

XVII. *Descriptions of some new Species of Cuvier's Family of Brachiopoda.* By W. J. BRODERIP, Esq., Vice-Pres. of the Geological and Zoological Societies, F.R.S., L.S., &c.

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AMONG the great additions to our zoological information contributed by Mr. Cuming, some of the species about to be described will hold a distinguished place, in consequence of the opportunity which their preservation in spirit has afforded to my friend Mr. Owen for giving the details of the anatomy of Cuvier's family of *Brachiopoda*, with that acuteness and accuracy which mark his researches.

This family is, moreover, very interesting from its geological relations. The different species of *Terebratula* assist in the identification of strata from the supracretaceous group to some of the lowest formations in the grauwacke series, both inclusive; *Orbicula* is said to have been found in the lower green-sand of Sussex, in the Speeton clay of Yorkshire, in both the great and the inferior oolite, in the carboniferous limestone, and in the Ludlow rock below the old red sandstone; and *Lingula* in the inferior oolite of Yorkshire, in the old red sandstone formation, and in other old fossiliferous beds. That the organization of the recent animals is the same with that of those species which lived and died thousands of years ago, there can be no doubt; and we may thus form some conclusion as to the nature of those most ancient seas wherein the fossils existed.

Genus. TEREBRATULA, Brug.

1. TEREBRATULA CHILENSIS.

Tab. XXII. Fig. 1.

Ter. testâ suborbiculari, gibbâ, albente, radiatim striatâ, striis latioribus, margine subcrenulato, subflexuoso.

Long. $1\frac{3}{8}$ poll., lat. $1\frac{2}{7}$, crass. $\frac{5}{8}$.

Hab. in sinu Valparaiso.

Mus. Cuming.

This species varies much in size and appearance. In the older shells the radiated *striæ* almost disappear; and very young individuals are nearly smooth and oblong; while those of intermediate growth have the *striæ* strongly marked. The specimen of which the anatomy is given is a very young one, and the dimensions above recorded are those of the largest which I have seen. The length is taken from the extreme end of the perforation to the opposite rim, the breadth from an imaginary line

bisecting it, and the thickness from another imaginary line, supposed to be drawn through the middle of the two valves and the included space.

Mr. Cuming found this *Terebratula* in the Bay of Valparaiso, at a depth ranging from sixty to ninety fathoms. The older shells were attached to rocks, and the younger to *Corallines* and *Fuci*.

2. TEREBRATULA UVA.

Tab. XXII. Fig. 2.

Ter. testâ ovato-oblongâ, ventricosâ, subglabrâ, subdiaphanâ, lineis concentricis substriatâ; valvâ perforatâ subelongatâ.

Long. 1 poll., lat. $\frac{5}{8}$, diam. $\frac{7}{12}$.

Hab. in sinu Tehuantepec.

Mus. Cuming.

This *Terebratula* was found by Captain Dare, while dredging for *Meleagrinæ margaritifera*, attached to a dead sea-worn bivalve, at a depth of from ten to twelve fathoms, and on a bottom of sandy mud.

GENUS. ORBICULA, Cuv.

1. ORBICULA LAMELLOSA.

Tab. XXIII. Fig. 2.

Orb. testâ cornedâ, fuscâ, suborbiculari, subdepressâ, lamellis concentricis elevatis rugosâ.

Long. $1\frac{1}{10}$ poll., lat. 1.

Hab. ad Peruviae oras. (Iquiqui.—Bay of Ancon.)

Mus. Cuming.

This species was found by Mr. Cuming in groups, the individuals being in many instances piled in layers one over the other on a sandy bottom, at a depth ranging from five to nine fathoms. At Ancon they were found attached to dead shells, and also clinging to the wreck of a Spanish vessel of about 300 tons, which went down in the Bay about twelve years ago. The sunken timbers (for the sheathing was gone to decay,) were covered with these shells, much in the same way that beams on land are sometimes invested with flat parasitic *Fungi*. At Iquiqui they were taken adhering to a living *Mytilus*.

It is to be observed, that the bearded appearance round the border of many of the specimens is produced by the dried remains of the *cilia* of the mantle. The lower valve varies very much according to circumstances, being thinnest and smoothest when it is least exposed: in those instances where the adhesion is co-extensive with the surface, it is very thin. Generally it is convex where it rises from the depressed area of the perforated part; but this convexity depends so much on position and other accidental circumstances, that it cannot be relied on with any safety as a character.

