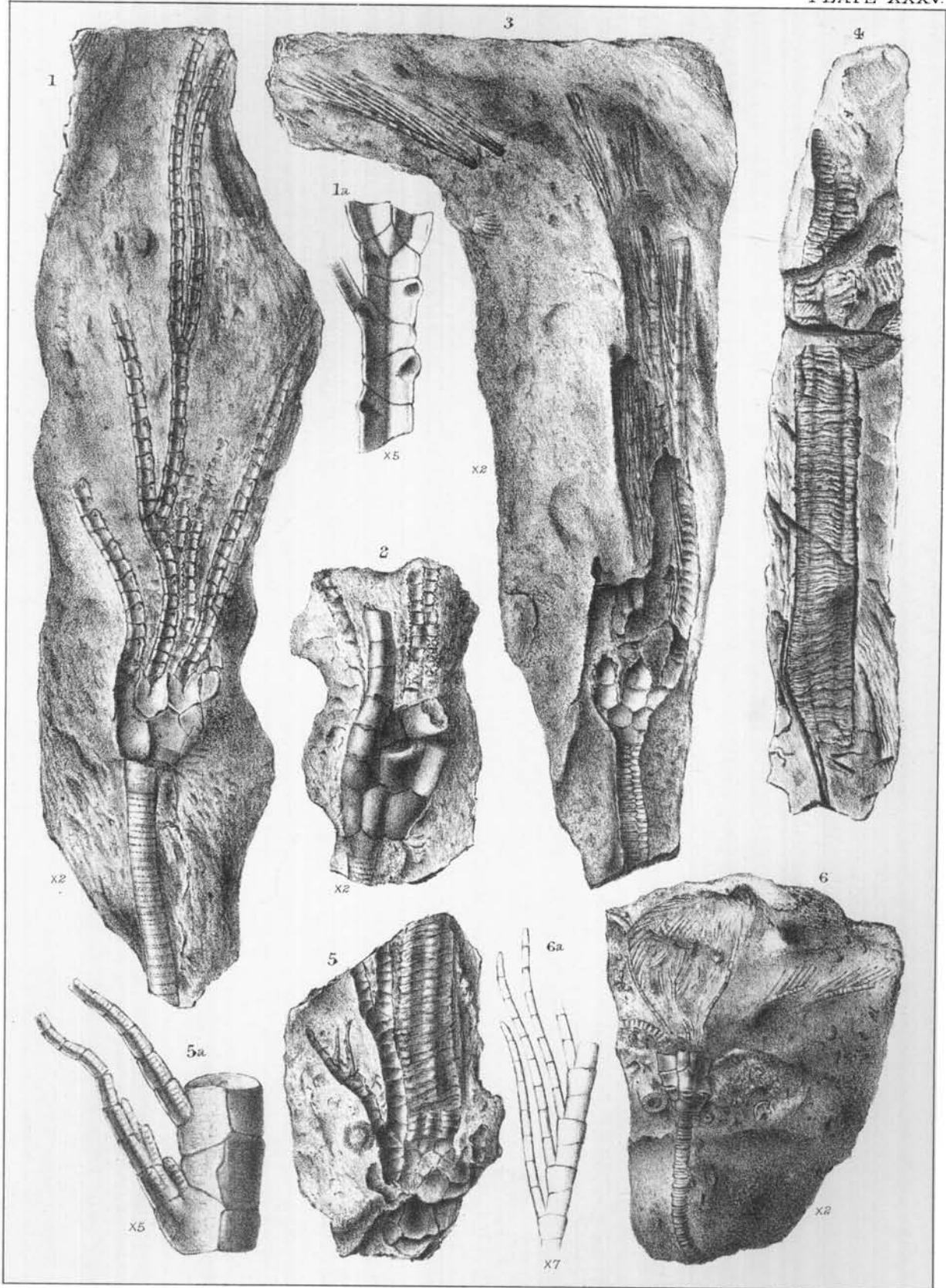


PLATE XXXVI.

SCAPHIOCRINUS? PLUMIFER, n. sp. (Page 228.)

FIG.

1. Mould of a specimen in rough preservation, $\times \frac{3}{2}$. 1 a, wax cast of the dorsal cup, showing the plates, the surface-ornamentation of which appears to have been obliterated, $\times 3$. Braunton. Museum of Practical Geology.

SCYTALOCRINUS? STADIODACTYLUS, *Whidborne*, sp. (Page 233.)

2. Wax cast of a specimen, showing the anal side of the dorsal cup and the ventral sac, nat. size (see Pl. XXXVII, fig. 14). 2 a, dorsal cup, $\times 4$. Braunton. Barnstaple Athenæum.
3. Specimen in which the dorsal cup is obliterated, but the expanded arms and pinnules are seen, $\times 2$. 3 a, gutta-percha cast of the central parts, $\times 4$. Barnstaple. Woodwardian Museum.
4. Wax cast of a specimen, showing the anal side of the dorsal cup and the beginning of the ventral sac, the plates of the stem being obliterated, $\times 3$. Pilton. Porter Collection.
5. Wax cast of part of a dorsal cup with closed arms, $\times 4$. Roborough. Barnstaple Athenæum.
6. Mould, showing the plates of the dorsal cup, the first and second primibrachs and the beginning of the arms, $\times 2$. Pilton. Porter Collection.
8. Mould of a smaller specimen, $\times 3$. Roborough. Barnstaple Athenæum.

SP. INDET.

7. Terminal portion of an arm, $\times 2$. 7 a, portion showing the pinnules, $\times 6$. Pilton. Porter Collection.

POTERIOCRINUS, sp. (Page 228.)

9. Mould of a defective dorsal cup, with portions of two arms and the upper part of the stem, nat. size. 9 a, portion of one of the arms, showing the pinnules, $\times 3$. Braunton Down. Museum of Practical Geology.

