

No. 1. — *Report on the Brachiopoda obtained by the United States Coast Survey Expedition, in Charge of L. F. DE POURTALÈS, with a Revision of the CRANIIDÆ and DISCINIDÆ by W. H. DALL.*

(COMMUNICATED BY PROFESSOR BENJ. PEIRCE, SUPERINTENDENT U. S. COAST SURVEY.)

IN the preparation of this paper I have been indebted to the Smithsonian Institution, under the direction of Professor Joseph Henry, for the use of their library and collection of recent brachiopods; to J. Gwyn Jeffreys, Esq., F. R. S., for kindly lending specimens of the brachiopods obtained by the English Deep-Sea Dredging Expedition, for comparison; and to Thomas Davidson, Esq., F. G. S., for many favors.

The animals which compose this class are of peculiar interest to the naturalist and geologist, as being represented in rocks of very early ages, and continuously through the various formations up to the present period. Their position in the natural system of classification being still a matter of discussion, all facts bearing on their anatomy and embryology are of the highest interest. I have endeavored, therefore, instead of compiling a mere list of species and descriptions, to enter as thoroughly into the details of anatomy as the means at hand would allow, and have considered the present a fit opportunity for rectifying the synonymy of some groups which, from the confusion in which they have been involved, have long been avoided by naturalists as stumbling-blocks.

It is hardly necessary to add, that I am indebted for the opportunity of doing this work to the kindness of Professor Agassiz, who placed the materials in my hands for examination, with the kind concurrence of M. de Pourtalès and Dr. William Stimpson

CLASS BRACHIOPODA CUVIER.

Animals provided with two shelly valves, each of which, normally, is bilaterally symmetrical. Valves united by three or more pairs of muscles, which, with all the other soft parts (except occasionally the intestine) are arranged in bilateral symmetry with relation to the longitudinal axis of the valves, respectively. Organs consisting essentially of a mantle com-

posed of two lobes, which have their anterior edges always disconnected, and which correspond to the valves of the shell; a disk of membrane, variously modified, with its edges fringed with a series of tubular brachia; a mouth situated within the posterior edge of this disk; a stomach with a more or less differentiated and anteriorly recurved intestine; a circulatory system more or less contained within a series of vessels and an atrial system of sinuses or lacunes; with a unilocular heart and usually one or two pairs of accessory pulsatile vesicles; with the genitalia usually suspended in the vascular sinuses and expelling their products through one or two pairs of oviducts opening externally; nervous ganglia in a ring surrounding the œsophagus; respiring oxygen by absorption through contact of the sea water with the surface of the tissues of the mantle and brachia; diœcious, and exclusively marine.

This diagnosis comprises all the characters which, after careful consideration, I find to be common to all the members of the class. There are other characters which are more or less characteristic of the more familiar forms of recent brachiopods, but which are not characteristic of the group as a whole. Thus, many of the recent forms are attached by a pedicel, while others in the same family are attached by the substance of the valves, and others of nearly allied groups are without an attachment of any kind. The shells of many brachiopods are perforated by minute tubuli lined by cœcal prolongations of the outer laminæ of the mantle lobes, while others in the same family, and perhaps, in some cases, in the same genus, are without these perforations. The mantle edge of many genera is provided with a more or less closely set border of setæ, while others in the same family are entirely without setæ, and even the same individual, in the earlier stages of its growth (but after the other organs are nearly complete) may be devoid of them. In some brachiopods the setæ are stated to be movable, while in others no muscles exist by which they might be moved. In some the blood is colored and in others colorless. The chemical composition of the shell differs in different genera, though in the great majority it is principally composed of carbonate of lime. The embryonic forms differ widely among themselves, some being segmented and possessing eye-spots like the fry of *Pneumodermon* and *Dentalium*, while others are unsegmented. In one genus the pedicel is developed out of the middle of the dorsal area of the embryo, so that the valves both bear a dorsal relation to the animal, while in others it would appear to extend from one extremity of the embryo, when the valves would bear a dorsal and ventral relation respectively.

It is evident that characters such as these, which are few of family, and none of ordinal value, can have no important bearing upon the classification of the group and its systematic position as a whole.

## ORDER ARTHROPOMATA OWEN.

- \*\* Syn. = *Arthropomata* OWEN, Enc. Brit. Ed., VIII, XV, Art. *Mollusca*, p. 336, 1858.  
 = *Brachiopodes, valves articulées* DESHAYES, An. s. Vert. Ed., II, VII, p. 309, 1836.  
 = *Palliobranchiata, testa cardine instructa* VAN DER HØEVEN, Handb. der Zoöl., p. 692, 1850.\*  
 = *Apygia* BRONN, Klass. Ordn. Thierr., III, 1 Abth. p. 301, 1862.  
 = *Articulata* HUXLEY, Lect. Class. 1864. Intr. Class. Anim., p. 116, 1869.  
 > < *Ancylobrachia + Cryptobrachia + Sclerobrachia + Sarcicobrachia* GRAY, Ann. Mag. Nat. Hist., II, pp. 435 - 438, 1848.  
 > < *Brachiopodés brachidés + B. cirridés* D'ORBIGNY, Cours Elém. Pal., II, p. 82, 1849.  
 > *Pedunculata* LATREILLE, Fam. Nat. Règ. An., p. 196, 1825.

*Characters.* Intestine ending in a closed sac. Lobes of the mantle united posteriorly. Valves articulated by teeth and sockets.

## FAMILY TEREBRATULIDÆ.

*Terebratulidæ* DALL, Am. Journ. Conch., VI, p. 101, 1870.  
 (*Thecidiidæ* exclus.)

## SUBFAMILY TEREBRATULINÆ DALL.

*Terebratulineæ* DALL, l. c. p. 101, 1870.

## GENUS TEREBRATULA AUCT. ex LLHWYD.

*Terebratula* LLHWYD, Lith. Britt. Ichn., 1699. Lam. Prodrôme, 1799. DALL Am. Jour. Conch., VI, p. 101, 1870.

Type *T. perovalis* SOWERBY, LAMARCK. *T. maxillata*, SOWERBY.

***Terebratula cubensis* POURTALÈS.**

*Terebratula cubensis* POURTALÈS, Bull. Mus. Comp. Zoöl., I, No. 7, p. 109, 1867.  
 DALL, Am. Jour. Conch., Vol. VI, pp. 105, 166, 1870.

*Terebratula vitrea*, var. DAVIDSON, Mon. Ital. Tert. Brach., I, p. 9, 1870; also JEFFREYS, in litt. (not of BORN).

Florida reefs, May, 1868, in 100 - 200 fathoms, rarer toward the east end of the reefs. Coast of Cuba near Havana, in 270 fathoms. Pourtalès, U. S. Coast Survey.

In upholding the specific distinctness of this species, which is without doubt closely allied to *T. vitrea*, I regret that I am obliged to differ from

\* I have adopted in the synonymy the very excellent system of notation proposed by Bronn and Strickland. This, or some similar system, is absolutely necessary for the comprehension of intricate synonymy. It is a matter of surprise that it has not been more generally adopted and made use of. The single asterisks denote references which I have not been able to verify by actual examination in person.

the distinguished naturalists whose names are quoted above. It must be admitted that honest differences of opinion may exist in regard to the specific limits of almost any species of animal; in this, as in other cases, I can only give utterance to my own personal opinion, based upon the material at my command. I have, in another publication, stated that I have found constant, though not extreme, differences between this species and *T. vitrea*, and, as no transition from the one to the other has yet been shown, I feel justified in considering these differences as of specific value. They were partly pointed out by M. de Pourtalès in his original description; and after a careful examination of many hundred specimens, and a critical comparison of them with a large series of *T. vitrea*, I have not been able to detect any inconstancy in the form of the loop in each species. While the other characters are more variable, yet even those show no more approach to each other than may usually be observed in two closely allied species.

The following comparative diagnoses will serve to point out these differences:—

*T. cubensis* has the margin of the valves laterally flexuous, varying to some extent in degree of flexuosity, with age. This diagnosis, however, refers to adult shells, in which a certain amount of flexuosity is always present. The convexity being in a hæmal direction, the margin of the hæmal valve is excavated on each side, giving the valve a subquadrangular aspect. The valves are usually rather inflated, giving the shell a tumid aspect. The hinge teeth are stout and thick, the deltidium moderate; foramen rather large. The shell is widest near the anterior margin of the valves, the cardinal border is strongly arched; the cardinal process is stout, blunt, broad, rounded and much recurved. The cardinal plate is divided; no shelly matter extending between the apophysal ridges. The shelly plates on each side of these ridges, extending to the dental ridges, are deeply concave, with the anterior border somewhat produced and rounded. The crura are short and blunt. The anterior part of the loop is characteristic and peculiar. It is strongly squarely convex in the middle, and a deep narrow gutter extends on each side of this convexity and is produced at each side into a point. Between these points and the median convexity on each side is a deep slit or fissure. The anterior end of the convexity is much produced, blunt, and square. It terminates behind in a slight sinus or indentation. The apex of the hæmal valve is much incurved.

*T. vitrea* has the lateral margins of the valves almost rectilinear, if there be any flexuosity the direction of the convexity is neural. Hence the outline of the hæmal valve is rounded ovate. The valves are more or less compressed, and there are frequently indications of a broad median ridge,

flattened and bounded by two obscure carinæ, which is never present in *T. cubensis*. The hinge teeth are slender and delicate, the deltidium much narrower, and the foramen usually smaller than in *T. cubensis*. The shell is widest behind the middle of the valves, giving a slight coffin-shaped aspect to the valves; the cardinal border is nearly straight, the cardinal process is slender, produced, and square at the end. The cardinal plate is divided, as in the last, the shelly plates on each side are nearly flat and anteriorly emarginated. The crura are sharply pointed. The anterior portion of the loop is but slightly convex in the middle, the gutters on each side are broad and shallow, there are no lateral slits, and instead of a median prolongation there is a deep, broad emargination or concavity in the anterior edge of this part of this loop. Instead of a sinus behind, there is a sharp point, which is, however, often broken off in dry specimens. The apex of the hæmal valve is not incurved. In fact, the shell of this species is flat where *T. cubensis* is concave, emarginated where *cubensis* is produced, entire where *cubensis* is fissured, broadest where *cubensis* is narrowest, narrowest where *cubensis* is widest, subearinate where *cubensis* is smoothly rounded, etc., etc. In both obscure fine radiating lines may be often seen. That these characters are constant throughout hundreds of specimens of *T. cubensis* I can testify from actual examination. I have found those here recorded of *T. vitrea* constant in some twenty specimens, and in all the *figures* of this species extant. Hence I have not the slightest hesitation in considering them as distinct species. The differences of the loops, solely, would distinguish them anywhere, and no more satisfactory specific character could be advanced.

In its general anatomy this species presents some similarity to *Waldheimia floridana*. I shall reserve a more explicit account of the structure for that species, and only mention here the anatomical points which appear more striking, and which are more or less peculiar to this species. Most of the soft parts are of a translucent yellowish white color. The mantle is of stouter consistency than in *W. floridana*, and may often be removed from the shell with but little injury if care be exercised. The muscles are similar in disposition to those of the other members of the *Terebratulidæ*, and present no new features. The peduncle is solid, cup-shaped at its extremity, and has the edge produced in cylindrical horny rootlets, which are attached to foreign bodies. The regular arrangement in layers of the muscles and corium, as well as the axial tube of the peduncle, found in *Lingula*, is less evident or absent in these forms. In this species the peduncle is very short and stout, broadly cordiform at its inner extremity when enveloped by its various tunics.

The brachia are arranged as in *T. vitrea*, as figured by Woodward; the central coil makes about four turns. The cirrhi are very short behind the

mouth, in front of the supra-œsophageal body. A striking feature in its anatomy, which I believe has not yet been noted in any publication on Brachiopods, is the absence of that great series of sinuses in the anterior part of mantle, which was termed by Hancock the "great pallial sinuses." So extraordinary did this appear to me, that I could not believe, at first, that I was not deceived by the translucency of the membranes, and it was only after an examination of many specimens that I became convinced that they did not exist in this species. There is in the free lobes of the mantle an extensive and extremely close and fine network of minute channels; or perhaps it might be said that the whole of the mantle lobes form one great lacune, the upper and lower walls of which are held apart by a profuse number of pillars of tissue, which appear like dark spots under the microscope, and which are situated so close together that the spaces about them are reduced to minute channels. This system occupies the anterior lobes of the mantle, which in some species also contain large branching sinuses, here absent. On the outer surface of the perivisceral chamber, above and below, on each side of the attachments of the principal muscles, a small system of sinuses exists, and here are situated the genitalia which necessarily assume a reticulated aspect quite different from the loops and branches seen in *Waldheimia* and *Terebratella*. In the inner lining of the mantle are scattered, everywhere, delicate branching spiculæ, looking like briars more than like deer-horns, and, while more or less interlocked, and here and there stout and thick, are still much more delicate and slender than those of *Terebratulina caput-serpentis* and *Megerlia truncata*, and do not often exhibit a stellar arrangement. They are much more numerous in some individuals than in others, and when present in abundance are found in almost every part of the epithelium, even to the brachial cirrhi, where the spicules are slender and not branched. They are especially numerous over the perivisceral chamber and in the supra-œsophageal tissue. The oral aperture presents no special peculiarities. The œsophagus is wide and funnel-shaped, narrowest at its junction with the stomach, which it enters at an acute angle. The stomach is small and oval, tapering toward the intestine, which is nearly twice as long as the œsophagus. In the stomach was a dark mass of calcareous granules, fragments of Foraminifera, etc., filling it quite full; among the *débris* was, in one specimen, the remains of a small red crustacean with a large carapax and (? six) legs, somewhat resembling a young *Limulus*, but much smaller. Other unrecognizable crustacean fragments were noticed in other cases. Notwithstanding the crowded state of the stomach, the intestine was always empty. Its cæcal end was somewhat blunt and rounded, and several fold-like thickenings of the mesentery recalled Hancock's figures of the termination of the intestine in *W. cranium*. The pointed lower ends of the

plicated openings of the oviducts were free from the body wall and attached to the parietal band on the anterior edge of the intestine a little way above the heart: first, by a tendinous process of considerable toughness; and, secondly, by the end of the plicated membrane itself. Between the two attachments a small foramen appeared, which seemed to be normal, but may possibly have been due to a lesion of the tissues. The heart in most specimens was pyriform and of moderately large size; in one or two it appeared of an hourglass shape, probably due to contraction. The disposition of the vessels was similar to that described by Hancock in *Terebratulina caput-serpentis*, as far as I was able to determine.

A very careful search was made for accessory pulsatile vesicles, but none were discovered, though I do not feel positive that they may not exist. The vessels which supply the genitalia are much looped and reticulated. The genitalia, as before mentioned, are situated in a reticulated series of sinuses, on the surfaces of the sides of the perivisceral tissues; this series does not pass in front of the muscular attachments, as far as I have been able to discover by repeated and careful examinations. It would seem as if this portion represented the pallial sinuses of Hancock, which exist in other genera, but which, in this species at least, seem to be suppressed anteriorly. The lacunes of the anterior portion of the mantle-lobe are homologous with the inner and outer pallial lacunes of Hancock. The genitalia agree in general features in all the specimens examined. They are of a yellowish color, and all appeared destitute of the reddish granular substance noticed in other species. On the other hand, a similar accumulation of reddish-yellow granules appears in the glandular funnels of the oviducts, which open by an oval and rather large aperture on each side, behind, and a short distance above the mouth.

Above and behind the mouth, and directly in front of the anterior ocluser (retractor) muscles, the external tissues of the perivisceral membrane are thickened, or a mass of cellular tissue is interposed between the laminae of the membrane. This causes a protuberance almost exactly resembling in shape and appearance a human nose. Below the inferior and most prominent portion of this protuberance is a deep groove or incised line, under which is another protuberance, short, wide, and transverse, shaped like a roll of parchment. For want of a better name I propose to call the lower protuberance the *supra-oesophageal body*; the fissure, the *inter-corporeal groove*; and the upper protuberance, the *nasi-form body*.

