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On some Bryozoa from the Inferior Oolite of Shipton Gorge, Dorset. Part II.

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6. *On some* Bryozoa *from the* Inferior Oolite *of* Shipton Gorge, Dorset. Part II.[1] By Edwin A. Walford, Esq., F.G.S. (Read April 12th, 1893.)

[Plates II.–IV.]

The Cheilostomatous Bryozoa have hardly been recognized with certainty in the Jurassic series, and Haime mentions two forms of the Escharidæ in his monograph[2] with considerable doubt and without illustration. In the little group dealt with in this paper are mingled both cheilostomatous and cyclostomatous features, but the former predominate, and, for the present, it is desirable to place the group there. We thus open a field for investigation which will trench deeply into the ground hitherto occupied by the Cyclostomata.

Messrs. Waters, Vine, and Ulrich have written of cheilostomatous structure in Palæozoic fossils; the English Jura now leads backward also the relations of this sub-order, and we need to scan this distant horizon of bryozoan development for signs sufficient to guide us on our way.

After I had read Part I. of my paper in 1889 I withdrew for further study two of the species related to those that I am about to describe. So many of their features were dissimilar to the Entalophora among which I had placed them, similar as they were in general aspect, that it seemed necessary to find a place for them elsewhere.

The characters of the two sub-orders Cheilostomata and Cyclostomata merge as we pass backward in time. This merging the accessory organs of the genus and species here described and figured will illustrate. Mr. A. W. Waters has paved the way to the same conclusion in a recent paper.[3] He writes:—'In the Cretaceous Melicertitidæ the characters are in the main chilostomatous united with some that are cyclostomatous, and also in a very large section of Palæozoic fossils there are important structures similar to those in recent Chilostomata."

It may ultimately be necessary to erect a new sub-order for the association of these intermediary forms. When, however, we understand better the various stages of growth and eccentricities of arrangement of cells, then perhaps the number of genera and species we have made and are making may be pruned to as moderate a growth as that to which Dr. Ed. Pergens, in his laborious work,[4]

[1] For Part I., see Quart. Journ. Geol. Soc. vol. xlv. (1889) pp. 561–574, pls. xvii.–xix.

[2] 'Descr. des Bryoz. Foss. de la Form. jurass.,' Mém. Soc. Géol. France, sér. 2, vol. v. (1854) p. 217.

[3] 'On Chilostomatous Characters in Melicertitidæ and other Fossil Bryozoa,' Ann. & Mag. Nat. Hist. ser. 6, vol. viii. (1891) pp. 48–53, pl. vi.

[4] 'Revision des Bryoz. du Crétacé figurés par d'Orbigny, 1ère Partie—Cyclostomata,' Bull. Soc. Belge de Géologie, vol. iii. 1889 (Mémoires), pp. 305–400.

has so far reduced the prodigality of d'Orbigny's nomenclature. And yet I write this after giving my leisure hours of the past three years to the study of the new genus *Pergensia*, so named in recognition of Dr. Pergens's labour of revision.

[Since the reading of this paper I have been aided by the gift of specimens from Miss E. C. Jelly, the author of a most valuable 'Synonymic Catalogue of Recent Marine Bryozoa.' *Lekythopora* and *Pœcilipora* have many points of relationship with the new genus *Pergensia*. To the general family likeness to the Celleporidæ I had previously drawn attention, in a comment upon the rostra and apertures of one form.

The globose ovicell-sacs of *Pergensia* find a parallel in the ovicells of *Lekythopora* and *Pœcilipora*, genera which Mr. P. H. MacGillivray has so well worked out. We notice the same type of mural and peristomial tubules, the same deep-seated opercula and varied zoœcial form. At the same time, it is not possible to escape conviction as to there being two forms of ovicell: the supra-oral type, which is a budding of minute cells at the back of the zoœcium; and the ovicell-sac, which is either inter-zoœcial or borne upon the zoœcial wall. The analogy of the cistern-cell of my Liassic genus *Cisternifera* to the ovicell-sac is apparent, and in one instance there appear to be the rudiments of a spouted process as in *Cisternifera*. These lead to the 'cellules accessoires' of d'Orbigny and possibly to the 'giant cells' of Busk and others.