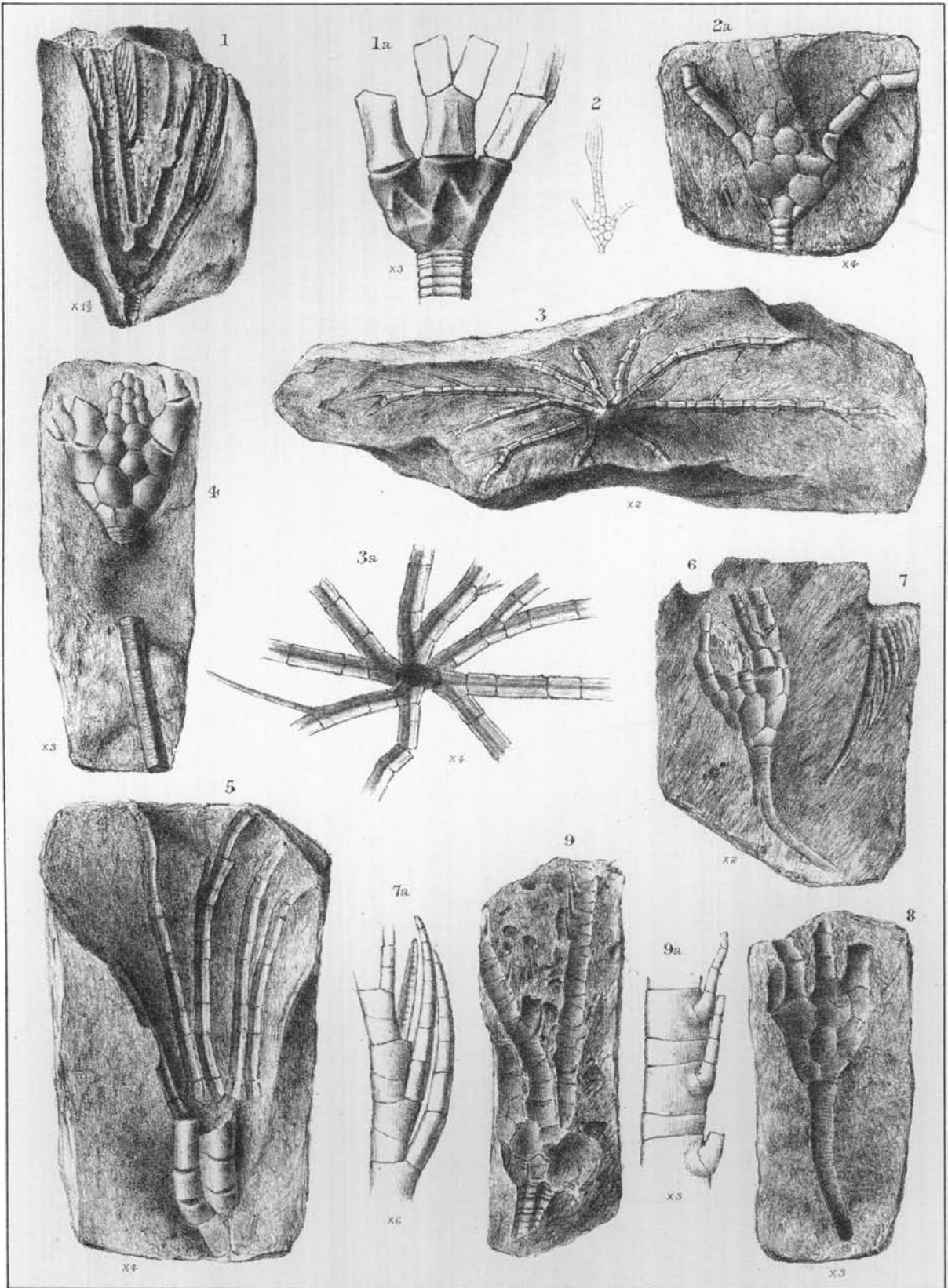


PLATE XXXVII.

CORNULITES DEVONIANUS, *Whidborne*. (Page 198.)

FIG.

1. Small specimen, × 8. Pilton. Porter Collection.
2. Small recurved specimen, × 8. Roborough. Porter Collection.
3. Larger specimen with irregular annulations, × 2. Pilton. Porter Collection.

MEDUSASTER PARVUS, n. sp. (Page 205.)

4. Mould of a specimen, showing the disc, the buccal plates, and the sixteen arms, × 9. North-east of Harford Landkey. Hamling Collection.

MEGISTOCRINUS? sp. (Page 218.)

5. Cast of a dorsal cup, showing primibrachs, secundibrachs, interradians, and interambulacrals, × 6. Barnstaple. Woodwardian Museum.

MARIOCRINUS? MUNDUS, n. sp. (Page 219.)

6. Specimen, showing the mould of the stem and the dorsal cup, and the cast of the arms, × 3. Croyde Rocks. My Collection.
7. Mould of the other side of the same dorsal cup, × 3. Croyde Rocks. My Collection.

PLATYCRINUS? ANGULIFERUS, n. sp. (Page 223.)

8. Mould of a specimen, showing two radials, some smaller plates, and the beginnings of the arms, × 2. Saunton Hotel. Mr. Coomara Swamy's Collection.
9. Detached radial, × 3. Roborough. Porter Collection.
10. Wax cast of a radial with stronger ornamentation, × 3. Pilton. Porter Collection.
11. Wax cast of another radial, × 3. Roborough. Porter Collection.
12. Mould of a detached columnar, probably belonging to this species, × 3. Vicarage Lane, Pilton. Barnstaple Athenæum.

SCAPHIOCRINUS? SALEBROSUS, n. sp. (Page 232.)

13. Mould of a dorsal cup, showing the tumid plates, × 2. Pilton. Porter Collection.

SCYTALOCBINUS STADIODACTYLUS, *Whidborne*, sp. (Page 233.)

14. The same specimen as figured on Pl. XXXVI, fig. 2, showing the dorsal cup, the ventral sac, and the arms, × 2. Braunton. Barnstaple Athenæum.

(*Figures 2, 3, 9, 10, and 11 have by accident been placed on the Plate upside down.*)

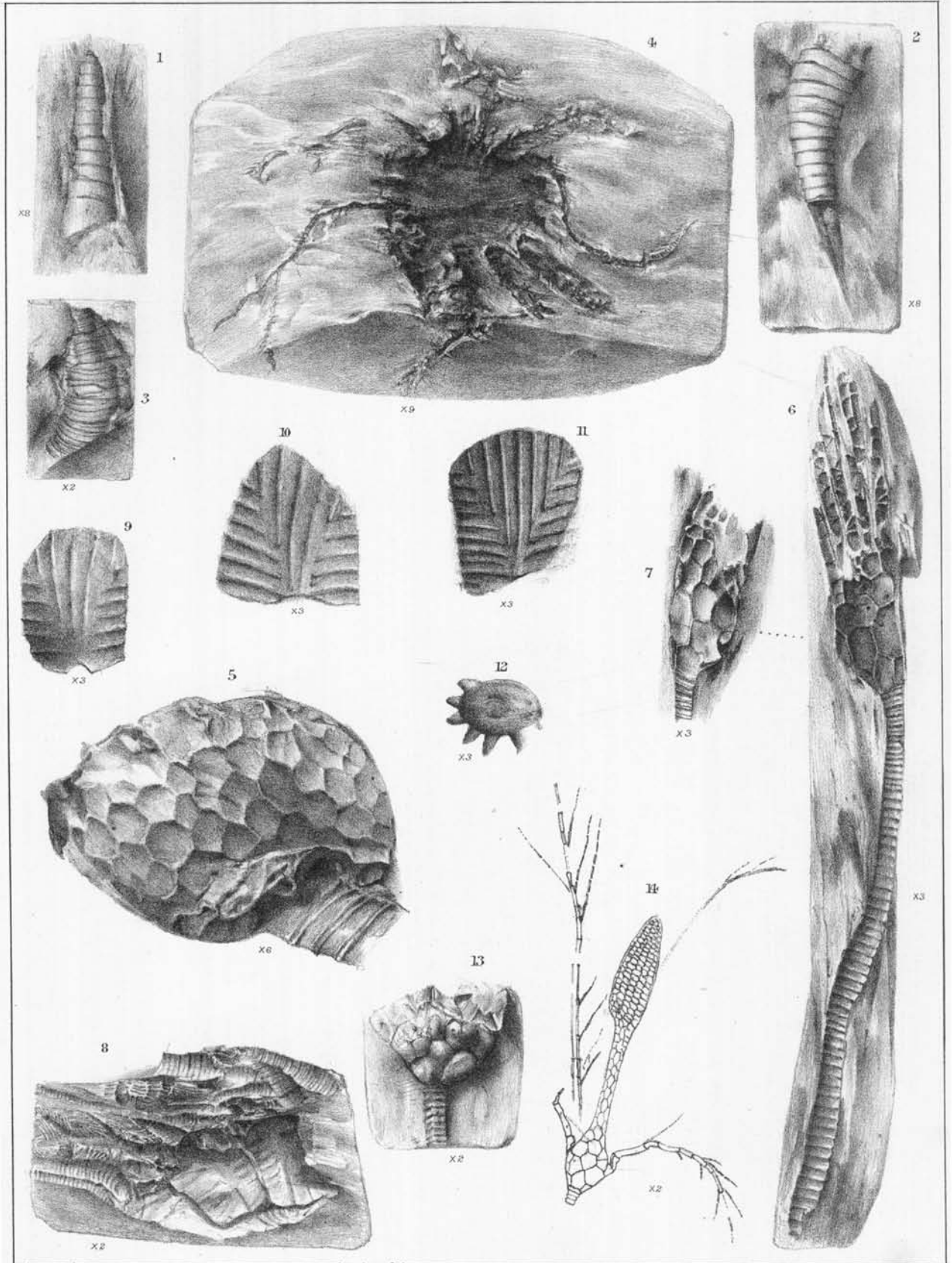


PLATE XXXVIII.