These organs do not exist in any of the species of Brachiopods (except *T. cubensis*) with which I am acquainted. Nothing of the kind is to be seen in *W. floridana*, *Terebratella coreanica*, *T. caurina*, *Waldheimia flavescens*, etc., etc. I am unable to say whether it occurs in *T. vitrea*,

but it is very likely that it does. What may be the office of these formations I cannot imagine, unless it may be to protect the muscles. In many specimens the nasiform body was crammed with spiculæ in one heterogeneous mass, forming an excellent shield for the muscles. The brachial cirrhi before these prominences were very much shorter than the others. I am not aware that these peculiar features have been noticed in any publication on this group. The hepatic digitations enter the stomach by two ducts on each side as in *W. floridana*, but are longer and more slender than in that species. The setæ are longer and more closely set in front than at the sides; they rarely are double in the same follicle; and in no case were more than two so noticed. They seemed to be almost uniformly broken off just beyond the edge of the mantle, but in those which remained unbroken no transverse markings were seen. A few dark pigment granules were noticed around the bases of the follicles, and a line of similar granules was seen between each two setæ, passing round the bases of the follicles and joining the next line, and so on continuously. The circumpallial muscle was narrow and slender.

No peculiarities of note were observed in the shell structure. The perforations appeared to be slightly further apart than in *T. vitrea*, but the difference was not much greater than that which may be observed in the shells of different individuals of the same species.

The external layer, mentioned by Hancock as occurring at the edges of the shells of other species, was well marked in perfect examples, and extended over a large part of the shells.

Attached to a piece of rock, dredged off the Samboes on the Florida coast, was a minute polished hyaline shell 4-100 of an inch in length, which, from its general appearance and the locality in which it was found, I believe to be the young of *T. cubensis*. That species is abundant in that locality, and the only other known species to which it might be referred is *W. floridana*. The latter, even in very small specimens, has quite a different aspect.

The shell in question was ovate, with the beak of the neural valve quite prominent, and with a small but sharply defined area. There was no deltidium, and the apex of the hæmal valve was somewhat prominent, recalling that of an embryonic (?) Brachiopod described by Mr. Jeffreys, under the name of *Terebratula capsula*. The punctures were very small and widely separated, arranged in quincunx order. The ends of the prisms of which the shelly matter is composed, by impinging upon the surface, gave it a beautifully reticulated or lacelike aspect. By gumming the lower valve to a piece of card, and allowing the end of a thread moistened with gum to dry fast upon the upper valve, I was fortunately able to separate the two without breaking them or injuring the remains of the animal within. These afforded some interesting notes.



*Muscular System.* — The muscles were of a dark reddish-brown, and consisted of a pair of cardinal muscles attached on each side of the notch in the hæmal valve, two pair of adductors in the usual position, and the pedicel muscle. No others could be distinguished.

*Brachia.* — There were no apophyses, and the brachia were supported by membranes of a horseshoe shape attaching them to the adductor muscles. They consisted of a single row of distant cirrhi attached to the edge of a horseshoe-shaped membrane, which passed behind the mouth and was broadest on each side of the mouth, and prolonged anteriorly about half the length of the valves, diminishing in breadth until it terminated in a point on each side. There was no loop in the literal sense of the word. On the outer edge of the membrane were long, slender, distant cirrhi, about ten on each side. On the inner side of the membrane were a few very short cirrhi, and the series was discontinued before passing below the mouth. The external cirrhi were continuous above or behind the mouth. They were tubular, hyaline, and presented transverse markings at short intervals, somewhat as if they were annulated. They were about .018 of an inch in length. The mantle was exceedingly thin, hyaline, with a plain edge, not furnished with setæ.

*Organs of Digestion.* — The mouth was transverse and small, the upper "lip" somewhat produced in the median line; the stomach was straight, short, bag-shaped, and a little constricted behind the mouth. Its termination was cæcal. Around the stomach a few yellowish hepatic digitations were observed. There were no other organs; intestine, ovaries, etc., being absent. The peduncle was short and slender.

The apex of the larger valve presented a curious appearance. It was not pointed, but kidney-shaped, and its consistency appeared to be somewhat granulated, differing from the rest of the shell in texture. The indentation lay in the median line just above the foramen. In the middle of the nucleus two well-marked pores or hyaline points, apparently perforations, were clearly visible. Around the edges of the nucleus the growth of the shell appeared to have been rather toward a bag-shape, and this gave an appearance of constriction around the edges of the nucleus. The upper margin of the arch of the foramen was a short distance below this. The upper part of the arch was closed by a very thin, transparent septum of shelly matter. The edge of the apex of the smaller valve appeared to be of the same granular texture as the nucleus, but this merged imperceptibly into the rest. There was no cardinal process, and a shallow emargination or notch of rounded shape completed the opening of the foramen when the valves were together. The cardinal muscles were attached on each side of this notch to the interior of the shell. The teeth of the hinge were already well marked.

**Terebratulina D'ORB.**

*Terebratulina* D'ORBIGNY, Comptes Rendus, XXV, p. 268, 1847.

Type *T. caput-serpentis* LIN. sp. Syst. Nat. Ed., XII, 1153, 1767.

**Terebratulina Cailleti CROSSE.**

*Terebratulina Cailleti* CROSSE, Journ. de Conchyl., XIII. (3d Series, V), p. 27, pl. i, figs. 1-3, 1865. POURTALÈS, Bull. Mus. Comp. Zoöl., I, No. 6, p. 109, 1867. DALL, Am. Journ. Conch., VI, p. 106, 1870.

This very distinct species was obtained by M. de Pourtalès off Chorrera, Cuba, in 270 fathoms; near Cojima, in 450 fathoms; off Double-headed-Shot Key, in 471 fathoms; and near Tennessee Reef, in 115 fathoms. Two specimens, from which the diagnosis of M. Crosse was drawn up, were obtained at the island of Guadaloupe in two hundred fathoms, by an Italian party who were searching for beds of coral. Although obtained in several localities, it does not appear to be an abundant species, as the number of specimens obtained by the United States Coast Survey Expedition was quite limited. It is well distinguished from other species by its granulated ribs, but varies so much in form and other characters, that I doubted whether all the specimens could be referred to Crosse's species, upon my first examination. They all differ from his figures in a remarkable auriculation of the valves and in the straightness of the hinge-line. These characters, though present, vary so much in the different specimens that I have come to the conclusion that the species is identical with his, and that his specimens were merely an extreme variety. The normal specimens, though varying in amount of inflation, almost exactly resemble *Terebratulina Michelottina* Davidson, described by that eminent palæontologist, in his monograph of the Italian Tertiary Brachiopoda (Geol. Mag., VII, No. 9), p. 14, September, 1870, pl. xix, figs. 22, a, b, c, from the Eocene (stage E) at Mossano, Italy. Were the two found living in the same seas, no one, I think, would hesitate to consider them identical. The median flexuosity is very variable, and often entirely absent. The nodulation of the ribs is more evident in young shells. They also vary from quite broad and flat to elongated and much inflated.

The smallest specimens of this species which I was able to find among those sent by M. de Pourtalès were nearly .1 of an inch in length. The characteristic sculpture was developed upon them to the very apex of the shell. The nucleus was already gone, being probably deciduous or soon lost by attrition upon the rocks to which the young shells attach themselves. The various muscles were already well developed. The mouth was as described in the young of the *T. cubensis*. The intestine was short, cylindrical, and straight. The lower portion was embraced by a few hepatic digitations. These lobes were very dark brown, the muscles of a

deep reddish-brown, and the brachia of a flesh-color. The latter were in the shape of a horseshoe, with no trace of a median lobe. They were close set and marked with transverse lines, as in *T. cubensis*. The membrane which covered the viscera was covered internally with irregular hyaline spots with well-marked boundaries, which no doubt are the limits of the lacunar channels of circulation. The mantle was quite transparent, with a brownish edge, and in each of the internal channels, corresponding to the ribs of the outside of the shell, was a single bristle, composed of longitudinal fibres of chitine, without any of the transverse markings which are seen in the setæ of the adult. The extreme tip of the bristle alone protruded from the mantle, and its inner extremity was slightly bulbous. It was of a glistening yellow color throughout. In those adults which I examined there were only five or six of these setæ in each mantle lobe. These specimens were obtained off Havana, in two hundred and seventy fathoms water.

The very extraordinary manner in which all the soft parts were crowded and crammed with masses of calcareous spiculæ defied my best efforts to obtain any very satisfactory results from the two or three alcoholic specimens at my command. A flocculent mass of white matter resisted the action of acid, and filled all the interstices of the membranes, so as to render them quite opaque. The genitalia were in such a condition that they were quite invisible, and the animals appeared to be out of season. The intestine was cylindrical, and ended much as it does in *T. caput-serpentis*. The mouth was surrounded by a dark-brown line. There were no structures above and behind the mouth, such as are described as existing in *T. cubensis*. The attached extremities of the muscles were of a very bright red-brown. Most of the specimens were overgrown with a tough, spongy organism, like velvet. The peduncle is white, slender, and exceedingly long, the exposed portion sometimes equalling in length one third of the shell. A brownish tinge pervaded all the tissues of the adult. Transverse markings were noticed on the brachia, as described in other species by Hancock.

One specimen growing on a rock which had become covered with sponge afforded an interesting observation. The peduncle was exceedingly long, and, on cleaning off the sponge, it was seen that the creature, on the growth of the sponge toward it, had apparently lengthened its peduncle to get out of the way; and while the original attachment still remained (and the glossy opalescent color of that part of the peduncle testified to its healthy condition), somewhat farther on, nearer the shell, a second attachment of the peduncle had taken place by the outgrowth, from the underside, of a bunch of cylindrical rootlets, exactly resembling the attachment of an ivy to a stone. The under side of the peduncle and the root-

lets were brown; the rest, opalescent white. It is true that there is no absolute proof that the peduncle had been lengthened, but I know not how else to explain the extraordinary length and second attachment, and I see nothing intrinsically improbable in the supposition.

#### GENUS WALDHEIMIA KING.

*Waldheimia* KING, Permian Fossils, p. 81, 1850. + *Eudesia* + *Macandrevia* KING.

Type *Waldheimia flavescens* LAM. sp. Hist., VII, p. 330, 1836.

#### *Waldheimia floridana* POURTALÈS.

*Waldheimia floridana* POURTALÈS, Bull. Mus. Comp. Zoöl., I, No. 7, p. 127, 1868. — DALL, Am. Journ. Conch., VI, p. 112, 1870.

*Terebratula septata* JEFFREYS, Proc. Royal Soc., 121, p. 446, ¶ 79, 1870.

*Terebratula septigera* JEFFREYS, l. c.

Not *T.* (*Terebratella*) *septata* PHILIPPI, Moll. Sicil., II, p. 68, t. 18, f. 7, 1844.

Not *T.* (*Waldheimia*) *septigera* LOVÈN, Ind. Moll. Scand., p. 29, 1846.

*T.* (*Waldheimia*) *peloritana*, var. JEFFREYS, l. c., not Seguenza Sicil. Brach., pl. vi, figs. 1–10, 1865.

Florida reefs, between 110 and 200 fathoms, rocky bottom, Pourtalès.

This species belongs to a peculiar group of the subgenus *Waldheimia* (*sensu stricto*), containing several recent and some fossil species. *Terebratula septata* Philippi, to which species *peloritana*, *septigera*, and *floridana* have been referred, proves to belong to a different genus (see Davidson, Mon. Ital. Tert. Brach.) from any of them. *T. peloritana* is referred by Mr. Davidson to *T. septigera*, in which Signor Seguenza concurs. We have, then, three allied but sufficiently distinct forms, as follows: *Waldheimia floridana* Pourt., *W. septigera* Lovèn, and *W. Raphaelis* Dall.\* The first is from the Florida coast, the second from the seas of Northern Europe, and the third from Japan.

The following table of measurements of large adult specimens will give an approximate idea of their respective forms:—

	Length, inch.	Width.	Diameter.
<i>W. floridana</i>	0.90	0.90	0.70
<i>W. septigera</i>	1.20	1.10	0.80
<i>W. Raphaelis</i>	1.75	1.30	1.00

Thus it is seen that the smallest species is by far the widest and most inflated, proportionately; the second species is the flattest, in proportion to its length; and the third is the most elongated. I have taken the largest adult specimens of each species for comparison; that of the *septigera* being far larger than the ordinary form of that species, as it is one collected by

\* Am. Journ. Conch., VI, p. 111, pl. vii, figs. a, b, c, d, 1870.

Mr. Jeffreys, F. R. S., on the British Deep-Sea Dredging Expedition, which was presented by him to M. de Pourtalès.\* The *W. floridana* presents very little variation among specimens of similar ages. A comparative diagnosis is here given.

*W. floridana*. — Color grayish or brownish white. Form nearly an equilateral triangle, widest near the anterior edge; much inflated. Anterior margin very strongly flexuous, the concavity being in the hæmal (dorsal) valve. The anterior corners of the hæmal valve sharply pointed. Area very narrow and short, deltidia just completing the foramen. Sides almost flat, neural (ventral) valve broadly channelled in the middle. Apex but slightly produced, short, rather acute. Cardinal process minute, pointed, not recurved. Hinge plate wider than long; anterior point over the septum, behind the crura of the apophyses. Hinge teeth very short and slender. Anterior ends of the lateral loops of the apophyses broadly flaring, the shelly portion of these loops broadest near their ends; hæmal arms of the apophyses close together and parallel for half the length of the shell. Narrowest part of the recurved loop near its posterior end. Visceral area small, muscular impressions within the posterior third of the dorsal valve. Stomach spherical with a long cylindrical intestine.

*W. septigera*. — Color as in the last. Form roundly ovate, somewhat truncated and wider in front. Anterior margin more or less flexuous. Anterior corners of the hæmal valve obtusely rounded. Area much wider and longer, solid, with no median line indicating a separation or division into deltidial plates. Sides rounded, inflated. Neural valve not channelled, slightly concave near the exuosity flat the anterior margin. Apex somewhat produced, blunt. Cardinal process broad, blunt, short, hardly differentiated from the hinge plate. Hinge plate longer than wide, anterior point passing forward between the crura. Hinge teeth very stout and strong. Anterior ends of the lateral loops incurved, their laminae widest near their posterior portion. Hæmal arms of the apophyses diverging in a wide curve from the hinge plate. Recurved part of the loop short, sides nearly parallel. Visceral area very small, muscular attachments even more posterior than in the last. Stomach posteriorly produced into a point, without differentiation of the intestine, and very much shorter than in the last.

*W. Raphaelis*. — Color deep brown. Form rather elongate, squarish, widest near the middle. Anterior margin sharply, shortly flexed. The

\* I have since had the opportunity, through the kindness of Mr. Jeffreys, of examining other and more normal forms of this and several other species obtained by him. These included one specimen of the *septigera*, which he regarded as a transition toward *W. floridana*, which has been figured for the Zoölogical Society, and which he very politely lent for comparison. It is elsewhere referred to.

convex flexuosities of the hæmal valve pointed, not at the outer corners, but nearer the median line. Area moderate, without any median line. Sides not inflated. Neural valve channelled for two thirds of its length, with two prominent rounded carinæ corresponding to the flexuosities of the margin. Apex very short and blunt. Cardinal process quadrate, long, abruptly recurved, like the blade of a hoe. Hinge plate longer than wide, anterior point passing between and almost beyond the crura. The latter are longer and more slender than in the previous species. Anterior ends of the lateral loops nearly parallel, the widest part of the shelly laminæ being near their posterior terminations, but the width of this part of the apophyses is nearly uniform from one end to the other. Hæmal arms of the apophyses diverging, in nearly straight lines, from the hinge plate. Recurved part of the loop proportionately much longer than in the two previous species; neural portion forming a regular ovoid. Visceral area very large, muscular impressions reaching the middle of the shell. Soft parts mostly unknown.

