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PRODROMUS

OF THE

PALÆONTOLOGY OF VICTORIA;

OR,

FIGURES AND DESCRIPTIONS

OF

VICTORIAN ORGANIC REMAINS.

DECADE V.

BY

FREDERICK McCOY,

F.G.S.; HON. F.C.P.S.; C.M.Z.S.L.; HON. F.G.S.E.; HON. M.G.S.M., ETC.
 AUTHOR OF "SYNOPSIS OF THE CARBONIFEROUS LIMESTONE FOSSILS OF IRELAND;" "SYNOPSIS OF THE SILURIAN FOSSILS OF IRELAND;" "CONTRIBUTIONS TO BRITISH PALÆONTOLOGY;" ONE OF THE AUTHORS OF "BRITISH PALÆOZOIC ROCKS AND FOSSILS," ETC.
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P R E F A C E.

As the publications of a Geological Survey cannot properly be limited to the maps and sections, but would be incomplete without figures and descriptions of the fossil organic remains made use of for the determination of the geological ages of the different geological formations of the country,* it has been determined to issue a "Prodromus" or preliminary publication of the Victorian Organic Remains in Decades, or numbers, of ten plates each, with corresponding letterpress, on the plan of the Decades of the Geological Survey of England, followed by the Geological Surveys of Canada, India, and several other Governments.

The Decades will contain figures and descriptions in the first place of the more characteristic fossils of each formation, of which good specimens may be in the National Collection; so that observers in the field may make use of them for preliminary or approximate determination of the geological ages of the strata they may meet. A portion of the impression of the plates will be kept back until a complete systematic treatise on the fossils of each formation may be issued when the materials approach completion.

This Fifth Decade contains illustrations of numerous fossils of the Tertiary and Upper and Lower Silurian formations, the right

*"Palæontological researches forming so essential a part of geological investigations, such as those now in progress by the Geological Survey of the United Kingdom, the accompanying plates and descriptions of British fossils have been prepared as part of the Geological Memoirs. They constitute a needful portion of the publications of the Geological Survey."—*Sir Henry T. De la Beche, Director-General of the Geological Survey of the United Kingdom, in notice prefixed to the first of the Decades of the English Geological Survey.*

understanding of the relations of which strata to each other, and to corresponding deposits in other parts of the world, can only be arrived at by the identification of their organic remains ; a knowledge of which will also materially assist the operations of the field geologists at present engaged in mapping these formations, and testing the theories relating to the occurrence of gold in the different stages of each of those geological periods.

The first and second plates give illustrations of the skull and teeth of a new extinct species, of Eared Seal, from the Pliocene Tertiary calcareous beds at Queenscliff ; nearly related to the living *Otaria* and *Arctocephalus* of our southern seas.

The third plate illustrates some of the more abundant and characteristic Brachiopoda of our Tertiary strata, one of them completely identical in size and shape with the recent *Waldheimia Australis* of our Bay, but the smallest fragment of which I find may be discriminated specifically by the larger size of the pores viewed with a strong lens.

The fourth plate is devoted to illustrations of two Tertiary species of *Cardium*, one of them so nearly related to the Upper Eocene or Oligocene Tertiary *Cardium semigranulatum* of the Bracklesham Bay beds of the Hampshire coast and the Isle of Wight, that none of the existing figures or descriptions of the best authors could enable the distinction to be recognised which I have pointed out based on the usual careful comparison of specimens from both localities.

The fifth plate gives further illustrations of the *Spondylus gæderopoides*, the Australian representative of the well-known European Tertiary and recent *Spondylus gæderopus* ; and an additional Victorian smaller and rarer extinct species.

The sixth and seventh plates are filled with figures of species of Upper Silurian Mollusca, of the more abundant forms characteristic of this formation ; of the Mollusca of which we have not previously

given any illustrations, but which are intended to facilitate the recognition of strata of this age by the field geologists now engaged on the eastern extensions of these beds. Some of the species (as the *Spirigerina reticularis*, *Leptaena depressa* or *rhomboidalis*, *Spirifera sulcata*, &c.) are identical with well-known abundant and characteristic forms in beds of the same age in England, Bohemia, Sweden, and North America; while others are representatives, peculiar to Australia, of other forms, such as *Pentamerus*, allied to *P. oblongus*, &c., characteristic of the same strata in the old and new worlds.

The next plate illustrates a new spheroidal Tertiary species of sponge, with long slender radiating silicious spicules of the European recent genus *Tethya*, and a most remarkable extinct gigantic species of Sea-pen, or *Graphularia*, allied to that of the European London clay formation, and also closely allied to the Sea-pen now living in Hobson's Bay (*Sarcoptilon*), but four times the size of the living types. These fossils have been found by the Rev. Mr. Legge in abundance in the Miocene Tertiary beds of Waurin Ponds, and it is to his enlightened zeal we owe our examples of these interesting Zoophytes, some of our figures of which suggest the idea that the recently announced discovery of the Mesozoic Cephalopodous Molluscan genus *Belemnites* in the Tertiary strata of South Australia may have really been a different interpretation of the same objects.

The ninth plate continues the illustrations of our numerous curious extinct Tertiary species of *Cypræa*.

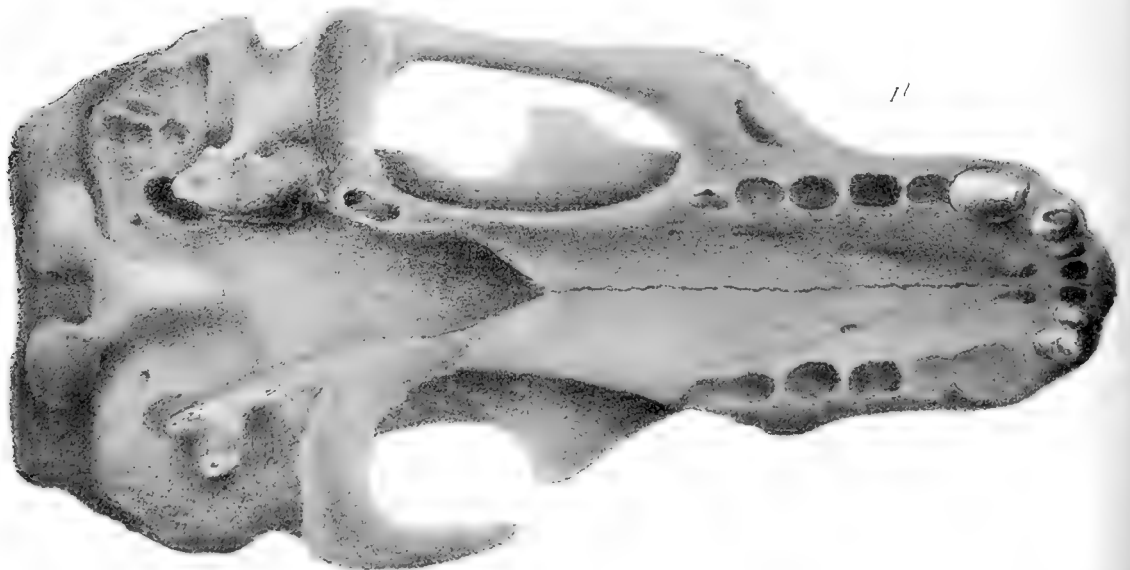
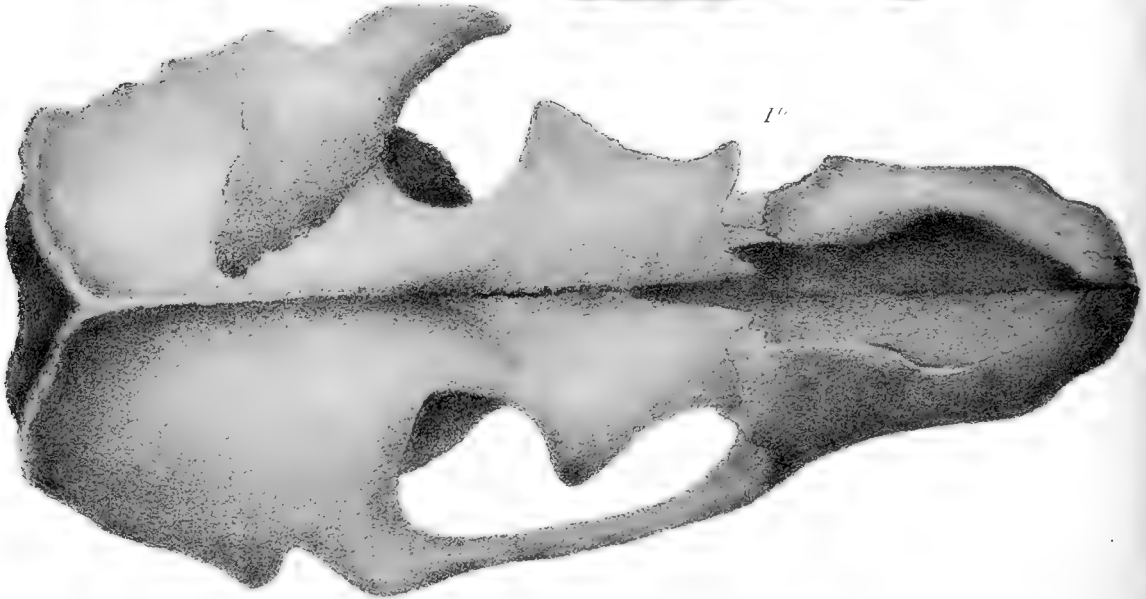
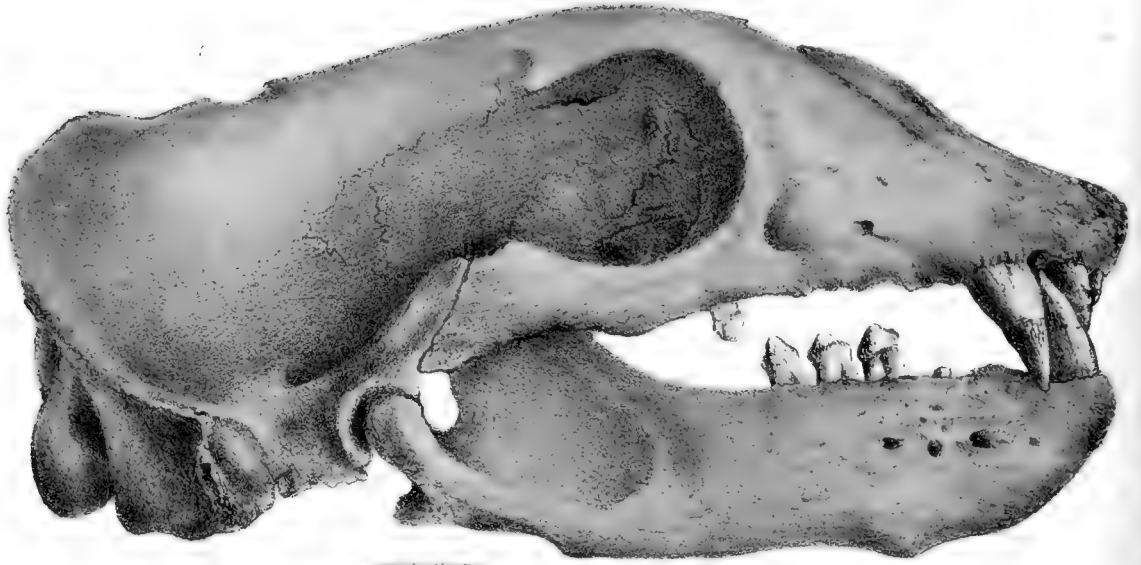
The last plate gives further illustrations of the Graptolites of our gold-fields slates; one, of a new type, contributed by M. Thureau from Sandhurst or Bendigo; and another identical with a species found in the similar slates of Canada, having the basal plate, not seen before in Australian types, although not very uncommon in slates of the same age in North America.

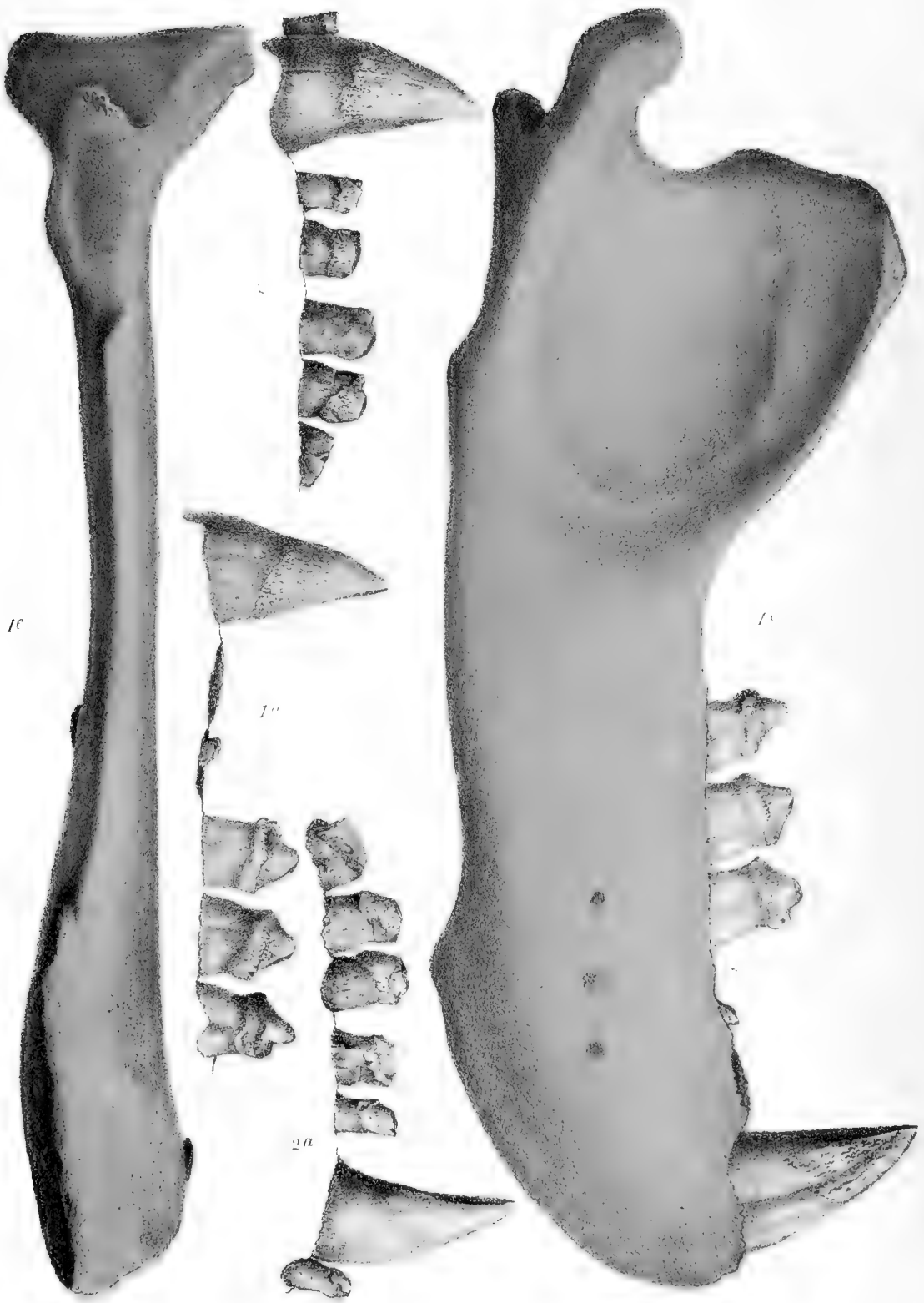
PREFACE.

The future Decades will continue the illustration of the fossil collections made in the course of the Geological Survey of the Colony.

FREDERICK MCCOY.

7th September 1877.





A. Bartholomew del. et sc.

1. & 2. Victoria

C. Troode & Co. imp.

PLATES XLI. AND XLII.

ARCTOCEPHALUS WILLIAMSI (McCoy).

[Genus ARCTOCEPHALUS (F. Coy.). (Sub-kingd. Vertebrata. Class Mammalia. Order Feræ. Fam. Phocidæ.)

Gen. Char.—Dental formula:— i , $\frac{3-3}{2-2}$; c , $\frac{1-1}{1-1}$; m ,* $\frac{6-6}{5-5}$ = 36.—*Upper jaw: Incisors*, 2 inner, on each side, small, crowns bifid by a transverse notch; outer one like a canine, two or three times larger than middle ones. *Canines* large; *molars* six, when young, cingulum on inner side of base; roots large, fangs connate. *Lower jaw: 4 incisors*, small, not notched; *canines* large, compressed; *molars* 5, shaped as in upper jaw, roots of fifth slightly divaricated. *Muzzle* tapering to front. *Palate bones* rather short, reaching only to middle of zygomatic arch. Ramus of lower jaw narrow, with a crest-like process on hinder part of lower edge in front of condyle.]