POTERIOCRINUS TENSUS, *Whidborne*. (Page 226.)

FIG.

1. Specimen, showing the cast of the dorsal cup, the expanded arms (in which no bifurcations are visible), and the exceedingly long slight pinnules, $\times 2$. Saunton Hotel. Partridge Collection.

SCAPHIOCRINUS ? PLUMIFER, n. sp. (Page 228.)

2. Gutta-percha cast of a specimen showing the dorsal cup and the closed arms, $\times 2$. Barnstaple. Woodwardian Museum.

SCAPHIOCRINUS TRANSCISUS, n. sp. (Page 230.)

3. Wax cast of a specimen, showing some plates of the anal side of the dorsal cup and the beginning of the ventral sac, nat. size. Poleshill. Porter Collection.

SCAPHIOCRINUS ? INORDINATUS, n. sp. (Page 230.)

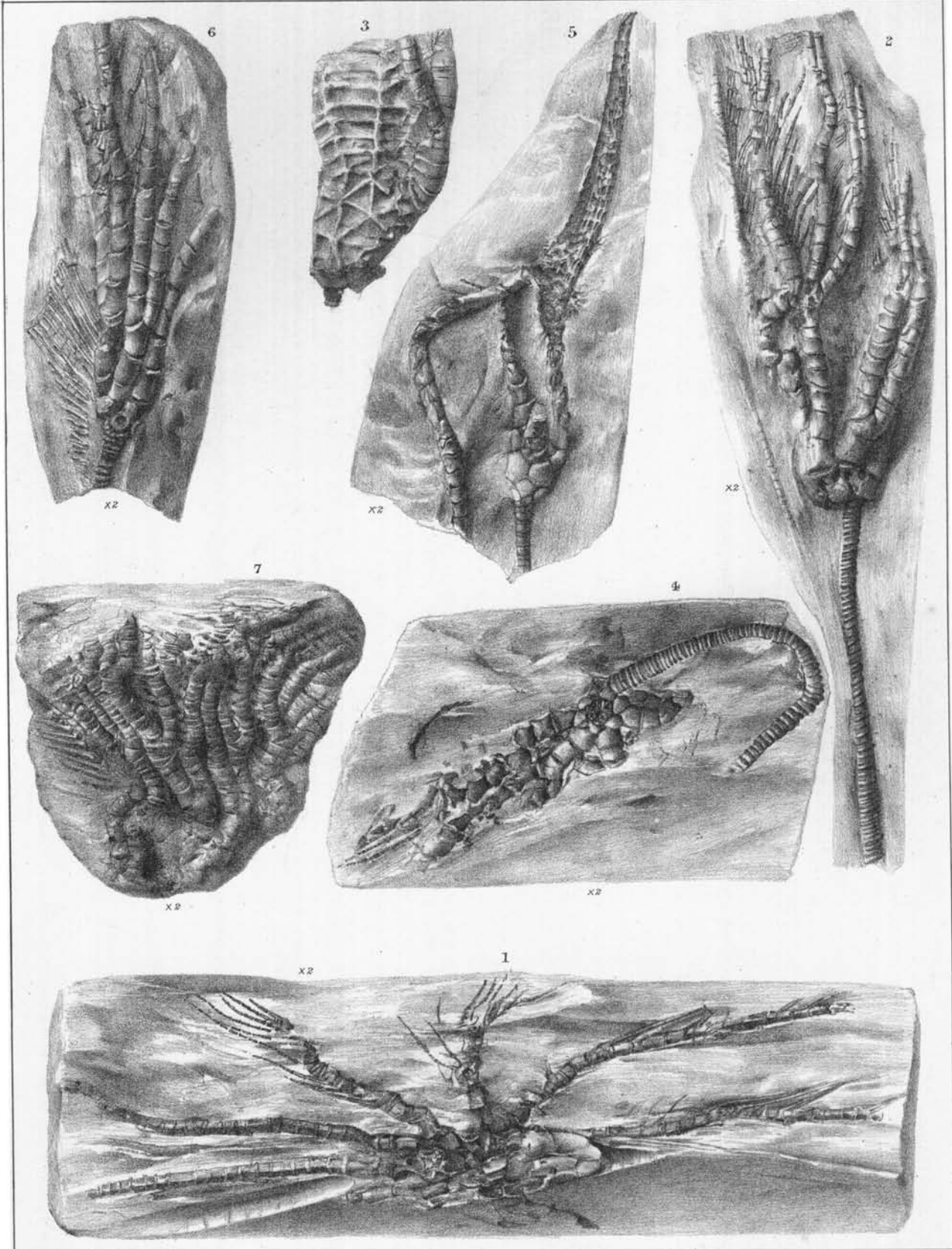
4. Cast of a flattened specimen, showing the arrangement of the plates of the dorsal cup, including the anal plate in the basal ring, and (in four of the arms) the two primibrachs, $\times 2$. Upcott Arch. My Collection.

SCYTALEOCRINUS ARACHNOIDEUS, n. sp. (Page 235.)

5. Gutta-percha cast of a specimen, showing the upper part of the stem, the plates of the dorsal cup, the ventral sac, and part of the arms, $\times 2$. Barnstaple. Woodwardian Museum.
6. Gutta-percha cast of another specimen, showing the arms, $\times 2$. Barnstaple. Woodwardian Museum.

CÆLIOCRINUS ? n. sp. (Page 236.)

7. Gutta-percha cast of a specimen, showing the mode of branching of the arms, their short cuneate plates, and the pinnules, $\times 2$. Barnstaple. Woodwardian Museum.



INDEX TO VOLUME III.

NOTE.—Synonyms and the page-numbers of casual references to genera and species are printed in *italics*. The large Roman numerals are plate-numbers, and the small Roman numerals refer to the numbers of the figures on the respective plates.

	PAGE
Acanthocladiidæ	189-192
Aclisina longissima	52; V, x
<i>Acroculia acuta</i>	48
— <i>Bischoffi</i>	48
Actinoceras? (Huronina) <i>Crickii</i>	33-35; IV, ix, x-xii
— <i>striatum?</i>	28
Actinocrinus? <i>Batheri</i>	222; XXXII, ii, iii
— <i>Porteri</i>	220, 221; V, xxi; XXX, viii; XXXI, i, ii, v; XXXII, i
Actinopteria <i>rudis</i>	131, 132; XV, xiv
Adelocrinus <i>hystrix</i>	224, 225; XXX, i-vii
Agoniatites <i>sp.</i>	24; IV, ii
Ambonychinæ	117, 118
Ammonoidea	24, 25
Anatifopus? <i>anglica</i>	9; I, iv
Anatinacea	72
Anisomyaria	114-144
Annulosa	198, 199
<i>Anodontopsis deltoideus</i>	93
<i>Anomites scabriculus</i>	170
Aparchites <i>Lindstroemi</i>	16; III, iii
<i>Arca prisca</i>	113
Arcidæ	109-113
Archæocidaridæ	202-204
Arthropoda	3-24
Articulata	145-180
Ashford Strand, brachiopoda from	145, 147, 153, 154, 159, 161, 167, 169, 172, 175
— — bryozoa from	185
Ashford Strand, echinodermata from	212, 213
— — fish from	3
Ashhill Quarry, brachiopoda from	149, 156, 157, 161, 163, 165, 175, 181
— — crinoid from	216
Asteroidea	204-206
<i>Athyris concentrica</i>	148-151
— <i>decussata</i>	148
— <i>depressa</i>	148-151
— <i>hispidata</i>	148
— (Seminula) <i>oblonga</i>	147, 148; XVII, xi, xii
— (Cleiothyris) <i>Royssii</i>	148-151; XVII, xiii-xv; XVIII, i-v; XX, i, ii
— <i>rugulosa</i>	149
— ? <i>sp.</i>	146, 147; XVII, x
<i>Atrypa decussata</i>	148, 149
— <i>hispidata</i>	148, 149
— <i>indentata</i>	147
— <i>oblonga</i>	147, 148
— <i>unguiculus</i>	157
<i>Avicula Austeni</i>	136
— <i>cancellata</i>	126
— <i>Damnoniensis</i>	126, 127
— <i>Ibergensis</i>	132, 133
— <i>pectinoides</i>	73
— <i>rudis</i>	131
— (<i>Pterinea?</i>) <i>serviens</i>	124
— <i>sp.</i>	122
Aviculidæ	117-138