No author, so far as I know, has commented upon the functions of the zoœcial tubules of *Lekythopora*, so plainly to be seen in the specimen with which Miss Jelly has kindly supplied me. It has seemed, in the study of my fossils, that they may develop around and above the primary aperture. In the Liassic *Cisternifera* a central tubule is a common feature; in *Pergensia* I have noted it in the species *P. porifera*.

Some cells that I have called zoœcia, with flat poriferous faces, may be the columnar vicarious avicularia of Busk, Waters, and others; but there are points of structure, insufficiently worked out, which make such association doubtful.

The stipe of *Lekythopora* and the mode of growth of the colony around it explain the cylindrical axis of *Pergensia*, and show that its 'colonial' growth was after the same fashion.—November, 1893.]

PERGENSIA, gen. nov.

Zoarium piriform or cylindrical, with a central axial tube round which the zoœcia grow in spiral or irregularly spiral series. Zoœcia tubular, open or with terminal tubules; ovicells supra-oral. Mural openings, front or back. Ovicell-sacs: globose, nest-like cells enveloping the free ends of zoœcia; irregular swellings of the zoarial wall, or globose cells borne on the zoarial wall.

PERGENSIA NIDULATA, sp. nov. (Pl. II. figs. 1, 2; Pl. III. figs. 1, 2, 3, 4.)

Maximum zoarial length 4·0 mm., zoarial width 1·1 to 0·5 mm.;

zoœcial length 0·5 mm., zoœcial width 0·17 mm.; mouth 0·1 to 0·07 mm.

Zoarium simple, erect, claviform, base narrow (Pl. II. figs. 1, 2).

Zoœcia tubular, often compressed, springing up closely from the central shaft, frequently with very long exsert ends, of varying form. (1) Pl. III. fig. 1, mouth ovoid, pore on the lower lip, front mural pore; the ovicell is a dome-shaped mass of tubules, with a larger central tubule projecting from the back of the zoœcium: (2) Pl. III. fig. 2, mouth ovoid, quadrate mural pore at the back, apertural plate with a large, transverse, ovoid opening above, tubules and a narrow, transverse opening below: (3) Pl. III. fig. 4, compressed, ending in two compressed tubular shafts or rostra with a narrow opening below: (4) Pl. III. fig. 3, young, two terminal processes, a median ovoid opening, lower labial pore.

Ovicell-sacs globose, nest-like in the free ends of the zoœcia, enveloping two or three; punctulate, like the zoarial surface, with finer pores between them (Pl. II. fig. 1).

The zoœcia tend to a linear arrangement, as in d'Orbigny's genus *Radiotubigera*.

The longitudinal section (Pl. II. fig. 2) shows an axial tube of uniform diameter with thick walls, the primary zoœcia lying close to the tube before trending outward. Stem sinuous.

The shafts or rostra of No. 3 resemble the rostra of the Celleporidæ. In other species of *Pergensia* the rostrum on one side bears an avicularium, while on the other side it bears tubules.

PERGENSIA MAJOR, sp. nov. (Pl. II. figs. 3, 4; Pl. III. figs. 11–18.)

Zoarial length 3 to 4 mm., zoarial width 1 to 3 mm.; zoœcial width 0·3 mm.; mouth 0·1 to 0·13 mm.

Zoarium erect, piriform, base narrow. Zoœcia tubular, springing at regular intervals from the stem outwards; exsert parts of exceptional length (1 mm.). See Pl. II. fig. 4.

Zoœcia: (1) Pl. III. figs. 17, 18, terminal, with a recessed trifoliate or sub-crescentic aperture, supra-oral pore and ovicell-tubules; peristomial aperture hexagonal, with thick raised border: (2) Pl. III. figs. 14–16, zoœcia lengthened, front wall notched or areolated, supra-oral ovicell-tubules, mouth-plate with several openings: (3) Pl. III. figs. 11–13, mouth with terminal tubules and transverse labial opening.