DESCRIPTION.—The old male skull, on which the *A. Williamsi* is founded, has the occipital crest well developed. It most nearly approaches the living Australian Eared Seal, the *Arctocephalus lobatus*, in the semi-elliptical posterior edge of the palate, and its backward extent; but differs in the larger roots, and very much smaller crowns of the molars, and in the much smaller relative size of the anterior and posterior lobes or cusps, as well as in the lower and less acute middle lobe. The canines are also larger and usually greatly worn by lateral oblique abrasion; the outer canine-like large upper incisors (*i*. 3) appearing relatively smaller. The forehead is much wider across the postorbital processes; the pre-maxillaries extend relatively farther back, and the zygomatic process is broader, the arch rather flatter, and especially the suture between the zygomatic portion of the squamosal is much less oblique, the consequent more forward extension of this bone in the *A. lobatus* and the general slenderness of the arch being conspicuously different from the fossil one. Length of skull from anterior edge of incisor alveolus to posterior edge of occipital condyles, 1 foot. Taking this length as 100, the following proportions are found:—Length to middle of posterior notched edge of palate, $\frac{47}{100}$ (*A. lobatus*, $\frac{47}{100}$); from anterior edge of incisor alveolus to hind edge of glenoid cavity, $\frac{68}{100}$ (*A. lobatus*, $\frac{73}{100}$); greatest width of skull opposite middle of glenoid fossa, $\frac{55}{100}$ (*A. lobatus*, $\frac{58}{100}$); length of lower jaw, $\frac{65}{100}$ (*A. lobatus*, $\frac{71}{100}$); depth of lower jaw vertical at front edge of *m*.³, $\frac{15}{100}$ (*A. lobatus*, $\frac{14}{100}$); from lower edge of basioccipital to top of supraoccipital crest, $\frac{14}{100}$ (*A. lobatus*, $\frac{14}{100}$); width across from tip of one postorbital process to the other, $\frac{36}{100}$ (*A. lobatus*, $\frac{23}{100}$); from front edge of incisor alveolus to posterior superior end of pre-maxillary bones, $\frac{31}{100}$ (*A. lobatus*, $\frac{26}{100}$).

In Dr. Gray and Mr. Gerrard's catalogue of bones of the Mammalia in the British Museum, the genera *Arctocephalus* and *Otaria*

* Dr. Gray gives $\frac{6-6}{6-6}$ as the molar formula for *Arctocephalus* in all his treatises on Seals, but it is obviously by error that more than five should be indicated on each side in the lower jaw. The hindmost upper molar often disappears with age, as in our fossil.

are distinguished, as far as the teeth are concerned, by the *Arctocephalus* having six molars above and *Otaria* five on each side, while in Professor Owen's Catalogue of Bones in the College of Surgeons this is reversed, and six upper molars is pointedly referred to as the main distinction of *Otaria* from *Arctocephalus* with five. Professor De Blainville's type skull of *Otaria leonina* (= *jubata*) is clearly figured with six upper molars, although referred to by Gray and Gerrard in their catalogue of bones as the only figure of the skull of their only certain species of *Otaria*. In the Voyage of the *Erebus and Terror* the *Arctocephalus lobatus* is as clearly figured by Gray with only five upper molars. Temminck, in his Fauna of Japan, shows that the young of probably the latter species has six upper molars, and only five when old, the hind one disappearing, and the socket becoming effaced or filled up by bone with age, in some cases only on one side. The skulls of *Arctocephalus* and *Platycephalus* (= *Otaria*) figured by F. Cuvier in the Mémoires des Muséum (t. ix.) have each six upper molars; and the great backward extension of the palate-bones nearly to the articulation of the lower jaw is mainly relied upon for separating the latter from *Arctocephalus*.

The only remains of this new extinct Eared Seal are the skull and lower jaws figured in our plates from the incoherent beds alternating with the Pliocene Tertiary limestones of Queenscliff at the entrance to Port Phillip Heads, where the large skull and jaw were found by Dr. Williams, the Health Officer of that place, who presented them to the National Museum collection. He says, in a note to me, that "it was found 5 feet below the surface in what was described as marl and sandstone, overlaid with limestone and sandy loam. The men who found the fossil were engaged in excavating limestone for road making from a sloping bank forming the boundary of Swan Ponds at the nearest point to the sea (the Narrows)." A second lower jaw with the same large roots and much smaller crowns and cusps to the molars than in the recent *A. lobatus* was got at Cape Otway by Mr. Wilkinson, the present Director of the Geological Survey of New South Wales, when he was connected with the Geological Survey of Victoria. Some additional specimens from the same place in the collection show the younger unworn

molars with very slender lateral cusps, and in all the cingulum is more obtuse and smooth, or nearly without the strong crenulations of the living species.

EXPLANATION OF FIGURES.

Plate XLI.—Fig. 1, side view of skull with lower jaw, one-half the natural size. Fig. 1*a*, same skull viewed from above, showing great width at postorbital processes. Fig. 1*b*, same skull viewed from below, showing form and extent of posterior edge of palate. Plate XLII.—Fig. 1*c*, lower jaw of above specimen, natural size, side view. Fig. 1*d*, inside view of teeth of same specimen, natural size. Fig. 1*e*, lower edge of same jaw, showing the posterior inflection, natural size. All the above from Queenscliff. Fig. 2, teeth of another specimen from Cape Otway, outside view, natural size. Fig. 2*a*, same teeth viewed from the inner side, natural size.

FREDERICK McCoy.

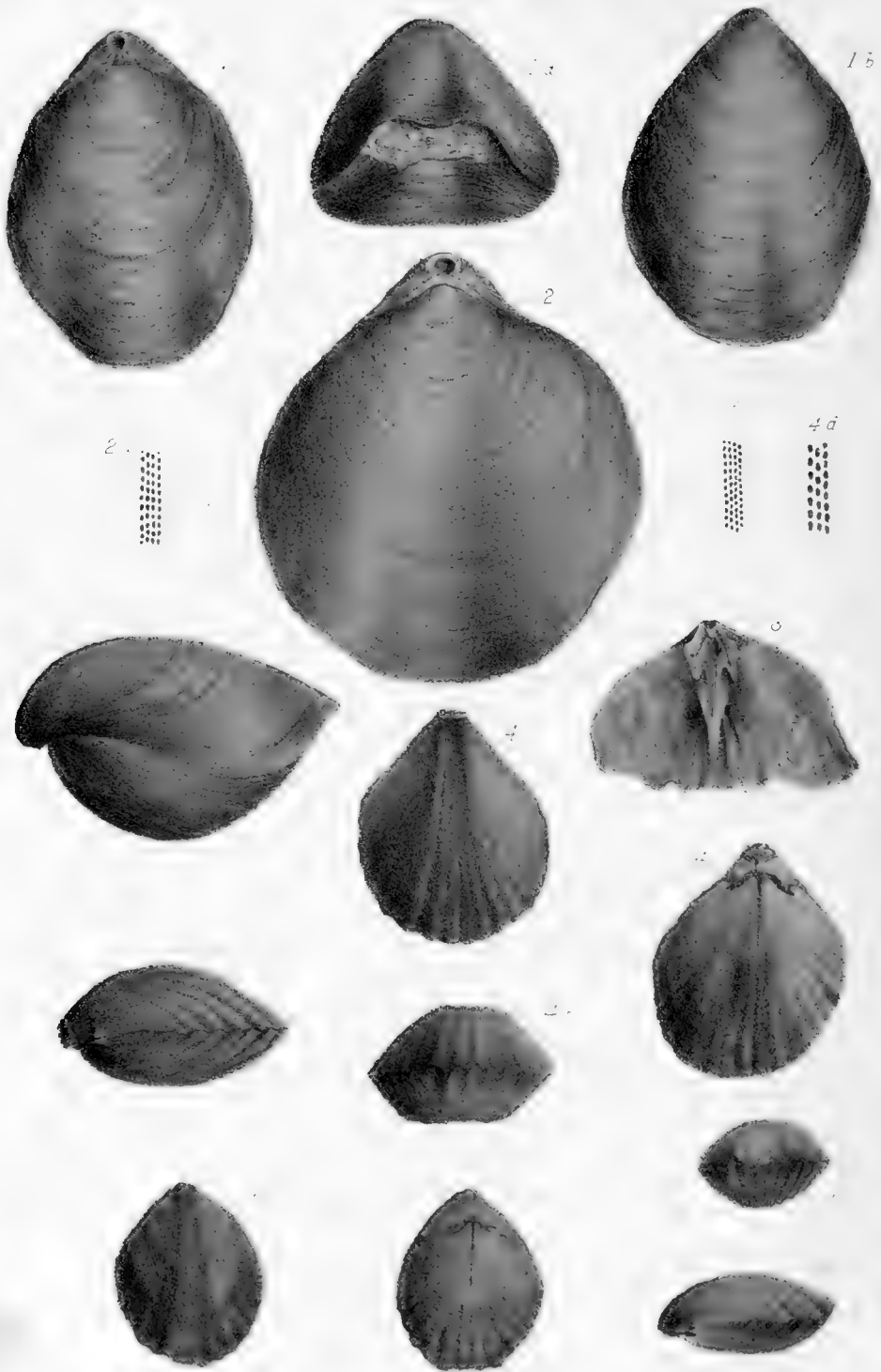


PLATE XLIII., FIGS. 1, 2, 3.

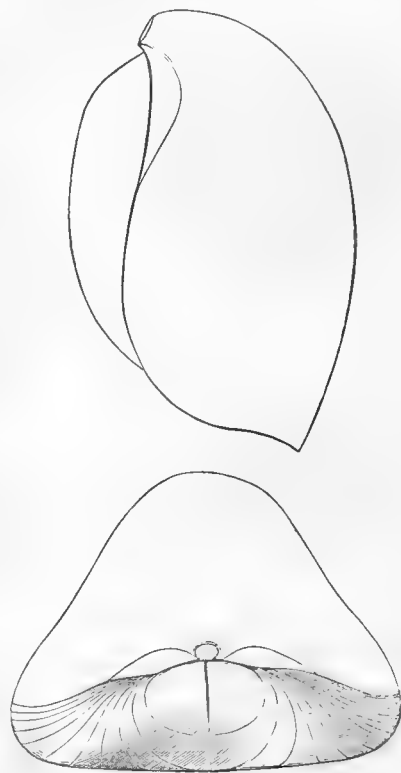
WALDHEIMIA CORIOENSIS (McCoy).

[Genus WALDHEIMIA (KING). (Sub-kingd. Mollusca. Class Palliobranchiata. Order Brachiopoda. Fam. Terebratulidae).

Gen. Char.—Subovate, beak of larger valve truncated by a foramen separated from the curved hinge-line by a deltidium; entering valve with a median rostral boss, from which a strong mesial septum extends towards the front. Loop reaching about two-thirds the length of the shell with a long recurved portion forming the only junction of the apophyses of both sides.

The very long recurved loop and the distinct septum in middle of entering valve readily separate this genus from Terebratula.]

DESCRIPTION.—Subovate, greatest width about the middle of the length, margin of sides convex in middle, becoming straight or slightly concave towards the narrow rounded front; receiving valve very convex or very obtusely carinated along the middle (in very old specimens the middle becomes concave near the front margin, dividing the mesial convexity into two indistinct obtuse wide ridges), sides flattened, very slightly convex, becoming slightly concave near the lateral margins; perforation of beak moderate, deltidium tripartite, the narrow middle portion convex, lateral portions flat; rostral ridges moderate, angulated, entering valve flattened in the rostral half, with the lateral margins abruptly deflected nearly at right angles towards the receiving valve, becoming gradually depressed in the middle towards the narrowed front (in old specimens the mesial depression becomes divided by a wide slight convexity, corresponding to the mesial marginal concavity of opposite valve); profile of receiving valve much arched near the large incurved beak, becoming tangentially straight towards the front, which is elevated at the margin into a deep sinus (bisinuate when old); profile of entering valve much arched from beak to the much and abruptly inflexed front margin, which is depressed to fill the sinus in the opposite valve; lateral margins simple, with an abrupt wide convex curve beyond the middle on each side where the margins rise to form the front sinus. Surface smooth with moderate lines of growth. Substance of valves thick, mesial septum about one-half the length of the shell. Length of large specimens, 2 inches 8 lines; proportional length of entering valve, $\frac{9.5}{100}$; width, $\frac{8.7}{100}$ to $\frac{7.5}{100}$; depth of receiving valve, $\frac{3.0}{100}$ to $\frac{4.5}{100}$, usually $\frac{4.0}{100}$; depth of entering valve, $\frac{1.5}{100}$.



Side and rostral views, natural size, of large specimen.

This is the largest of all our Tertiary Brachiopoda, and is quite unlike any living or Tertiary forms at present known, the shape of the large valve reminding us of that of the lower Oolitic *Terebratula sub-Bentleyi*.

I transfer to this species now the specific name which I formerly used for the species recently figured and described under the name *W. Gambierensis* by Mr. Etheridge, as the two species are found together in the chief localities, and there can be no geological difficulty in continuing the use of a name frequently referred to as a MSS. species for some years; but I mention the change now as some specimens of the former type sent to various Exhibitions may still have this name in collections.

Abundant in the Miocene Tertiary sands of Corio Bay, Geelong (A^d 15); also at (A^d 24) Bird Rock; in similar beds of Jan Juc; in similar beds (F^c 26) more rare at Muddy Creek; common in similar beds at A^d 26.

EXPLANATION OF FIGURES.

Plate XLIII.—Fig 1, unusually long and narrow specimen, entering valve, natural size. Fig. 1a, front view, showing the disproportion of the large receiving with the entering valve, with the form of the sinus in the margin of same specimen. Fig. 1b, receiving valve of same specimen. Fig. 1c, profile of same specimen, but in this view the entering valve appears too deep from being viewed obliquely. Fig. 2, large unusually wide specimen, natural size. Fig. 2a, pores of surface magnified. Fig. 3, thickened interior of entering valve, with septum.

PLATE XLIII., FIGS. 4 AND 6.

WALDHEIMIA MACROPORA (McCoy).

DESCRIPTION.—Ovato-subpentagonal, greatest width varying from a little before to a little behind the middle; both valves moderately convex, receiving valve most so; lateral margins nearly in one plane with the middle of the front margin, but raised towards the receiving valve by a large intermediate angular sinus on each side. Receiving valve with a nearly regular convex longitudinal profile, greatest depth a little behind the middle, from whence the curve is a little more sudden to the beak, which is moderately prominent with bluntly rounded sides; foramen moderately large, with a tripartite deltidium, the middle portion of which is narrow and more convex than the lateral ones; two strong prominent, obtusely angular or rounded ridges extend from the beak to the front margin, which is raised on each side into a large angular sinus at their ends; between these two ridges the surface is flattened or hollowed to the general level of the sides, which slope to the lateral margins with very slight convexity; there are usually three ridges, simple or branched, between the two larger bounding the middle space; sides with six or seven obtusely angular

ridges simple or branching, arching outwards from the two main ridges of the middle division, arising at successive distances so that those nearer the middle are shorter than the outer ones (contrary to the usual rule). Entering valve with a mesial division extending from the beak to corresponding portion of front margin not more convex nor conspicuously raised than the adjacent portions of the moderately convex sides, from which it is separated by a conspicuous angular smooth space reaching to the angular sinus on each side of the front margin; usually three simple ribs and often a fourth shorter branch on the middle ridge, and five to eight simple or rarely branched ribs extending obliquely to the lateral margins at an acute angle, from the sides of the middle area, so that the more anterior ones are shorter than those behind; mesial septum slightly less than half the length of the entering valve. Usual length, 1 inch 4 lines; proportional width, $\frac{8.0}{100}$; depth of receiving valve, $\frac{3.5}{100}$; length of entering valve, $\frac{8.5}{100}$; depth of entering valve, $\frac{2.0}{100}$. Surface punctations, about 18 or 19 in the space of one line.

Every word of the above description will apply as well to the varieties of the living *W. flavescens* of Hobson's Bay as to the fossil, except the punctation, which is, I think, conspicuously coarser in the fossil, being about 27 or 28 to the line in *W. flavescens*. There is another Tertiary species very like this in our beds, but easily distinguished by the sharp angularity of the sides of the beak. I should have thought Mr. Davidson's *W. Garibaldiana* identical with this species, but, as in a letter I have seen from him to the Rev. Mr. Tennison-Woods he thinks differently, I use for the present form my old name *macropora*, referring to the coarse punctation of the surface, which is conspicuously larger and with fewer openings in a given space than in the recent species.