	PAGE		PAGE
Aviculinae	118-138	Barnstaple,echinodermata from	203, 218, 221, 224, 226-232, 234-236
Aviculopecten <i>aquisgranensis</i>	129	— gasteropoda from	49, 57, 58
— <i>cf. exactus</i>	134.	— lamellibranchiata from	73, 83, 88, 96, 101, 105, 108, 124-126, 128, 129, 131, 137, 138
— <i>granulosus</i>	130, 131; XIII, xv	— trilobites from	10
— <i>nexilis</i>	129, 130; XVI, v, vi; XVII, ii, iii	Batocrinidæ	218
— (<i>Meleagrina</i>) <i>rigida</i>	73	Batostomellidæ	196, 197
— <i>transversus</i>	127, 128; XVI, i-iv	Bellerophon <i>bisulcatus</i>	68-70
<i>Axinus deltoideus</i>	93	— <i>clathratus</i>	62
— <i>nuculoides</i>	92, 93	— <i>decussatus</i>	62
— <i>orbicularis</i>	93, 95	— (<i>Bucania</i>) <i>elegans</i>	62, 63; VII, i
Baggy, brachiopoda from	147, 164, 175, 177, 183, 184	— <i>globatus</i>	64, 65
— cephalopoda from	32-34	— <i>Gostariensis</i>	67
— Conulites from	199	— labyrinthodes	63, 65; VIII, i, ii
— crustacea from	10, 19, 23	— <i>macromphalus</i>	66
— echinodermata from	204	— <i>macrostoma</i>	66
— gasteropoda from	38, 45, 46, 56, 60, 63, 64, 69, 70	— <i>Sandbergeri</i>	67
— lamellibranchiata from	87, 89, 94, 96, 98, 101, 105, 106, 110, 114, 126, 129	— subglobatus	64, 65; VIII, iii
Barnstaple Athenæum, brachiopoda in	150, 151, 156, 159, 163, 170, 174, 179, 181	— <i>trilobatus</i>	68
— — bryozoa in	186, 198, 199	— <i>Uriei</i>	70, 71
— — cephalopoda in	24, 28-33	— ? sp.	65, 66; VIII, vii
— — echinodermata in	208, 212, 216, 219, 220, 223, 224, 229, 232, 234	Bellerophontidæ	62-71
— — fish in	3	<i>Berenicea irregularis</i> ?	197
— — gasteropoda in	37, 39, 41- 43, 45, 47, 49, 51, 53, 55, 57, 58, 61, 63-65, 67	Beyrichia <i>æquilatera</i>	20, 21; III, xv
— — lamellibranchiata in	73, 77, 79, 80, 81, 83, 86, 88, 98-100, 102, 104, 105, 108, 110, 112, 121, 126, 128, 129, 132, 134, 139, 141-144	— <i>Damesii</i>	21; III, xvi
— — myriopoda in	4	Beyrichiopsis <i>Ruperti</i>	22; III, xvii
— — ostracoda in	16	Blastoidea	211-214
— — trilobites in	10, 12	Brachiopoda	145-184
— brachiopoda from	151, 163, 172, 176, 183	Brachymetopus <i>Woodwardii</i>	13, 14; II, ix-xi
— bryozoa from	186, 198	Bradiford, brachiopoda from	153, 157, 161, 165, 167, 177, 179
— cephalopoda from	24, 30, 33	— bryozoa from	190
		— echinodermata from	212, 213
		— lamellibranchiata from	81, 100, 104, 112, 132, 139, 141, 143
		— trilobite from	10
		Braunton, brachiopoda from	149, 153, 157, 163, 165, 168-170, 175, 179
		— cephalopoda from	26
		— echinodermata from	204, 208, 210, 219- 222, 224, 228, 229, 231, 234
		— gasteropoda from	43, 57
		— lamellibranchiata from	80, 106, 110, 118, 122, 128, 129
		— trilobites from	10, 12

	PAGE		PAGE
British Museum, brachiopoda in	154	<i>Cimitaria</i>	85
— cephalopoda in	29, 33	Cirripedia	9
— lamellibranchiata in	85, 110	Cleiothyris	148-151
— trilobites in	10	Cobracephalus angulosus	119; XIII, ix
Brushford, brachiopoda from	156	Codonaster conicus	214, 215; XXIX, iv
— bryozoa from	185, 190	Cœliocrinus, sp.	236; XXXVIII, vii
— cephalopoda from	31	Coleolus	38
— crinoid from	224	Collar Bridge, brachiopoda from	161
— gasteropoda from	53, 56, 60, 65	Conularia <i>continens</i>	35
— lamellibranchiata from	98, 128	— <i>deflexicosta</i>	35, 36; IV, xiii
— trilobites from	10, 11	Coomara Swamy Collection, crinoids in	223, 229
Bryan Collection, Productus in	172	Cornulites devonianus	198, 199; XXXVII, i-iii
Bryozoa	184-198	Crania ? <i>ricta</i>	182; XXII, x
<i>Bucania Archiaci</i>	62	— <i>ringens</i>	182
— <i>elegans</i>	62	Craniella <i>insecura</i>	180, 181; XXII, ix
Budleigh Salterton, brachiopoda from	154	— <i>Meduanensis</i>	181
Camarotœchia Partridgiæ	161, 162; XIX, xii-xiv	Crenipecten ? <i>auritus</i>	139; XV, vii; XVI, xv, xvi
— <i>togata</i>	163, 164; XIX, xv-xviii	Crinoidea	215-236
Camerata	217-225	<i>Cromyocrinus</i>	232
Camelford, brachiopoda from	153	Croyde, brachiopoda from	149, 153, 156, 157
Capulus <i>acutissimus</i>	49, 50	—	159, 161, 165, 167, 169-171, 175, 177, 179
— <i>acutus</i>	49, 50	— bryozoa from	185, 186, 188, 190, 192,
— <i>Bischoffi</i>	49, 50	—	196, 201,
— <i>compressus</i>	47, 48; V, xviii	— cephalopoda from	33
— <i>conicus</i>	49, 50	— crustacea from	8
— <i>dormitans</i>	46	— echinodermata from	208, 209, 219, 220
— <i>Hainensis</i>	46	— gasteropoda from	45, 47, 53
— <i>hercynicus</i>	49, 50	— lamellibranchiata from	78, 88, 96, 100,
— <i>rostratus</i>	46; V, xv, xvi	—	101, 117, 121, 124, 129, 133, 138
— <i>selcanus</i>	49, 50	— trilobites from	10
— <i>terminalis</i>	46, 47; V, xvii	Crustacea	6-24
<i>Cardinia Bodana</i>	80	Cryptostomata	184-195
— <i>inflata</i>	92, 93	Ctenodonta <i>antiqua</i>	101, 102, 103, 104; XIII, v
— <i>trapezoidalis</i>	92, 93	— <i>daleidensis</i>	102
<i>Cardioconcha</i>	72	— ? <i>elliptica</i>	103, 104; XIII, vi
Cariderpestes <i>gyius</i>	3-5; I, ii	— <i>gibbosa</i>	102
<i>Cassianella</i>	119	— (Palæoneilo) <i>lirata</i>	100-102; XII, xii,
Cephalopoda	24-35	—	xiii; XIII, i-iv
Ceratiocaris ? <i>sub-quadrata</i>	7; I, v	— <i>Newtonii</i>	99, 100; X, xv
— <i>sp.</i>	8; I, vi; II, xii	— (Kœnenia) <i>cf. obsoleta</i>	106, 107;
Chonetes <i>Hardrensis</i>	177, 178; XXII, iv	—	XII, x
— <i>Illinoisensis</i>	179, 180; XXII, vii, viii	— <i>tensa</i>	104-106; XII, viii, ix
— <i>Laquessiana</i>	177	— <i>unioniformis</i>	102
— <i>Logani</i>	179	Cucullæa <i>amygdalina</i>	109-111
— <i>Margaritacea</i>	179; XXII, v, vi	— <i>angusta</i>	109-111
— <i>sarcinulata</i>	178	— <i>complanata</i>	111
		— <i>depressa</i>	111, 112; XI, xiv; XII, ii, iii