Ovicell-sacs: ovoid, urn-shaped, or irregular. The common form is ovoid, with tubular termination as in *Crisia*. Zoarial surface covered with the protruding ends of pore-tubes, between which are finer pores.

The apertural plate is often pierced with pores, as in Busk's genus *Calymnophora*. Zoœcial covers are scattered sparsely about the zoarial surface.

PERGENSIA MINIMA, sp. nov. (Pl. II. fig. 12; Pl. III. figs. 5–10.)

Zoarial length 2·0 mm., zoarial width 1·0 mm.; zoœcial length 0·33 mm., zoœcial width 0·13 mm.; mouth 0·07 mm.

Zoarium erect, piriform, beginning with a thin cylindrical stem

bearing few zoœcia, then suddenly increasing in size by rapid multiplication of zoœcia, until a stoutly piriform head of crowded tubes is formed (Pl. II. fig. 12).

Zoœcia small, slightly exsert, tubular, wrinkled: (1) Pl. III. figs. 5–8, with ovoid mouth, supra-oral ovicell proceeding from the back, pore below the lower lip: (2) compressed, mouth ovately triangular, two short processes above, trifoliate opening at the back: (3) Pl. III. fig. 10, mouth ovoid, lip arched, apertural plate with a transverse ovoid opening and tubules.

The ovicell-sacs are globose swellings enveloping several zoœcia. Pl. III. fig. 8 may represent an early stage of one. It bears a flat top with a perforated disc.

PERGENSIA PORIFERA, sp. nov. (Pl. II. fig. 6; Pl. IV. figs. 1–5, 16, 17.)

Zoarial length 3·2 mm., zoarial width 1·0 mm.; zoœcial length 1·4 mm., zoœcial width 0·17 mm.; mouth 0·1 mm.

Zoarium erect, claviform, the axial shaft protruding from the top (Pl. II. fig. 6). Zoœcia arranged in an irregularly linear series, about six to every annulation, tubular, tapering slightly, exsert for one third of the length.

Zoœcia: (1) Pl. IV. fig. 3, central tubular opening, process on each side of the supra-oral rostrum, globular process on the lower lip, mural pore below it: (2) Pl. IV. figs. 1, 2, compressed, upper and lower lip arched, lower lip with pore below, ovicell supra-oral, springing from the back of the zoœcium: (3) Pl. IV. fig. 17, young zoœcium at the top of the zoarium, with ovoid mouth, trifoliate aperture, and pores around it on the inner wall; small avicularia on the lower lip: (4) mural pore orbicular, with cover (Pl. IV. fig. 5).

Zoarial surface punctate, with fine intermediate pores.

One of the doubtful zoœcial forms, resembling a columnar avicularium (Pl. IV. fig. 16), appears to have a cover, through which the tubules below can be seen.

Pergensia porifera is closely related to *P. nidulata*, but as yet the ovicell-sacs have not been found.

PERGENSIA AMPHORALIS, sp. nov. (Pl. II. fig. 8; Pl. III. figs. 21–24.)

Zoarial length 4·0 mm., zoarial width 1·0 mm.; mouth 0·07 mm.

Zoarium erect, claviform to cylindrical, axial tube protruding at the base and summit (Pl. II. fig. 8). Zoœcia sub-immersed, or free for half their length, crowded, equidistant, arranged in vertical lines or irregular, about sixteen to a volution.

Zoœcia: (1) Pl. III. fig. 21, upper lip arched, ovicell at the back, aperture ovoid, recessed: (2) Pl. III. fig. 24, compressed, front lip notched, or the wall areolated; mouth ovoid, with tubules. Front mural pore.

Zoœcial coverings, pitted with the impress of tubules, occur detached on the zoarial surface. Clusters of tubuli are to be seen between the zoœcia in one or two specimens. The ovicell-sacs have not been found.

Var. *a*.—Pl. II. fig. 5.

Young, amphora-shaped.