I have been thus explicit, perhaps more so than the subject requires, because the first two of our species have been united by Mr. Jeffreys, whose opinion is justly entitled to weight, though I am forced to disagree with him upon the present occasion. I consider *septigera* and *floridana* as two well-marked and distinct species, in which opinion I have reason to believe Mr. Davidson concurs. *W. septigera* and *Raphaelis* are more nearly allied, but the points of difference already noted are quite sufficient to distinguish them, aside from the habitat and the fact that the adult *Raphaelis* is twice the size of the largest *septigera* hitherto collected.\*

The greater portion of the mantle of *W. floridana* is of the most extreme tenuity and perfect transparency. It is furthermore so closely attached to the shell as to render its removal intact — even with the aid of acid — a matter of great difficulty. With this exception, the examination

\* In the specimen already alluded to, and regarded by Mr. Jeffreys as a transitional form between *septigera* and *floridana*, all the characters of *septigera* as above given are well marked. It differs from the ordinary forms of *septigera* in being proportionately wider than many of them, and in the sharper angles of the marginal flexuosities. But it is noticeable that these last are not at the anterior corners, as is always the case in *floridana*, but are strictly within the anterior margin at some little distance from the anterior corners, as is always the case in *septigera*. Hence I cannot admit that there is any transition exhibited in this specimen, but merely an exaggeration of the usual characters of the species. The apophyses are missing. One of the other specimens of *septigera*, in the same lot, fortunately preserved the ovaria, and I am glad to be able to state that they differ entirely in form and extent from the same organs in *W. Raphaelis*. This is a good character, though it varies somewhat, within certain limits. I must again thank Mr. Jeffreys for the kindness which he has shown in forwarding specimens for examination, — an example worthy of imitation by other naturalists, and well calculated to assist in dispelling false impressions, and in adding to the accuracy of scientific work.

of its anatomy is easy. The following notes are the result of a careful dissection of several specimens. The soft parts are mostly of a translucent whitish color. The number and disposition of the muscles are similar to those of *W. australis*, already described by various authors. The muscles themselves are of a glistening tendinous appearance, except at their points of attachment, where they are of a more or less dark yellowish-brown. The peduncle is moderately long, and the portion which is external or contained in the foramen is covered with a dark, horny reddish-brown membrane or skin, and the attached extremity is trumpet-shaped. Upon opening the shell in its normal position, the median spires of the brachia are seen to be somewhat widely separated, and between them is stretched a fine translucent membrane extending forward from the under lip of the mouth and following the downward curve of the median lobes. In this great extension of this membrane this species differs from *T. caput-serpentis* and *W. australis*, in which species the cirrhi of the median lobes touch at their extremities, and are separated by only a very narrow strip of membrane between their bases, so that the appearance is almost as if there was but a single broad band of cirrhi in the median line. This intervening membrane in ordinary specimens of *W. floridana* is about .24 of an inch in width at its narrowest visible portion. The upper and lower bands of cirrhi in the lateral loops are also much more widely separated by a similar membrane, than in *W. australis*. The reason of this appears in the fact that the brachial band follows the outer edge of the apophyses in both species until it curves downward in the middle, and the shelly portions of the apophyses in *W. floridana* are very much wider than in *W. australis*; hence the greater separation. The longest of the brachial cirrhi, in front, measure about .14 inch in length; those of that part of the band which passes behind the mouth are about the same length. They are, as in other species, disposed in a double row, the cirrhi of one row being opposite the spaces of the other. The spiral portion in the middle lobe makes about two complete turns. With regard to their disposition and the manner in which the cirrhi are set upon the brachial band, I can add nothing to the observations of Mr. Hancock, with which my own agree in every particular. A series of transverse lines at regular intervals was observed on the individual cirrhi, somewhat resembling in appearance the transverse markings on the setæ. The mouth is, as usual, just in front of the posterior junction of the brachial bands, and is in a rather long flexuous groove, the edges of which are of a dark brown color, and somewhat thickened. The upper or posterior lip, if such it may be called, has a forward prolongation or convexity in the median line, to which a slight concavity or indentation in the lower lip corresponds. The œsophagus is about half as long as the intestine, and has a slight curve, of which the

convexity is anterior; it is transversely flattened close to the mouth, and is a little compressed laterally, behind that portion. It is of a nearly uniform calibre throughout. It has quite a thin lining membrane, which becomes thicker, though still smooth, in the stomach, and quite thick and longitudinally plicated in the intestine. The stomach is well differentiated from the alimentary canal and intestine, and is of an oval shape. It is embraced by the hepatic digitations, which are of a greenish-yellow color, and empty into the stomach by four ducts. The orifices of these ducts are of a compressed oval shape, obliquely inclined, and the anterior pair, which correspond to the right and left anterior congeries of hepatic digitations, are twice as large as the posterior pair, which similarly correspond to the anterior lobes or bunches of digitations. The individual digitations appear to be longer, larger, and less numerous than those of *W. australis*, etc., as described by Hancock. They are traversed by numerous ducts and bloodvessels, and the hepatic matter, when separated, appeared to be of a granular consistency. Among the yellowish granules in the hepatic matter, both before breaking it down and afterward, were noticed certain darker granules, similar in general appearance to those found in the ovary. The digitations are distinctly arranged in four groups, of which the anterior pair are the larger. The upper and posterior surface of the stomach is bare, and the arrangement of the mesentery and the gastro- and ileo-parietal bands essentially agrees with the description of the same parts in other species of this group, as given by Hancock. The intestine is twice as long as the œsophagus, of uniform calibre, and perfectly straight. It leaves the stomach abruptly without any dilatation of the portion adjacent to the latter organ, and reaches about half-way to the dorsal valve. The heart is situated behind the junction of the stomach and intestine. The termination of the intestine is abruptly rounded off and not at all pointed. It is entirely closed, and is upheld by the mesentery. It is also of a much darker color than the rest of the alimentary canal, being of a deep chestnut-brown hue.

The great pallial sinuses and their ramifications in *W. floridana* are of much less extent and disposed in quite a different manner from that which obtains in *W. australis*. The hæmal pallial system consists essentially of four branches which are remarkable for their straight course and the paucity of their ramifications. The neural pallial system is very similar, with a greater number of small sinuses about the perivisceral cavity, but in both lobes the narrowness and small extent of the sinuses, as compared with those of other species, is very marked, and the same is true with regard to the ovaries. But a very few exceedingly delicate spiculæ were observed in the floor of the greater sinuses. The heart consists of a very minute pyriform vesicle situated behind the intestine at its junction with



the stomach, and sending one vessel in the hæmal direction along the median line of the stomach, and another on each side laterally. It is attached by its lesser extremity, and, contracted by the alcohol, appears exceedingly minute. A very careful search failed to reveal any accessory pulsatile vesicles, yet it is possible that, from their extremely small size, they may have been overlooked. The ovaries are very limited in extent and principally confined to that portion of the sinuses which surrounds the visceral cavity, only their ultimate extremities entering the larger branches of the great sinuses. Those in the hæmal valve are vermiform, slightly hooked at their posterior extremity. Those in the neural valve form open loops, with the "bight" posterior, and the two anterior extremities just entering the two outer sinuses. Their manner of suspension is the same as in the other species of the genus. The ova were visible in all stages of growth. Those floating free in the lacunes were nearly spherical, and of a flesh color; their substance seemed of a granular consistency, due perhaps to the action of the spirit in which they were preserved. The immature ova were pyriform, attached to the ovary by their pointed ends. With the yellowish matter of the ovary were interspersed specks of a brownish granular matter, which appeared dark yellowish under a high power and intermixed with what seemed to be fat-globules. Somewhat similar specks were observed in the hepatic matter. This was more abundant toward the middle line of the ovary, but was irregularly distributed. No spermatophoræ or spermatozoa were observed in any of the specimens examined. The oviducts were situated as in *W. australis*. The lining membrane of their trumpet-shaped portion was drawn into thin plicæ. Their apices were teat-shaped, with very small orifices.

The mantle margin is folded as in other species; the fold is deeper in the sides than in front, and not wide anywhere. The setæ are very slender and fine, irregularly marked with transverse lines, but smoother toward their outer ends. They protrude from their follicles, hardly more than one third of their length. In no instance was more than one seen to issue from a single follicle. The circumpallial muscular band is very slender and narrow. No coloring matter was observed in or about the follicles. The mantle edge was brownish, and seemed to have a slightly villous epithelium. No setellæ, such as I have elsewhere described as existing on the setæ of *Discina* and *Lingula*, were to be found.

I did not observe any noticeable peculiarity in the perforations of the shell-structure. The "suture" or breaking point, described by Messrs. Jeffreys and Carpenter in *W. cranium*, exists in all the species with a reflected loop, and is due to the deposition of the shelly matter of the loop in laminae parallel with the longer axis of the shell, which makes the loop weaker at the point of reflection than elsewhere.

## SUBFAMILY PLATIDIINÆ.

*Platidiinæ* DALL, Am. Journ. Conch., VI, p. 142, 1870.

## GENUS PLATIDIA COSTA.

*Platidia* O. G. COSTA, Faun. del Reg. Napoli, p. 47, January, 1852. — DALL, Am. Journ. Conch., VI, p. 142, 1870.

*Morrisia* DAVIDSON, An. Mag. Nat. Hist., p. 371, May, 1852, and the generality of authors.

***Platidia anomioides* SCACCHI sp.**

*Terebratula anomioides* SCACCHI; Phil. Moll. Sicil., II, p. 69, pl. xviii, fig. 9, 1844.

*Platidia anomioides* COSTA, l. c.; DALL, Am. Journ. Conch., VI, p. 143, figs. 20, 21, 1870.

This species was dredged off the Samboes on the Florida coast in two hundred and thirty-seven fathoms. This is the second genus (*Crania* being the other) of Brachiopoda which has been added to our fauna by the researches of the United States Coast Survey Expedition. It has since been obtained by Mr. J. Gwyn Jeffreys, F. R. S., of the English Deep-Sea Dredging Expedition on the Porcupine, in 1869, in the Shetland Channel, at a depth of three hundred and forty-five fathoms. Previously this species had only been known as an inhabitant of the Mediterranean in deep water. The specimen from the Florida coast presents no differences in size or general appearance from the Mediterranean form. The calcareous prisms of which the shell is composed, and the perforations, are remarkably large and conspicuous.

## SUBFAMILY MEGATHYRINÆ DALL.

*Megathyrinæ* DALL, Am. Journ. Conch., VI, p. 143, 1870.

*Argiopidæ* KING, Perm. Foss., p. 142, 1850.

Shell with a straight wide hinge line; apophyses consisting of a submarginal loop, attached to the hinge margin, provided with crura and intersected by one or more submarginal elevations or septa.

Brachia in a single series, following the loop, surrounding a smooth disk or membrane, in the posterior median portion of which the mouth is situated. Setæ absent from the mantle edge. Pedunculated.

## GENUS MEGATHYRIS D'ORB.

*Megathyris* D'ORBIGNY, Pal. Fran. Ter. Cret., p. 147, 1847. — DALL, Am. Journ. Conch., VI, p. 144, 1870.

*Argiope* DESLONGCHAMPS, Mém. Soc. Lin. Norm., VII, p. 9, 1842.

Not *Argiope* SAVIGNY, Desc. de l'Égypte, XXII, p. 334, 1827. — THORELL, Ann. Mag. Nat. Hist., p. 190, 1868; a genus of spiders.

It has been stated by some authors that Savigny's name was *Argyope* or *Argyopes*, and hence not synonymous with *Argiope*, Desl.; but this is an error, which a reference to Thorell's paper, or to the original work of Savigny, will enable any one to correct.

#### SUBGENUS CISTELLA GRAY.

*Cistella* GRAY, B. M. Cat., p. 114, January, 1853. — DALL, l. c. p. 145.

*Zellania* MOORE, Proc. Som. Arch. Nat. Hist. Soc., 1854.

Shell with a single submarginal septum and bilobed loop. Surface smooth or radiately ribbed. Brachia deeply emarginated by the septum. Cardinal process absent or inconspicuous.

Type *Cistella cuneata* Risso sp., 1826.

Habitat: living in the Mediterranean.

#### *Cistella* (? **Schrammi** var.) **rubrotincta**.

?? *Argiope Schrammi* (var.) CROSSE and FISCHER, Journ. de Conchyl., XIV (3<sup>me</sup> Ser. VI), p. 269, pl. viii, fig. 6, 1866. = *Cistella Schrammi* DALL, Am. Journ. Conch., VI, p. 146, 1870.

West of Tortugas, 30 to 43 fathoms, January 14, 1869, Pourtalès. Guadeloupe, W. I., 200 to 250 fathoms, Crosse and Fischer.

Shell small, semicircular, with the area at right angles to the plane of the hæmal (dorsal) valve. Hæmal valve rather flat, with about ten pale yellow rather strong ribs with brilliant scarlet interspaces; a slight depression externally may be noticed on the surface of the valve, and occasionally an attempt at a median rib, near the margin. Interior whitish, marked by the punctations which are clearly visible to the naked eye in a good light. Margin smooth, except for the fimbriated appearance caused by the incomplete marginal perforations which are visible as grooves under a lens. Hinge line straight, without area, hinge plate, or distinct cardinal process. Septum triangular, extending from the hinge margin to the anterior border of the shell. Most elevated point, forming the apex of the triangle in the middle of the valve, rather bulbous and of a red color. Anterior slope of the septum to the border of the shell, straight without nodules; this part of the septum is thin and even. Posterior slope of the septum irregularly concave, thick, and nodulous, tapering to a point at the hinge margin. On either side of the septum below its apex is a transverse wing or plate at right angles to the septum, of a thick nodulous form, the two wings, taken together, presenting a heart-shaped plate with the broad end downward. These extensions, however, are not confluent with the valve, except close in by the base of the septum. Apophyses attached to the hinge margin, provided with rather broad crura pointing toward each other horizontally; the lower edges of the laminae of the apophyses con-

fluent with the shell throughout its entire length, and attached to the septum a short distance in front of the transverse plate, and running up on the sides of the thin part of the septum for a short distance. Area behind the laminae much thickened for the muscular impressions, excavated beneath the lower edges of the transverse septal plate. Hinge margin as wide as the shell, deeply grooved for the reception of the teeth of the neural valve.

Neural valve convex, with a straight hinge margin and broad area. Foramen usually much eroded; deltidia rudimentary, widely separated; hinge teeth strong. Interior of the valve with a low well-marked septum, rounded, broadest near the middle of the valve, where its upper edge is somewhat excavated; extending from the edge of the foramen to the anterior border of the shell, where there is a slight indentation. Length of the shell .15 inch, width .18 inch.

This shell, of which a moderately large series was obtained, has a general resemblance in form to *C. Schrammi*, but has a greater number of ribs, wants the smooth mesial area, and is of a totally different coloration, being scarlet with pale yellow ribs, while *Schrammi* is figured of a rufous brown, paler on the beaks. There are some discrepancies between the figure and the description of *C. Schrammi*, and, in spite of the apparent differences, I do not feel confident that the shells before me, and those described by Crosse and Fischer, are more than varieties of one species. The form of the septum and the transverse lamina at once separate the Coast Survey shells from any other species, but of *C. Schrammi*, unfortunately, the apophyses are not figured. I have, therefore, indicated the present form under a provisional varietal name, which will serve to distinguish it until more exact knowledge is attained. I should add that the scarlet color is not distributed in solid rays, but, under a lens, appears in concentric lines transverse to the ribs and broadest in the interspaces.

The examination of the soft parts of this species added nothing new. It appeared to resemble the next species in every particular. The ovaria were three-branched in the neural valve. The size and extent of the transverse plate of the septum varied in different specimens.

#### **Cistella (? Barrettiana var.) lutea.**

?? *Argiope Barrettiana* DAV., P. Z. S., February, 1866, p. 103, pl. xii, fig. 3.

= *Cistella Barrettiana* DALL, Am. Journ. Conch., VI, p. 146, 1870.

?? *Argiope Antillarum* CROSSE and FISCHER, Journ. de Conchyl., XIV (3<sup>me</sup> Sér.

VI), March, 1866, p. 270, pl. viii, fig. 7. = *Cistella Antillarum* DALL, Am. Journ. Conch., VI, p. 146, 1870.

Tortugas, 30 - 43 fathoms, POURTALÈS. Northeast coast of Jamaica, 150 fathoms, BARRETT, DAV. Guadeloupe, W. I., 200 - 250 fathoms, CROSSE and FISCHER.