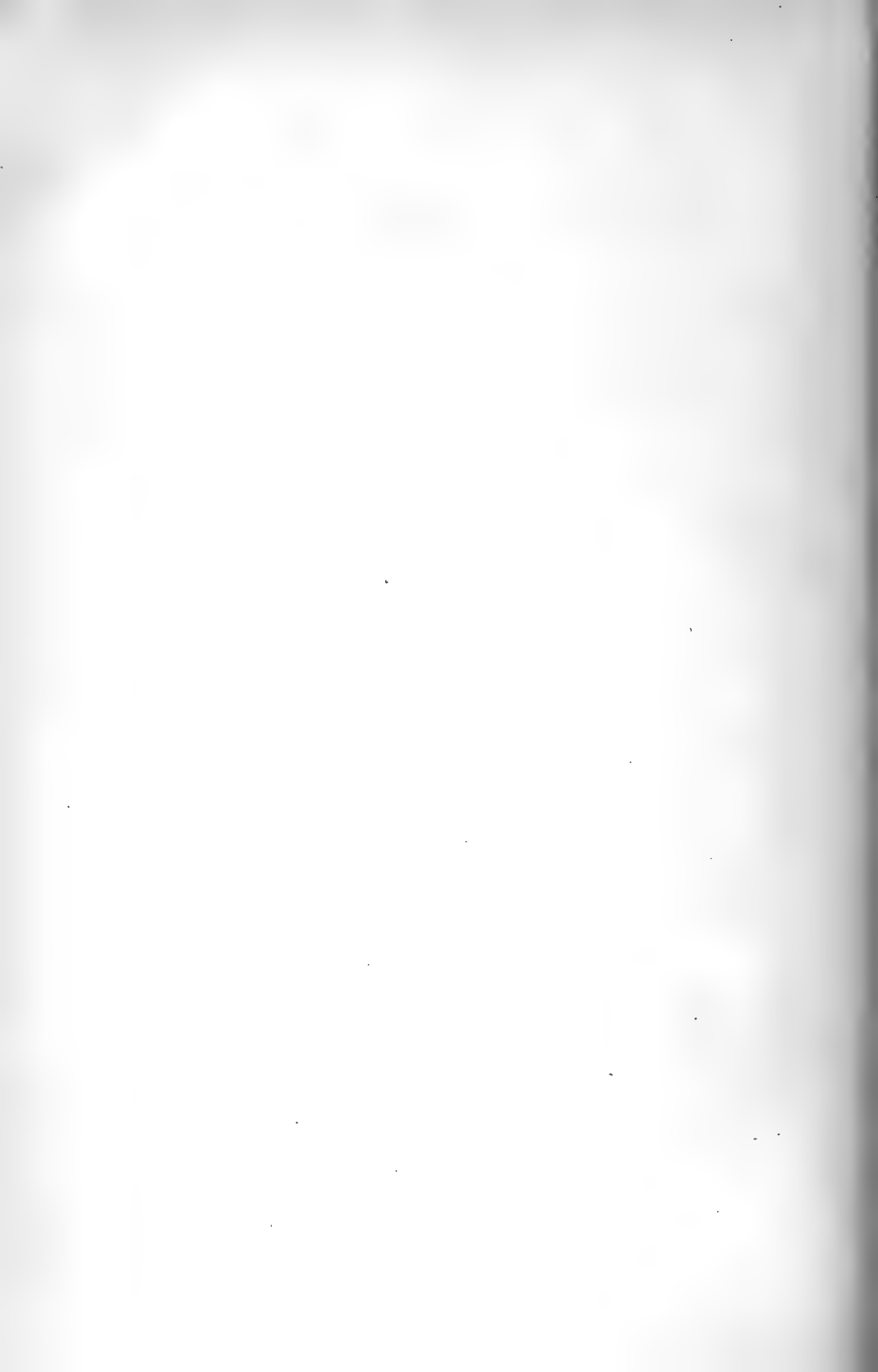
There are many varieties in the relation of length to width, gibbosity, and variations from pentagonal to ovate form in this species as in the recent *W. flavescens*.

Very common in the Older Pliocene Tertiary strata of Flemington; more rare in Oligocene beds between Mount Eliza and Mount Martha.

EXPLANATION OF FIGURES.

Plate XLIII.—Fig. 4, average size and shape of internal cast, receiving valve natural size. Fig. 4a, side view of same specimen. Fig. 4b, front margin of same specimen (the upward angular sinus at the end of the two main ridges usually more strongly marked as compared with the others). Fig. 4c, view of same specimen, showing the entering valve with mesial septum (the three mesial ridges usually more distinctly separated from the lateral ones by a rather wider triangular space). Fig. 4d, half a line of surface magnified to show the size and number of the pores (compared with Fig. 5 showing a similar space similarly magnified of the recent *W. flavescens*). Fig. 6, smaller more ovate specimen, natural size, receiving valve. Fig. 6a, view of entering valve of same specimen. Fig. 6b, front view of both valves. Fig. 6c, side view of both valves.

FREDERICK MCCOY.



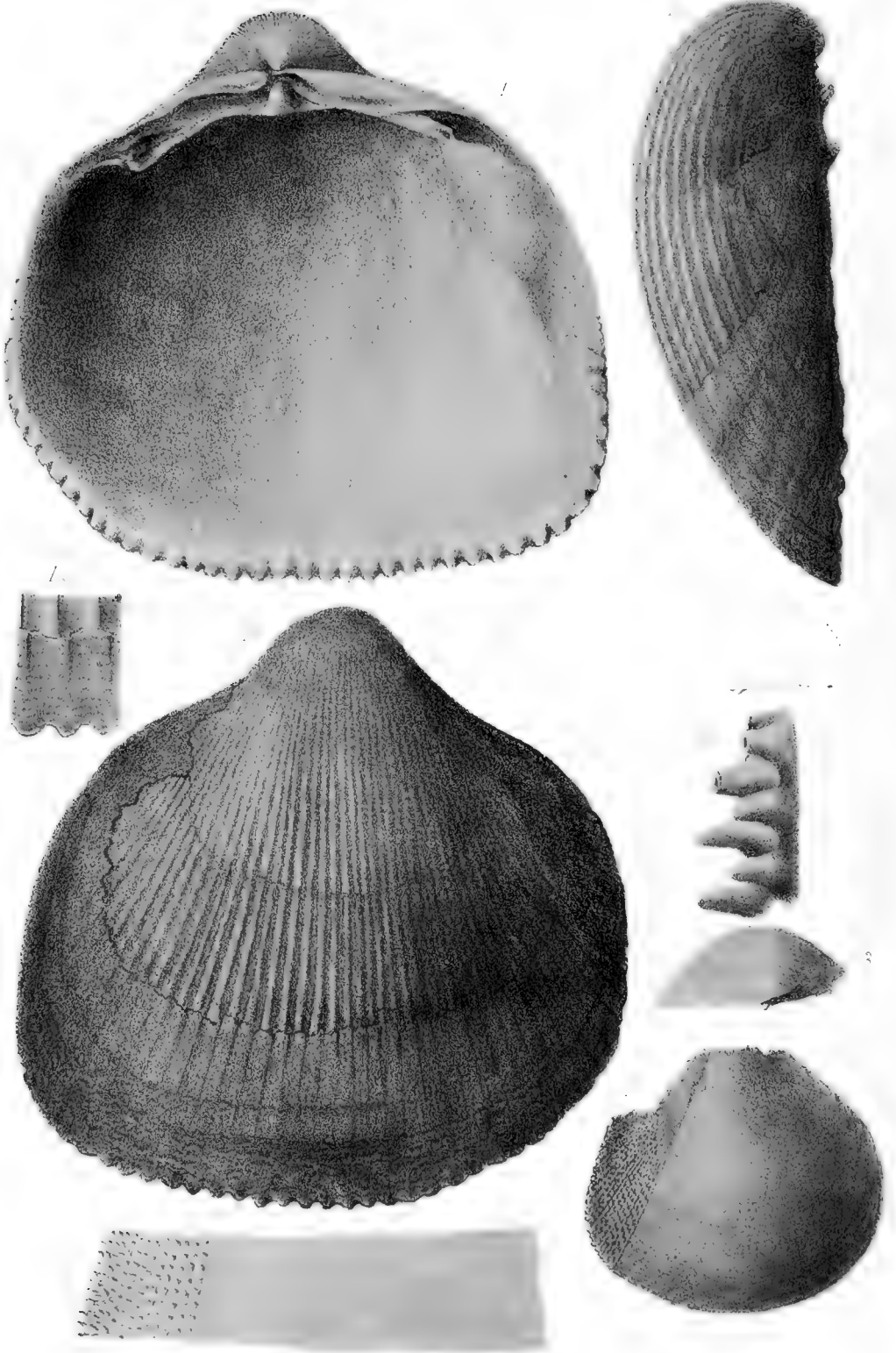


PLATE XLIV., FIG. 1.

CARDIUM PSEUDOMAGNUM (McCoy).

[Genus CARDIUM (LIN.). (Sub-kingd. Mollusca. Class Lamellibranchiata. Order Ishedrotolita. Fam. Cardiadæ.)

Gen. Char.—Shell sub-cordate; margins close or gaping anteriorly and posteriorly; cardinal teeth, 2, 1, or absent; lateral teeth, one anterior and one posterior, or absent. Marine. Range in time from Palæozoic to Recent.

The surface is usually costate, radiatingly, but in the section *Protocardium* the radiating ridges are only distinct on the posterior slope, and there is a slight sinus in the pallial scar.]

DESCRIPTION.—Rotundato-quadrate, ventral margin slightly convex, nearly straight, inclined at about 80° to the nearly straight posterior margin, the respiratory angle between them being obtusely rounded; anterior margin broadly rounded, gradually arching into the ventral margin; beaks tumid, moderately oblique, sub-central, apical angle 79° in young, 80° in old specimens; valves moderately tumid, greatest depth at about half the length from the beak, the marginal half more flattened than the rostral half, which is strongly arched; posterior slope flattened, the diagonal bounding ridge broadly rounded. Ribs 50, sub-equal, flat, smooth, without spines or marked striæ, and separated by very narrow sulci; their ends strongly toothing the internal margin. Length (of large specimen) from anterior to posterior margin, $3\frac{1}{2}$ inches; proportional depth from beak to ventral margin (perpendicular to latter), $\frac{97}{100}$; greatest depth of one valve, $\frac{40}{100}$.

There is no *Cardium* in the Australian seas in the slightest degree resembling this fine species; which is not very near any of the Tertiary species known to me in any part of the world. The nearest analogue I know of is the recent *Cardium magnum* (Born.) of the Gulf of Mexico, with which it agrees in size and approximately in shape and ribbing; the posterior slope is larger, less oblique or more nearly rectangular in the fossil; the ribs are also more numerous (about 33 in living species), flatter, and separated by much finer or narrower sulci.

Very abundant in the Miocene Tertiary sandy beds (A^d 22 and 23), Bird Rock Bluff, near Geelong.

EXPLANATION OF FIGURES.

Plate XLIV.—Fig. 1, inner view of average specimen, natural size, showing the cardinal and lateral teeth and denticulation of the margin. Fig. 1a, profile view of same specimen. Fig. 1b, external view of same specimen, showing in the lower part the narrow sulci between the broad flat ridges when the surface is perfect, and showing in the middle and upper portion the narrower ridges and wider interspaces when the superficial layer of shell is removed. Fig. 1c, portion of surface magnified, showing the appearance of the ridges when the surface is perfect and removed, and their relation to the toothing of the margin.

PLATE XLIV., FIGS. 2, 3.

CARDIUM (PROTocardium) ANTI-SEMIGRANULATUM
(McCoy).

DESCRIPTION.—Rotundato-quadrate, gibbous; respiratory angle (between posterior and ventral margin) obtusely rounded, posterior margin nearly straight, ventral margin slightly convex, anterior margin rounded. Posterior slope with very fine simple ridges (about sixteen in 2 lines at 1 inch from beak), closely set with small arched tubulo-conical spinose tubercles; rest of surface nearly smooth, or with very faint longitudinal striæ (about eighteen in 2 lines at 1 inch from beak); about sixteen crenulations of the inner edge of ventral margin, and about eight on edge of posterior slope in a space of 2 lines at $1\frac{3}{4}$ inches from beak. Length from anterior to posterior margin, 1 inch 10 lines; depth of one valve, $\frac{4}{100}$; from beak to opposite ventral margin, $\frac{9.5}{100}$.

This is one of the extraordinarily close representatives of well-known European Tertiary fossils found in our strata of similar age. It is closely related to *Cardium (Protocardium) semigranulatum* (Sow.) of the Bracklesham Bay, Barton, Colwell Bay, Upper Eocene or Oligocene strata of the Hampshire coast and Isle of Wight, and besides a less and more evenly convex ventral margin, I can only distinguish it with certainty on careful comparison of specimens from the English localities, by the greater fineness (or larger number in a given space) of the longitudinal striæ of the body of the shell and the spinulose ribs on the posterior slope, and of the corresponding crenulations of the margin. In this respect the French Eocene nearly allied species, *C. semistriatum*, *C. semiasperum*, *C. parile*, *C. fraudator*, and *C. Wateleti* of Deshayes are still farther removed from our species. The spinulose ridges on the English specimens of *C. semigranulatum*, from the Bracklesham Bay strata, are only about nine in the space of two lines at one inch from the beak, while our representative form has sixteen in a corresponding space.

Rare in Lower Miocene Tertiary of Moorabool.

EXPLANATION OF FIGURES.

Plate XLIV.—Fig. 2, average specimen, natural size, imperfect near the beak. Fig. 2a, profile view of same specimen. Fig. 2b, curved tubular spines on posterior ridges magnified. Fig. 2c, portion of surface of posterior slope and middle of the shell magnified to show the spinulose character of the former and the faint indication of striæ seen on the latter with the lens. Fig. 3, rostral view of another specimen, natural size.

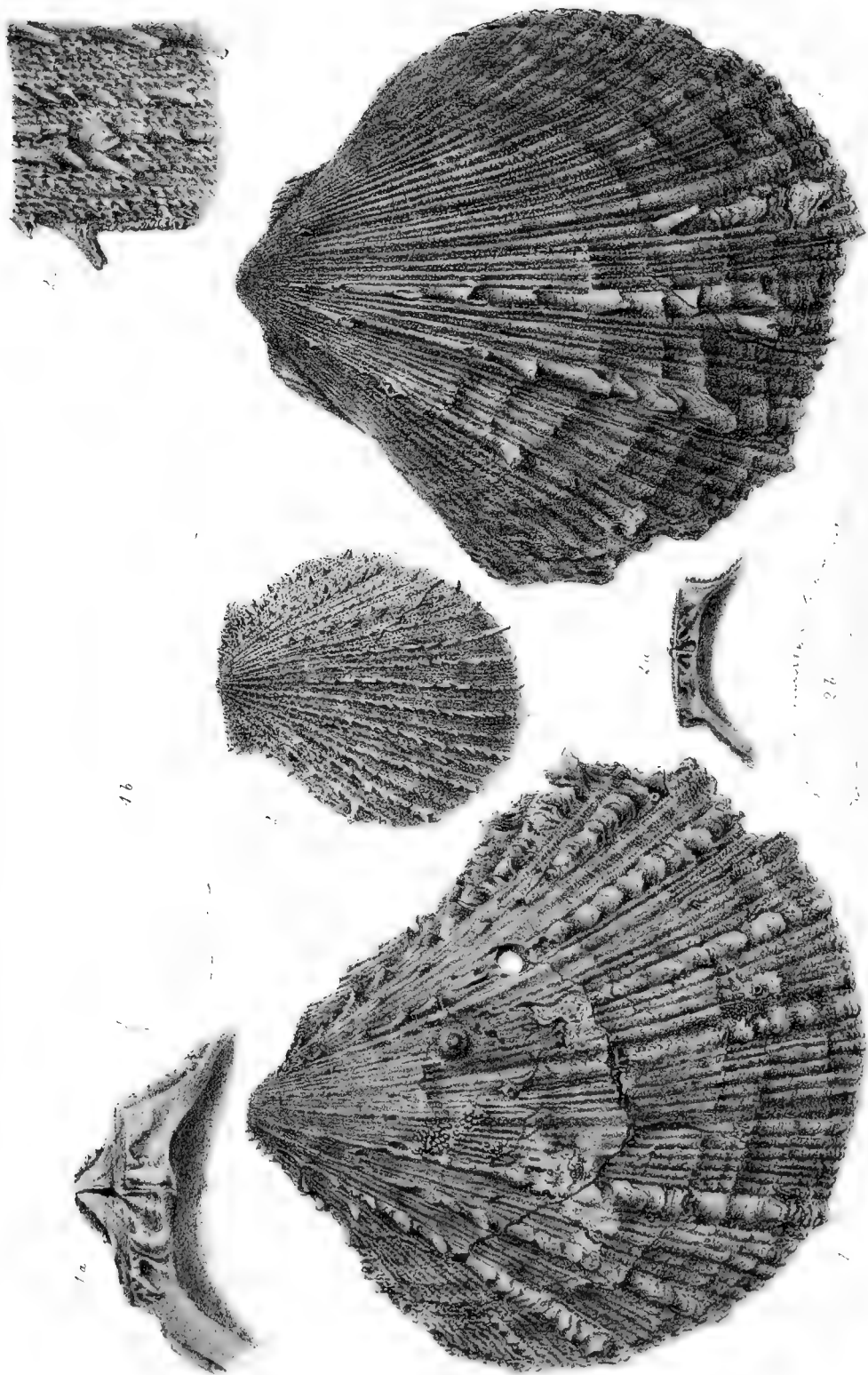
FREDERICK MCCOY.