	PAGE		PAGE
<i>Cucullæa Hardingii</i>	109-111	<i>Euphemus Barumensis</i>	70, 71; VII, ii
— <i>trapezium</i>	109, 110	<i>Fenestella antiqua</i>	185
— <i>unilateralis</i> 72, 109-111; XI, iv-xiii; XIII, x, xi		— <i>crassa</i>	188
<i>Curtonotus elegans</i>	93, 95	— <i>laxa</i>	188, 189
— <i>unio</i>	97	— <i>fanata</i>	185
<i>Cyathocrinus Barumensis</i>	227	— <i>Lyelli</i>	187
— ? <i>macrodactylus</i>	215	— <i>multiportata</i>	188
<i>Cypricardia deltoidea</i>	93, 94	— <i>plebeia</i> . 185, 186; XXII, xiv, xv; XXIII, i	
— <i>impressa</i> ?	75	— <i>polyporata</i> . 188; XXIII, iv, v	
— ? <i>rhombea</i>	93	— ? <i>umbrosa</i> . 186, 187; XXII, xvi; XXIII, ii, iii	
— <i>semisulcata</i>	76	— <i>vera</i>	187
<i>Cyrtia</i>	153, 156	Fish remains	3; I, i
<i>Cytherodon adpressus</i>	93	<i>Fistulipora</i> ? sp.	197; XXIII, xvii
— <i>Chemungensis</i>	93, 95	—	198; XXIII, xviii, xix
— <i>quadrangularis</i>	93, 95	<i>Flexibilia</i>	215-217
— <i>rhombus</i>	93	Frankmarsh, brachiopoda from . 157, 161, 165, 175	
<i>Desmodonta</i>	72-89	— bryozoa from	190, 198
<i>Digoniomya elegans</i>	117; XIII, xiii	— cephalopoda from	31
<i>Discina nitida</i>	183; XXII, xi, xii	— gasteropoda from	40, 43, 53
<i>Dolabra angusta</i>	109	— lamellibranchiata from . 99, 106, 108, 116	
— <i>depressa</i>	111	Fremington, brachiopoda from . 161, 168, 172-174, 80	
— <i>Hardingi</i>	109	— cephalopoda from	33
— <i>unilateralis</i>	109	— echinodermata from . 209, 216, 227	
<i>Drepanaster</i>	208, 209	— gasteropoda from	49
<i>Dulverton, fossils from</i>	31, 113	— lamellibranchiata from . 99, 108, 114, 116	
East Anstey, fossils from . 7, 10, 159, 188, 195		— trilobite from	12
<i>Echinocaris Whidbornei</i>	6, 7; I, iii	Freshwater West, Capulus from	46
<i>Echinodermata</i>	199-236	Gasteropoda	35-71
<i>Echinoidea</i>	199-204	Geological Society's Museum, fossils in . 129, 165	
<i>Edmondia</i> ? <i>Athensæ</i>	81; IX, iii	<i>Glaucaneme bipinnata</i>	190
— <i>Bodana</i>	80, 81; IX, v, viii	<i>Gomphoceratidæ</i>	27, 28
— <i>Burlingtonensis</i>	80	<i>Goniatites</i> sp.	25; IV, i
— ? <i>Hamlingii</i>	82; XI, iii	Goodleigh, brachiopoda from . 153, 161, 167, 168	
— <i>subovata</i>	80	— lamellibranchiata from	128
<i>Encrinasteriæ</i>	204, 205	<i>Grammysiidae</i>	74-86
<i>Entomostraca</i>	10-14	<i>Gymnolæmata</i>	184-198
<i>Eocidaris</i> ? <i>acuaria</i>	203	Hagley Bridge, brachiopoda from	153
<i>Euasteriæ</i>	205, 206	Hamling Collection, brachiopoda in . 156, 158, 159	
<i>Eugaster granifer</i>	207	— bryozoa in . 188, 193, 196	
— ? <i>perarmatus</i> . 209, 910; XXVII, iv-vi		— crustacea in	8
<i>Euomphalus radians</i>	54		
— <i>serpens</i>	52, 53		
— <i>vermis</i>	52, 53; VI, iv		
— sp.	53		