Shell uniform light brownish-white; with twelve principal radiating ribs on each valve, and secondary riblets between them, toward the margin. Neural valve with a more or less marked depression extending from the beak to the anterior margin, where it forms a slight convexity. Corresponding to this internally is a slight rounded ridge. Hinge line straight, sides and anterior margin slightly rounded. Area flat, smooth, as wide as the shell. Pseudo-deltidia large, triangular, widely separated. Foramen very large and usually much eroded. Hinge teeth moderately large and strong. Muscular impressions very posterior, hidden beneath the area when viewed from above. Margin slightly crenulated. A few faint striae discernible upon the surface of the ribs. Hæmal valve smaller, flatter, with a straight hinge line slightly emarginated in the middle, no area or cardinal process; teeth and sockets large and strong. Septum large and stout, composed of three or four radiating ribs, with thin shelly matter between them, forming nodules and notches on the upper edge; the whole of a subtriangular form somewhat resembling a half-opened fan. Posterior edge slightly concave, reaching a little behind the middle of the shell; anterior edge reaching the anterior margin of the shell, which is here slightly concave or emarginated, giving the valve a somewhat bilobed appearance. Muscular impressions much thickened, forming two rather concave disks. Apophyses consisting of two hæmal bands attached to the hinge margin, first with two broad crura pointing toward the median line, the arms of the apophyses extending in a rounded curve within the middle third of the shell, and attached by their lower edges to the thick disk-like muscular scars, and, lastly, to the septum on each side about its middle, close to the shell. Cardinal plate, or hinge plate, absent. Area behind the muscular disks somewhat excavated.

The anterior portion of the apophyses is more posterior than in *C. Neapolitana*, and the margin is not granulated as in that species. It would seem from Mr. Davidson's figures that the loop of *Cistella Barrettiana* Dav., is more anterior than in this species; the latter being also unprovided with the posterior extension of the septum seen in the figures of the former, and being, moreover, entirely destitute of the red markings between the ribs. It agrees with *C. Antillarum* Crosse and Fischer, as figured in general appearance, but wants the red markings attributed, in the description, to that species, and the ribs are also carried over the apex, while that portion of *C. Antillarum* is described as smooth. No comparisons can be drawn in regard to the apophyses, as Crosse and Fischer did not figure those of their species. It is possible that the present species, *C. Antillarum* and *C. Barrettiana* are forms of one species, in which case the last name has priority, or it may be that the two latter are distinct from the present species,

though synonymous with each other; but they should not, as M. Crosse observes in a letter on the subject, be united until clear proofs are shown of identity, and therefore I have proposed for the present form a provisional varietal name, which may serve to distinguish it until the question is settled by the comparison of specimens. My largest specimen measured .26 inches wide by .18 long.

Small as is this species, it is considerably larger than those of the Mediterranean, and it was with much interest that I submitted it to an anatomical examination.

I have not met with much success among these small species in the use of acid in dissolving away the shell from the animal, and have been principally obliged to work with specimens forcibly removed from their shells, — a process which is not calculated to present the parts in the best condition. Nevertheless, I have been able to determine some points of interest in a satisfactory manner.

The brachia in this and the other species of the genus are arranged around the edge of a broad membrane, which covers the concavity of the shell, like a drumhead. The hoop of the drum is represented by the apophyses. The brachia differ from the same organs in the *Terebratulinae* in being arranged in a single series instead of a double one. Of this there can be no doubt, it is very evident upon a casual inspection, and is entirely confirmed by careful dissections. In this species the drumhead membrane is divided into two lobes by the septum. The edges of these lobes are fringed with the brachia. The latter, in the alcoholic specimens, show distinct transverse markings. They are usually curled up in front and on each side, while those which are situated behind the mouth are longer than the others, and usually lie smoothly over them, extending forward without any marked curve, pointing toward the anterior margin of the shell, and extending clear over the central membrane, even beyond the posterior edge of the septum. The brachia are covered with an epithelium furnished with cilia, are tubular, and communicate with a series of brachial channels, which did not appear to differ from those of *Waldheimia* as described by Hancock, as far as I was able to discover. The great brachial canal was rendered conspicuous by a band of cartilaginous substance which seemed to form its external covering, or rather beneath which it was situated, and which was longitudinally striated. The external edge of the membranes, between which the apophyses were formed, was directly attached to the pallial lobes at the points where the apophyses are attached to the muscular disks of attachment already described. On either side of this attachment, however, was a kind of pocket, opening externally, where the brachial and pallial membranes did not coalesce; and, there being one on each side of the point of union, there were consequently four in all,

two on each side of the septum.\* The drumhead membrane, covering the space inside of the brachia, was translucent white or opalescent, and quite thick and tough toward the middle of each lobe.

I am inclined to think that an error has been perpetuated in regard to the position of the mouth of *Megathyris decollata*. It has been figured and described by Woodward as being of a circular form, and situated in the midst of the drumhead membrane. It is certainly not so situated in *Cistella*; and I do not believe that it is in *Megathyris*, though I have only seen dry specimens. In the present species it is placed, as in all the *Terebratulidæ*, at the back of this membrane, just in front of the posterior junction of the brachia, and at the bottom of a deep transverse groove which is of a stout membranous consistency, and the two sides of which, for convenience' sake, I have called the lips (*labia*). In the present species the oral groove is situated far back and close to the brachia, which are exceptionally long behind it, as already described. It is, in fact, entirely hidden by them until they are laid back. The groove is very long and quite deep, the entrance to the œsophagus being trumpet-shaped and flattened transversely. Were the brachia disposed as in Woodward's figure, the oral groove would be hidden. I am disposed to think that this was really the case in the specimen figured, and that the extraordinary circular mouth there figured was an accidental lesion of the dry tissues, which might easily be taken for a mouth in so small an animal. The labia, in all the Brachiopods I have examined so far, have invariably exhibited a tinge of darker color than the surrounding tissues. The present case forms no exception. The posterior lip presents a small prominence in the median line, and the anterior lip a small emargination or concavity below this prominence. This structure is also common to all the Brachiopods I have examined.

The œsophagus is wide, transversely flattened, with thin walls, and of an orange color. It enters the stomach nearly at a right angle, without much dilation. The stomach is oval with thicker and firmer walls; the inner lining appearing slightly villous and rugose. The intestine is not differentiated from the stomach on the lower side, but on the upper side a deep groove occurs at the juncture. The canal is stout and thick at its lower extremity, tapers slightly, and terminates in a somewhat bulbous, but pointed cæcal extremity, attached to the perivisceral membrane. The various membranous bands which support the alimentary system present no differences from the homologous structures in other species of the *Terebratulidæ*. The stomach was filled in each case with a yellowish flocculent matter. The hepatic lobules resembled those of other species, entering

\* There is but one on each side, close to the hinge margin, in the last species.

the stomach by two ducts on each side, of which the anterior were the larger. They did not extend over or cover the sides of the intestine.

The heart is extremely small and difficult to find. It is situated lower down than in most species and between and hidden by the hepatic lobules. It is nearly spherical. No accessory pulsatile vesicles were found after close scrutiny.

The ovaries differ in appearance from those of *Waldheimia* and *Terebratulina*. They hang like a frill or puckered ribbon-like lamina from the pallial membranes, and form a simple loop on each side of each valve. Those of the hamal (dorsal) valve were most developed. The ends of the loops extended into the great pallial sinuses. The rounded granules which studded the frills were of two kinds. Those at or near the extreme edge were of a pellucid deep brown hue, while those closer to the pallial membranes were mostly of a pale yellowish color and quite opaque. The oviducts are very inconspicuous and not easily found. They are situated in the usual position, but exhibit only a very few short folds, and the external opening directly in the midst of them, instead of being at the end of a rather long duct, as in other forms. There are only two of them. They do not appear to be attached to the intestine or mesenteries, but lie flatly upon the parietes.

The pallial sinuses are comparatively insignificant in this species, being very narrow, almost linear, channels with few branches. A few spiculæ were observed in some of them. The margin of the mantle is perfectly plain, without setæ, and adhering closely to the shell. Yet the circumpallial muscular band is much broader than usual and strongly marked. When torn from the shell, the cæcal prolongations of the mantle were beautifully shown. They were often bifurcate and occasionally had three or even four branches.

The punctate structure of the shell was very coarse. Even the crura and laminae of the apophyses were punctate.

The nervous system was not traced out, but the œsophageal ganglia presented no special peculiarities.

The border of the mantle appeared to be ciliated. The peduncle, so wide and short as to resemble a mere muscular disk, was strongly attached to the shell by the peduncular muscle, beside which a broad tendinous band appeared to pass entirely across, in front of the dorsal adjustors (posterior retractors of Owen), giving an additional solidity and firmness to the attachments of the peduncle. The extremities of all the muscles were very much enlarged and thickened, while their median portions were slender and tendinous. No striated fibres were observed.



## ORDER LYOPOMATA OWEN.

- Syn. = *Lyopomata* OWEN, Enc. Brit., Ed. VIII, XV, Article *Mollusca*, p. 339, 1858.  
 = *Brachiopodes, valves libres* DESHAYES, LAMK., An. s. Vert., 2<sup>d</sup>e Ed., VII, p. 309, 1836.  
 = *Palliobranchiata, testa acardis* VAN DER HØEVEN, Handb. der Zoöl., p. 692, 1850.  
 = *Pleuropygia* BRONN, Klass. Ordn. Thierr., III, 1 Abth., p. 301, 1862.  
 = *Inarticulata* HUXLEY, Lect. Class., 1864. Intr. Class. Anim., p. 116, 1869.  
 >< *Pedunculata* + *Sessilia* LATREILLE, Fam. Nat. Règ. Anim., p. 204, 1825.  
 < *Brachiopodes brachidés* D'ORBIGNY, Cours. Élém. Pal., II, p. 82, 1849.  
 < *Sarcicobrachia* GRAY, Ann. Mag. Nat. Hist. 2d Ser. II, p. 438, 1848.

*Characters.* Arms free, unsupported by shelly apophyses. Intestine opening by a lateral anus. Lobes of the mantle disunited all around their borders. Brachia without a distinct median lobe. Shell, in most cases, without hinge teeth, articulation, or cardinal process.

## FAMILY CRANIIDÆ.

- Syn. = *Craniidæ* H. and A. ADAMS, Gen. Rec. Moll., II, p. 583, 1858. — JEFFREYS, Brit. Conch., II, p. 24, 1863.  
 = *Cranidæ* OWEN, Anat. Inv. Index, p. 683, 1855. — D'ORBIGNY, Cours Élém. Pal., II, p. 90, 1849.  
 = *Cranidées* D'ORBIGNY, Pal. Fran. Ter. Crét., IV, 1844.\* Comptes Rendus, XXV, p. 269, 1847. An. Sci. Nat. c. xiii, p. 350, 1850\* (fide GRAY, B. M. Cat.).  
 = *Craniadæ* GRAY, Syn. Brit. Mus., p. 155, 1840.\* — *IBID.*, l. c., p. 88, 1842. P. Z. S., p. 202, 1847. Ann. Nat. Hist., 2d Ser., II, p. 438, 1848. — DAVIDSON, Int. Class. Brach., p. 51, 1851. — WOODWARD, Man. Rec. and Foss. Shells, p. 235, 1854. — OWEN, Anat. Inv., p. 503, 1855. — CLARK, Brit. Test. Moll., p. 37, 1855. — GOSSE, Mar. Zoöl., II, p. 80, 1856. — DAVIDSON, Mem. Lin. Soc. Norm., X, p. 84, 1856. — SUESS, Wohns. der Brach., p. 38 (220), 1859. — MRS. GRAY'S Moll., IV, p. 202, 1859. — CARPENTER, Lect. Moll. Smithsonian Rep., p. 276, 1860. — CHENU, Man. de Conchyl., II, p. 230, 1862. — BRONN, Klass. Ordn. Thierr., III, 1 Abth., p. 301, 1862.  
 = *Craniadées* DAVIDSON, Mém. Soc. Lin. Norm., X, p. 226, 1856.  
 < *Les Cranies* FÉRUSAC, Tabl. Syst., folio 38, 1819. — RANG, Man. Moll., p. 262, 1829. — DESHAYES, Enc. Méth., II, Table, 1830. Hist. An. s. Vert., 2<sup>d</sup>e Ed., VII, p. 309, 1836.  
 < *Cranie* HERRMANNSEN, Ind. Gen. Mal., I, p. 315, 1846 (as of FÉR. RANG, and DESH).

- < *Craniaceæ* MENKE, Syn., p. 56, 1828,\* olim.  
 < *Craniacea* MENKE, Syn., Ed. II, p. 96, 1830. — ANTON Verz., p. xii, 1839. — AGASSIZ, Nomencl. Fasc. IX, p. 31, 1846. — MÆRCH, Cat. Yoldi, p. 64, 1852.  
 < *Craniidæ* FORBES, Mal. Mon., p. 38, 1838.\* — KING, Ann. Nat. Hist., XVIII, p. 28, 1846. Perm. Fos., p. 78, 1850.  
 < *Craniadæ* FORBES and HANLEY, Brit. Moll., II, p. 364, 1853.  
 < *Les Orbicules* CUVIER, Leçons d'Anat. Comp. An. VII, I, t. 5, 1798\* (fide GRAY). Règne An., II, p. 504, 1817; Tabl. El. Hist. Nat., p. 435, 1799.  
 < *Athyridæ* MCCOY, Carb. foss. Irel., p. 104, 1844.  
 < *Orbiculæ* HERRMANNSEN, Index Gen. Mal., II, p. 156, 1847 (as of DESHAYES).  
 < *Les Ostracées* LAM., Phil. Zool., 1809.\* (Ed. 1830, p. 317.)  
 < *Placunea* RAFINESQUE, Anal. Nat., p. 148, 1815.  
 < *Fixivalvia* LATREILLE, Fam. Nat. Règn. An., p. 205, 1825. (Ed. Berth, p. 196.)  
 < *Palliobranches à coquilles non symétriques* BLAINVILLE, Man. Mal., p. 515, 1825.  
 < *Terebratulidea* G. B. SOWERBY, Trans. Lin. Soc., XIII, p. 469, 1822.

Shell calcareous; hingeless; without perforation for a pedicel; attached by the umbones of or the entire lower valve, or rarely free. Upper valve suborbicular, with a subcentral apex. Lower valve subcircular or pyriform. Four principal muscular impressions in each valve. Shell structure punctate. Animal with free spiral arms, the direction of the apex of the spires toward the concavity of the upper or hæmal valve. Mantle extending to the edge of the valves, closely adhering, without setæ upon its external edge. Animal holding the same relation to the attached valve which obtains in the *Terebratulidæ*, but actually reversed in relation to surrounding objects, on account of the attachment being by the surface, instead of by the recurved apex, of the neural valve.

#### SYNOPSIS OF THE FAMILY.

Genus *Crania* RETZ: Shell attached; upper valve with the muscular impressions usually excavated, but occasionally convex, without apophyses of any kind, inner surface vaulted, without septa; impressions of the pallial sinuses flabelliform, separated in front. Margin of the valves tuberclose or papillose. Type *Crania craniolaris*, Lin. sp. Syst. Nat., Ed. XII, p. 1150, 1767.

?? Subgenus *Pseudocrania* MCCOY. Shell free, with the impressions of the pallial sinuses fimbriated and confluent in front. Margins smooth. Anterior muscular impressions larger than the posterior ones. Type *Crania*

*antiquissima* Eichwald, sp. McCoy, Annals Nat. Hist., VIII, p. 388, 1851. The value of this section is doubtful.

Subgenus *Cranopsis* DALL. Attached; upper valve with two pointed slender apophyses divaricating from the internal apex, where the muscular impressions of the anterior pair are situated in the typical *Crania*. Type *Crania Parisiensis*, DEFRANCE, DAVIDSON, Mém. Soc. Lin. Norm., X, pl. xiii, fig. 23 a, b, 1856.

Genus *Craniscus* DALL. Fixed valve divided by a transverse and a longitudinal septum into three cells, the posterior of which contains the muscular impressions and the rostellum. Type *Crania tripartita* MUNSTER, sp. DAVIDSON, l. c fig. 21.

It is extraordinary that the two sections here indicated have not been separated previously, and indicates that this group has received little attention from modern authors. The differences between the genera *Crania* and *Craniscus* are fully as great as any existing between the acknowledged genera of the *Terebratulidæ*; and the characters of *Cranopsis*, as separated from *Crania*, are well marked. The genus *Spondylobolus* of McCoy appears to have rather more affinity with the *Lingulidæ* than with this group, as I have elsewhere observed, and it is not included here for that reason.