PALÆONTOLOGY OF VICTORIA.

(Tertiary Mollusca)

Pl



A. Bartholomew del et lith

Prof. M. C. Coy. descr.

De Gruy & Leigh imp.

PLATE XLV., FIGS. 1 AND 3.

SPONDYLUS GÆDEROPOIDES (McCoy).

[Genus SPONDYLUS (LIN.). (Sub-kingd. Mollusca. Class Lamellibranchiata. Order Pleuroconcha. Fam. Spondylidæ.)

Gen. Char.—Shell irregular, inequivalve, inequilateral; hinge-line short, straight, forming quadrate ears on each side of the beaks; a flat triangular cardinal area divided longitudinally by a median cartilage groove which separates the beak of the large attached valve from the hinge-line; two large cardinal teeth in each valve with pits for opposite teeth, and a triangular central cartilage pit connected with groove of cardinal area; ligament simple, external; adductor impression large, rounded a little on the posterior side of middle; pallial scar, strong, entire; surface rough, spiny.

Mesozoic to recent warm seas in deep water attached to corals or rocks.]

DESCRIPTION.—(See Decade IV., Plate XXXVIII.)

EXPLANATION OF FIGURES.

Plate XLV.—Fig. 1, outside view, natural size, of larger valve (bored at one point by carnivorous gasteropod) with more numerous large ridges than usual. Fig. 1a, view of hinge-teeth and cardinal area of same specimen, showing the latter divided in the middle by the cartilage pit. Fig. 1b, profile outline view of same specimen. Fig. 3, view of upper valve of specimen with fewer large ridges than usual, natural size.

PLATE XLV., FIG. 2.

SPONDYLUS PSEUDO-RADULA (McCoy).

DESCRIPTION.—Longitudinally ovate, apical angle about 85° slightly oblique, both valves moderately convex, substance very thin; ears rather small, covered with radiating very numerous, fine, closely spinulose striæ; surface of upper valve with about ten to fifteen narrow prominent ridges radiating from the beak, set at irregular intervals with long curved, compressed, rather slender spines; between each pair of larger ridges are three, five, seven or thirteen very much finer alternate striæ, the middle one largest, all closely set with fine setaceous spines. The lower valve with more numerous spinose ridges (about twenty). Length of large specimens, $3\frac{1}{4}$ inches; more usual size, about $1\frac{1}{2}$ inches; proportional width, $\frac{8.0}{10.0}$ to $\frac{8.0}{10.0}$; length of hinge-line, $\frac{5.0}{10.0}$ to $\frac{4.0}{10.0}$; depth of upper valve, $\frac{2.5}{10.0}$ to $\frac{3.0}{10.0}$; depth of lower valve, $\frac{3.0}{10.0}$ to $\frac{5.0}{10.0}$; nine fine ridges in a space of 2 lines at 10 lines from beak.

This thin, delicate species is easily distinguished from the other large common species, *S. gæderopoides* (McCoy), of the same beds by the spinulose small ridges between the larger ones. There is

no recent species very nearly allied to it ; the *S. multimuricata* of the Moluccas coming perhaps nearest, but having more numerous ridges with thicker and coarser spines, and much fewer and less spinulose intermediate striæ. Of fossil species, the nearest is the *S. rarispina* (Desh.) and the *S. radula* (Desh.) of the older French Tertiaries, from which it differs in its narrower form, fewer large ribs, and more numerous and more spinulose interstitial ones. The concentric scaly laminæ so common on the rostral portions of the lower valve of this genus are scarcely indicated, and only on the sides, if at all. The species is in most localities only about $1\frac{1}{2}$ inches in length, but at Bairnsdale Mr. Howitt has collected gigantic specimens, upwards of 3 inches in length, which agree with the others in all the main characters, and in these the unusual thinness of the valves is even more remarkable than in the small ones, recalling the living Australian *Spondylus fragilis* of Sowerby in this respect (although quite different in all other characters). Some of these Bairnsdale specimens show the spines nearly $1\frac{1}{2}$ inches in length, tapering to the end and with the remarkable lateral compression contrasting with the flattening in the opposite direction more common in other species.

Not uncommon, of small size, in the Oligocene Tertiary clays and limestones near Mount Martha, in Port Phillip Bay ; rare, of small size, in the clay beds of Muddy Creek ; about the same size in the sandy Tertiary (A^d 28) of Fyansford.

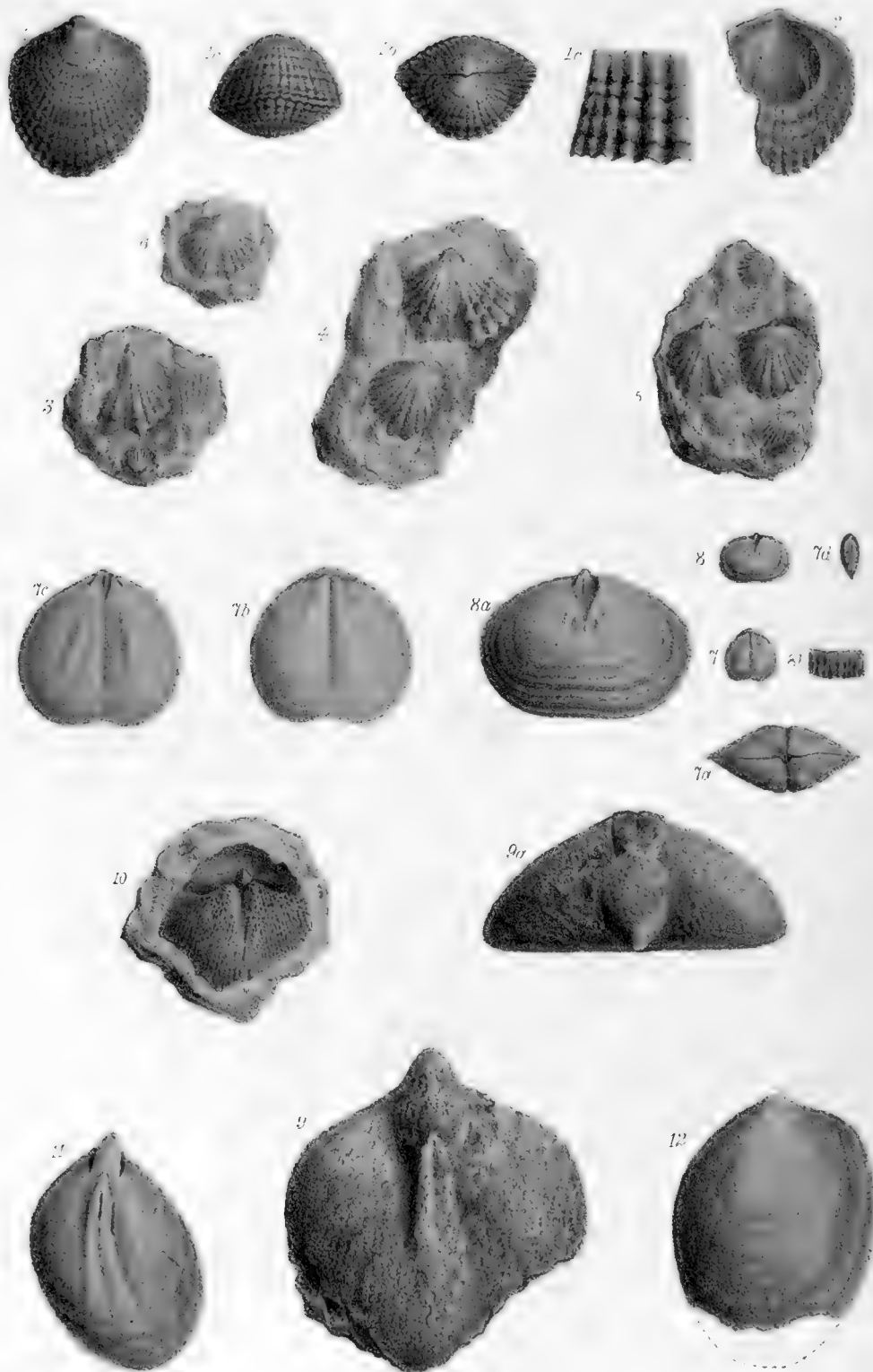
Very large in the sands and limestones of Miocene Tertiary age of Bairnsdale.

Of large size, very thin and fragile, in the Older Pliocene sandy clays of Mordialloc.

EXPLANATION OF FIGURES.

PLATE XLV.—Fig. 2, upper valve of middle sized specimen, natural size. Fig. 2a, view of hinge of same specimen. Fig. 2b, profile outline view of same specimen. Fig. 2c, portion of surface magnified to show the spinulose character of the smaller ridges between the larger ones.

FREDERICK McCoy.



A. Bartholomew del. et lith.

Prof. M. C. Coyd direct.

C. Froedel & Co. imp.

PLATE XLVI., FIG. 1.

LEPTÆNA (LEPTAGONIA) RHOMBOIDALIS (WILCK. SP.).

[Genus LEPTÆNA (Dal.). (Sub-kingd. Mollusca. Class Palliobranchiata. Ord. Brachiopoda. Fam. Orthisidæ.)

Gen. Char.—Semicircular, depressed, entering valve concave, the other evenly convex from the straight hinge-line, which is as long as the shell is wide; cardinal area distinct, slightly rhomboidal, about equally formed of both valves; the convex or receiving valve has a triangular opening, from the sides of the base of which diverge two strong cardinal tooth ridges, the aperture nearly filled by the projecting angle of a rhomboidal, two or four lobed, boss at the beak of the entering valve, leaving only a minute perforation, separated by a small pseudo-deltidium from the apex; punctured structure minute, often indistinct or obsolete; internal surface rough with little points; entering valve with a small bifid tooth at the beak, in front of which are two small diverging socket ridges, between which is a moderate longitudinal septum. Some species show a minute tubular foramen at the apex of the beak, others are closed.

This genus may be said to embrace three sections or subgenera not worthy I think of generic rank, on careful study of a very extensive suite of specimens of most of the known species. These are:—*Leptæna Dalman*, restricted to the type of his last species, the *L. transversalis*, in which the valves are almost equally curved in the same direction, the receiving or foraminated one convex; the other concave outwardly, and having the muscular impressions and ovarian spaces larger than in the others. 2nd. *Strophomena*, in which the valves are flat or very slightly convex when young, the margin in a few species becoming by age deflected usually towards the receiving valve, e. g. *L. euglypha* (Dal.) and *Strophomena rugosa* (Raf.). 3rd. *Leptagonia* (McCoy), with both valves abruptly bent at right angles towards the entering valve, and the rostral portion concentrically wrinkled. In former works I included *Chonetes* (Fischer) amongst the sub-genera of *Leptæna*, but, in deference to the opinion of de Koninck and Davidson, I now omit it.]

DESCRIPTION.—Square prismatic; rostral portion quadrate; sides and front margin nearly straight, slightly undulated; slightly convex near the beaks; irregularly concave before reaching the angle, which is seldom as high as the surface near the beak; concentric wrinkles, about twelve to fifteen, strong, rounded, slightly undulated, and some of them occasionally interrupted in parts, following the direction of the margin, and turning abruptly outwards near the cardinal line; deflected front prismatic; sides sub-parallel, or slightly converging towards the front margin, which is flattened, or with few irregular longitudinal folds, dilated at the cardinal angles into flattened ears; longitudinal striæ coarse, obtuse, equal, about nine to twenty (usually twelve) in the space of 2 lines at the edge of the rostral portion; interior of receiving valve with two short cardinal teeth, diverging at 115°, from the ends of which a slender prominent ridge curves forwards and inwards on each side, forming the boundary of the rather large, ovate, adductor impressions, which reach about half the length of the rostral portion, the two being separated by a mesial ridge extending rather less than their length; interior of entering valve with the rostral portion very concave, and sharply defined from the deflected front by a prominent narrow margin; rostral tooth very large, and deeply bifid; the pits for the teeth of the opposite valve are flanked anteriorly by two thick ridges, which gradually incurve, forming the tubercular boundary to the rounded posterior pair of muscular impressions; anterior to which are the much smaller anterior pair of ovate impressions, with tumid boundaries; the mesial separating ridge extending two-

thirds the length towards the deflected edge, which latter bears numerous fine, nearly straight, linear, simple or once-branched pallial impressions, about twice the size of the external striæ; inner surface of both valves with small spinulose tubercles; cardinal area moderately large in both valves. Average width of flat rostral portion at cardinal angles 1 inch 3 lines; proportional width of ditto at middle, $\frac{7.2}{100}$; length of ditto, $\frac{5.5}{100}$; length of deflected front, $\frac{5.5}{100}$.

REFERENCE.—*Conchita rhomboidalis* (Wilckens) (1769) Nachricht = *Anomites rhomboidalis* (Wahl.), Nova Acta Upsal, vol. viii. (1821) = *Productus depressus* (Sow.) Min. Con. t. 459. = *Leptæna depressa*, Sil. Syst. t. 12, f. 2 + *L. tenuistriata*, Sow. Sil. Syst. t. 22, f. 2a + *L. rugosa* (Dal.).

In some states of preservation, or partial decomposition, each of the longitudinal striæ seems divided into two, giving rise, I have no doubt, to the species *L. tenuistriata* (Sow.), but by far the greater number of specimens in the Caradoc and Bala rocks only show, on accurate measurement, the same number of striæ in a given space as the Wenlock specimens. Some specimens in which the front is gradually rounded into the sides, agreeing with *L. rugosa* (Dal.), differ in no other respect from the normal specimens, and the passage is so gradual and obviously unimportant, that I have no doubt of the specific identity of the forms. Some specimens have the muscular impressions narrower, and the dental lamellæ diverging at a less angle than above, and varying in length from little more than one-third to nearly two-thirds the length of the visceral disk. The variety with wide muscular impressions has them varying also from less than one-half to more than one-half the length of the visceral disk. These varieties do not at all accord with any of the changes of form or striation noted; nor is there any relation between the fineness of the striation and the geological position, although, generally speaking, the fine striation is most common in specimens from the old beds.

I cannot find the slightest difference in the number of striæ in a given space, or in any of the other characters, between the European Silurian examples and those occurring in the rocks of corresponding age in Victoria.

Common in the Upper Silurian (Wenlock shale) at Yering, Upper Yarra.

EXPLANATION OF FIGURES.

Plate XLVI.—Fig. 1, specimen of receiving or dental valve, natural size (one side imperfect, but made up by dotted lines).

PLATE XLVI., FIGS. 2-5.

TREMATOSPIRA LIOPLEURA (McCoy).

[Genus TREMATOSPIRA (HALL). (Sub-kingd. Mollusca. Class Palliobranchiata. Order Brachiopoda. Fam. Spiriferidæ.)

Gen. Char.—Hinge-line shorter than the width of the shell; cardinal angles rounded; receiving valve with slightly produced or incurved beak, truncated by a small round perforation, separated from the hinge-line by a deltidium; no cardinal area; beak of entering valve received into a triangular pit under beak of receiving valve, as in *Pentamerus*. Teeth, sockets, and spiral apophyses as in *Spirifera*. Surface longitudinally sulcated. Texture fibro-punctate.]

DESCRIPTION.—Orbicular when young, transversely oval and deeply bilobed when adult by a very deep, obtusely rounded sinus, scarcely raising the margin; both valves moderately convex, entering valve most so. Entering valve with eight simple ridges on each side of two slightly larger middle ones, which after 4 lines in length dichotomise so as occasionally to form four faintly marked mesial ridges not toothing the margin; after about 5 or 6 lines in length the lateral ridges suddenly become obsolete, leaving a broad, round, expanded, smooth, lateral margin on each side, marked only by concentric waves of growth, the mesial ridges only reaching the margin from the great depth of the scarcely raised mesial sinus. Receiving valve with reflected lateral margins when old, and a very deep rounded mesial hollow prolonged in front into a prominent tongue-shaped lobe, which fills without elevating the sinus in the opposite valve. About nine or ten lateral ridges, and about four faint mesial ridges at the end in old specimens, due apparently to the subdivision of one mesial ridge of the first 5 lines in length. In very old specimens the lateral ridges bifurcate. Length of receiving valve, 7 lines. Texture coarsely granulate or fibro-punctate under the lens. There is a moderately long mesial septum and two short diverging impressions of the base of teeth or apophyses in the small valve, and two small teeth in the opposite one or converging dental lamellæ; the apex of the beak is perforated. Apical angle, 110°.