Zoœcia: upper lip arched, with pore, recessed ovoid aperture, lower labial pore, short side-processes, sessile mural avicularium. Ovicell supra-oral, proceeding from the back of the zoœcium. Ovicell-sacs not known. Upon the front wall of certain zoœcia is traced a large scar.

PERGENSIA JUGATA, sp. nov. (Pl. II. figs. 9, 10; Pl. IV. figs. 6–13, 18–21.)

Zoarial length 5·0 mm., zoarial width 1·0 mm.; zoœcial width 0·12 to 0·15 mm.; mouth 0·06 mm.

Zoarium dumb-bell shaped, axial tube protruding at each end. Zoœcia diverging from the constricted central part in apparently linear series or in spiral, often irregular lines (Pl. II. figs. 9, 10).

Zoœcia tubular, tapering, or compressed, some placed sideways upon the zoarium, frequently with long exsert parts: (1) Pl. IV. figs. 7, 10, 11, conoidal, compressed, placed sideways upon the zoarium, front having a long transverse opening below and other openings above, with tubules; summit open, with tubules: (2) Pl. IV. fig. 12, compressed, mouth ovoid, with lobed superior and ovoid inferior openings; ovicell at the back: (3) Pl. IV. fig. 9, mouth ovately triangular; upper lip arched, with pore, lower lip straight, with pore. Clusters of tubuli occur between the zoœcia (Pl. IV. fig. 6).

Ovicell-sacs (Pl. IV. figs. 8, 20) common, inflations of the zoarial surface or cells, enveloping several zoœcia, generally globose: upper surface often flat, the whole pierced and slashed with zoœcial and other openings.

Zoarial surface punctate with protruding pores, wrinkled where the zoœcia are few, the whole covered by an outer film pierced with fine pores.

The longitudinal section (Pl. II. fig. 10) illustrates the divergent growth of the zoœcia from the central part and around the axial tube. In the piriform central cell at the base are numerous reddish-brown, globular, crystalline bodies (Pl. IV. fig. 19). The axial tube also contains some reddish-brown crystals. Sections cut partly through and viewed as opaque objects are great aids in zoœcial study, and illustrate well the mode of growth (Pl. IV. fig. 21). Some details can often be seen by staining the specimen.

PERGENSIA JUGATA, var. BI-GIBBOSA, nov. (Pl. II. fig. 11; Pl. IV. figs. 14, 15.)

Same form as *P. jugata*, with slightly stouter zoœcia. Primary aperture coarctate (Pl. IV. fig. 14) with ovoid peristomial aperture; avicularium on the side of the zoœcium: ovicell-sacs cordate, or in the form of irregular cells or swellings (Pl. IV. fig. 15).

PERGENSIA GALEATA, sp. nov. (Pl. III. figs. 19, 20, 25–33.)

Zoarial width 1·3 mm.; zoœcial length 1·0 mm., zoœcial width 0·1 mm.; mouth 0·09 mm.

Zoarium erect, cylindrical, of nearly equal thickness throughout. Zoœcia tubular, obscurely arranged in a linear series, often compressed, exsert for one half or more of their length (Pl. III. fig. 27).

Zoœcia: (1) Pl. III. fig. 33, upper lip arched, aperture coarctate, peristomial aperture ovately triangular, thick; ovicell supra-oral, front mural pore triangular: (2) Pl. III. fig. 30, compressed, mouth filled with tubules, front wall having a furrow and a narrow ovoid opening; at the base an oval opening with very fine tubules (? ovicell): (3) Pl. III. figs. 25, 26, compressed, with two terminal rostra—one with tubules, the other with a narrow opening, a small opening at the junction of the rostra, an ovicell-sac or opening at the base, as in *Lekythopora hystrix*, MacGil.

Zoœcial covers (Pl. III. fig. 29) are scattered on the zoarial surface, whether pushed off at a certain stage of development, or sheared off in fossilization, it is hard to say. Surface punctate, with fine inter-pores.

The twin rostral processes spring from above a central opening or aperture, and are similar to the twin rostral processes of *Cellepora hastigera*, Busk.[1]

Summary.