The genus *Pholidops* Hall appears congeneric with *Pseudocrania* McCoy. It is known principally from casts, however, and further researches may establish its validity.

#### GENUS CRANIA RETZ.

Non binomial syn. *Ostracites minimus* . . . *numulus Brattensburgensis dictus* STOBÆUS, Act. Lit. Sci. Svec., pp. 14 and 21, 1731 \* (fide RETZ.), and Opuscl. I, p. 31, Tab. 1, figs. 1-3, 1752.

*Helmintholithus craniolaris* LINNÉ, Syst. Nat., XII, III, p. 162, 1768.

*Anomites craniolaris Brattensburgenses et Ignaburgensis* WAHLENBERG, Act. Upsala, 1821 \* (fide BRONN).

*Nummuli Brattenburgenes* WALLER, Syst. Min., II, p. 500, 1775.

*Criopus fimbriatus* + *Criopoderma (turbinatum)* [taken collectively] pars, POLI, Test. utriusq. Sicil., I, p. 34, 1791; II, pp. 189, 255, 261, 1795 (fide G. W. TRYON, Jr.

*Ostracites minimus*, &c. BEUTH, Jul. et Mont. subt., p. 130, 1776.

Actual syn. = *Crania* RETZIUS, Schrift., Berl. Ges. Naturf. Freunde, Bd. II, p. 72, 1781. — PHILIPPSON (?), Diss. Hist. Nat., p. 11, § v, No. 1, 1788. — SCHRÖTER, Lith. Lex., IV, p. 265, 1785. — BRUGUIÈRE, Enc. Méth. Vers., I, tabl. p. xiii, 1789. — DEFRANCE, Dict. Sci. Nat., XI, p. 312, 1818. — G. B. SOWERBY, Gen. Shells, fasc. XII, n. d., 1821 (?). Trans. Lin. Soc., XIII, p. 431, 1822. — HÆNINGHAUS, Isis, p. 108, 1822 \* (fide ENGELMAN). — NILSSON, Kong. Vet. Ak. Handl., p. 378, 1824. Act. Holm., p. 326, 1825.\*

- Petref. Suec., p. 37, 1827. — GRAY, Ann. Phil., XXVI (N. Ser. X), p. 244, 1825. — MENKE, Syn. Ed. II, p. 96, 1830. — PHILIPPI, Moll. Sicil., p. 100, 1836.\* — GRATELOUP, Cat. Zool., p. 55, 1838.\* — MORRIS, Cat. Brit. foss., p. 121, 1843. — LOVÈN, Index Moll. Scand., p. 29, 1846. — KING, Ann. Nat. Hist., XVIII, p. 28, 1846. *IBID.*, Perm. Foss., p. 84, 1850. — SOWERBY, Thes. I, p. 366, 1847. — JAY, Cat. Shells, Ed. IV, p. 94, 1850. — DAVIDSON, Int. Class. Brach., p. 122, 1853. — FORBES and HANLEY, Brit. Moll., II, p. 365, 1853. — OWEN, Anat. Invert., p. 503, 1855. — CLARK, Brit. Test. Moll., p. 27, 1855. — DAVIDSON, Mém. Soc. Lin. Norm., X, pp. 24, 226, 1856. — GOSSE, Mar. Zoöl., II, p. 30, 1856. — H. and A. ADAMS, Gen. Rec. Moll., II, p. 583, 1858. — BRONN, Klass. Ordn. Thierr., III, 1st Abth. p. 302, 1862. — CHENU, Man. de Conchyl., p. 230, 1862. — DAVIDSON, Mon. Sil. Brach., p. 78, 1866. — JEFFREYS, Brit. Conch., II, p. 24, 1863; V, p. 165, 1869 (RETZ. non PHILIPPSON, as asserted by Jeffreys). — HALL, Pal. New York, IV, p. 26, 1870.
- = *Cranie* LAMARCK, Phil. Zool., Ed. 1830, p. 317; Ed. I, 1809.\*
- > *Crania* LAMARCK, Prodr., p. 83, 1799.\* — MEGERLE v. MUHLFELDT, Entw. Syst. Schaalh., 1811\* (fide SCHUM.). — LAMARCK, Hist. An. s. Vert., 1<sup>re</sup> Ed. VI, p. 237, 1819. — FÉRUSAC, Tabl. Syst., p. xxxviii, 1821. — GRAY, Lond. Med. Repos., 1821\* (fide HERRM.). — BLAINVILLE, Man. Mal., p. 515, 1825. — RANG, Man. Moll., p. 262, 1829. — DESHAYES, Enc. Méth. Vers, II, C, p. 15, p. 553, Tab. acéph., 1830. — LAMARCK, Hist. An. s. Vert., 2<sup>de</sup> Ed. VII, p. 297, 1836. — THOMAS BROWN, Conch. Textb., Ed. V, p. 108, 1839. — MACGILLIVRAY, *Ibid.*, Ed. IX, p. 123, n. d. — THORPE, Brit. Mar. Conch., p. 125, 1844. — CUVIER, Règne An. Moll. Ed. Deshayes, p. 251, 1845. — QUENSTEDT, Handb. Petref., p. 494, 1852. — WOODWARD, Man., p. 236, 1854.
- > < *Crania* SCHUMACHER, Essai, p. 37, 1817.
- > *Crania*  $\alpha$ , SCHUMACHER, Essai, p. 101, 1817.
- Not *Crania*  $\beta$ , SCHUMACHER, Essai, p. 102, 1817. = *Discina*.
- Not *Crania* GOULD, Moll. U. S. Expl. Exped., p. 465, 1852. = *Discina*, sp.
- = *Craniolites* SCHLOTHEIM, Petref., p. 247, 1820.
- = *Cranicella* RAFINESQUE, Analys. Nat., p. 148, 1815.
- = *Orbicula* CUVIER, Tabl. Élé. Hist. Nat. p. 435, 1798; and Règne An., 1<sup>re</sup> Ed., p. 504, 1817. Règne, An. Moll., Ed. Deshayes, p. 250, 1845. — LAMARCK, Hist. An. s. Vert. I, VI, p. 242, 1819.
- > < *Orbicula* LAMARCK, Hist. An. s. Vert., Ed. II, VII, p. 313, 1836.
- > *Orbicula* LAMARCK, Prodr., 1799.\* — BOSC., Hist. Nat. Coq., II, p. 243, 1801. — LAMARCK, Syst. An. s. Vert., p. 140, 1801. — CUVIER, An. Mus., I; Mém. sur la Lingule, p. 9, 1802. — SCHUMACHER, Essai, pp. 55, 176, 1817. — DESHAYES, Enc. Méth. Vers., III, p. 668, 1832 (not tabl. 2, p. 553, 1830).
- = *Orbicula* sp. EICHWALD, Sil. Schicht. Syst., p. 169, 1840; Urwelt, Russl., I, p. 98, 1840; II, p. 75, 1842.
- = *Orbiculoidea* sp. RYCKHOLT, Mélanges Pal., pl. iv, fig. 3\* (fide DAVIDSON, Intr., p. 128).

- > *Orbicularius* DUMÉRIL, Zoöl. Analyt., p. 168, 1806.  
 = *Discina* sp. TURTON, Dith. Brit., p. 238, 1822 (Gen. diag. exclus.).  
 = *Anomia* sp. LINNÉ, Syst. Nat., Ed. X, I, p. 700, 1760; Ed. XII, p. 1150, No. 216, 1767. — GMELIN, Syst. Nat., p. 3340, 1792. — CHEMNITZ, Conchyl. Cab., VIII, p. 72, 1785. — SCHRÖTER, Einl., III, p. 381, 1778.\* — POLI, Test. utriusq. Sicil., II, p. 189, 1795. — DILLWYN, Cat. Shells, I, pp. 285, 286, 1817.  
 = *Anomites* sp. DAVIDSON, Mém. Soc. Lin. Norm., X, p. 226, 1856, in syn. (not of LINNÉ, Syst. Nat., 1768).  
 = *Patella* sp. O. F. MÜLLER, Prodr. Zool. Danica, p. 237, No. 2870, 1776; Zoöl. Danica, I, p. 4, 1788. — GMELIN, Syst. Nat., p. 3721, 1792. — MONTAGUE, Trans. Lin. Soc., XI, p. 195, 1808. — HUMPHREY (ubi? fide SBY. and RVE). — KOCH and DUNKER, Beitr. Oöl.-Geb., p. 51, 1837. — RÖEMER, Verst. Oöl.-Geb., p. 135, 1840.  
 = *Terebratula* (part) SCHWEIGGER, Naturgesch., p. 690, 1820\* (fide GRAY, An. Phil., 1825).  
 = *Producta*? sp. KLIPSTEIN, Beitr. Ost. Alp., VIII, pp. 60, 239, 1843.  
 = *Siphonaria* sp. QUENSTEDT, Handb. Petref., I, p. 442, 1852!  
 = *Numulus* AGASSIZ, Nomencl. fasc., IX, p. 60, 1846.  
 = *Siphonotreta* sp. EICHWALD, Zoöl., I, p. 274, 1829\* (fide BRONN l. c.)  
 = *Criopododerma* AGASSIZ, Nomencl. Ind., p. 301, 1848 (corr. POLI).  
 = *Criopus* GRAY, Lond. Med. Repos., 1821\* (fide HERRM., AGASSIZ) — FLEMING, Phil. Zool., II, p. 499, 1822, and Brit. An., pp. 367, 377, 1828. — KING, Perm. Foss., p. 84, 1849. — LEACH (GRAY), Moll. Gt. Brit., p. 358, Dec. 1852.  
 = *Cryopus* DESHAYES, Hist. An. s. Vert., VII, p. 314, 1836.

Shell with or without a more or less produced beak and false area in the lower valve. The two posterior muscular impressions are near the cardinal border, and usually larger and more widely separated than the two anterior scars. The latter are near the centre of the valves, and in the lower valve are confluent in front, or barely separated by a small nose-like prominence, or *rostellum*, which is usually excavated at its most elevated extremity for the attachment of a muscle, which at its other end is attached near the cardinal border of the upper valve between the post-adductor scars; the shelly matter being slightly produced on each side of this attachment in some species, forming two slight tooth-like prominences. Margin of the shell more or less tuberculous or papillose. Lower valve differing in position and extent of attachment to extraneous objects. Upper valve conical, with the apex subcentral; internally vaulted, simple, without apophyses or septa. Lower valve without septa or apophyses, unless the *rostellum* be so considered. Exterior foliated, concentrically or radiately striate, or smooth. Great pallial sinuses leaving more or less flabelliform or paucidigitated impressions on the shelly matter, which impressions are not confluent anteriorly.

Soft parts with two spiral arms in the horizontal plane, with the apices of the spires directed toward the concavity of the lower valve. Intestine terminating between the lobes of the mantle on the (? right) side.

The genus as described by Retzius, was founded on several species which he confounded together under the name of *Crania Brattensburgensis*. Under this name he included the "*Ostracites minimus* . . . *Numulus Brattensburgensis dictus*" of Stobæus, the *Anomia craniolaris* of Linné, and a recent species said to be from the Philippines, but probably the same previously described by Müller under the name of *Patella anomala*, from the Scandinavian seas.

The question now arises as to which of these shall be taken as the type of the genus, and shall therefore retain the specific name given by Retzius. With regard to this authors have differed, and the result has been a confusion only equalled in the generic synonymy of this unfortunate group. Most of them have transferred the *C. Brattensburgensis* of Retzius to the synonymy of the recent species (*C. personata* Lam.), overlooking the fact that Lamarck's name has not priority, and ignoring Müller's name entirely, though it preceded that of Retzius. On the other hand, they have placed the *Numulus Brattensburgensis* of Stobæus in the synonymy of *C. nummulus* Lam., with the *Anomia craniolaris* of Linné, which in its turn is long prior to that of Lamarck. This disregard of priority by the earlier authors has always been a fruitful cause of confusion and annoyance to subsequent students. As Retzius evidently had the species described by Stobæus in his mind as the species of which he supposed he was describing the recent form, I think that the only course left for us is to accept Stobæus' species as the type. Schumacher, in his *Essai* (p. 102), says that Retzius had sent him specimens of the two species which he had described, and that the *C. Brattensburgensis* Retz. was a fossil. Now most, if not all, authors agree that Stobæus' species was identical with *Anomia craniolaris* of Linné, which is identified by Hanley and others with the *Crania nummulus* of Lam., which of course becomes a synonyme. Stobæus was not a binomial author, and Linné's name being the first binomial appellation, his specific name must stand. Lamarck, also, in adopting the genus *Crania* (*Prodrome*, p. 83, 1799), took *Anomia craniolaris* as the type.\* Schröter, Gmelin, and Dillwyn, as well as Chemnitz, continued to confound the recent and fossil species under the name of *craniolaris*. Müller, in 1776, was the first author to describe the European form, under the name of *Patella anomala*, with a correct habitat, and it afterwards received from Poli the specific name of *turbinata*, though not in a binomial sense.

\* Woodward also adopts it as the type, and Davidson, under the specific name of *Brattensburgensis*

The synonymy of the type, according to these views, will stand as follows:—

**Crania craniolaris** LIN. sp.

Non-binomial synonymy. *Ostracites minimus parasiticus calvarium hominis utcumque referens, numulus Brattensburgensis dictus* K. STOBÆUS, Diss. epist. Act. Litt. et Sci. Svec. pp. 14–21, figs. 1, 2, 1731\* (RETZ., l. c. p. 74, 1781). Opuscl., p. 31, t. 1, figs. 1, 2, 1752.

*Anomites craniolaris Brattensburgensis* WAHLB., Act. Ups., VIII, p. 60, 1821\* (fide BRONN, Ind. Pal.).

*Concha testa planiore orbiculata cranium humanum referente* LINNÉ, Fauna Svecica, p. 384, No. 1347, t. 2, fig. 1347, 1746 (a later edition is probably referred to in the Syst. Nat. l. c.)

*Helmintholithus (anomiae) craniolaris* LINNÉ, Syst. Nat., Ed. XII, III, p. 164, 1768.

*Ostracites minimus sive ostracites numismalis* BEUTH, Jul. et Mont. subt., p. 130, t. 7, No. 46, 1776.

Actual synonymy. *Anomia craniolaris* LINNÉ, Fauna Svecica, 2150, fig. 2150, Ed. II, 1761. Syst. Nat., Ed. X, t. 1, p. 700, No. 183, 1760. Syst. Nat., Ed. XII, t. 1, pt. II, p. 1150, No. 216, 1767. — GMELIN, Syst. Nat., t. 1, pt. VI, p. 3340, No. 1, 1792, partly (+ *C. anomala* + *turbinata* part). — CHEMNITZ, Conchyl. Cab., VIII, p. 72, t. 76, pars, 1785. — DILLWYN, Cat., I, p. 285, No. 1, 1817. — HANLEY'S Conchyl. Lin., p. 119, 1855.

*Crania Brattensburgensis* (pars) RETZIUS, Schrift. Berl. Ges. Naturf. Freunde, Band II, p. 73, 1781 (fig. excl?) (+ *C. anomala* part?). — SCHUMACHER, Essai, p. 101, 1817.

*Crania nummulus* LAMARCK, Hist. An. s. Vert., Ed. I, t. 6, p. 238, No. 2, 1819. — LAMARCK, Hist. An. s. Vert., Ed. II, t. 7, p. 299, No. 2, 1836. — HÆNINGHAUS, Mon. Crania, p. 5, No. 5, figs. 5 a, b, c, 1828. — DESHAYES, Enc. Méth. vers, II, C, p. 17, 1830, &c., &c.

*Crania personata* part, LAMARCK, Hist. An. s. Vert., Ed. I, VI, p. 238, 1819. Not *C. personata* of LAMARCK, Ed. II, VII, p. 299, 1836.