Young specimens slightly approach the young *Hemithyris diodonta* in appearance, but the lateral ridges are more numerous, and the two mesial ridges of the entering valve not so much elevated nor so obviously larger than the adjoining ones, while the broad, smooth, or unridged, bilobed margins or sides of the adult give a strongly distinctive character suggesting the specific name. The mesial hollow in the entering valve differs from that of *H. diodonta* in having about four faintly marked ridges as thick as those of the sides. When large, the lateral ridges, as well as the mesial ones, branch, which those of *H. diodonta* do not usually do.

Very common in May Hill sandstone of the hills near porphyry dyke near Mount Disappointment (B^b 17).

EXPLANATION OF FIGURES.

Plate XLVI.—Fig. 2, old individual of wide variety, entering valve, natural size. Fig. 2*a*, same view magnified. Fig. 2*b*, portion of surface of same specimen more highly magnified. Fig. 3, long variety, receiving valve, natural size. Fig. 3*a*, same view magnified. Fig. 3*b*, entering valve of same specimen magnified. Fig. 3*c*, side view of both valves of same specimen magnified. Fig. 4, intermediate variety, entering valve, natural size. Fig. 4*a*, same view magnified. Fig. 5, long variety, young individual, entering valve, natural size. Fig. 5*a*, same view magnified. Fig. 5*b*, view of receiving valve of same specimen magnified. Fig. 5*c*, rostral view of both valves of same specimen magnified. Fig. 5*d*, front view of both valves of same specimen magnified.

PLATE XLVI., FIG. 6.

TREMATOSPIRA FORMOSA (HALL).

DESCRIPTION.—Longitudinally ovate, moderately convex, beak of large valve pointed, a very narrow mesial sulcus containing two ridges smaller than those of the sides; 10 or 11 regular simple sub-angular ridges on each side crossed by a few strong imbrications of growth near the margin. Surface coarsely granulo-punctate. Length, 4 lines; width, $\frac{80}{100}$. Apical angle, about 100°, or rather less.

REFERENCE.—Hall. Pal. N. Y., vol. 3, t. 36, f. 2.

There seems no difference between the Australian specimens and those of the Lower Helderberg shales of Albany.

Not uncommon in May Hill sandstone of (B^b 17) hills west of Mount Disappointment.

EXPLANATION OF FIGURES.

Plate XLVI.—Fig. 6, specimen of receiving valve, natural size. Fig. 6*a*, same view magnified. Fig. 6*b*, portion of surface more highly magnified, showing the coarse tubulo-punctate surface.

PLATE XLVI., FIGS. 7, 8.

SPIRIFERA Plicatella (LIN.). VAR. MACROPLEURA (CONRAD).

[Genus SPIRIFERA (Sow.). (Sub-kingd. Mollusca. Class Palliobranchiata. Order Brachiopoda. Fam. Spiriferidæ.)

Gen. Char.—Transversely oval or sub-rhomboidal, gibbous, often radiatingly ridged and with a mesial ridge on entering valve and corresponding mesial sinus on receiving valve; hinge-line usually as long as the shell is wide; cardinal area nearly parallel-sided, of moderate width in

the receiving valve, the beak of which is large and incurved, very narrow in the opposite one, the beak of which is small; shell structure fibrous; foramen notching the area of both valves, that of the entering valve open, that of the receiving valve with an internal pseudo-deltidium bordered by two strong diverging dental lamellæ in the receiving valve, and by the flattened bases of the spiral apophyses in the other, which also usually shows a small mesial septum.]

DESCRIPTION.—Rhomboidal, wider than long, hinge-line usually shorter than width of valves; cardinal angles obtusely rounded; cardinal area moderately wide in each valve; valves moderately convex; mesial fold large, rounded, flattened towards the margin with two (or a trace of a third) large rounded ribs on each side, sometimes distinct to the hinge-line, at others only waving the margin. Surface with fine longitudinal striæ (about nine in 1 line at 6 lines from beak) alternate near the margin and crossed by lines of growth. Average width, rather over $1\frac{1}{2}$ inches; proportional length, $\frac{6.5}{100}$; depth of both valves, $\frac{6.0}{100}$.

REFERENCE.—Conrad, An. Rep. Pal., N. York, 1840. Hall, Pal. New York, vol. 3, t. 27.

There can be no doubt of the identity of our Australian fossil and the *S. macroleura* of the American geologists from their "Lower Helderberg" rocks of New York, which are of the same age as the Wenlock formations of English writers, but I greatly doubt the propriety of separating it specifically from the *S. cyrtæna* (Dal.) (or *S. plicatella* (Lin.)), as many writers prefer to call it now) typical specimens of which from Sweden are so variable as to show all the characters of *S. macroleura* on a somewhat reduced size.

Common in the Wenlock shale (B^b 22) near Kilmore (N.E.).

EXPLANATION OF FIGURES.

Plate XLVI.—Fig. 7, view of internal cast of receiving valve, natural size. Fig. 7a, rostral view of same specimen, showing cardinal area. Fig. 7b, magnified portion of surface of cast, showing lines of reticulo-punctuation. Fig. 8, entering valve, imperfect on both sides, natural size.



PLATE XLVI, FIGS. 9, 10.

SPIRIFERA SULCATA (His.).

DESCRIPTION.—Transversely rhomboidal, wider than long; hinge-line exceeding the width of the shell, cardinal angles usually acutely pointed; valves very convex, receiving one much larger and more convex than the other, with a large incurved beak and a very deep wide concave mesial hollow bounded by two very prominent rounded ribs, with two to six ribs on each side (usually three); entering valve smaller and flatter, with a very large prominent flattened mesial ridge, with usually three ribs on each side; cardinal area wide and concave, but variable. Surface crossed with

very prominent scale-like laminae strongly curved over the ridges and showing a fine longitudinal striation under the lens. Width of very large specimen, 1 inch 9 lines; proportional length of receiving valve, $\frac{6.0}{10.0}$ to $\frac{7.5}{10.0}$; length of entering valve, $\frac{4.0}{10.0}$; depth of receiving valve, $\frac{3.0}{10.0}$; of entering valve, $\frac{2.0}{10.0}$; three to four laminae in 1 line at 3 lines from beak; ten longitudinal striæ in 1 line.

... REFERENCE.—*Delthyris sulcata*, Hisinger, *Lethæa Suecica*, t. 21, f. 6.

The much greater size of the Australian specimens than those commonly found in Europe is the only difference I can find between them, and this does not in the least disturb my opinion as to their identity, as I have been able to place in the National Museum for comparison a specimen from the Upper Silurian limestones of the typical Swedish locality, Klinteham, Gothland, 1 inch 4 lines wide. This specimen is of the receiving valve, has three ridges on each side, and in number of lamellæ and longitudinal striæ in a given space and all other characters it agrees with corresponding varieties from our Yarra beds, where all the European variations of relative length to width, acuteness or obtuseness of cardinal angles, convexity of valves, height of cardinal area, and number of lateral ribs are represented. I think it quite possible that the large *Spirifera perlamellosa* of the Lower Helderberg (= Wenlock) beds of New York may prove to be a local variety of this species, which is very characteristic of the Upper Silurian age.

Common in the Wenlock shale of Yering, Upper Yarra.

EXPLANATION OF FIGURES.

Plate XLVI.—Fig. 9, front view of widest specimen, natural size. Fig. 9a, same specimen viewed from entering valve, showing cardinal area and acute lateral angle. Fig. 9b, magnified portion of transverse scale-like lamellæ (the longitudinal striæ not represented). Fig. 10, view of receiving valve of specimen longer in proportion to the width, natural size. Fig. 10a, rostral view of same specimen, showing the cardinal area.

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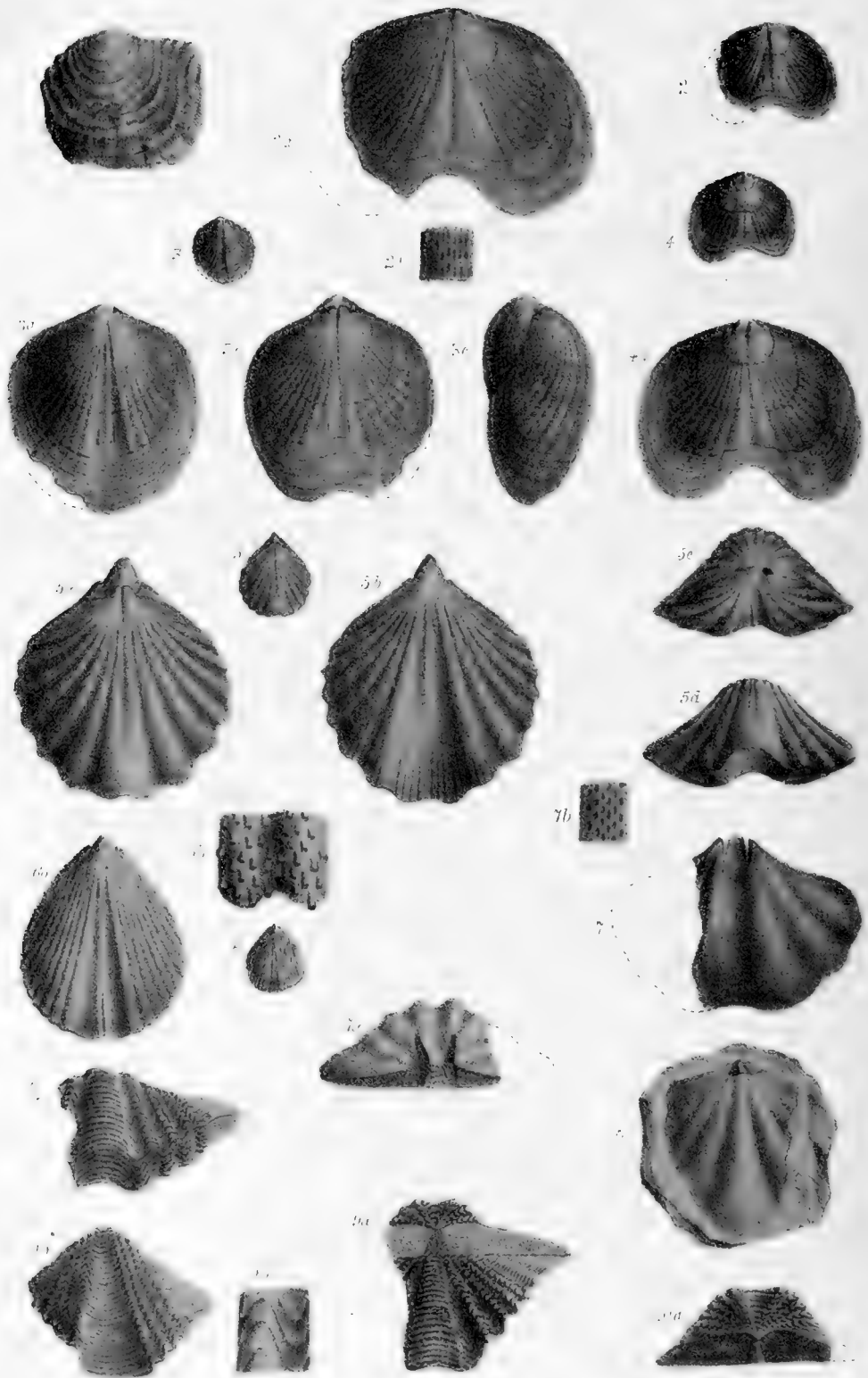


PLATE XLVII, FIGS. 1, 2.

SPIRIGERINA RETICULARIS (LIN. SP.).

[Genus SPIRIGERINA (D'ORB.). (Sub-kingd. Mollusca. Class Palliobranchiata. Order Brachiopoda. Fam. Spiriferidæ.)

Gen. Char.—Shell oblong, marked with radiating dichotomous ridges; beaks close, or showing a small round opening close under the beak, separated from the hinge-line by a deltidium of two pieces; internally the receiving valve has two short diverging cardinal teeth (one on each side of the deltidial space); the entering valve has a very short mesial septum, and two long apophyses obliquely coiled in large flattened conical spires, base of each nearly parallel with the plane of the margins of the valves, apices near the middle of inner surface of the entering valve. In receiving valve the two muscular impressions are very large, occupying nearly half the space of the interior; the pallial trunks are very simple, with few slender branches.]

DESCRIPTION.—Elongate, ovate, or sub-triangular from the hinge-line extending into compressed ears nearly as wide as the shell, (small varieties often nearly orbicular); in ordinary adult specimens the receiving valve is nearly flat, convex at the beak, which is small and prominent, becoming gradually concave towards the margins, which are more or less reflected; the opposite valve very gibbous along the middle, gradually sloping towards the margin; surface covered with strong rounded or sub-angular ridges, irregularly branching and increasing in thickness towards the margin, separated by deep sulci rather less than the ridges in width, both crossed by irregular, strong, scaly lines of growth, averaging five or six in 2 lines at 6 lines from the beak (varying from four to seven). Average length, a little over 1 inch; proportional width, $\frac{8.5}{100}$ to $\frac{10.3}{100}$; depth of both valves, from $\frac{6.0}{100}$ to $\frac{7.0}{100}$; in specimens four lines long the valves are evenly convex and nearly orbicular; the entering valve little more tumid than the receiving one; *cast* of the beaked valve showing a deep oblique pit on each side of the beak for the hinge-tooth; a large, broad, oval, muscular impression, faintly divided down the middle and obscurely radiated, occupies the middle of the rostral half, round this is a space closely set with small irregular papillæ; external margin smooth.

REFERENCE.—*Anomia reticularis*, Lin. Syst. Nat. = *Terebratulites priscus*, Schlot. Petref. und Nachtr. = *T. explanatus*, Id. = *Terebratula affinis*, Sow. Min. Con. and Sil. Syst. t. 6, f. 5. = *A. aspera*, Sow. Sil. Syst. t. 12, f. 5. = *A. orbicularis*, Sow. Sil. Syst. t. 19, f. 3, 4.

This is a very variable shell, but the above description indicates the most common and characteristic variety. It varies, 1st, in the convexities of the valves, both as to degree, distance from the beak at which it is greatest, and equality; some small varieties, and the young at all times, having the valves almost equally and evenly convex: 2nd, in form, some, particularly the young and the small varieties, being nearly orbicular, others being elongate and nearly triangular from the width of the hinge-line and

narrowness of the front : 3rd, in the number, thickness, and closeness of the ridges, and the scales which cross them, both of which are often smaller and closer than the above-described typical variety. The beaks are sometimes so close that the cardinal area, small perforation, and deltidium in the larger valve cannot be seen ; in other specimens they are all distinct.

This is one of the few fossils clearly common to the Silurian and Devonian formations, in both of which it occurs in Victoria, the Australian examples being undistinguishable from those of Europe in the same formations. Both the fine-ridged variety forming the *T. affinis* of Sowerby, and the variety with broader and fewer ridges forming his *A. aspera*, occur in the Devonian and Silurian rocks of this colony.

Abundant in the Upper Silurian strata of Yering, Upper Yarra.

EXPLANATION OF FIGURES.

Plate XLVII.—Fig. 1, view of larger valve of average or rather small specimen, natural size. Fig. 1a, front end view of same specimen, showing the wave in the margin. Fig. 1b, rostral end view of same specimen. Fig. 1c, portion of surface magnified to show the strong scaly laminae of growth crossing the longitudinal ridges. Fig. 2, view of interior of another specimen, showing the muscular impressions, natural size.

PLATE XLVII., FIGS. 3, 4, 5, 6.

RHYNCHONELLA (HEMITHYRIS) DECEMPPLICATA (Sow.).

[Sub-genus HEMITHYRIS (D'ORB.). (Sub-kingd. Mollusca. Class Palliobranchiata. Order Brachiopoda. Fam. Rhynchonellidæ.)

Gen. Char.—Foramen triangular, not separated from the hinge ; beak acute, pointed, entire ; no cardinal area ; entering valve with a small mesial septum ; apophyses short, arched, triangular, with small dental lamellæ ; two strong diverging cardinal teeth bordering the opening in the large valve, supported by dental lamellæ, extending to the inner surface of the valve.]

DESCRIPTION.—Sub-rhomboidal, apical angle 115° ; both valves moderately convex ; mesial ridge and hollow very large and sharply defined, forming an abruptly defined angular sinus in the front margin, nearly as high as wide, bidentate by two strong angular ridges on the entering valve, and one very much smaller in the middle of the sinus of the receiving valve ; lateral ribs sub-angular, rather smaller than the mesial ones, five to seven (but usually six) in number, all continued simply to the beak ; surface crossed by fine transverse lines of growth. Average width (of small specimen), $5\frac{1}{2}$ lines ; proportional length, $\frac{9.3}{10.0}$; length of entering valve, $\frac{8.5}{10.0}$.

REFERENCE.—*Terebratulula decemplicata*, Sow. Sil. Syst. t. 21, f. 17.