1. The discovery in the Inferior Oolite of the South of England of bryozoa belonging to the Cheilostomata, a sub-order not definitely known below the Cretaceous group.

2. The occurrence in the same colony of bryozoa having the form of ovicell and long tubular zoœcia of the Cyclostomata, together with the appendages and apertures of the Cheilostomata.

3. The description of a new genus *Pergensia*, characterized by a long cylindrical axis, globose ovicell-sacs on the body of the zoarium and supra-oral ovicell, zoœcia with trifoliate opercular aperture or with various openings and tubules.

4. The description of the following species:—

Pergensia nidulata, *P. major*, *P. minima*, *P. porifera*, *P. amphoralis*, *P. jugata*, *P. jugata* var. *bi-gibbosa*, and *P. galeata*.

EXPLANATION OF PLATES II.–IV.

Plate II.

Fig. 1. *Pergensia nidulata*, sp. nov. ×12.
2. „ „ Longitudinal section, showing the axial tube. ×12.
3. „ *major*, sp. nov. Longitudinal section, showing the axial tube and ovicell-sac with termination. ×12.
4. „ „ ×12.
5. „ *amphoralis*, sp. nov., var. *a*. ×25.
6. „ *porifera*, sp. nov. ×25.
7. „ sp. Longitudinal section. ×20.
8. „ *amphoralis*, sp. nov. ×12.
9. „ *jugata*, sp. nov. ×12.
10. „ „ Longitudinal section, showing the axial tube and divergent growth of zoœcia. ×12.
11. „ „ var. *bi-gibbosa*. ×12.
12. „ *minima*, sp. nov. ×12.

[1] By Mr. R. Kirkpatrick's courtesy I was enabled to examine Busk's types in the British Museum (Natural History), at South Kensington.

PLATE III.

All the figures in this Plate are magnified 50 diameters, except fig. 27, which is ×12.