The measurement merely relates to the extent of surface of the upper valve, the

length being taken from the extreme edge of the border above the perforation to the opposite rim; and the breadth following an imaginary line, bisecting the former at right angles.

2. ORBICULA CUMINGII.

Tab. XXIII. Fig. 1.

Orb. testâ subconicâ, suborbiculari, crassiusculâ, striis ab apice radiantibus numerosis; epidermide fuscâ.

Long. $\frac{7}{10}$ poll., lat. $\frac{8}{12}$.

Hab. ad Paytam Peruviae, ad Sanctam Elenam, et ad Panamam.

Mus. Cuming.

The concentric lines of growth in this species are crossed by the numerous *striae* which radiate from the *apex* of the upper valve. The under valve, which varies from convexity to flatness, is much the thinnest, and is only marked by the concentric lines.

Found by Mr. Cuming at the localities above given, attached to the lower sides of stones in sandy mud at low water, and in some instances at a depth of six fathoms. The remains of the *cilia* give a bearded appearance to the border of the shell in many of the dried specimens, as in *Orb. lamellosa*.

Orb. Cumingii approaches nearest to *Orb. striata*, described by Mr. G. B. Sowerby in the 'Transactions of the Linnean Society'.

3. ORBICULA STRIGATA.

Tab. XXIII. Fig. 1*.

Orb. testâ crassiusculâ, subrotundâ, substriatâ, radiatim castaneo strigatâ; epidermide tenui, fuscâ.

Long. $\frac{7}{12}$, lat. vix $\frac{7}{12}$, crass. $\frac{2}{12}$ poll.

Hab. ad Guatemalæ oras. (Isle of Caña.)

Mr. Cuming dredged two individuals of this species at the depth of eighteen fathoms. They were attached to rocks. The dimensions are taken from the largest specimen; but the smallest is figured on account of the superior brilliancy of the stripes.

Genus. LINGULA, Brug.

1. LINGULA AUDEBARDII.

Tab. XXIII. Fig. 14.

Ling. testâ oblongâ, glabrâ, cornedâ, pallidè flavâ, viridi transversim pictâ, limbo anteriore rotundato, viridi.

Long. $1\frac{2}{3}$ poll., lat. $\frac{5}{12}$.

Hab. ad Insulam Punam. (Bay of Guayaquil.)

Mus. Cuming.

The rounded anterior edge of this shell is green, and the transverse lines of that colour are produced by the progressive increase of the shell, which is smooth and parchment-like. In all the dried specimens the thin anterior edge is contracted into a square form, so as to produce a resemblance to a very square-toed shoe; but in its natural state this edge is rounded. A general contraction, moreover, gives the dried shells a narrower and more ventricose character than they really possess; and the remains of the *cilia* of the *branchiæ* give to their anterior edges a bearded appearance. The dimensions above given were taken from the largest specimen which I have seen: the individual dissected by Mr. Owen is comparatively small.

Mr. Cuming found this species, which bears the name of the Baron de Férussac, at about half-tide, in an extensive bottom of hard coarse sand, from four to six inches below its surface. The extent of the sand was about twelve miles long, and two miles wide.

2. LINGULA SEMEN.

Tab. XXIII. Fig. 17.

Ling. testâ ovato-oblongâ, crassiusculâ, planâ, albidâ, levissimâ, politâ, limbo anteriore rotundato.

Long. $\frac{9}{12}$ poll., lat. $\frac{4}{12}$.

Hab. ad Insulam Platam.

Mus. Cuming.

This shell, the only one I have seen, was dredged by Mr. Cuming in fine coral sand from a depth of seventeen fathoms. It may be a young individual; but the shell is so much firmer than it usually is in *Lingula* (so firm, indeed, as not to have contracted at all in drying), that I cannot but look on it as an undescribed species. In size and appearance it bears a near resemblance to a melon seed.

Mr. Cuming informs me that he found another specimen, about a line longer, at the same time and in the same place, but that he has unfortunately mislaid it.

PLATE XXII.

Fig. 1. TEREBRATULA CHILENSIS.

2. TEREBRATULA UVA.

PLATE XXIII.