This species is found fossil in Sweden, where Stobæus and Linné obtained their specimens, and the lower valves, furnishing a rude imitation of a face stamped on a coin, were sufficiently common to obtain the popular designation of Brattensburg money, or pennies. According to Deshayes and Sowerby, it presents the peculiarity of being attached by only a small portion of its lower valve. This, however, is a character of slight importance. I have omitted all the other ostensible synonymes of *craniolaris* Lin. and *nummulus* Lam., because I have not had the opportunity of certainly identifying them, and therefore have preferred to retain only those of which there was no doubt whatever. In order to render the matter more clear and throw as much light as possible upon the subject, I subjoin the synonymy of the second species described by Retzius.

**Crania Egnabergensis** RETZ.

Non-binomial syn. *Numulus minor rarissimus oculi et naso prominentibus e lapidina Egnabergensi in Gothungia* K. STOBÆUS, l. c. figs. 3, 4\* (fide RETZ., l. c.). Opusc., p. 31, t. 1, figs. 3, 4.

*Anomites craniolaris Egnabergensis* WAHLB., Act. Ups., VIII, p. 60, 1821\* (fide BRÖNN, Ind. Pal.).

Actual syn. *Crania Egnabergensis* RETZ., l. c. p. 75, t. 1, figs. 4-7, 1781. *Crania striata* DEFRANCE, Dict. Sci. Nat., Vol. XI, p. 315, 1818. — LAMARCK, Hist. An. s. Vert., VI, p. 239, 1819; Ed. II, VII, p. 301, No. 5, 1836. — DESHAYES, Encyc. Méth., II, C, p. 19, No. 9, 1830 (not *C. striata* SCHUM.).

Found fossil at Balsberg and Charlottenlund in Scania. It is well distinguished from the preceding species by its radiating ribs.

The recent species, which may be referred to the genus *Crania*, are as follows:—

*Crania Suessii* RVE., Mon. Crania, pl. i, fig. 2, 1862. Sydney, Australia.

*Crania rostrata* HÆNINGHAUS, Mon. Crania, p. 3, No. 3, fig. 3, 1828. — RVE., Conch. Icon., pl. i, fig. 3, 1862. — DESHAYES, An. s. Vert., Ed. II, Vol. VII, p. 302, 1836. (Syn. exclus.) Mediterranean, W. Africa?

I have received a Mediterranean specimen of this species from Mr. Davidson; it may also extend along the northwest coast of Africa, as stated by Reeve. Deshayes' synonymy is very erroneous, and includes both *turbinata* and *anomala*.

*Crania* (?? *Cranopsis*) *japonica* A. ADAMS, Ann. Mag. Nat. Hist., 3d Series, XI, p. 100, 1863. Gotto Island, Japan, 71 fms.

And the following:\*\*—

**Crania anomala** MÜLL. sp.

A. Typical. Syn. *Patella anomala* MÜLL., Prodr. Zool. Dan., p. 237, 2870, 1776. Zool. Dan., I, p. 4, t. 5, figs. 1-8, 1788. — GMELIN, Syst. Nat., p. 3721, No. 151, 1792.

*Patella distorta* MONT., Trans. Lin. Soc., XI, p. 195, pl. xiii, fig. 5, 1808. — FLEM., Edin. Encyc., VII, 65, t. 204, fig. 4.

*Patella Kermes* HUMPHREY\* (ubi?) fide SBY., Tr. Lin. Soc. — RVE., Conch. Icon. Mon. Crania, sp. 4, 1862.

*Anomia craniolaris* (pars) CHEMN., VIII, p. 72, t. 76. — GMELIN, Syst. Nat., p. 3340, No. 1, 1792. — DILLWYN, Cat., I, p. 285, 1817 (not of LINNÉ).

*Anomia turbinata* DILLWYN, Cat., I, p. 286, 1817. Polii syn. exclus.

*Criopus anomalus* FLEMING, Phil. Zoöl., II, p. 499, 1822, and Brit. An. p. 377, 1828.

\*\* I have separated the synonymy of the var. (?) *turbinata*, in order that those who consider it a good species may make use of the synonymy, but I myself consider it as a strict synonyme of *anomala*.



- Criopus orcadensis* LEACH (GRAY), Moll. Gt. Brit., p. 358, pl. xiii, figs. 6-8, December, 1852.
- Orbicula norvegica* LAMARCK, Syst., p. 140, 1801 (not SBY., Lin. Tr. and Gen. Sh., RANG, Man., nor BLAINVILLE, Man., p. 515). — LAMARCK, Hist. An. s. Vert., Ed. I, Vol. VI, p. 242, 1819. Ibid., Ed. II, Vol. VII, p. 316, No. 1, 1836. — DESHAYES, Enc. Meth., III, p. 668, 1832, partly (+ *turbinata*, part). — SCHUMACHER, Essai, p. 176, pl. xxi, fig. 2, 1817. — THOMAS BROWN, Conchol. Textb., Ed. V, p. 107, pl. xiv, fig. 32 (no such figure there), 1839. — MACGILLIVRAY, Ibid., Ed. IX, p. 123, pl. xiv, fig. 32 (same remark applies), n. d. — DE BLAINVILLE, Dict. Sci. Nat., XXXVI, p. 292, 1825, partly (+ *Discina ostreoides*, part).
- Orbicula anomala* CUVIER, Tabl. Élé. de l'Hist. Nat., p. 435, 1799, and Règne An., II, p. 504, 1817; Ed. Desh. Moll., p. 251, 1845, partly (+ *turbinata*, part).
- Discina ostreoides* TURTON, Dith. Brit., p. 238, 1822 (not of LAM.).
- ? *Crania Brattensburgensis*, part, RETZ., Schrift. Berl., Ges. Naturf. Fr., Band II, p. 73, 1781 (+ *craniolaris*, part).
- Crania turbinata* WOOD'S Ind. Test., Ed. HANLEY, pl. xi, fig. 2, 1856 (not *turbinata* POLI).
- Crania personata*, part, DEFRANCE, Dict. Sci. Nat., XI, p. 312 (+ *turbinata*, part), 1818.
- Crania personata* LAMARCK, Hist. An. s. Vert., Ed. I, VI, p. 238 (syn. exclus.), 1819. Ibid., Ed. II, VII, p. 298 (syn. excl.), 1836 (not *personata* BLAINV., Dict. Sci. Nat. Cah. V, figs. 2-9, fide DESHAYES, l. c. pr.). — SOWERBY, Trans. Lin. Soc., XIII, p. 431, 1822. Gen. Sh. Fasc., XII, figs. 1 and 2, n. d. (1821?). — BLAINVILLE, Dict. Sci. Nat., XXXII, p. 304, 1824. Ibid., Man. Mal., p. 515, 1825.\*\* — NILSSON, Kong. Vet. Ak. Handl., Part II, p. 324, partly, 1825\* (fide Fér. Bull. Sci. Nat. + *craniolaris* part). — THOMAS BROWN, Conch. Textb., Ed. V, p. 108, pl. xiv, fig. 5, 1839. — MACGILLIVRAY, Ibid., Ed. IX, p. 123, pl. xiv, fig. 5, n. d. — SUESS, Wohns., I, p. 41 (223), 1859.
- Crania norvegica* SOWERBY, Thes. Con., I, p. 368, pl. 73, figs. 15 and 17, 1847. — FORBES and HANLEY, Brit. Moll., I, pl. U, fig. 2, 1853.
- Crania rostrata* THORPE, Brit. Mar. Conch., p. 125, 1844 (not of HÆNINGHAUS).
- Crania anomala* SOWERBY, Conch. Man., Ed. II, p. 125, fig. 197 a, 1842. — LOVÈN, Index Moll. Scand., p. 29, 1846. — FORBES and HANLEY, Brit. Moll., II, p. 366, pl. lvi, figs. 7 and 8, 1853. — DAVIDSON, Int. Class. Brach., p. 123, figs. 44-46, pl. ix, figs. 237, 238. — WOODWARD, Man. Moll., p. 235, figs. 157-159, 1854. — CLARK, Brit. Test. Moll., p. 37,

\*\* I do not know whether Deshayes refers in his cited remarks to these two references also, but there is nothing in the context to indicate the Mediterranean form (*turbinata*), and the reference of Blainville is to *C. personata* Sowerby, which is undoubtedly *anomala*.

1855. — GOSSE, Marine Zoöl., II, p. 80, fig. 120, 1856. — DAVIDSON, Mém. Lin. Soc. Norm., X, p. 229, pl. xiii, figs. 14-16, 24, 32, 33, 35, 36, 1856. — H. and A. ADAMS, Gen. Rec. Moll., II, p. 583; III, pl. cxxxii, figs. 3, 3 a, 3 b, 1858. — SUESS, Wohns., I, p. 39 (221), 1859. — CHENU, Man. Conchyl., II, p. 230, figs. 1178, 1862. — REEVE, Conch. Icon. Mon. Crania, pl. i, fig. 4, 1862. — JEFFREYS, Brit. Conch., II, p. 24, pl. i, fig. 3, 1863; V, p. 165, pl. xix, fig. 6, 1869

Hab. North European seas.

B. var. *turbinata* POLI.

*Anomia turbinata* POLI, Test. Utrius. Siciliae, II, p. 189, 261, t. 30, fig. 15, 1795, in synonymy. — DILLWYN, Cat., I, p. 286, No. 2, 1817, in part (+ *anomala*, part).

*Anomia craniolaris* (part) GMELIN, Syst. Nat., p. 3340, 1792. — DILLWYN, Cat., I, p. 285, No. 1, 1817 (+ *craniolaris* part).

*Criopus fimbriatus* (part) POLI, Test. Utrius. Sic., II, p. 189, 1795. "Hab. in *Anomia turbinata*" POLI, l. c. (animal).

*Criopoderma turbinatum* POLI, II, p. 261, No. 1, 1795 (shell).

*Patella anomala* DILLWYN, Cat., I, p. 286, in syn.

*Orbicula turbinata* LAMARCK, Hist. An. s. Vert., Ed. II, VII, p. 317, 1836.

*Crania personata* BLAINVILLE, Dict. Sci. Nat., XI, p. 312; XXXII, p. 304, pl. lxxxiv, fig. 2, Cah. xv, 1818 (not of LAM., Hist., Ed. II, VII, p. 299, note, fide DESHAYES (?). Cf. previous note, p. 33).

*Crania personata* DESHAYES, Encyc. Méthod., II, C, p. 16, 1830; partly; (+ *anomala* part, per citation of RETZ.).

*Crania ringens* HÆNINGHAUS, Mon. Crania, p. 3, No. 2, fig. 2. — DESHAYES, Encyc. Méth., II, p. 16, No. 3, 1830. — LAMARCK, Hist. An. s. Vert., Ed. II, VII, p. 302, 1836. — SBY., Thes., I, p. 367, pl. lxxiii, figs. 10, 11, 1847. — SUESS, Wohns., I, p. 41 (223), 1859.

*Crania rostrata* DESHAYES, Hist. An. s. Vert., Ed. II, VII, p. 302, No. 7, 1836; partly (+ *anomala* and *rostrata* part).

Not *Crania rostrata* HÆNINGHAUS, Mon. Cran., p. 3, No. 3, fig. 3, 1828. — RVE., Icon., pl. 1, fig. 3, 1862.

Hab. Mediterranean.

C. var. *alba* JEFFREYS.

*Crania anomala* var. *alba* JEFFREYS, Brit. Conch., V, p. 165, 1869.

Hab. Shetland, Hebrides.

The shell of *Crania anomala* is rounded, with a slight tendency toward a squarish form. The posterior border of the valves is nearly straight, and Barrett, who examined living specimens, asserts that the two valves open and shut on this edge, like the sides of a hinge. Upper valve sub-conical or depressed, with the apex not prominent and rather posterior. External surface smooth in normal specimens, or slightly marked with concentric lines of growth. Internally rather smooth, with coarse and conspicuous punctation. The margin of the valves is rough, and pre-

sents under a glass conspicuous calcareous prisms, radiating from the centre of the shell. The muscular impressions are very variable in shape and position as well as prominence. The color is usually a livid reddish-brown, with occasional white rays. The extreme nucleus of the shell is mammillated. The lower valve varies in thickness according to the object upon which it rests. If the latter be smooth and level, it is often very thin and almost imperceptible, so that Müller was not without justification in overlooking it. The margin is usually rough or tuberculose, and the muscular impressions vary as in the upper valve.

The variety *alba* of Jeffreys is pure white, or occasionally with a few radiating brown lines, but does not differ otherwise from the normal form. From specimen figures and descriptions of *C. turbinata*, I have been unable to discover any characters which are not common to varieties of *C. anomala*. I agree with Mr. Jeffreys in thinking *C. ringens* Hæninghaus, to be synonymous with *anomala* on general considerations, but I have seen no typical specimens of *ringens*.

The few specimens of *Crania* dredged by the United States Coast Survey Expedition (off the Sambos, Florida, in 116 fathoms, and off the Sand Key in 105 fathoms) offer some apparently constant differences from *C. anomala*. They are somewhat distorted, very transverse, and have obscure indications of radiating rugosities. The shells are smaller than *C. anomala*, have a strong concentric foliation caused by the imbrication of the lines of growth. The color is much the same as in *anomala*; one white specimen with a few radiating brown lines was dredged on a stone in 126 fathoms, off Sand Key, by M. de Pourtalès. The interior of the lower valves was of a green color. The posterior muscular impressions are smaller and closer together than in *C. anomala*. It is very possibly, however, a strongly marked variety of that species; but in case the collection of a larger number of specimens should prove its distinctness, I would propose for it the name of *C. Pourtalesii*.

NOTE. — Not having personally been able to examine Poli's Test. Utriusq. Siciliæ, I have been indebted to the kindness of Mr. George W. Tryon, Jr., for examining the work for me. It is evident to any one who appreciates the binomial system of nomenclature, that Poli was in no sense binomial. He named the animal generically and specifically, while the shell received two additional names, making four in all, if we take them together, involving the absurdity of the animal being a different genus and species from its shell.

The references of Poli given below, from Mr. Tryon's notes, are as follows:—

Vol. I, p. 34. "Genus 15, *Criopus*," description of animal as follows: "Habitat in *Anomia imperforata*."

Vol. II, p. 189. "*Anomia turbinata*," description of shell follows, and to it is added a description of the animal as "*Criopus fimbriatus*."

Vol. II, p. 255, a Table of Genera contains:—

Genus 18. *Criopus* (animal). Genus 18. *Criopoderma* (shell).

Species 1. *Criopus fimbriatus*, "Habitat in *Anomia truncata* et capite serpentis LIN.; in *Anomia turbinata*."

Vol. II, p. 261. List of species:—

1. *Criopoderma turbinatum*. *Anomia turbinata*.

2. *Criopoderma truncatum*. *Anomia truncata*.

3. *Criopoderma caput serpentis*. *Anomia caput serpentis*.

Plate 30, fig. 15, *Anomia turbinata*.

Poli evidently considers *Anomia* as a synonyme, and only uses it by way of explanation. It is evident that such a system of nomenclature as the above can never be fairly squared with the binomial system.