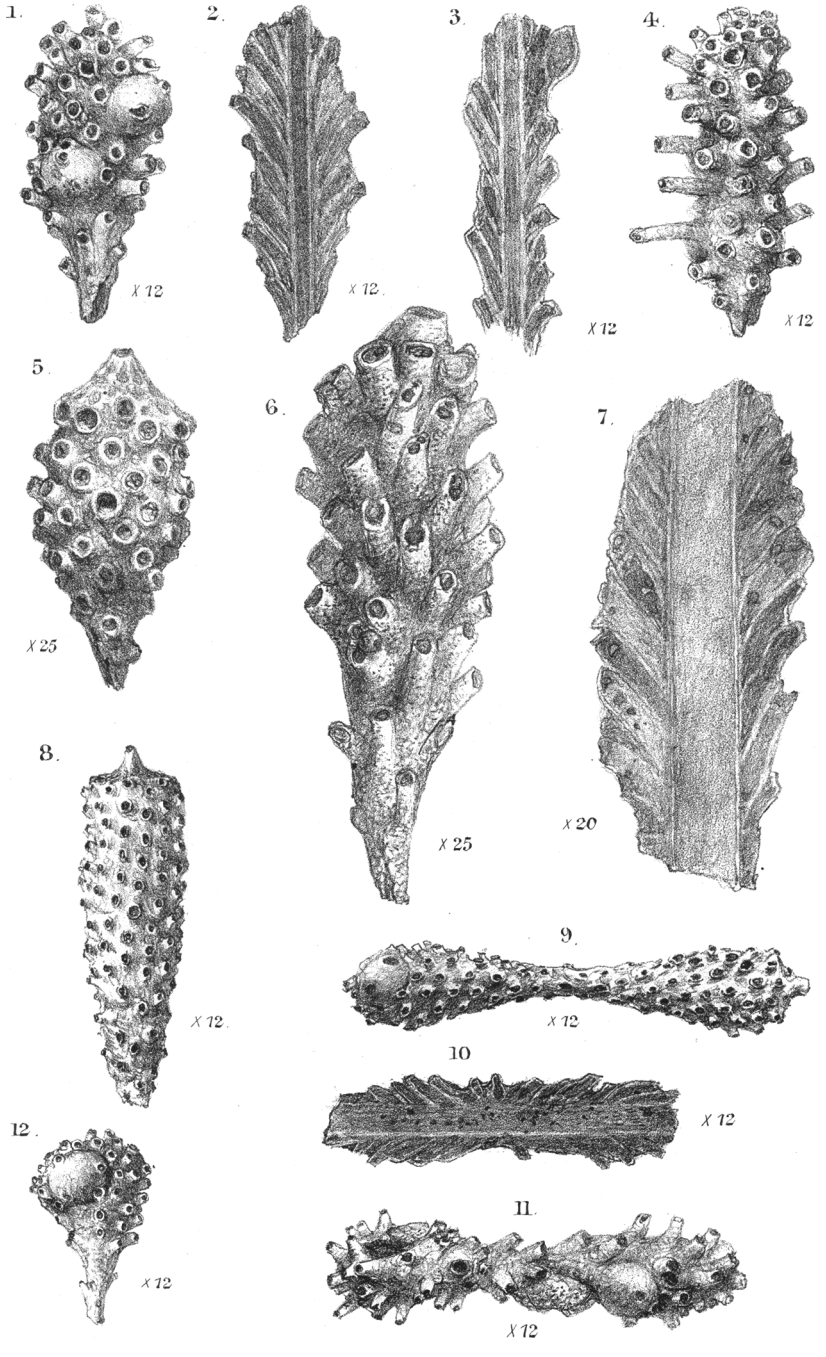
Fig. 1. Zoœcium of *Pergensia nidulata*, sp. nov. with supra-oral ovicell.
2. „ „ „ with apertural plate.
3. „ „ „ young.
4. „ „ „ with rostral processes, broken.
5. „ *Pergensia minima*, sp. nov.
6. „ „ „ with supra-oral ovicell.
7, 8, 9. Zoœcia of „ „ 7 and 8 viewed from different points.
10. Zoœcium of „ „ with apertural plate.
11, 12, 13. Zoœcia of *Pergensia major*, sp. nov. 12 and 13: the same zoœcium viewed from different points.
14. Zoœcium of „ „ with notched lip.
15. „ „ „ with mural opening at the back.
16. „ „ „
17, 18. Apertures of „ „
19. Zoœcium of *Pergensia galeata*, sp. nov.
20. „ „ „ with tubules.
21, 22, 23, 24. Zoœcia of *Pergensia amphoralis*, sp. nov.
27. *Pergensia galeata*, sp. nov.
25. Zoœcium of *Pergensia galeata*, with rostral processes and opening.
26. „ „ „ like fig. 25, but with basal (ovicell?) opening.
29. „ „ „ with termination displaced.
28, 30, 31, 32. Zoœcia of *Pergensia galeata*.
33. Zoœcium of *Pergensia galeata*, with mural pore.

PLATE IV.

Figs. 1, 2. Zoœcia of *Pergensia porifera*, sp. nov. ×50.
3. „ „ „ with broken mouth. ×50.
4. Zoœcium of „ „ with mural pore. ×50.
5. „ „ „ with mural pore and cover. ×50.
6. Zoœcia of *Pergensia jugata*, sp. nov. with clusters of interzoœcial tubules. ×50.
7. Zoœcium of „ „ „ terminal tubules & mural openings. ×50.
8. Ovicell-sac of „ „ ×50.
9–13. Zoœcia of „ „ ×50.
14. Ovicell-sac of *Pergensia jugata*, var. *bi-gibbosa*, nov. ×50.
15. Zoœcium of „ „ „ „ ×50.
16. Avicularium (?) of *Pergensia porifera*. ×50.
17. Zoœcium of „ „ ×50.
18. *Pergensia jugata*. End of zoarium, showing the compressed termination of the axial tube. ×25.
19. „ „ Longitudinal section, showing globose crystalline bodies in the cell and the axial tube. ×100.
20. „ „ Ovicell-sac. ×50.
21. „ „ Longitudinal section, partly cut through and viewed as an opaque object, to show the cell-arrangement above the axial tube. ×15.