Fig. 1. ORBICULA CUMINGII.

1*. ORBICULA STRIGATA.

2. ORBICULA LAMELLOSA.

14. LINGULA AUDEBARDII.

17. LINGULA SEMEN.

intermediate to the *Lamellibranchiate* and *Tunicate* orders; not, however, possessing, so far as they are at present known, distinctive characters of sufficient importance to justify their being regarded as a distinct class of *Mollusks*, but forming a separate group of equal value with the *Lamellibranchiata*.

PLATE XXII.

Anatomy of *Terebratula*.

Fig. 1. *Terebratula Chilensis*, Brod., natural size.

2. *Terebratula Uva*, Brod., natural size.

3. Perforate valve of *Terebratula Chilensis*.

a. The perforation, or groove, through which the tendons of the muscles pass to form the pedicle.

b. The teeth of the hinge, which are locked in the depressions *b. b.* of fig. 4.

c. The muscular impressions.

4. Imperforate valve of the same specimen.

a. The middle depression of the hinge.

b. b. The lateral depressions.

c. The mesial process, or ridge continued from the hinge.

d. The lateral processes of the same, which are attached to the bends of

e. e. The elastic calcareous loop.

f. f. Small processes at the origins of the *crura* of the loop.

g. g. Impressions of the anterior pair of muscles.

h. h. Impressions of the posterior pair.

Figs. 5. to 9. are dissections of a smaller specimen of *Ter. Chilensis* magnified two diameters.

5. The soft parts corresponding to the perforate valve.

6. The soft parts corresponding to the imperforate valve. The branchial vessels, brachial filaments, and liver, may be distinguished through the semi-transparent mantle.

7. The soft parts viewed from the same aspect as in Fig. 5, with the mantle-lobe reflected, showing more distinctly the branchial vessels, and exposing the arms in their natural position.

8. The soft parts viewed from the same aspect as in Fig. 6., with the mantle-lobe reflected, exposing part of the visceral mass, and the bend of the arms following the bend of the calcareous loop.

9. The mantle-lobes further separated, the calcareous loop broken through and removed, and the arms dissected off and displaced, to show the decussation of the muscles, and the small visceral mass.

Fig. 10. A small portion of one of the arms, magnified.

11. A small portion of the edge of the mantle, highly magnified.

a. The branchial *cilia*.

β. The marginal fringe.

γ. The marginal canal.

δ. The branchial artery.

ε. The branchial vein.

ζ. *Ova*.

12. The alimentary canal, as seen from above or behind, and a portion of the liver of *Terebratula psittacea*, Brug., magnified.

a. The mouth.

β. The *œsophagus*.

γ. The stomach, with the *parietes* imperfect where the liver has been removed: it is turned towards the left side, to show

δ. The intestine.

ε. The *anus*.

ζ. A portion of the liver.

13. A few of the hepatic follicles, highly magnified, showing the vascular network upon their *parietes* formed by the hepatic vessels.

14. *Terebratula psittacea*, with the greater part of the imperforate valve removed to show the soft parts.

14*. *Terebratula psittacea*, with the perforate valve and lobe of the mantle removed to show the arms, one of which has been artificially unfolded.

15. *Terebratula Sowerbii*, King, natural size: the greater part of the perforate valve has been removed to show the *ova* accompanying and obscuring the branchial vessels, seen through the mantle.

16. The separated valves of *Terebratula Sowerbii*: in the imperforate valve the arms, and one lobe of the mantle have been removed, to show the calcareous loop, visceral mass, muscles and *ova*, surrounding the vessels of the opposite mantle-lobes.

The following letters indicate the same parts in each figure.

a. The mantle-lobe of the imperforate valve.

b. The mesial fissure, corresponding to the mesial process of that valve.

c. The mantle-lobe of the perforate valve.

d. d. The fringed margins of the mantle.

e. The tubular prolongation accompanying the pedicle.

f. f. The anterior pair of muscles arising from the imperforate valve.

g. g. The posterior pair of muscles arising from the imperforate valve.

g'. g'. Fig. 16. The insertion of these muscles into the pedicle.

h. h. The anterior pair of muscles arising from the perforate valve.