	PAGE		PAGE
Hamling Collection, echinodermata in	206, 209	Leiopteria Conradi . . .	124, 125; XIV, vii
— — gasteropoda in . . .	43, 45, 53	— ? murata . . .	125; XIV, viii
— — lamellibranchiata	82, 110, 121, 124	<i>Leperditia dorsicornis</i> . . .	18
Harford Landkey, Asteroidæ from . . .	206	— <i>mundula</i> . . .	19
Heanton, fossils from . . .	14, 136	Leperditiidæ . . .	15-24
Hexacrinidæ . . .	223-225	Lepidesthes? devonicans	200-202; XXIV, i, ii; XXV, iii
Holopella <i>antiqua</i> . . .	43	<i>Leptaena caperata</i> . . .	175, 176
— <i>Hennahiana</i> . . .	43	— <i>Hardrensis</i> . . .	177
— <i>tenuisulcata</i> . . .	51; V, vii; VI, iii	— <i>interrupta</i> . . .	172
<i>Holoptychius</i> . . .	3	— <i>membranacea</i> . . .	176
Homomyaria . . .	72, 89-113	— <i>prælonga</i> . . .	168
Hope's Nose, Chonetes from . . .	178	— <i>scabricula</i> . . .	170, 176
		— <i>sordida</i> . . .	178
Ichthyocrinidæ . . .	215-217	Leptodesma anatinum	122-124; XIV, iv-vi
Ilfracombe Beds, brachiopoda in . . .	168	— citimum . . .	120; XIII, vii
Inadunata . . .	225-236	— cultellatum	121, 122; XIV, ii, iii
Inarticulata . . .	180-184	— sp. . .	121; XVI, i; XVII, i
Incheldon, brachiopoda from . . .	149	Leptodomus constricta	75, 76; VIII, viii, ix
Ironpost, bryozoa from . . .	195	— semisulcata	76, 77; IX, xxiii, xxiv
— gasteropoda from . . .	55	Lingula <i>circularis</i> . . .	184
— lamellibranchiata from . . .	99, 113	— <i>squamiformis</i> . . .	183, 184; XXII, xiii
— Orthoceras from . . .	31	Looe, brachiopoda from . . .	159
Isochilina canaliculata	15; II, xiii-xv; III, i, ii	Lower Orchard Quarry, cephalopoda from . . .	31
<i>Isocrinus macrodactylus</i> . . .	215	Loxonema anglicum . . .	43, 44; V, vi
		— Hallii . . .	41; V, viii
Kingdon's, brachiopoda from	153, 161, 165, 167, 173, 177	— <i>Hennahianum</i> . . .	43
— cephalopoda from	24, 28, 30, 32	— priscum . . .	42, 43
— Conulites from . . .	199	— <i>rugiferum</i> . . .	43, 44
— crustacea from . . .	10, 16	— <i>subulata</i> . . .	41
— gasteropoda from	39, 42, 43, 51, 53, 55, 57, 63, 64, 67	— trochleatum . . .	41, 42; V, iv, v
— lamellibranchiata from	80, 83, 88, 94, 101, 126, 141	Luscott, cephalopoda from . . .	26
Kingscote, bryozoa from . . .	188	— Barton, brachiopoda from . . .	153
Kingsgate, bryozoa from . . .	185	<i>Macrocheilus imbricatum</i> . . .	45
Klædenia bursæformis	22, 23; III, xviii-xxiii	Macrochilina pusilla . . .	40; V, iii
Knowle Quarry, lamellibranchiata from . . .	110	— turbinea . . .	39, 40; V, i, ii
<i>Kænenia</i> . . .	106	<i>Macrodon pygmaeus</i> . . .	112
		Mainstone, brachiopoda from . . .	177
Lamellibranchiata . . .	72-144	Malacostraca . . .	6-8
Landlake, brachiopoda from . . .	165	<i>Manon cribosum</i> . . .	197
— lamellibranchiata from . . .	77, 131	Mantell Collection, Sphenotus in . . .	85
Laticosta Cave: see Baggy.		Marioerinus? mundus	219, 220; XXXIV, v; XXXVII, vi, vii
<i>Leda perdentata</i> . . .	104, 105	<i>Martinia</i> . . .	157
Leioclema? distans . . .	196; XXIII, xvi	Marwood, brachiopoda from . . .	163
		— cephalopoda from . . .	28, 30, 32

	PAGE		PAGE
Marwood, gasteropoda from	30, 45, 49, 65, 67	Naticopsis Hallii	44, 45; V, xi-xiii
— lamellibranchiata from	75, 79, 85, 94, 102, 110, 112, 126, 127	Nautilidæ	25-27
— trilobites from	10	Nautiloidea	25-35
Meadfoot, Tentaculites from	38	Newport, brachiopoda from	172
Medusaster parvus	205, 206; XXXVII, iv	New Road Quarry, trilobites from	10
Meer Top, lamellibranchiata from	134	North Moulton, lamellibranchiata from	110
Megistocrinus? sp.	218; XXXVII, v	Nucula latissima	105, 107, 108
Melocrinidæ	219, 220	— lineata	97, 98; X, xiii, xiv
Melonitidæ	199-202	— ovata	107
Millepora gracilis	193-195	— plicata	98
Modiola? amygdalina	114, 115; XIII, xii	— pullastriformis	102
Modiolopsis sp.	114; XII, vii	Nuculidæ	97-108
Mollusca	24-144	Nuculites adpressa	93
Molluscoidea	145-198	— Chemungensis	93
Murchisonia anglica	59, 60; VI, xiv	— ? latissimus	107; XII, xi
— angulata	59, 60	— sulcatina	104
— bistriata	62	Ophio-enerinasteriæ	206-210
— quadricincta	61	Ophiurea	206-211
— similis	61, 62; V, xxii, xxiii	Ophiurella? gregaria	210, 211; XXVIII, iii
— turbinata	59, 60	Ophiuridæ	210, 211
— sp.	60; VI, xv	Ophiuroidea	206-211
Museum of Practical Geology, brachiopoda in	149, 155, 156, 163, 170, 179, 183	Orbicula nitida	183
— of Practical Geology, bryozoa in	186, 187	Orchard House, brachiopoda from	153
— of Practical Geology, cephalopoda in	26, 28-30, 33	Orthis Hardrensensis	177
— of Practical Geology, echinodermata	201, 203-205, 207-210, 215, 217, 221, 222, 224, 228, 229, 231	— interlineata	165; XX, vi, vii
— of Practical Geology, gasteropoda in	43, 45, 53, 57, 58, 60, 63, 64, 67, 69, 70	— parallela	165
— of Practical Geology, lamellibranchiata in	75, 77, 78, 80, 83, 86-89, 92, 94, 96, 98, 100, 102, 105, 106, 110, 111, 114, 117, 118, 122, 126, 128, 131, 133, 138	— plicata	165
— of Practical Geology, trilobite in	10, 11	— productoides	175
Myophoria deltoidea	93, 94; X, v-viii	— semicircularis	166
— inflata	92, 93; X, iii, iv	— sp.	165; XX, viii, ix
— trigona	96, 97; X, ix-xi	Orthoceras Barumense	30, 31; IV, vii, viii
Myriopoda	3-5	— cylindraceum	31
Mytilarca? modioloides	117, 118; XIII, viii	— Ludense	28, 29
Mytilidæ	114-117	— speciosum	29, 30; IV, iv
Natica? meridionalis	45, 46; V, xiv	— striatum	28
Naticidæ	44-46	— tentaculare	38
		— vennense	31, 32
		— sp.	28, 29
		— sp.	32; IV, vi
		Orthoceratidæ	28-35
		Orthonychia acuta	48-51; V, xx, xxi; VI, i, ii
		— conica	49
		— quincyensis	49
		— rotunda	48; V, xix
		— subplicata	49
		Orthotetes crenistria	166-168; XX, x, xi