In former works I have looked upon the *Rhynchonella decemplicata* as a mere variety of *R. diodonta* and *bidentata*, which two latter (especially if their identity with *R. borealis* of Schlotheim, as suggested by Davidson, be established) may possibly be distinguished with advantage, although I feel much inclined to hold to my old opinion. The *R. decemplicata*, however, as restricted, seems to be confined in England to that bed of sandstone at the base of the Wenlock series, forming the true base of the Upper Silurian system to which Professor Sedgwick and myself gave the name of May Hill sandstone after I had demonstrated its palæontological distinction from the Caradoc sandstone forming the top of the Lower Silurian or Cambrian series with which it had previously been confounded by Murchison and all other geologists. It is of great interest to find that precisely the same shell occurs in similar abundance in a precisely similar sandstone, marking the same geological horizon in Victoria. It was in fact one of the first fossils I identified on reaching Melbourne, proving that city to stand on the lower part of the Upper Silurian formations.

Extremely abundant in the fine yellowish May Hill sandstone (B^b 15) exposed in the road in section 44, parish of Wallan. Very common in the whitish May Hill sandstone (B^b 17) near porphyry dyke, west of Mount Disappointment.

EXPLANATION OF FIGURES.

Plate XLVII.—Figs, 3, 4, 5, 6 : several specimens of both valves, natural size.

PLATE XLVII., FIGS. 7, 8.

NUCLEOSPIRA AUSTRALIS (McCoy).

[Genus NUCLEOSPIRA (HALL). (Sub-kingd. Mollusca. Class Palliobranchiata. Order Brachiopoda. Fam. Spiriferidæ.)

Gen. Char.—Transversely oval, both valves convex with a narrow mesial sulcus in each; hinge-line shorter than width of shell; beak of receiving valve sometimes perforated with a pit, forming a spoon-shaped chamber, with a strong cardinal tooth at base on each side; a mesial septum from beak to front margin; beak of entering valve with a large up-curved spatulate internal process grasped by the teeth of the opposite valve, into the cavity of the beak of which it extends; from the sides of this process extend the bases of the spiral apophyses resembling those of *Spirifera*; a mesial septum from beak to front margin as in the receiving valve; surface smooth; structure of shell fibro-punctate, extending into minute tubular spines on surface.]

DESCRIPTION.—Transversely oval, beaks very small, both valves moderately and nearly equally convex, most so at about one-third of the length from the beaks; a very slight narrow mesial sulcus in each valve, slightly indenting the front margin; sides semi-elliptically rounded; surface with a few strong imbrications of growth marked under the lens, with coarse tubulo-punctate longitudinal interrupted striæ; width, 5 lines; proportional length, $\frac{7^3}{10^3}$; depth of both valves, $\frac{3^5}{10^5}$.

This species is almost identical with the Wenlock shale *Atrypa compressa* (Sow.) of Wales in shape, and with the *Nucleospira ventricosa* (Hall) of the Lower Helderberg beds (= Wenlock) of New York, but is more compressed than the latter and rather wider and more regularly transversely oval than either. The remains or indications of coarse punctation and longitudinal streaky remains apparently of minute tubular spines, can be seen on the casts with a lens. The *N. pisum* of the English Wenlock shale is longer and much more convex.

Common in May Hill sandstone (B^b 17) of hills west of Mount Disappointment.

EXPLANATION OF FIGURES.

Plate XLVII.—Fig. 7, view of entering valve, natural size. Fig. 7a, rostral view, showing the two valves of same specimen, magnified. Fig. 7b, entering valve of same specimen magnified. Fig. 7c, receiving valve of same specimen, magnified, showing chamber in beak. Fig. 7d, side view of same specimen, natural size. Fig. 8, broader variety, receiving valve, natural size. Fig. 8a, same view magnified, showing chamber in beak and cardinal teeth. Fig. 8b, portion of surface of same specimen magnified to show the tubulo-punctate structure.

PLATE XLVII., FIGS. 9, 10, 11, 12.

PENTAMERUS AUSTRALIS (McCoy).

[Genus PENTAMERUS (Sow.). (Sub-kingd. Mollusca. Class Palliobranchiata. Order Brachiopoda. Fam. Rhynchonellidæ.)

Gen. Char.—Shell ovate, convex, beaks incurved, receiving valve largest, with or without mesial fold, with or without hinge-line and cardinal area; a deep triangular pit under the beak of receiving valve into which the beak of the entering valve is strongly incurved. Internally the receiving valve has one bipartite central septum divaricating to form the walls of the external triangular opening, enclosing a triangular space much smaller than the two lateral ones; in the entering valve there are two sub-parallel septa, one on each side of the middle, to which the socket walls converge, sometimes defining a rostral chamber like that of the receiving valve. Texture of shell fibrous. Palæozoic only.]

DESCRIPTION.—Longitudinally sub-ovate, moderately convex, widest a little behind the middle, narrower in front, with an indistinct broad slight mesial elevation of the middle of the entering valve. Surface nearly smooth, with a few concentric lines of growth and a few faint irregular longitudinal furrows. Cardinal area

moderate sharp edged. Triangular chamber in beak of receiving valve small, and its medial septum extending rather less than half the length of the valve; two septa from cardinal teeth of entering valve about one-sixth the length of the shell, slightly arched with concavity inwards, enclosing a sub-ovate rostral space, in front of which are two slight indications of parallel ridges with a still slighter medial one, not reaching the middle of the shell. Casts of receiving valve longitudinally rugoso-granulate, with mesial septum about half the length of the shell; cast of entering valve with a prominent ovate rostral space defined by the two arched septa or dental lamellæ, from which a broad flattened prominent nearly parallel-sided projection extends nearly to the middle of the shell, pointed towards the beak, and gradually blending with the surface of the shell in front, usually showing a faint mesial furrow, in the middle of which and on each side three small slits seem to indicate slight internal septa rising from inner surface of valve. Length of entering valve, varying from $1\frac{1}{2}$ to nearly 3 inches; proportional width, about $\frac{7.5}{100}$; depth of entering valve, about $\frac{5.5}{100}$. (Owing to imperfections of specimens the proportional measurements cannot be given precisely.)

This may be looked upon as an Australian representative of the European and American *P. oblongus* of exactly the same geological horizon at base of Upper Silurian, which it strongly resembles in size, shape, and surface. It is, however, perfectly distinguished by the inarching of the septa of the entering valve and the large ovate rostral space so defined in the casts. These plates do not converge to the middle like those forming the rostral chamber of the Bohemian *P. Sieberi*.

Abundant in the May Hill sandstones (base of Upper Silurian) of section 12, parish of Yering.

EXPLANATION OF FIGURES.

Plate XLVII.—Fig. 9, internal cast of large specimen of entering valve (imperfect in front), showing ovate rostral space, enclosed by inarched dental lamellæ, with the pointed nearly parallel-sided mesial elevation divided by small median sulcus, natural size. Fig. 9a, rostral view of same specimen. Fig. 10, internal cast of beak of receiving valve, showing internal lines of granulo-punctate surface with mesial septum and rostral chamber, and a faint indication of the cardinal area. Fig. 11, obliquely compressed specimen of entering valve, showing the surface with faint radiating irregular markings and lines of growth, together with the two inarched rostral plates, and the more anterior pair of slightly indicated parallel septa with slighter ridge between them, natural size. Fig. 12, another less distorted specimen of same valve, showing the surface, natural size.

FREDERICK MCCOY.





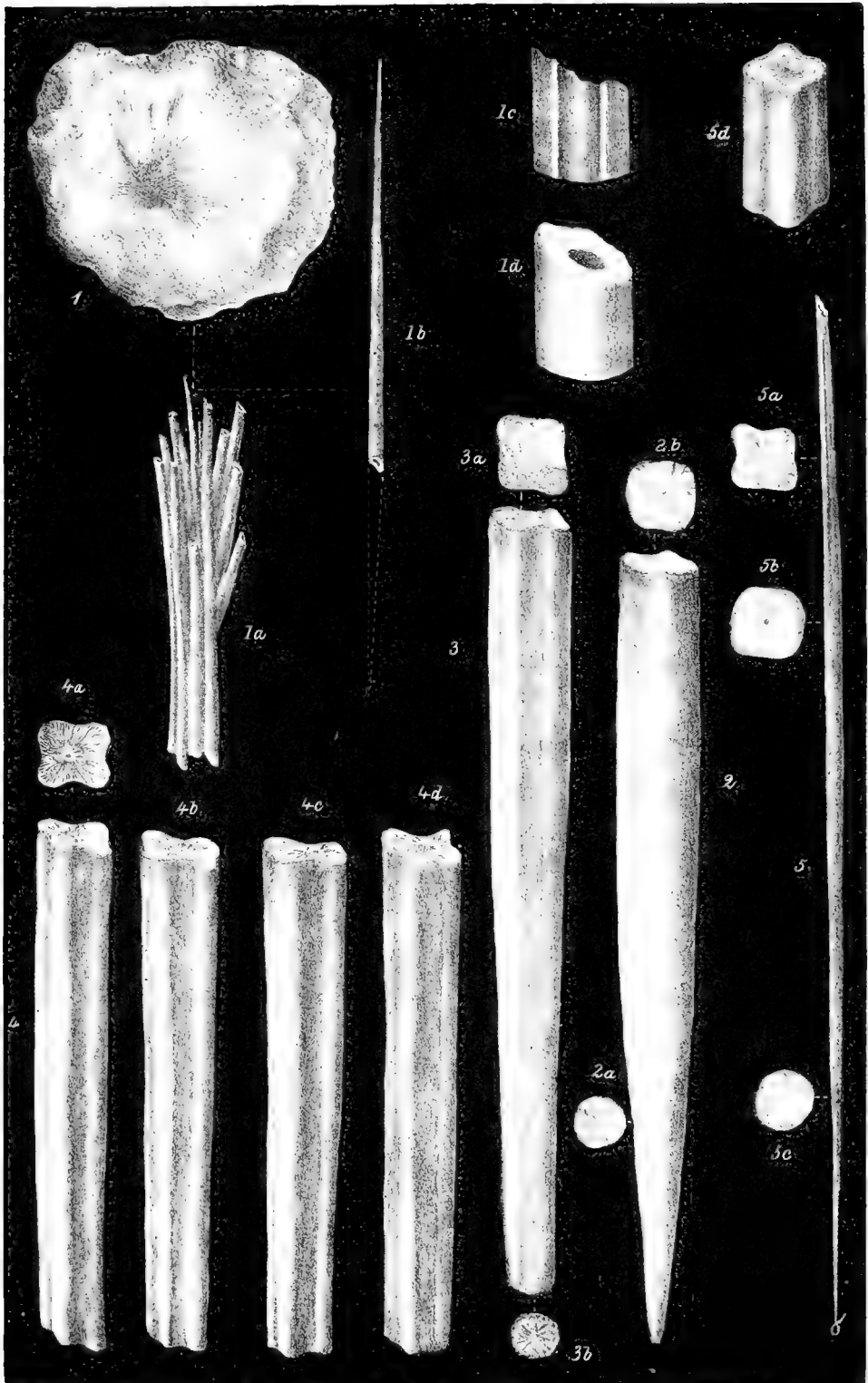


PLATE XLVIII., FIG. 1.

TETHYA NEWBERYI (McCoy).

[Genus TETHYA (LAM.). (Sub-kingd. Radiata. Class Protozoa. Order Rhizopoda. Fam. Spongiidæ.)

Gen. Char.—Sponge tuberous, compact, invested with a distinct rind or skin, interior sarcoïd with numerous very long slender, silicious spicula, collected into bundles and radiating from a more compact nucleus to the circumference. Marine.]

DESCRIPTION.—Forming irregularly lobed masses from 1 to 2 inches in diameter, composed of long setaceous spicula, radiating from a point, and grouped in bundles; each spicule hollow, nearly smooth, straight, or nearly so, circular in section and tapering to a point at each end. About eighteen spicules in the transverse space of 1 line; some apparently about 1 inch long.

The first specimen obtained of this object was sent to Mr. Cosmo Newbery for analysis as a mineral species, but he, perceiving that the fine fibres of which the mass was composed were pure silex, forwarded the specimen to me as probably an organic fossil. I have great pleasure in dedicating the species to my excellent colleague, whose chemical researches have been so beneficial not only to the geological survey but to the colony at large.

The fine hairlike or "asbestiform," hollow, silicious spicules exactly accord with those of sponges of the recent genus, *Tethya*, in size, shape, structure, and chemical constitution, in their radiated arrangement, and tendency to associate in imperfect bundles; like them, also, the pointed lower and upper ends do not extend usually the whole way from the point of radiation (which probably agrees nearly with the point of attachment), but they arise and terminate occasionally at various intermediate points. I have not seen any triradiate terminations to any of the spicules such as occasionally occur with the simple forms in the recent *Tethya*, but they are so brittle that such may yet well be found. The general form of our fossil is not so regularly spheroidal as in the living European *Tethya cranium*, but is rather more lobed and irregularly flattened in parts as in the *Tethya penicilliformis* of Gray (or *Halichondia mammillaris* of Johnston), but the "asbestiform" spicules of both

these species are nearly identical with each other and with our fossil.

Not uncommon in the cream-colored Miocene Tertiary strata of Boggy Creek, near Sale, Gippsland.

EXPLANATION OF FIGURES.

Plate XLVIII.—Fig. 1, specimen, natural size. Fig. 1a, bundle of silicious spicules, magnified, showing that the pointed terminations are at different distances from the base. Fig. 1b, most perfect portion of spicule observed, magnified to show the slender fusiform shape. Fig. 1c, fragment of spicule more highly magnified, showing the appearance with transmitted light under the microscope of the translucent thick hollow tube. Fig. 1d, portion of ditto, viewed by reflected light, showing the external surface and internal tubular hollow.

PLATE XLVIII., Figs. 2, 3, 4.

GRAPHULARIA ROBINÆ (McCoy).

[Genus GRAPHULARIA (MIL. EDW. AND HAIME). (Sub-kingd. Radiata, Class Zoophyta, Order Zoophytaria. Fam. Pennatulidæ.)

Gen. Char.—Calcareous axis very long, straight, tapering towards each end, tapering more rapidly towards the conoidal lower extremity, of which the transverse section is circular; more gradually tapering towards the upper portion, the section of which is tetrahedral with one of the sides, forming a broad shallow furrow, the other three sides being less concave. Transverse section showing a thin dense external coating, with a fine sub-crystalline internal structure radiating from the centre, and crossed occasionally by concentric lines of growth.]

DESCRIPTION.—Corallum straight, conically tapering rather rapidly to a point and with a circular section for lower 2 inches of the length, beyond which the section becomes gradually tetrahedral, the four angles forming narrow rounded ridges increasing in prominence and defining an irregular depressed flattened or concave side between each pair; hard dense superficial layer marked on surface with irregular longitudinal short impressed striæ under the lens; inner portions radiatingly fibrous perpendicularly to the surface. Length unknown (upwards of 1 foot), usual diameter of quadrate portion rather less than $\frac{1}{2}$ inch; circular lower portion tapering to a point in 2 inches from a diameter of 5 lines, at an angle of about 10° .

There is a large fleshy sea-pen living in Hobson's Bay, *Sarcophtilus grandis* (Gray), the hard internal calcareous axis of which is a perfect miniature of our fossil in all the more important respects; it has the same hard surface, minutely streaked with longitudinal interrupted striæ, a strongly radiated transverse internal structure and one end circular in section, gradually passing into a quadrangular section with increasingly prominent longitudinal, rounded, ridge-

like, angles towards the other end. The axis of our living species is about 7 inches long and about 1 line in diameter, and, like the European living genus *Pennatula*, it has the quadrangular portion below, gradually assuming the circular section in the upper half, while our gigantic fossil prototype, like the European Tertiary extinct genus, *Graphularia*, has the circular portion below, and the longer upper portion quadrangular. I refer our fossil therefore to *Graphularia*, although it as much exceeds the European Tertiary *Graphularia Wetherelli* in size, as it does the living analogues.

From the form of the conical lower portion, becoming quadrate after 3 or 4 inches from the conical lower pointed apex, and the hard surface and radiatingly crystalline structure so nearly resembling a *Belemnite*, and so nearly agreeing with the object described by Professor Tait as a Belemnite from the Tertiary beds of the same age as ours in South Australia, I cannot help thinking that, as the phragmacone has not been observed, the supposed discovery of that common Mesozoic genus of *Cephalopoda* in Australian Tertiary strata may be founded on a similar zoophyte, with a different rate of tapering, but of a generic type recognised as Cainozoic.

To show the structural identity, I have figured the recent and fossil axes together on our plate, reversing the natural position of the recent one, which is represented with the upper end downwards, so that the transverse sections—circular, subquadrate, and prominently four ridged, with concave sides—may be compared with the correspondingly shaped sections of the fossil. The four longitudinal ridges corresponding to the four angles of the tetrahedral section usually present a slight spirally oblique twist, reminding us of the recent genus *Umbellularia*.