DISCUSSION.

The PRESIDENT said that this was a paper which could be appreciated only after it was printed. Great interest attached to it, because the Author described a genus which blends together two sub-orders.



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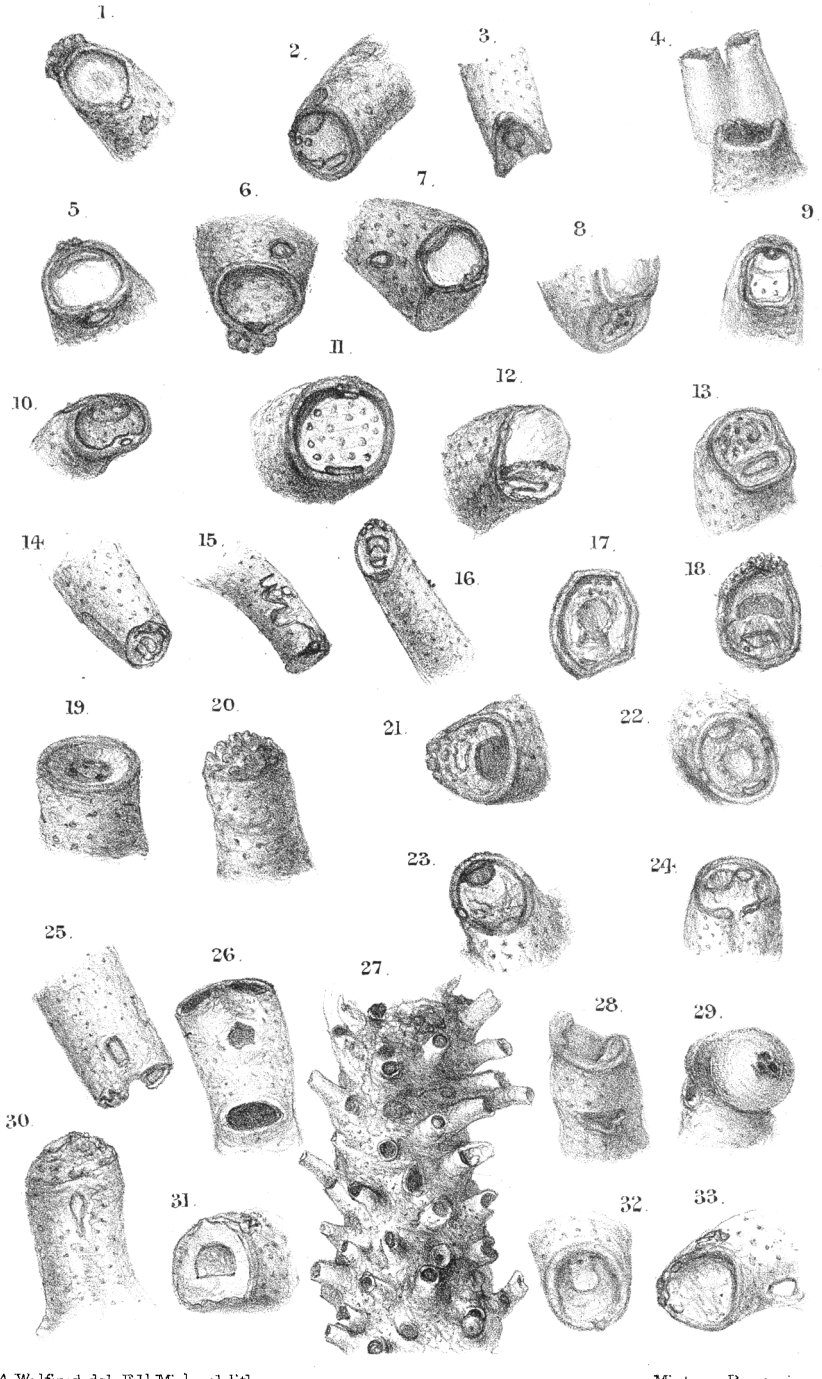
INFERIOR OOLITE BRYOZOA.