	PAGE		PAGE
Ostracoda	12-24	Pilton, brachiopoda from	145, 146, 151-153, 157, 159, 163, 165, 167, 168, 170, 171, 174-176, 179-182
Palæaster longimanus	204, 205; XXVI, i-iv; XXIX, iii	— bryozoa from	185, 186, 188, 193, 199
<i>Palæoconcha</i>	72	— crustacea from	7, 10-12, 17, 19-22
<i>Palæoneilo brevis</i>	100	— echinodermata from	201, 204, 207, 210, 215, 216, 221, 223, 224, 226, 228-230, 232, 234
— <i>sulcatina</i>	104	— gasteropoda from	36, 38, 40, 46-49, 52-54, 57, 59, 60, 62, 65
Palechinoidea	199-204	— lamellibranchiata from	78, 79, 83, 88, 96, 101, 108, 121-123, 127, 128, 131, 132, 134, 136, 137, 139, 141, 143
Panenka anglica	72-74; VIII, x, xi	— Vicarage Well, brachiopoda from	161
Parallelodon priscus	113; XII, vi	— cephalopoda from	33
— <i>pygmæus</i>	112, 113; XII, iv, v	— gasteropoda from	39, 41, 42, 53, 58, 61, 65
Partridge Collection, brachiopoda in	166, 173, 183, 184	<i>Pinnatopora</i>	189, 190
— — cephalopoda in	31	Plaistow Mill Quarry, Prothyris from	88
— — crinoids in	226, 227	<i>Platyceras acutissimum</i>	49
— — crustacea in	16-18	— <i>acutum</i>	49
— — gasteropoda in	40	— <i>compressum</i>	47
— — lamellibranchiata in	129	— <i>conicum</i>	49
<i>Pecten alternatus</i>	138	— <i>cultellus</i>	49, 50
— <i>nexilis</i>	129	— <i>dubium</i>	49
— <i>polytrichus</i>	132, 133	— <i>hercynicum</i>	49
— <i>transversus</i>	127	— <i>quincyensis</i>	49, 50
Pectinidæ	139-144	— <i>selcanum</i>	49
Pembrokeshire, brachiopoda from	183	— <i>subplicatum</i>	49
— cephalopoda from	30	Platycrinus ? anguliferus	223; XXXVII, viii-xii
— gasteropoda from	46, 69	Pleuromectites Hicksii	142, 143; XVI, xiv
— lamellibranchiata from	80, 94, 97, 126, 127	— <i>lepis</i>	142; XVI, xii, xiii
Penniretipora bipinnata	190, 191; XXIII, vi-viii	— Piltonensis	140, 141; XVI, vii-xi
— <i>virgata</i>	191, 192; XXIII, ix	Pleurotomaria aspera	56, 57-59; VI, x-xiii
<i>Pentremites ovalis</i>	212, 213	— <i>distinguenda</i>	56
Pentremitidea Phillipsii	212, 213; XXIX, v, vi	— <i>expansa</i>	54, 55
Perischoëchinidæ	199-204	— <i>gracilis</i>	55, 56
Pernopecten insperatus	143, 144; XVII, v	— Hamlingii	56, 57, 58; VI, ix
Petherwyn, brachiopoda from	157, 165, 167	— <i>interstitialis</i>	57, 59
— bryozoa from	185, 188	— <i>minima</i>	57, 58
— lamellibranchiata from	94	— <i>minuta</i>	57, 58
Phacops <i>granulatus</i>	11	— <i>victrix</i>	58
— <i>latifrons</i>	10, 11; I, vii-x; II, i-iv	— sp.	59; V, ix; VI, viii
Phillipsia Hicksii	11-13; II, v-viii	Pleurotomariidæ	56-62
Phthonia <i>cf. cylindrica</i>	85	Poleshill, brachiopoda from	145, 147, 149, 153, 159, 161, 167, 168, 170, 171, 175, 179
— sp.	85; IX, xix	— bryozoa from	185, 186, 190, 197, 199
— sp.	86		
Phyllocarida	6-8		
Pilland, Aviculopecten from	128		
Pilton, Actinoceras from	33		

	PAGE		PAGE
Poleshill, echinodermata from	216, 231	Productus interruptus	172, 173; XXII, i-iii
— lamellibranchiata from	112, 122	— <i>laxispinus</i>	177
— ostracoda from	15	— <i>longispinus</i> ?	169
— trilobites from	10	— <i>prælongus</i>	168, 169; XX, xii, xiii
<i>Porcellia Symondsii</i>	27	— — var. <i>simplicior</i>	169, 170; XX, xiv, xv
Porter Collection, brachiopoda in	145, 146, 151, 159, 163, 166, 170-174, 179-182	— <i>scabriculus</i>	170, 171; XX, xvi-xviii; XXI, xii
— — bryozoa in	186, 188, 197, 199	— cf. <i>subaculeatus</i>	174, 175; XXI, i-iii
— — cephalopoda in	31, 33	— <i>tenuistriatus</i>	173
— — crustacea in	7, 9, 10, 12, 14, 15, 19-22	Proctidæ	11-14
— — echinodermata in	204, 209, 210, 216, 221, 223, 224, 226-228, 230-232, 234	Prosobranchia	39-71
— — gasteropoda in	36, 38, 40, 46- 48, 52-54, 57-60, 62	Protaster granifer	207; XXVI, v, vi
— — lamellibranchiata in	75, 78-80, 83, 86, 88, 94, 96, 97, 112, 114, 116, 122, 123, 128, 131, 134, 136, 137, 139, 141-143	— <i>gregarius</i>	210
Poterioceras sp.	27, 28; IV, iii	— <i>perarmatus</i>	209
— sp.	28; IV, v	— ? (<i>Drepanaster</i>) <i>scabrosus</i>	208; XXIX, i, ii
Poteriocrinidæ	225-236	— — var.	209; XXVII, i-iii; XXVIII, i, ii
Poteriocrinus <i>Batheri</i>	233, 234	Prothyris contorta	87, 88; IX, xv, xvi
— <i>Barumensis</i>	227, 232; XXXIV, vi; XXXV, iii	— <i>recta</i>	86, 87; IX, xii-xiv
— <i>stadiodactylus</i>	233	— <i>scalprata</i>	72, 88, 89; IX, xvii, xviii; X, xvi, xvii
— <i>tensus</i>	226, 227; XXXV, i, ii; XXXVIII, i	— sp.	144; XVII, vi
— sp.	228; XXXV, iv, v; XXXVI, ix	Protocidaris acuaria	203; XXV, i, ii
Pottington, brachiopoda from	168	Pseudomelaniidæ	39-44
— trilobite from	12, 14	<i>Pterinea</i> cf. <i>Damnoniensis</i>	126
Pouch Bridge, brachiopoda from	149, 155, 159, 161, 167, 169, 175	— <i>Ibergensis</i>	132
— — bryozoa from	188, 189	— <i>radiata</i>	128
— — gasteropoda from	60	Pterinopecten <i>Austeni</i>	136, 137; XV, x, xi
— — lamellibranchiata from	101, 126	— ? <i>Hallii</i>	134, 135; XV, ii-vi
Præcardiidæ	72-74	— <i>mundus</i>	137, 138; XV, xii, xiii
Primitia <i>bovifrons</i>	19; III, xxv-xxx	— <i>polytrichus</i>	132-134; XV, i
— <i>dorsicornis</i>	18; III, xiii	— <i>scabriradians</i>	135, 136; XV, viii; ix; XVII, iv
— <i>sparsinodosa</i>	16, 17; III, iv-vi	Pteropoda	35-39
— <i>vestita</i>	19; III, xiv	Ptychopteria <i>Damnoniensis</i>	72, 126, 127; XIII, xiv; XIV, ix-xiii
— sp.	17; III, vii, xi	— <i>Salamanca</i>	126, 127
— sp.	18; III, xii	— <i>Sao</i>	126, 127
Productus <i>Cora</i>	173	<i>Pullastra antiqua</i>	100-102
— <i>corrugatus</i>	173, 174; XXI, iv, v	— ? <i>complanata</i>	83
— <i>fimbriatus</i>	172	— <i>elliptica</i>	103
		Raleigh, fossils from	141, 161
		Regulares	211-215
		Renssellæria ? <i>formosa</i>	145, 146; XVII, vii-ix