I am indebted to the Rev. Mr. Legge, of Brighton, for my first knowledge of this interesting fossil, which he found in some abundance in the Wauru Ponds quarries, where, under the name of "square bones," they had attracted the attention of the workmen. At Mr. Legge's request, instead of dedicating the species to himself, I have named it after his late wife, who always took a great interest in his geological investigations and scientific expeditions generally.

Common in Miocene Tertiary strata of Wauru Ponds, near Geelong, and in similar beds (A^a 22), Bird Rock Bluff.

EXPLANATION OF FIGURES.

Plate XLVIII.—Fig. 2, specimen of lower conical end, natural size. Fig. 2*a*, circular section at portion marked, (corresponding with the circular section of the living form, fig. 5*c*). Fig. 2*b*, subquadrate section at upper end of fragment, (corresponding to subquadrate section of living form, fig. 5*b*). Fig. 3, another specimen, natural size, with the lower conical apex broken off. Fig. 3*a*, tetrahedral section of upper end with concave sides and rounded angles, (corresponding to fig. 5*a*, section of the living form). Fig. 3*b*, circular section of lower end of fragment, (corresponding to fig. 2*a* of previous fossil, and fig. 5*c* of living form). Fig. 4, portion from more near upper end, showing the ridges between the four concave sides forming longitudinal slightly twisted rounded ridges, (corresponding to fig. 5*d*, magnified portion of living type). Fig. 4*a*, transverse section showing the distinct radiated structure with occasional concentric lines of growth and external dense layer, (corresponding to top of magnified fig. 5*d*, from living type). Fig. 4*b*, view of a second side of same specimen as fig. 4. Fig. 4*c*, view of a third side of same specimen as fig. 4. Fig. 4*d*, view of fourth side of same specimen as fig. 4.

Fig. 5, internal axis of the living Victorian sea-pen, *Sarcoptilus grandis* (Gray), natural size. A small portion is broken off the basal tetrahedral portion (which is represented upwards for more convenient comparison with the fossil *Graphularia*, the form of the upper and lower sections of which are reversed). The upper end tapers to a filiform point, which is flexible, as represented near the bottom of the plate, but is straight when in its natural position imbedded in the fleshy substance of the polypes. Fig. 5*a*, tetragonal section with concave sides and rounded angles at point marked, magnified to show the identity of radiated structure and general shape with the other end of the fossil. Fig. 5*b*, subquadrate section at point marked, magnified to show the identity with the subquadrate section of part of the fossil and the external superficial layer, radiated structure, and concentric lines of growth. Fig. 5*c*, circular section of opposite end, magnified to compare with section of circular portion of fossil. Fig. 5*d*, portion of sides of tetragonal end of axis with the four prominent rounded ridges, concave sides, external dense layer, radiated transverse fracture and concentric lines of growth, magnified to compare with the fossil, fig. 4.

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(continued from Plate XLVIII.)

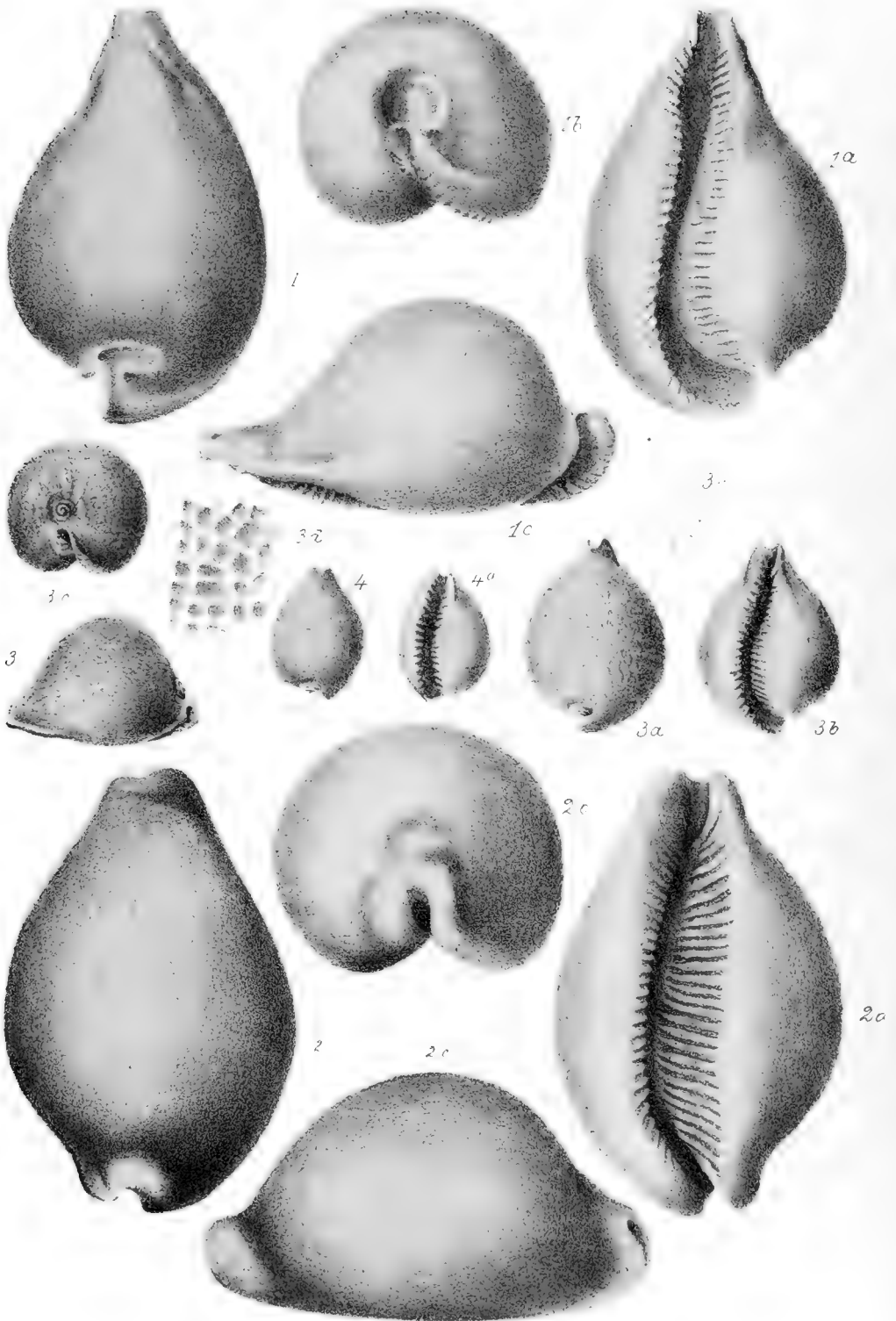


PLATE XLIX., FIG. 1.

CYPRÆA (LUPONIA) LEPTORHYNCHA (McCoy).

[Genus CYPRÆA (LINN.). (Sub-kingd. Mollusca. Class Gasteropoda. Order Pectinibranchiata. Fam. Cypræideæ.)

Gen. Char.—Shell ovato-oblong; spire very short, or entirely covered by the body-whorl; back rounded; inner and outer lips inrolled; aperture narrow, as long as the shell, reflected at both ends, transversely toothed and ridged on each side.

Sub-genus.—*Aricia* (Gray). Surface highly polished; gibbous above; flattened, thickened, and dilated at the sides below; spire covered; aperture straight, narrow; outer and inner lips callous, thickened, wide, dentated.

Sub-genus.—*Luponia* (Gray). Ovato-pyriform, ventricose, smooth, polished; spire usually covered, depressed; aperture narrow, straight; inner margin plicato-crenulated; outer lip denticulated.]

DESCRIPTION.—Pyriform, back ventricose and abruptly rounded towards the posterior side, which has a shallow depressed umbilicus, partially exposing three or four turns of the spire (the apex of which is the most depressed), tapering more gradually anteriorly to a straight slender beak or canal, subtruncate in front, margined on each side by a narrow thickened extension of the inner and outer lips, separated by a definite hollow from the back; an obliquely longitudinal depression occupies the middle of the back of the anterior canal, extending from a little to the right at base to a little on the left of the middle in front, it is bordered by two small oblique, prominent, obtuse ridges; no posterior canal, the outer lip only projecting backwards in a short lobe with a thickened quadrate margin. Base only slightly thickened at the anterior and posterior ends, thin and simply convex in the middle; outer lip inflected with about 42 strong, sub-equal, tooth-like ridges, narrower than the spaces between them, slightly sinuous so as to widen the aperture at base of anterior canal, the posterior third of its length abruptly inarched towards the left side in nearly quarter of a circle extending slightly beyond the line of the apex of the spire; inner lip convexly rounded with short slender ridges, irregular in size, shape, and direction. Surface smooth and glossy. Length of average specimen, 2 inches 5 lines; proportional width, $\frac{6.5}{100}$; height, $\frac{5.5}{100}$; diameter of umbilicus or exposed spire, $\frac{1.5}{100}$; length of anterior canal, $\frac{1.9}{100}$; backward extension of outer lip, $\frac{1.5}{100}$.

This species slightly reminds one of the European Eocene *C. inflata* and *C. globularis*, but the greatly inarched toothed posterior end of the outer lip easily distinguishes it, as well as the different form of the anterior beak; it is also slightly allied to the *C. Haveri* and *C. Genei* of Michelotti in his work on the Miocene fossils of N. Italy, but is easily distinguished by the same characters.

In the slight indication of two tubercles separated by a marked depression at base of back of anterior canal, as well as in its definite thickened lateral margins, and shallow umbilicus exposing the spire, it slightly resembles the *C. eximia*, but is easily distinguished

by the much shorter and narrower anterior canal, with much smaller, oblique, ridge-like tubercles, by the reflected posterior canal being replaced by a one-sided quadrate lobe or end of the outer lip, by the very much shorter, smaller, and narrower tooth-ridges on the inner lip, and by the remarkable quadratic curvature or inarching towards the left side of the posterior third of the aperture and toothed outer lip.

The species seems to vary very little in any respect. The substance is thin and light.

Common in the blue Oligocene Tertiary clays and limestones near foot of Mount Eliza and Mount Martha, Mornington.

EXPLANATION OF FIGURES.

Plate XLIX.—Fig. 1, dorsal view of average specimen, natural size. Fig. 1a, basal view of same specimen. Fig. 1b, end view of same specimen. Fig. 1c, profile view of same specimen.

PLATE XLIX., FIG. 2.

CYPRÆA (ARICIA) CONSOBRINA (McCoy).

DESCRIPTION.—Ovate, thick, back very convex, base thickened; columella moderately flattened, and sloping inwards at a marked angle; transverse section four-fifths of a circle; dorsal profile with greatest height a little behind the middle, anterior portion only tapering a little more gradually than the posterior portion; anterior canal very short, slightly reflected, obtuse, deeply indented by the notch, not very sharply defined from the back, and only slightly extended laterally by an obtusely rounded thickening of the base; two slight oblique indentations with obsolete obtuse ridge between them at dorsal middle of base of anterior canal; posterior canal similarly short, obtuse, and imperfectly defined, and not distinctly reflected; base thickened, convex in middle, with a slight, obtusely rounded, extension on sides of anterior and posterior canals; aperture narrow, gently arched towards the left side behind; outer lip rounded and strongly inflected with about 30 rounded teeth, short on middle and behind, lengthened on the flattened, very steeply sloped, anterior third; inner lip flattened and steeply sloped inwards, with long narrow transverse deep sulci, with broader flattened dental ridges between them. Surface smooth. Length, 2 inches 8 lines; proportional width, $\frac{6.5}{100}$; height, $\frac{5.6}{100}$.

This species seems a near relation of the *C. eximia* and *C. platypyga* in its heavy thick substance, form of the flattened and thickened base and inner lip and the peculiar character of the long

narrow deep transverse sulci of the inner lip with the much broader flat intervening spaces representing the dental ridges, but it is easily distinguished by its more egg-shaped form, much shorter canals, and concealed spire.

Very rare in the Lower Miocene or Oligocene Tertiary strata of Moorabool River.

EXPLANATION OF FIGURES.

Plate XLIX.—Fig. 2, dorsal view, natural size. Fig. 2*a*, view of base of same specimen. Fig. 2*b*, posterior end view of same specimen. Fig. 2*c*, side view of same specimen.

PLATE XLIX., FIGS. 3, 4.

CYPRÆA (LUPONIA) CONTUSA (McCoy).

DESCRIPTION.—Small, thin, globular, transverse section nearly circular; longitudinal profile of back highest at one-third the length from the posterior end, from whence it forms nearly a quadrant of a circle in front, a little elongate at base of beak; abruptly falling from same point to the slightly projecting spire, which is of three slightly convex whorls, the apex being obtusely pointed and prominent; anterior canal very short with an abruptly reflexed margin, and with a very deep rounded notch, the sides slightly expanded and separated from the back by a narrow impressed sulcus; posterior canal deeply notched to level of spire, defined on left side by a small semicircular ridge, the right boundary twice as long, formed of the rounded or subquadrate lobe forming the posterior end of outer lip. Mouth narrow, inarched to left side at posterior end to level of spire; inner and outer lips slightly thickened, defined before and behind by small prominent marginal ridges; each lip with about 21 regular, narrow, prominent, dental ridges, narrower than the intervening spaces. Whole surface of back irregularly reticulated with small contusions or irregular polygonal bruise-like depressions, bounded by irregular, faintly marked, transverse ridges on the posterior portion, the intervals being crossed by irregular longitudinal wrinkles, both sets losing all order in the irregular wrinkled reticulation of the middle and anterior portion of back; lateral small flanges, and back of anterior and posterior canals smooth. Average length, 1 inch 2 lines; proportional width, $\frac{7.5}{100}$; height, $\frac{7.0}{100}$; diameter of umbilicus and spire, $\frac{1.7}{100}$; length of anterior canal, $\frac{1.8}{100}$; backward extension of outer lip or right edge of posterior canal, $\frac{1.0}{100}$.

This common little species is curiously distinguished by its surface seeming to be covered with little bruises or indentations of irregular size and shape resembling a minutely shrivelled fruit;

the little bounding ridges or wrinkles being destitute of all order in some specimens, but showing indistinct transverse ridges towards the posterior end in others. The form is more globular than any of the allied *Cypreæ* of the Australian Tertiary rocks. In young individuals the canals are still shorter, the spire more prominent, and the teeth fewer in number. In some old specimens the thickening of the base leaves a definite thickened marginal boundary from the surface of the sides.

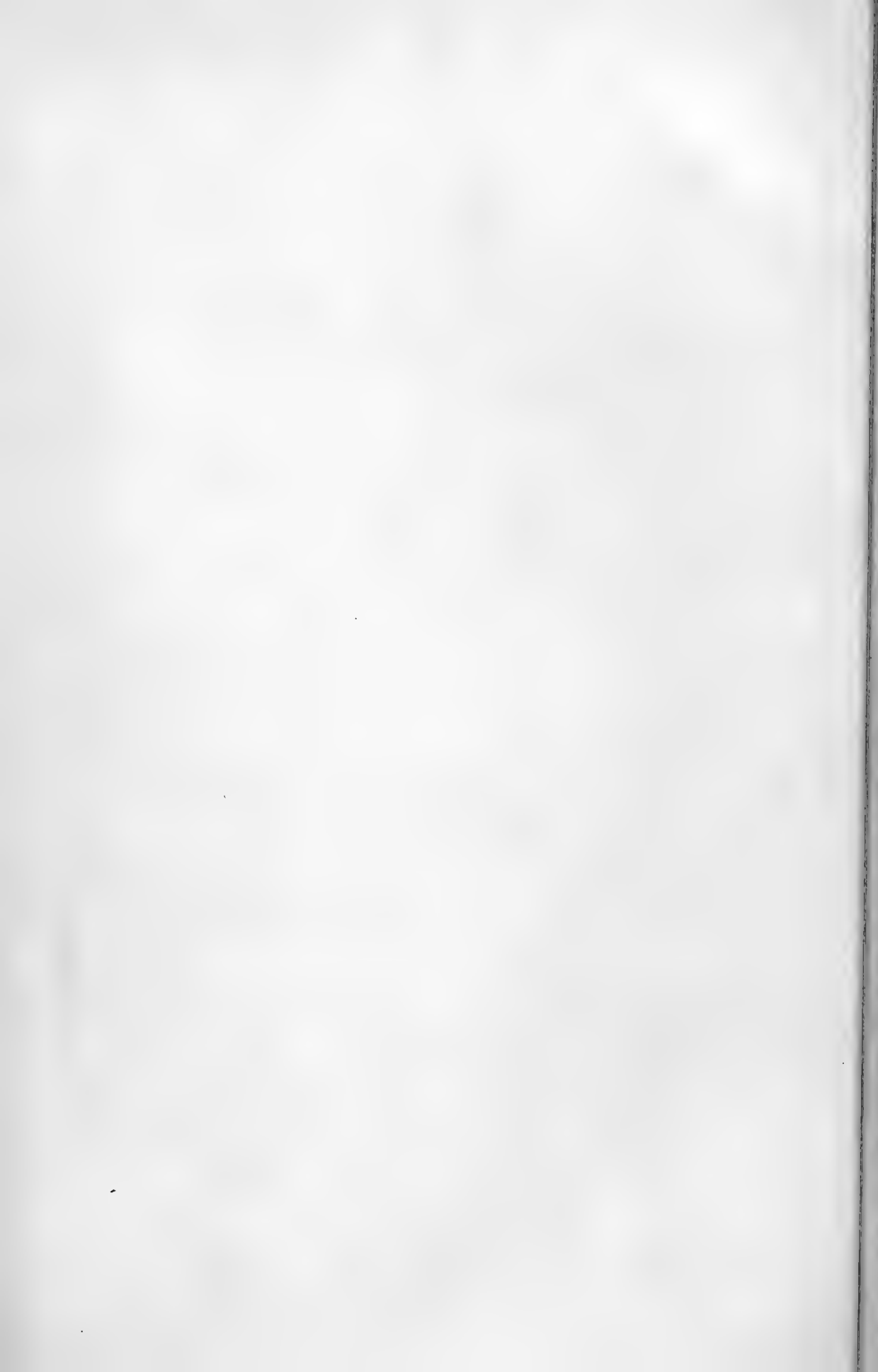
The species is not nearly allied to any living or extinct form with which I am acquainted.