#### FAMILY DISCINIDÆ.

- Syn. = *Discinidæ* GRAY, Syn. Brit. Mus., I, p. 155, 1840.\* Ibid., p. 88, 1842. P. Z. S., p. 202, 1847. Ann. Mag. Nat. Hist., II, p. 439, 1848. — DAVIDSON, Int. Class. Brach., pp. 51, 125, 1853. — WOODWARD, Man. Rec. and Fos. Sh., p. 237, 1854. — DAVIDSON, Mém. Lin. Soc. Norm., X, p. 84, 1856. — H. and A. ADAMS, Gen. Rec. Moll., II, p. 584, 1858. — MRS. GRAY'S Moll., IV, p. 202, 1859. — SUESS, Wohns., I, p. 42 (224), 1859. — CARPENTER, Lect. Moll., Smithsonian Rep., p. 276, 1860. — BRONN, Klass. Ord. Thierr., III, I Abth. p. 301, 1862.
- = *Discinidées* DAVIDSON, Mém. Lin. Soc. Norm., X, p. 231, 1856.
- = *Orbiculacea* ANTON, Verzeichn., p. 21, 1839\* (fide HERRM.).
- = *Orbiculidæ* KING, Ann. Mag. Nat. Hist., XVIII, p. 28, 1846. — OWEN, Anat. Inv., p. 503, 1855. — CHENU, Man. de Conchyl., II, p. 231, 1862.
- < *Orbiculina* AGASSIZ, Nomencl. Index, p. 757, corr. præc. 1848 (not LAM., gen. Rhizop.).
- < *Orbiculidæ* D'ORBIGNY, Cours Élém. Pal., II, p. 89, 1849.
- < *Les Orbicules* CUVIER, Leçons d'Anat. Comp., I, t. v, 1798\* (fide GRAY). — Règne An., II, p. 505, 1817.
- = *Orbicules* DESHAYES, Encyc. Méth., II, table, 1830. Ibid., LAM., Hist. Nat. An. s. Vert., Ed. II, Vol. VII, p. 309, 1836.
- = *Orbiculidæ* MCCOY, Carb. fos. Ireland, p. 104, 1844.
- < *Orbicule* HERRMANNSEN, Ind, II, p. 156, 1847, as of DESH.
- < *Craniadæ* FORBES and HANLEY, Brit. Moll., II, p. 364, 1853.
- < *Les Craniés* FÉRUSAC, Tabl. Syst., folio 38, 1819. — RANG, Man. Moll., p. 262, 1829.
- < *Craniaceæ* MENKE, Syn., Ed. I, p. 56, 1828, olim.\*
- < *Craniacea* MENKE, Syn., Ed. II, p. 96, 1830. — AGASSIZ, Nomencl. Fasc., IX, p. 31, 1846. — MOERCH, Cat. Yoldi, p. 64, 1852.

- < *Cranie* HERRMANNSEN, Ind. Gen. Mal., I, p. 315, 1846 (as of RANG., FÉR., and DESH.).  
 < *Brachiopea* RAFINESQUE, Anal. Nat., p. 148, 1815.  
 < *Palliobranches à coq. non symmetriques* BLAINVILLE, Man. Mal., p. 515, 1825.  
 < *Fixivalvia* LATREILLE, Syst. Règn. An., p. 205, 1825 (Ed. Berth, p. 196).  
 < *Terebratulidea* G. B. SBY., Trans. Lin. Soc., XIII, p. 469, 1822.

Characters. Shell structure permeated with very minute tubuli. Shell attached to foreign bodies by a pedicel passing through the neural valve, inarticulated. Valves suborbicular, with a subcentral apex. Animal with free spiral arms, with the apices of the spires directed toward the neural valve. Mantle extremely vascular, fringed with long chitinous setæ furnished with setellæ.

#### SYNOPSIS OF THE FAMILY.

Genus *Discina* LAM. Type *D. striata* SCHUMACHER sp. 1817.

Subgenus *Discina*, *sensu stricto*. Shell with subequal externally convex valves, with subcentral apices. Lower valve with a small subtriangular longitudinal septum or prominence in the centre, with a minute circular orifice beneath it, for the peduncle, from which an impressed line or furrow extends on the inside, posteriorly, for a short distance. Shell of rather solid texture, impunctate; perforated by very minute tubuli (?). Type *D. striata* SCHUM., = *D. radiosa* GLD., + *D. Evansii* DAV., + *D. norvegica* SBY., + *D. ostreoides* LAM.

Subgenus *Orbiculoidea* D'ORBIGNY,\* = *Schizotreta* KUTORGA.† Shell similar to the last, but with the perforation at the posterior end of the furrow, which last is impressed from the outside, instead of from the inside as in *Discina*. Type *Orbiculoidea elliptica* KUTORGA. DAV., Int., p. 129, pl. ix, figs. 253 - 255, 1852.

Subgenus *Discinisca* DALL, = *Discina* AUCT. Lower valve more or less flattened, concave or compressed. Upper valve more convex; apices of both subcentral or subposterior. Lower valve with a small septum as in *Discina*, behind which is an impressed disk or area, externally concave, and internally elevated. This is perforated by a longitudinal fissure, extending from a short distance behind the septum nearly to the posterior margin, which is often slightly indented behind it. Shell more or less horny in texture, minutely tubulous. Type *Discina lamellosa* BROD. RVE., Conch. Icon., pl. i, fig. 4, 1862.

Genus *Trematis* SHARP.‡ — *Orbicelka* D'ORBIGNY.§ Shell with the upper valve with a posterior apex and small false area. Lower valve flattened, with a

\* Comptes Rendus, XXV, p. 269, 1847.

† Verh. Kais. Min. Ges., 1847.

‡ Quart. Journ. Geol. Soc., No. 13. Vol. IV., p. 66, June, 1847.

§ Comptes Rendus, XXV, p. 269, August, 1847.

large foramen extending nearly to the posterior border. Shell structure in two layers, the outer calcareous and sculptured with a peculiar netlike sculpture resembling perforations; inner layer horny, minutely tubulous, as in *Discina*. Type *Orbicula terminalis* CONRAD, in Nat. Hist. New York, Part IV, Geology (EMMONS), p. 395, fig. 4, 1842.

I am not prepared at present to admit *Siphonotreta* and *Acrotreta* into this family, but am inclined to think, with Kutorga, that they form a peculiar group by themselves.

*Keyserlingia* Pander (Bull. Ac. Sci. St. Petersb., III, p. 46, 1861, Type *K. reversa* Pand., pl. ii, fig. 1, *a-g*), appears to have relations with *Trimerella* or *Gotlandia*, or perhaps with *Siphonotreta*, but its position is at present doubtful.

Rarity of specimens and errors in identifying types are probably the reasons of the confusion of forms existing in this unfortunate family.

#### GENUS DISCINA LAM.

- Syn. = *Discina* GRAY, Ann. Phil., XXVI (New Ser., X), p. 244, 1825. Ibid., transl. Isis, p. 494, 1834. Syn. Brit. Mus., p. 155, 1840,\* and p. 88, 1842. — DAVIDSON, Int. Class. Brach., pp. 51, 126, 1853. — WOODWARD, Man., p. 237, 1854. — DAVIDSON, Mém. Soc. Lin. Norm., X, p. 84, table, p. 232, 1856. — H. and A. ADAMS, Gen. Rec. Moll., II, p. 584, 1858. — MRS. GRAY'S Moll., IV, p. 202, 1859. — SUESS, Wohns., I, p. 42 (224), 1859. — CARPENTER, Lect. Moll., Smithsonian Rep., p. 276, 1860. — HALL, 13th Regent's Rep., p. 77, 1861. — BRONN, Klass. Ordn. Thierr., III, 1st Abth., p. 301, 1862. — HALL, 14th Regent's Rep., p. 130, 1864. — Pal. N. Y. Vol. IV, Part I, p. 15, 1870.
- > *Discina* LAMARCK, Hist. An. s. Vert., VI, p. 236, 1819; Ed. II, VII, p. 296, 1836. — RANG, Man. Moll., p. 263, 1829. — CUVIER, Règne An. Ed. Voigt, III, p. 602.\* — THOMAS BROWN, Conch. Textb., Ed. V, p. 108, 1839. — MACGILLIVRAY, Ibid., Ed. IX, p. 124, n. d.
- = *Crania*  $\beta$  SCHUMACHER, Essai, p. 102, 1817.
- = *Crania* (sp.) GOULD, Moll. U. S. Expl. Exped., p. 465, 1852.
- = *Orbicula* SOWERBY, Min. Conch., VI, p. 4, pl. 506, 1830. — DESHAYES, Enc. Méth. vers, II, tab. aceph., 1830 (not Ibid., III, p. 668, 1832). — G. B. SOWERBY, JR., Conch. Man., Ed. II, p. 209, 1842. — MORRIS, Cat. Brit. foss., p. 123, 1843. — KING, An. Mag. Nat. Hist., XVIII, p. 28, 1846. — SBY., Thes., I, p. 365, 1847. — MÆRCH, Cat. Yoldi, p. 64, 1852. — OWEN, Anat. Invert., p. 503, 1855. — CHENU, Man. Conchyl., II, p. 231, 1862.
- = *Orbicula* (sp.) LAMARCK, Hist. An. s. Vert., Ed. II, pp. 317, 318, 1836. — EICHWALD, Urwelt Russl., II, p. 76, 1842.
- > < *Orbicula* LAMARCK, Phil. Zoöl. (Ed. 1830, p. 317), Ed. I, 1809.\* — SOWERBY, Gen. Sh. fasc. XIII, n. d. (1821). Trans. Lin. Soc., XIII, p. 466,

1822. — BLAINVILLE, Dict. Sci. Nat., XXXII, p. 304, 1824. Ibid., XXXVI, p. 291, 1825. — DEFRANCE, Ibid., XXXVI, p. 293, 1825.  
 = *Patellites* (sp.) SCHLOTHEIM, Petref., I, p. 114; II, p. 108, 1820–1823.  
 = *Patella* (sp.) BRONGNIART, Tabl. des Terr., p. 419, 1829.  
 = *Calyptræa* (sp.) GOLDFUSS, Alberti, Betr., Mon. Trias., pp. 54, 93, 1831\* (fide BRONN, Ind. Pal.).  
 = *Terebratula* pars, SCHWEIG., Naturg., p. 690, 1820\* (fide GRAY, An. Phil.).  
 Not *Orbicula* CUVIER, Tabl. Élé. R. An., p. 435, 1798. — LAMARCK, Hist. An. s. Vert., I, VI, Part I, p. 242, 1819. — DESHAYES, Enc. Méth. Vers, III, p. 668, 1832. — SCHUMACHER, Essai, p. 55, 1817. — THOMAS BROWN, Conch. Textb., p. 107, Ed. V, 1839, nor MACGILLIVRAY, Ibid., Ed. IX, p. 123, n. d. (= *Crania*).

## SUBGENUS DISCINA (LAM.) DALL.

Shell of rather solid texture, with a considerable amount of calcareous matter in it; no signs of punctation to be seen with a half-inch objective. Valves convex, the lower valve varying in amount of convexity with its habitat, but always more or less inflated. A small, sharp, longitudinal septum rises from the centre of the lower valve, of a subtriangular shape, covering and hiding a small tubular perforation of the apex of the shell. This perforation is very oblique, and from its internal opening a groove extends backward nearly half-way to the posterior border of the shell inside. The anterior muscular scars meet in front of the septum and form a semilunar elevation with the points directed backward. The posterior scars in the lower valve are small and widely separated. On the external surface the foramen appears nearly in the middle of the shell, and the furrow is continued *anteriorly* for a short distance. (There is no furrow in my specimens outside *behind* the foramen, which is the only point of difference from Sowerby's figures.)

Upper valve convex, apex subcentral; a slight median longitudinal callus internally. There is no strongly impressed disk about the foramen as in *Discinisca*, though slight traces of a differentiated area exist there.

Type *Discina striata* SCHUM. sp.

Syn. *Crania* ( $\beta$ ) *striata* SCHUMACHER, Essai, p. 102, pl. xx, figs. 1 *a-f*, 1817 (not of DEFRANCE). Habitat?

*Crania radiosa* GLD., Moll. U. S. Expl. Exped., p. 465, figs. 480, *a-c*, 1852.

Hab. Cape Palmas, Liberia, not Rio.

\*\* Not *Orbicula striata* Sby., in Murch. Silurian Syst., tab. v, fig. 21, 1839, and Siluria, pl. xx, fig. 3, 1859. This species is perhaps identical with *Discina Verneuilii* Dav., 1848; but if it should prove distinct, it must have a new name, as that of Schumacher has many years' priority. It occurs in the upper Ludlow rocks of Shropshire, and the *D. Verneuilii* in the Wenlock limestone of England.

- Orbicula striata* SOWERBY,\*\* Thes. Conch., I, p. 366, pl. lxxiii, fig. 9, 1847.  
— FORBES and HANLEY, Brit. Moll., II, p. 368, 1853. — DAVIDSON, An. Mag. Nat. Hist., IX, p. 376, 1852. Habitat ?
- Orbicula Evansii* DAVIDSON, P. Z. S., 1852, p. 81, No. 12, pl. xiv, figs. 32 - 34. An. Mag. Nat. Hist., IX, p. 376, 1852. — SUESS, Wohns., I, p. 44 (226), 1859. Hab. Bodegas, Cal., in error.
- Orbicula norvegica* SOWERBY, Trans. Lin. Soc., XIII, p. 468, pl. xxvi, fig. 2, 1822. Syn. exclus.; Gen. Shells, fasc., XIII, figs. 3 - 5, n. d. (1821 ?), (not of LAM.). Ballast, North Africa.
- Orbicula* (s. g. *Discina*) *norvegica* BLAINVILLE, Dict. Sci. Nat., XXXII, p. 304, 1824. Man. Mal., p. 515, pl. lv, fig. 5, 1825 (not of LAMARCK).
- Orbicula* (s. g. *Discina*) *ostreoides* RANG, Man. Moll., p. 263, 1829.
- Orbicula ostreoides* REEVE, Conch. Icon. Mon. Orb., No. 7, pl. 1, figs. 7 a, 7 b, 1862.
- Discina ostreoides* LAMARCK, Hist. An. s. Vert., Ed. I, VI, p. 237, 1819. Ibid., Ed. II, VII, p. 297, 1836 (no description). — THOMAS BROWN, Conch. extb., Ed. V, p. 108, pl. xiv, fig. 8, 1839. — MACGILLIVRAY, Ibid., Ed. IX, p. 124, pl. xiv, fig. 8, n. d.
- Not *Discina ostreoides* TURTON, Dith. Brit., p. 238, 1822 (= *Crania anomala*).
- Discina norvegica* CROUCH, Int. Lam. Conch., pl. xiii, fig. 2 \* (fide FORBES and HANLEY, II, p. 368).
- Patella anomala* SOWERBY, Trans. Lin. Soc., XIII, p. 468, 1822, in synonym. (not of MÜLLER).

When changes in nomenclature depend upon the identification of types described by the earlier authors, the work is one of great difficulty, and requires the utmost caution, lest fresh confusion be the result. In many cases an approximation to a determination alone can be arrived at, and authors may conscientiously differ as to the decision, and its bearings on nomenclature. In the present case, however, there is but little difficulty, as the species under consideration has been well described and carefully figured by the describers, though under several names; the history of the type specimens is very clear, and was put on record at the time.

Lamarck constituted the genus *Discina* to receive a shell which he called *D. ostreoides*, but of which he did not give any figure or specific description. The specimen was received from Mr. J. Sowerby, and is the same species and from the same lot of specimens, as the shell described by Mr. G. B. Sowerby in the Lin. Transactions, and well figured by him there, under the name of *Orbicula norvegica*. His very excellent figure enables me to speak with positiveness in saying that it is identical with *Crania radiosa* Gould, of which the type specimens are before me. The figures of Schumacher are sufficiently exact to allow of identifying the species with his *Crania striata*. The figures given by Reeve and Davidson are excellent, and almost certainly represent the same species, though this is a matter of



little consequence, the main point being the identification of Sowerby's shell with the specimens before me, which may be regarded as certain. The habitat of the species is undoubtedly African, the localities "Rio," "Bodegas," etc., being erroneous.

The fact of the type being settled, only one course remains, — to rearrange the genus in accordance with the facts. Objections may, and probably will, be raised against such rectifications, but accuracy being the aim and basis of all science, nothing else is worth regarding, and rectifications, however long delayed, are inevitable at last.

The species has been well described by various authors, and there is nothing further in regard to it for me to add. The catalogue number of Dr. Gould's types, in the Smithsonian Cabinet, is 5962. They were obtained at Cape Palmas, West Africa. The exceedingly minute foramen hidden beneath the septum might well excuse Dr. Gould for calling it a *Crania*. I am not aware of any other species of true *Discina* in a recent state, but there are several species usually denominated *Discina*, with which I am unacquainted autoptically.

There are no species of *Orbiculoidea* or *Trematis* known in a recent state.

The following species of *Discinisca* have been found living. I have examined only those after which an exclamation-point is placed.

*Discinisca stella!* GOULD, Proc. Bost. Soc. Nat. Hist., VII, p. 323, Sept., 1860.

— REEVE, Conch. Icon., pl. 1, fig. 1, 1862.

Singapore and Phillipines. CUMING. China Seas. STIMPSON.

*Discinisca lamellosa!* BRODERIP, P. Z. S., 1833, p. 124. — REEVE, Conch. Icon., pl. 1, fig. 3, 1862.

Panama to Peru.