- h. h.* Fig. 16. The insertions of these muscles into the opposite valve.
i. i. The posterior pair of muscles of the perforate valve.
k. k. The fringed *brachia*, or labial arms.
l. l. Their free spiral extremities.
m. m. The branchial vessels ramifying upon the mantle-lobes.
n. n. The two systemic hearts.
o. The mouth.
p. The stomach.
q. The liver.
r. The *ova*.

PLATE XXIII.

Anatomy of *Orbicula*.

- Fig. 1. *Orbicula Cumingii*, Brod., natural size.
 1*. *Orbicula strigata*, Brod.
 2. Group of *Orbicula lamellosa*, Brod., natural size.
 3. External surface of the lower or flattened valve of *Orbicula lamellosa*.
 4. Internal surface of the same.
 a. a. The muscular impressions.
 b. The fissure through which the pedicle passes.
 c. The central process, or ridge of the perforated valve.
 5. The soft parts of *Orbicula lamellosa*, *in situ*, after the removal of the convex valve; showing the ciliated and vascular mantle, the shell-muscles and visceral mass.
 6. The soft parts of *Orbicula lamellosa*, exposed by the removal of the flattened and perforated valve, showing a similarly organized mantle-lobe, and the expanded base of the pedicle, or foot.
 7. The soft parts, as in Fig. 5, farther exposed by reflecting the mantle-lobe. The stomach and decussating visceral muscles are shown by the removal of the liver and ovary.
 8. The soft parts, as in Fig. 6, similarly exposed by the reflection of the mantle-lobe, and the removal of the liver and ovary. The whole course of the intestinal canal is here seen.
 9. The visceral mass and reflected portions of the arms, with their spiral extremities, and the cavities in the muscular stem exposed. The alimentary canal, with the mouth and *anus*, and the liver and ovary, are shown.
 10. A side view of the soft parts, with the mantle-lobes separated to show the *anus* just below the bend of the right arm, the spiral extremity of which is unfolded.

- Fig. 11. A magnified view of the superior mantle-lobe injected, with the hearts, ovary, digestive and nervous systems.
12. A highly magnified view of a small portion of the brachial tentacles and stem.
13. A highly magnified view of a small portion of the edge of the mantle, showing the terminal divisions of the branchial vessels, and the setose *cilia*.

The same letters indicate the same parts in each figure.

- a. The mantle-lobe of the flattened or lower valve.
- b. The mesial fissure corresponding to the mesial process of the valve.
- b'. The shell-secreting edge prolonged beyond the roots of the *cilia*.
- c. The mantle-lobe of the convex or upper valve.
- d. d. The fringed margins of the mantle.
- d'. The long setose *cilia*.
- d''. The shorter *cilia*.
- e. The expanded peduncle.
- f. f. The anterior pair of shell-muscles.
- g. g. The posterior pair of shell-muscles.
- h. h. The anterior superior visceral muscles.
- i. i. The posterior inferior visceral muscles.
- k. k. The fringed *brachia*, or arms.
- k'. The transverse basis.
- l. l. The free spiral extremities.
- m. m. The canals in the fleshy basis of the arms.
- n. n. The branchial vessels. These are figured as injected at fig. 11. the dark lines n'. being the arteries.
- o. o. The two hearts. (The letters are placed in the orifices of communication with the veins of the opposite mantle-lobe.)
- p. p. The arteries going to the liver, ovary, &c.
- q. The mouth.
- r. The *œsophagus*.
- s. The stomach.
- t. The intestine.
- u. The *anus*.
- v. The liver.
- w. The ovary.
- x. The subœsophageal *ganglia*.
- y. The filaments from them.
- z. The circumscribing *aponeurosis* of the *viscera*.

14. *Lingula Audebardii*, Brod.

15. The soft parts of the same species, exposed by the removal of the upper

valve, or the one which corresponds to the imperforate valve of *Orbicula*, and to the perforate valve of *Terebratula*.

a. The shell-secreting margin of the mantle.

b. The cavity containing the roots of the *cilia*.

b'. The same laid open.

c. The *branchia*.

d. The branchial vein.

e. The interbranchial space of the mantle, which is also vascular.

f. The anterior muscles, attached at one extremity only to the shell.

g. The anterior pair of shell-muscles analogous to the anterior shell-muscles of *Orbicula*.

h. The third pair of muscles analogous to the decussating muscles of the *viscera* in *Orbicula*.

i. The posterior shell-muscle.

k. k. The liver seen through the mantle.