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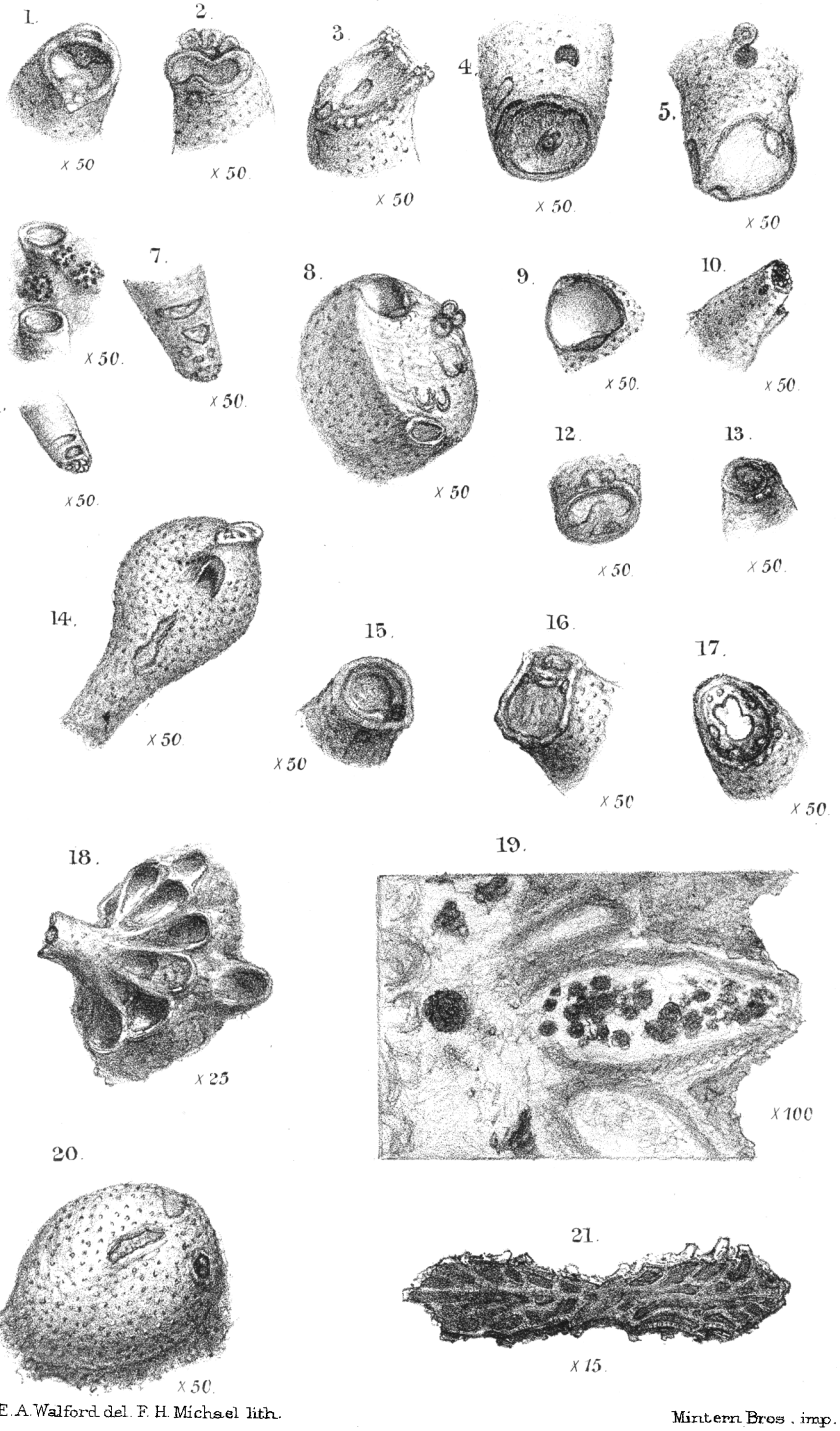

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