	PAGE		PAGE
<i>Retzia</i>	146	Scaphiocrinus? <i>salebrosus</i>	232; XXXVII, xiii
Rhabdomeson? <i>distans</i>	196	— <i>transcisus</i>	230; XXXVIII, iii
— <i>gracile</i>	194; XXIII, xi-xv	— <i>sp.</i>	231, 232; XXXIV, viii
Rhaphistoma <i>junius</i>	54-56; VI, v-vii	<i>Schizodus adpressus</i>	93-95
Rhodocrinus? <i>sp.</i>	217, 218; XXXI, iii	— <i>equalis</i>	94, 95
<i>Rhombopora</i>	193	— <i>Chemungensis</i>	94, 95
Rhynchonella <i>laticosta</i>	164; XX, iii, iv	— <i>deltoides</i>	94
— <i>Partridgiæ</i> 161, 162; XIX, xii-xiv		— <i>fallax</i>	96
— <i>pleurodon</i>	161	— <i>inflatus</i>	92, 93
— <i>reniformis</i>	164	— <i>Kefersteini</i>	92, 93
— <i>subdentata</i>	163	— <i>quadrangularis</i>	95
— <i>togata</i>	163, 164; XIX, xv-xviii	— <i>rhombus</i>	93-95
Roborough, brachiopoda from	147, 149, 151, 153, 161, 163, 171, 175, 179	— <i>trapezoidalis</i>	92, 93
— bryozoa from	186, 199	— <i>trigonus</i>	96, 97
— echinodermata from	216, 223, 234	Scytatocrinus <i>arachnoideus</i>	235; XXXVIII, v, vi
— gasteropoda from	58	— <i>stadiodactylus</i>	233, 234; XXXVI, ii-vi, viii; XXXVII, xiv
— lamellibranchiata from	75, 80, 122, 134, 141	Seminula <i>oblonga</i>	147, 148; XVII, xi, xii
— trilobites from	10	Shirwell, brachiopoda from	153, 161, 165, 167, 169, 173, 177
Rock Hill Quarry, brachiopoda from	177	— cephalopoda from	24, 28, 30, 32
— Inn Quarry, brachiopoda from	167, 169	— crustacea from	10, 16
<i>Saccocaris</i>	7	— gasteropoda from	39, 42, 43, 51, 53, 55, 57, 63, 64, 67
Salpingostoma? <i>macromphalus</i>	64, 65, 66-68; VIII, iv, v	— lamellibranchiata from	80, 83, 88, 94, 101, 110, 126, 141
— <i>macrostoma</i>	66	Sloly, Actinoceras from	33
<i>Sanguinolaria lirata</i>	100	— brachiopoda from	153, 158, 184
— <i>soleniformis</i>	84, 85	— crustacea from	6, 8, 10
Sanguinolites <i>mimus</i>	78, 79; IX, iv, vi, vii	— echinodermata from	217, 222
— <i>Porteri</i>	77, 78; IX, ii	— gasteropoda from	45, 64
— <i>solenoides</i>	83	— lamellibranchiata from	77, 79, 80, 84, 88, 102, 105, 110, 126, 132
Saunton, brachiopoda from	147, 153, 158, 161, 165, 167, 169, 174, 175, 183, 184	— myriopoda from	4
— bryozoa from	190, 197, 198	Smoking House Lane, fossils from	139, 171
— crustacea from	8, 10, 15-17	Snapper Quarry, fossils from	155, 158, 185
— echinodermata from	223, 226	Solariidæ	52-56
— gasteropoda from	42, 55, 69	South Petherwyn, brachiopoda from	149, 153, 155, 175, 176
— lamellibranchiata from	82, 92, 96, 98, 100	— — gasteropoda from	58, 60
Scalariidæ	51, 52	— — lamellibranchiata from	72, 86, 104, 128
Scaldia? <i>longa</i>	89, 90; X, i, ii	Sowden, gasteropoda from	49
<i>Scalites</i>	54	Spathella <i>munda</i>	115, 116; IX, i; XI, i, ii
Scaphiocrinus? <i>inordinatus</i>	230; XXXIV, vii; XXXV, vi; XXXVIII, iv	Sphenotus <i>Hicksii</i>	83; IX, ix
— <i>plumifer</i> 228, 229; XXXI, iv; XXXIII, i; XXXVI, i; XXXVIII, ii		— ? <i>seleniformis</i>	84, 85; XII, i
		— <i>solenoides</i>	83, 84; IX, x, xi

	PAGE		PAGE
<i>Spirifera arachnoidea</i>	166	Tiverton, Cucullæa from	110
— <i>Archiaci</i>	152	Top Orchard Quarry, brachiopoda from	151, 153, 156, 157, 169, 170, 175, 177, 181
— <i>Barumensis</i>	153-155, 158	— — — bryozoa from	190, 192, 195, 196, 199
— <i>Bouchardi</i>	156, 157	— — — cephalopoda from	29, 30, 33
— <i>decussata</i>	148	— — — echinodermata from	204, 209, 214, 223, 224, 227
— <i>de-Royssii</i>	148	— — — gasteropoda from	37, 47, 49, 58, 63
— <i>disjuncta</i>	152, 153	— — — lamellibranchiata from	73, 75, 86, 100, 119, 126, 129, 134, 139, 141, 142, 144
— <i>lineata</i> ?	151	— — — trilobites from	10
— <i>Lonsdalii</i>	152, 153	Trepostomata	196-198
— mesomala	158, 159; XIX, viii, ix	<i>Trigeria</i>	146
— microgemuna	151, 152; XVIII, vii, viii	Trigoniidæ	92-97
— <i>Murchisoniana</i>	153, 155	Trilobita	10-14
— obliterated	156, 157; XIX, i-iv	<i>Trimercephalus lævis</i>	11
— <i>rudis</i>	163	<i>Tropidodiscus trilobatus</i>	68, 69; VIII, vi
— <i>unguiculus</i>	157	<i>Tropidoleptus carinatus</i>	145
— (Martinia ?) Uriei	157, 158; XIX, v-vii	Tubicola	198, 199
— Verneuilii	152-156, 158; XVIII, ix-xiii	<i>Turritella trochleata</i>	41, 42
Spiriferidæ	146-161	Tutshill, brachiopoda from	153
<i>Spiriferina cristata</i>	159-161; XIX, x, xi	Ulrichia interserta	23, 24; III, xxiv
<i>Spirigera Roissyi</i>	149	Unicardiidæ	89, 90
Streblopteria	140	Upcott Arch, brachiopoda from	149, 151, 153, 157, 161, 165, 167-169, 177
Streblotrypa Gregorii	192, 193; XXIII, x	— — — bryozoa from	190
<i>Streptorhynchus crenistria</i>	166	— — — crinoids from	230, 232
Strophalosia calvus	177	— — — gasteropoda from	40
— productoides	171, 175-177; XXI, vi-xi	— — — lamellibranchiata from	98, 125, 129, 143
Strophomena rhomboidalis	168; XX, v	— — — Orthoceras from	31
Strophomenidæ	165-168	— — — ostracoda from	15
Subclymenia Symondsii	26, 27; VII, iii-iv	Vertebrata	3
Taxocrinus macrodactylus	215, 216; XXXIII, ii-iv	West Angle Bay, brachiopoda from	183
— stultus	216, 217; XXXIV, i-iii	— — — gasteropoda from	69
<i>Tellina inflata</i>	92	— — — lamellibranchiata from	80, 94, 97, 126
Tentaculites conicus	36, 37; IV, xiv	— — — Orthoceras from	30
— (Coleolus ?) tentacularis	38, 39; IV, xv	Wiviliscombe, brachiopoda from	153, 167
— <i>tenuicinctus</i>	38		
— <i>tenuis</i>	38		
<i>Terebratula elongata</i> ?	148-150		
— <i>laticosta</i>	164		
— <i>pleurodon</i> ?	161		
Terebratulidæ	145, 146		
Tetrabranchiata	24-35		
<i>Thetis</i> ? <i>trigona</i>	97		
Tintagel, brachiopoda from	153		

INDEX TO VOLUME III.

247

	PAGE		PAGE
Woodwardian Museum, brachiopoda in	149, 151, 153, 155, 169-171	Woodwardian Museum, lamellibranchiata in	73, 75, 77, 84, 88, 92, 96, 100, 102, 108, 110, 111, 119, 124-126, 128, 137, 138
— — bryozoa in	186, 187, 192, 195, 196, 198	Wrafton Lane, brachiopoda from	157, 168, 169 177, 185
— — cephalopoda in	24, 30, 33	— — echinodermata from .	212, 213
— — crustacea in	7, 8, 10, 11	— — lamellibranchiata from	136, 141 143, 165
— — echinodermata in	204, 214, 217, 218, 221, 222, 226-232, 234- 236	— — trilobites from	. . 14
— — gasteropoda in	42, 49, 55, 57, 58, 64, 69	Yeotomes, Actinoceras from.	. . 33