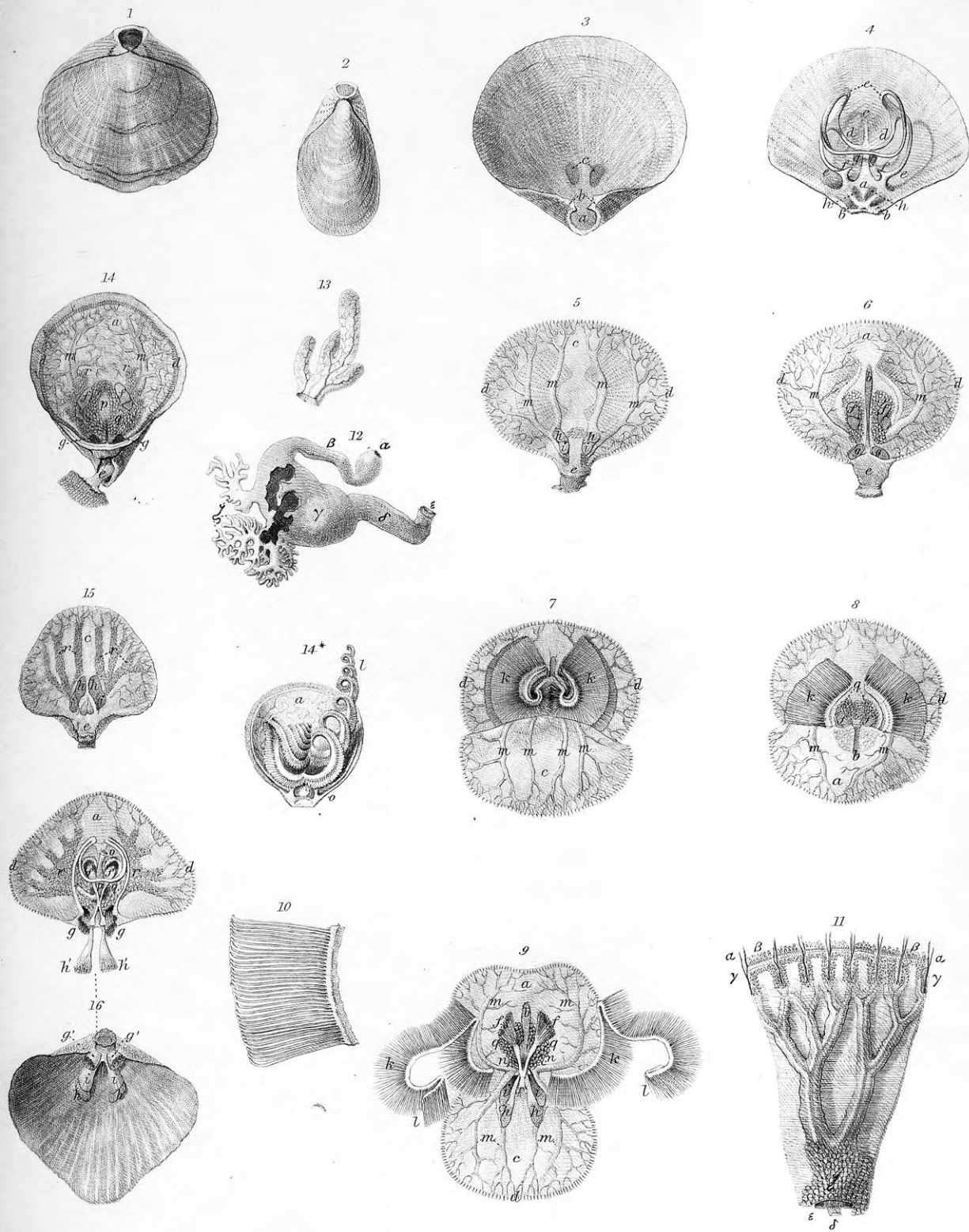
l. l. The straight portion of intestine.

m. m. The ovaries.

Fig. 16. A magnified view of the respiratory organs of one of the mantle-lobes.

a, b, b', c, d, e, signify the same parts as in the preceding figure.

17. *Lingula Semen*, Brod.