Type of the subgenus. I have examined an immense number of specimens from Panama, and find that they exhibit many varieties. The apex of very young shells is circular, whitish, and of a different texture from the remainder of the shell. This circumstance was first pointed out by Mr. E. S. Morse. The nucleus is probably the remains of the embryonic shell. The species has no radiating striæ, and is a thinner shell than *lævis*.

*Discinisca tenuis* SBY., Thes., I, p. 366, pl. 73, figs. 4, 5. (not REEVE, Conch. Icon., pl. i, fig. 5, 1862).

Hab. ?

Reeve's figures of "*Orbiculis tenuis*" do not represent Sowerby's species, but agree very well with some of the varieties of *D. lamellosa*. I have seen no specimens of either of the former species, but the figures exhibit discrepancies too great to be reconciled. Sowerby gives no localities, and

Reeve's localities, or one of them, probably refer to the form which he figures. It can hardly, however, be found both in Chili and South Australia, and the double habitat is probably due to an error in labelling or identification.

*Discinisca lævis!* SBY., Trans. Lin. Soc., XIII, p. 468, pl. xxvi, figs. 1 *a-d*, 1822. — REEVE, Conch. Icon., pl. i, figs. 4, *a, b*.

Concepcion, Chili. CUMING.

A specimen of this species was received from Peru through Mr. Cuming, labelled *strigata* Broderip.

*Discinisca Cumingii!* BROD., P. Z. S., 1833, p. 124. — REEVE, Conch. Icon., pl. i, fig. 6, 1862. = *D. strigata* BROD., teste REEVE.

Cape St. Lucas to Panama.

Mr. Reeve's figure offers no characters by which it might be distinguished from the last species. The specimens received under this name from Mus. Cuming cannot be distinguished from *D. stella* Gould, by constant characters.

*Discinisca (?) antillarum* D'ORBIGNY, Moll. Cuba, p. 368, pl. xxviii, figs. 34 - 36, 1853. — REEVE, Conch. Icon., pl. i, fig. 2, 1862.

Cuba, Martinique. CUMING.

I have never seen this species, which is stated by Reeve to resemble *D. stella*. It has relations with *D. Cumingii*, and a series should be compared. This species was not obtained by M. de Pourtalès.

*Discina (Discinisca ?) atlantica* JEFFREYS, MSS.

Northeast Atlantic.

I am indebted to Mr. Jeffreys for information in regard to this species, which is on the point of being published in the Proceedings of the Zoölogical Society of London.

The following species of Brachiopods, which were not obtained by the Coast Survey Expedition, are known to inhabit the Caribbean province.

*Cistella Woodwardiana* DAVIDSON, P. Z. S., Feb. 1866, p. 103, pl. xii, fig. 4, *a, b, c*.

Northeast coast of Jamaica in 60 fathoms, BARRETT.

*Thecidium Barrettii* WOODWARD. DAVIDSON, Geol. Mag., I, pl. ii, figs. 1 - 3, 1864. P. Z. S., 1866, p. 104.

With the last-mentioned species.

*Glottidia (?) antillarum* REEVE, Conch. Icon., pl. ii, fig. 8, 1861.

Martinique. CUMING.

## REFERENCES TO PLATES.

## Plate I.

- Fig. 1. Diagram of *Terebratula vitrea*, natural size.
2. Diagram of *Terebratula cubensis*, natural size.
  3. Diagram of *Waldheimia floridana*, natural size.
  4. Diagram of *Waldheimia septigera*, natural size.
  5. Diagram of *Cistella lutea*, much enlarged, showing the loop, septum, and disk-like muscular attachments.
    - 5 a. Side view or section of the same, showing the ribbed septum.
  6. Diagram of *Cistella rubrotincta*, much enlarged, showing the interior and the transverse plate of the septum.
    - 6 a. Side view of the same.
  - 7 a, b. Crania (? *anomala* var.) *Pourtalesii*, inside and outside of the upper valve much enlarged.
  8. Fry of *Terebratula cubensis*, very much magnified: *a*, nucleus of the neural valve with its two pores (*b*); *c*, constricted neck of the valve beyond the nucleus; *d*, thin septum closing the upper part of the foramen; *f*, foramen; *h*, nucleus of the hæmal valve with pores.
 

It will be observed that, in the closed apical termination, the posterior lamina partly closing the foramen, and the lateral grooves or areas on each side of the latter, this immature form presents characters entirely analogous to those (upon which Professor King has lately based a genus, *Agulhasia*,) exhibited by a species which I am inclined to regard as an immature *Terebratulina*.
  9. Soft parts of the same: *a*, horseshoe-shaped membrane; *b, f*, muscles; *c*, mouth and bag-shaped stomach, with (*d*) hepatic lobules.
  10. Spicule from adult *Terebratula cubensis*, much magnified.
  11. Cæcal termination of the intestine of the same, enlarged.
  12. Ovaria of *Terebratula cubensis*, enlarged, showing the position with relation to the muscles of the neural valve.
  13. Same, in the hæmal valve.
  14. Diagram of the parts about the mouth from the side, enlarged: A, nasiform body; B, intercorporeal groove; C, supra-œsophageal body; D, excavation below it and behind the brachia; E, brachia; F, mouth; H, dorsal adjustor muscles (retractors of Owen); I, hepatic lobules; J, heart with vessel; K, side of stomach and intestine, from which the hepatic lobules have been removed, showing the two ducts, by which the lobules communicate with the cavity of the stomach.
  15. Diagram of the supra-œsophageal portion of the body from in front,

enlarged: A, dorsal adjustors; B, frilled portion of oviducts, seen as if through the transparent tissues; C, anterior tubular portion of oviducts, terminating externally in (E) the oblique genital foramen; D, D', upper and lower portions of the nasiform body; F, intercorporeal groove; H, supra-œsophageal body; I, space between the last and the brachia; J, stumps of brachia, cut off to expose the other parts; K, oral groove between the superior and inferior labia; L, mouth, with the median prominence of the superior labium above it; M, median notch or sulcus of the inferior labium (N).

16. Attachments of the free end of the frilled portion of the oviduct, much enlarged: A, free end of right oviduct; B, attachment of the same to the mesentery (E); C, apparent foramen; D, secondary attachment, which appears to be of a tendinous consistency and carries a bloodvessel which enters the oviduct, to all appearance.

#### Plate II.

Fig. 1. Diagram of the soft parts of *Waldheimia floridana*, much enlarged. In this figure the pedicel, the peduncular muscles, and all the other muscles except the oclusors, have been removed. The posterior parts of the mantle lobes are not represented, as they would cover the parts which it is desired to exhibit. The neural lobe is above and the hæmal lobe below. The pallial sinuses are represented with much more prominence than they actually exhibit. They are really almost invisible and are exceedingly difficult to trace even under a high power, so that their outlines as here given must be regarded as provisional, though they are probably sufficiently accurate. The parts are represented as they appear (with the calcareous matter removed by acid), floating in water, with the peduncular end towards the observer. The small genitalia are suspended in the posterior part of the sinuses. The posterior end of the stomach, with the heart and hepatic lobules, appear between the oclusors. Below them is the fold in which the septum of the hæmal valve extends half-way to the margin between the median sinuses. The oviducts are seen in their proper position. The broad brachial disk, with its appendages so widely separated, is seen through the transparent membranes. The pallial lobes are fringed by the very short close-set setæ, inside of which runs the slender circumpallial muscle.

2. Represents the stomach with its appendages from behind. The hepatic digitations, obscurely divided into lobes, cover the lower portion of the stomach, and above them is seen the heart at the junction of the intestine and stomach. On each side are seen the edges of the oral groove or labia in front.

3. Side view of the same, with the hepatic lobules removed to show the

openings of the ducts. The position of the brachia and labia with regard to the œsophagus, and of the heart, are shown.

4. Diagram of *Cistella* var. *lutea*, representing the animal in the shell, with the long brachial cirrhi behind the oral groove turned back to show the groove and position of the mouth. The other cirrhi are curled up in their natural position.

5. Side view of the stomach, intestine, and hepatic lobules of the same species, with a section of the œsophagus, showing the position of the cirrhi and labia. The heart is seen below, just behind the hepatic lobules.

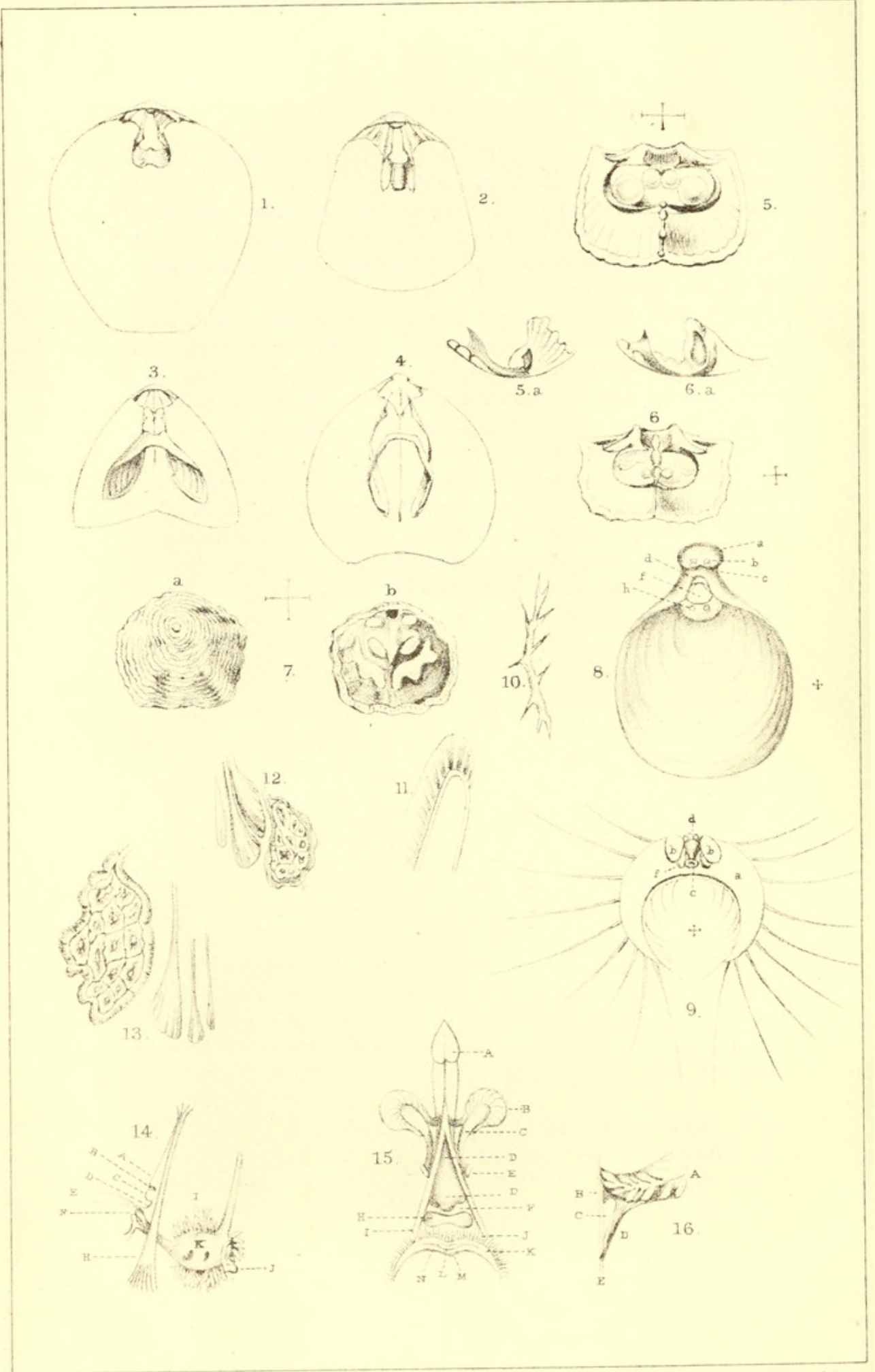
6. Same, with the lobules removed, showing the openings of the ducts, the position of the heart, and the shape of the mesentery in which the intestine is suspended.

7. Genitalia of the same, showing how they are suspended from a ribbon-like lamella, with the ova in various stages upon the edge of it.

8. Rudimentary folds and simple opening of the oviducts of the same.

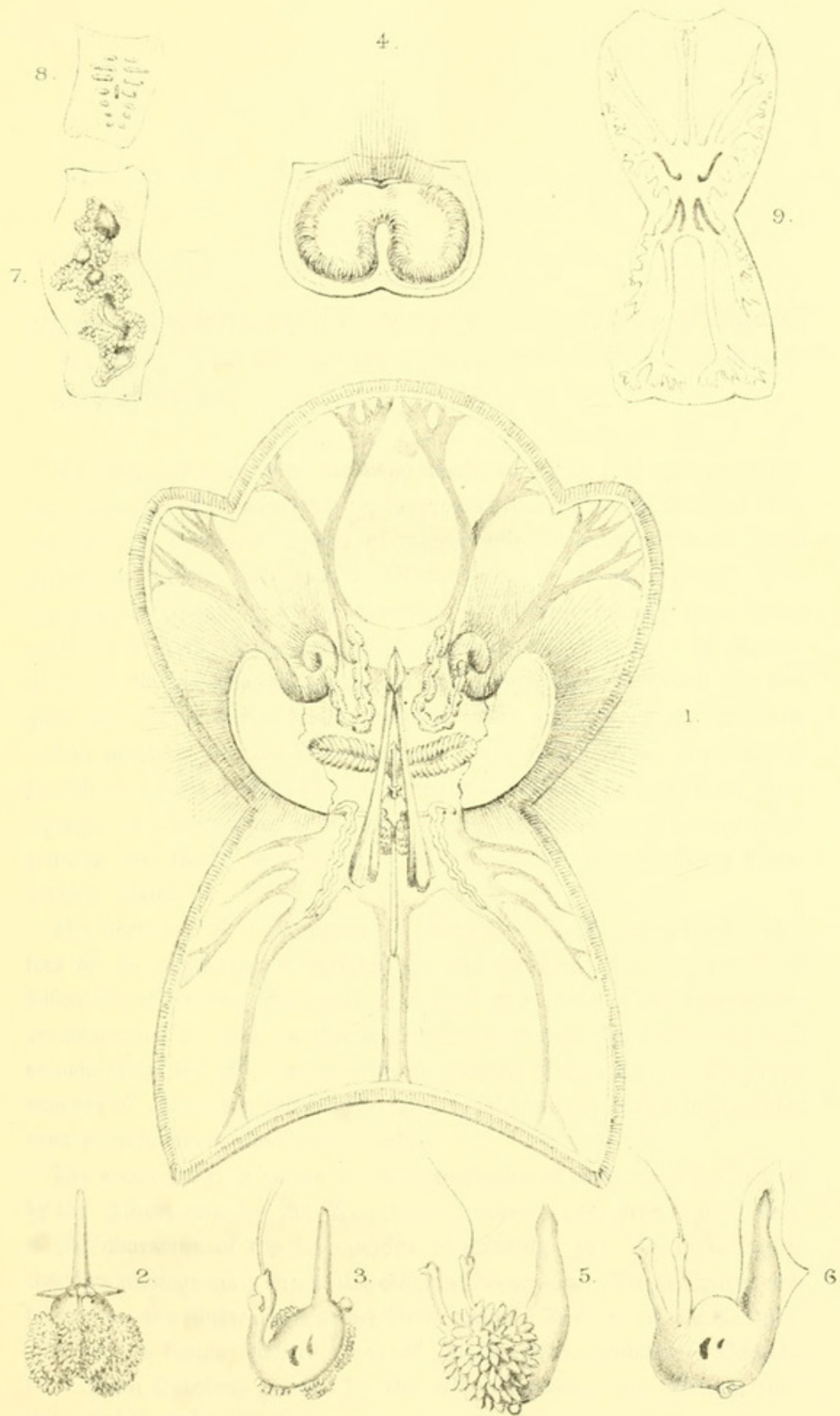
9. Diagram of the pallial sinuses of *Waldheimia septigera*, with the ovaria, from a dry specimen. The hæmal lobe is above.

CAMBRIDGE, May, 1871.



W.H. Dall, del.

Print by H.W. Longfellow.





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