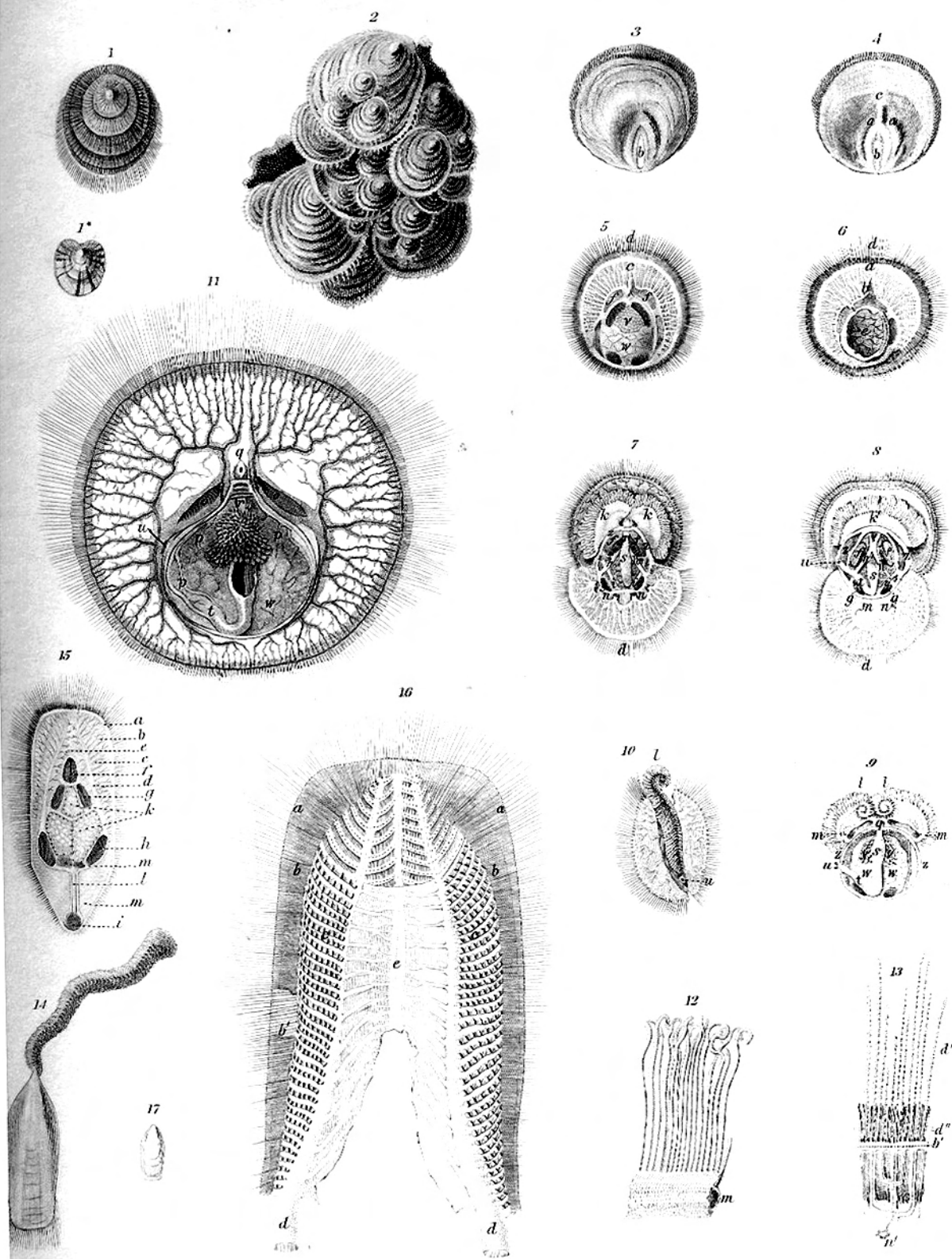


del.

Zeitter, s.c.

Terebratulina.

1 & 3-11. *Ter. Chilensis.* 2. *Ter. Uva.* 12-14. *Ter. psittacea.* 15-16. *Ter. Lowryi.*



a. & G. Sowerby, del.

Zeiller, sc.

Orbicula & Lingula.

Orb. Cumingii. 1. *Orb. strigata.* 2-13. *Orb. lamellosa.* 14-16. *Ling. Audubardi.* 17. *Ling. Cmen.*