Abundant in the bluish Oligocene Tertiary clays and limestones of Mornington, near the foot of Mount Eliza and Mount Martha.

EXPLANATION OF FIGURES.

Plate XLIX.—Fig. 3, side view of average specimen, natural size. Fig. 3*a*, dorsal view of same specimen. Fig. 3*b*, basal view of same specimen. Fig. 3*c*, posterior end view of same specimen. Fig. 3*d*, magnified view of portion of surface. Fig. 4, dorsal view of younger specimen, natural size, showing shorter canals. Fig. 4*a*, basal view of same specimen showing fewer teeth.

FREDERICK MCCOY.



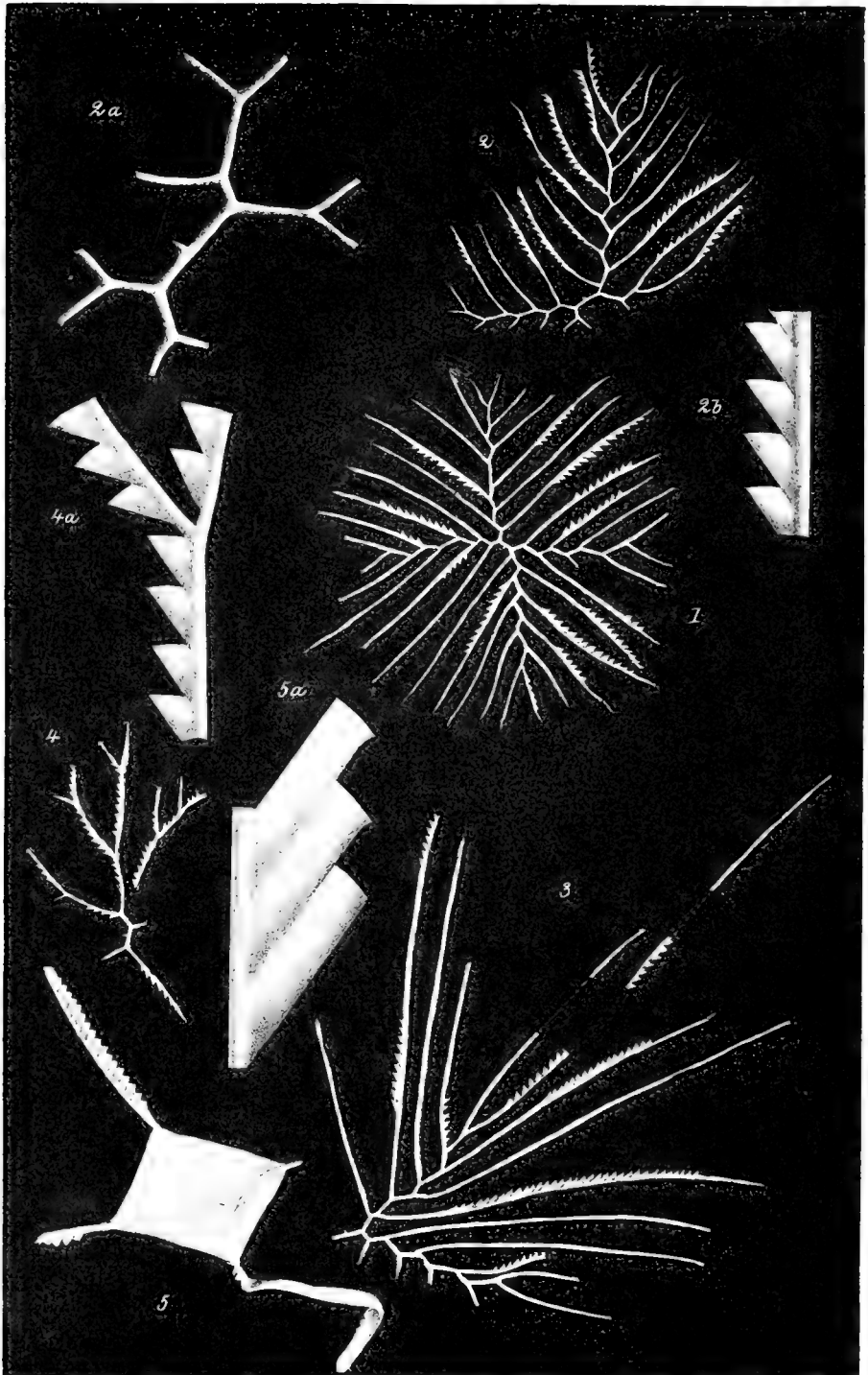


PLATE L, FIGS. 1, 2, 3, 4.

GRAPTOLITES (DIDYMOGRAPSUS) THUREAU
(McCoy).

[Genus GRAPTOLITES (LIN.). (Class Zoophyta. Order Hydrozoa. Fam. Graptolitidæ.)

Gen. Char.—Polypidom horny, elongate, compressed, with a slender solid axis along one edge, followed by a parallel common longitudinal canal, from which one close row of cells extends, each inclined upwards and outwards, and all terminating in separate apertures on the serrated edge opposite the solid axis.

Sub-genera.—1, *Graptolites* (proper). Stem single and simple; Upper and Lower Silurian. 2, *Didymograpsus* (McCoy). Stems simple, but united in groups of two or more by the pointed uncelled lower end. Some of these have a round horny disc connecting the non-celluliferous bases of the grouped stems; Lower Silurian. Some writers divide the species into sub genera *Tetragraptus*, *Loganograptus*, &c., according to the number of stems conjoined, a character certainly not of generic value.]

DESCRIPTION.—Radicule conical, minute, in the middle of a short straight funicle $1\frac{1}{2}$ lines long, which bifurcates equally at each end, giving rise to the four equal main branches or stolons of the complete polypidom; each branch about 1 inch long, bent regularly in zigzag angles of about 135° , alternately giving off at intervals of about 1 line, on both sides from the salient angles, the regular, straight, simple stems, five or six in number on each side, and about 1 inch in length (more or less as they are nearer the base or the apex), each with a row of broad, acutely angular cell-denticles, seven in the space of 3 lines; the upper edge of each cell slightly convex and nearly at right angles with the back, and rather longer than the undivided portion, the lower edge two-thirds uncovered by the next cell, and making an angle of about 45° with the back; from the point of one cell to the next about equal to the width from the same point to the back. The whole polypidom, of about forty stems, forms a slightly quadrate circle or rounded square about 2 inches in diameter.

REFERENCE.—McCoy, Ann. and Mag. Nat. Hist. v. 18, p. 129 (1876).

This species will not quite fit into any of the newly suggested genera of recent writers; so I fall back for the present on my old genus *Didymograpsus*, with an extension which might make it include all compound Graptolites having more than one unbranched stem, with a single row of cells each, arising from an uncelluliferous connecting basal tube or radicle and funicle (including *Loganograptus*, *Dichograptus*, &c.).

I name this species after the discoverer, M. Thureau, of Sandhurst, who first brought it under my notice, and who has presented two specimens (one nearly perfect) to the National Museum at Melbourne. The regular zigzag bendings of the four branches of the funicle, from which the stems arise, form an arrangement of

great beauty, and easily distinguish it from any other with which I am acquainted. For those writers who prefer to break up the genus *Didymograpsus*, the name *Goniograptus* might be suggested for such types as the present, in which the branches of the funicle (for which I would suggest the name stolons) are angularly bent at the points of budding into the celluliferous stems.

Rare in the black and red slates of the Llandeilo flag age of the Bendigo goldfield, Sandhurst, Victoria.

EXPLANATION OF FIGURES.

Plate L.—Fig. 1, nearly perfect specimen, natural size. The cells appear sometimes on the right and sometimes on the left side, according to the accidental direction of the flattening on the plane of deposition of the stone. Those branches that appear without cells have the non-celluliferous back exposed, and the cells are probably imbedded in a plane at right angles to that in which the branches are spread. Fig. 2, portion of another, larger specimen, natural size. Fig. 2*a*, portion of ditto, magnified to show the small conical central funicle and the primary branches of the stolon. Fig. 2*b*, cells of ditto, magnified. Fig. 3, portion of very much larger specimen, natural size. Fig. 4, an allied form not sufficiently perfect for description, natural size.

PLATE L., FIG. 5.

GRAPTOLITES (*DIDYMOGRAPSUS*) *HEADI* (HALL).

DESCRIPTION.—Central stype straight, about 1 line long, bifurcating at each end into two equal straight branches (four in all) several inches long, connected at base by a quadrate nearly square corneous disc, the four straight sides of which measure about 7 lines between the branches and 8 lines between the pairs. Cell denticles five in 3 lines, straight or slightly curved, making an angle of about 35° with the back, exposed portion one-fourth the length of the cell, the diameter of the aperture and exposed outer side about equal and rather less than one-third the width from angle to back; when perfect, edge of aperture slightly convex, and the angle forming a thick downward arched hook.

REFERENCE.—Geol. Surv. Can. Dec. 2, p. 94, t. 6, f. 8.

The specimen figured is the only Graptolite which has yet occurred to me in Australia with the central corneous quadrate disc, such as Prof. Hall has made known in the *G. Headi* of Cambrian or Lower Silurian slates of Canada. The angle made by the cells with the axis is stated to be about 50° by Prof. Hall, but his figure more nearly agrees with our example.

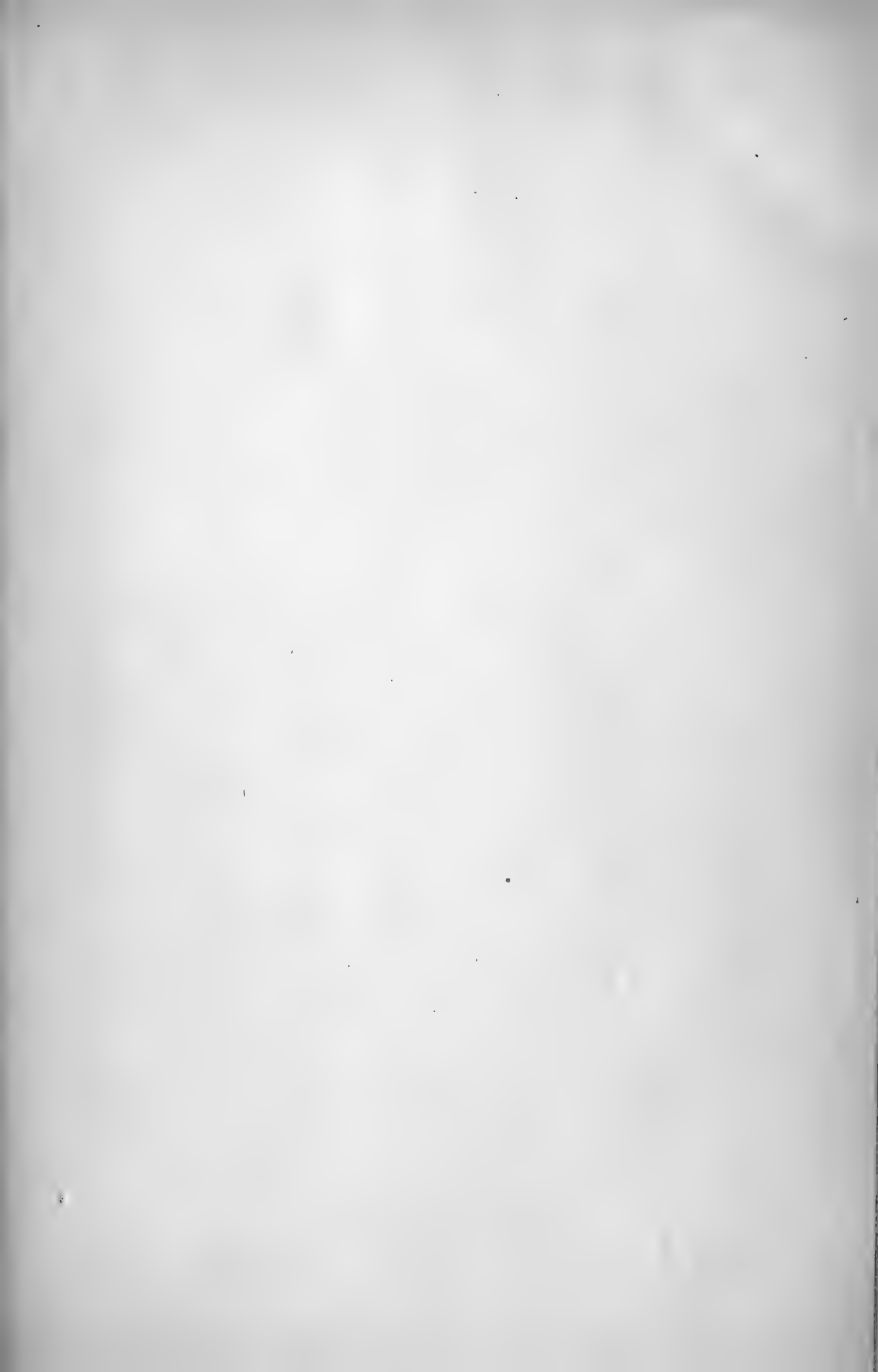
Rare in the black Llandeilo flags of (W.L.S. 1, 19 S.W.), section 16, parish of Dariwill, Sutherland's Creek, together with *D. Loganii*, *D. pristis*, and *D. bryonoides*, as in Canada.

EXPLANATION OF FIGURES.

Plate L.—Fig. 5, quadrate corneous disc and basal portion of the four branches arising from the short central stipe, natural size. Fig. 5*a*, three cells, magnified. In some parts the cells are not so straight as in this figure but slightly curved outwards and downwards. The hooked outer angle is also larger in well-preserved points.

FREDERICK MCCOY.





CONTENTS OF DECADES.

N.B.—The originals of all the Figures are in the National Museum, Melbourne.

DECADE I.

- PLATE I.—*Phyllograptus folium* (His. sp.). Var. *Typus* (Hall).—*Diplograpsus mucronatus* (Hall sp.).—*Diplograpsus pristis* (His. sp.).—*Diplograpsus rectangularis* (McCoy).—*Diplograpsus* (*Climacograptus*) *bicornis* (Hall).—*Graptolites* (*Didymograpsus*) *fruticosus* (Hall sp.).
PLATE II.—*Graptolites* (*Didymograpsus*) *quadribraehiatus* (Hall sp.).—*Graptolites* (*Didymograpsus*) *bryonoides* (Hall sp.).—*Graptolites* (*Didymograpsus*) *octobraehiatus* (Hall sp.).—*Graptolites* (*Didymograpsus*) *Logani* (Hall sp.).
PLATES III., IV., and V.—*Phascolumys pliocenus* (McCoy).
PLATE VI.—*Voluta Hannafordi* (McCoy).—*Voluta anti-cingulata* (McCoy).—*Voluta anti-scalaris* (McCoy).
PLATE VII.—*Voluta macroptera* (McCoy).
PLATE VIII.—*Podozamites Barklyi* (McCoy).—*Podozamites ellipticus* (McCoy).—*Podozamites longifolius* (McCoy).
PLATE IX.—*Lepidodendron Australe* (McCoy).
PLATE X.—*Petraster Smythi* (McCoy).—*Urasterella Selwyni* (McCoy).

DECADE II.

- PLATE XI.—*Squalodon Wilkinsoni* (McCoy).—*Charcharodon angustidens* (Ag.).—*Charcharodon megalodon* (Ag.).
PLATES XII. and XIII.—*Gangamopteris angustifolia* (McCoy), and var. *G. spatulata* and *G. obliqua*.
PLATE XIV.—*Taniopteris Daintreei* (McCoy).—*Pecopteris Australis* (Mor.).
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DECADE III.

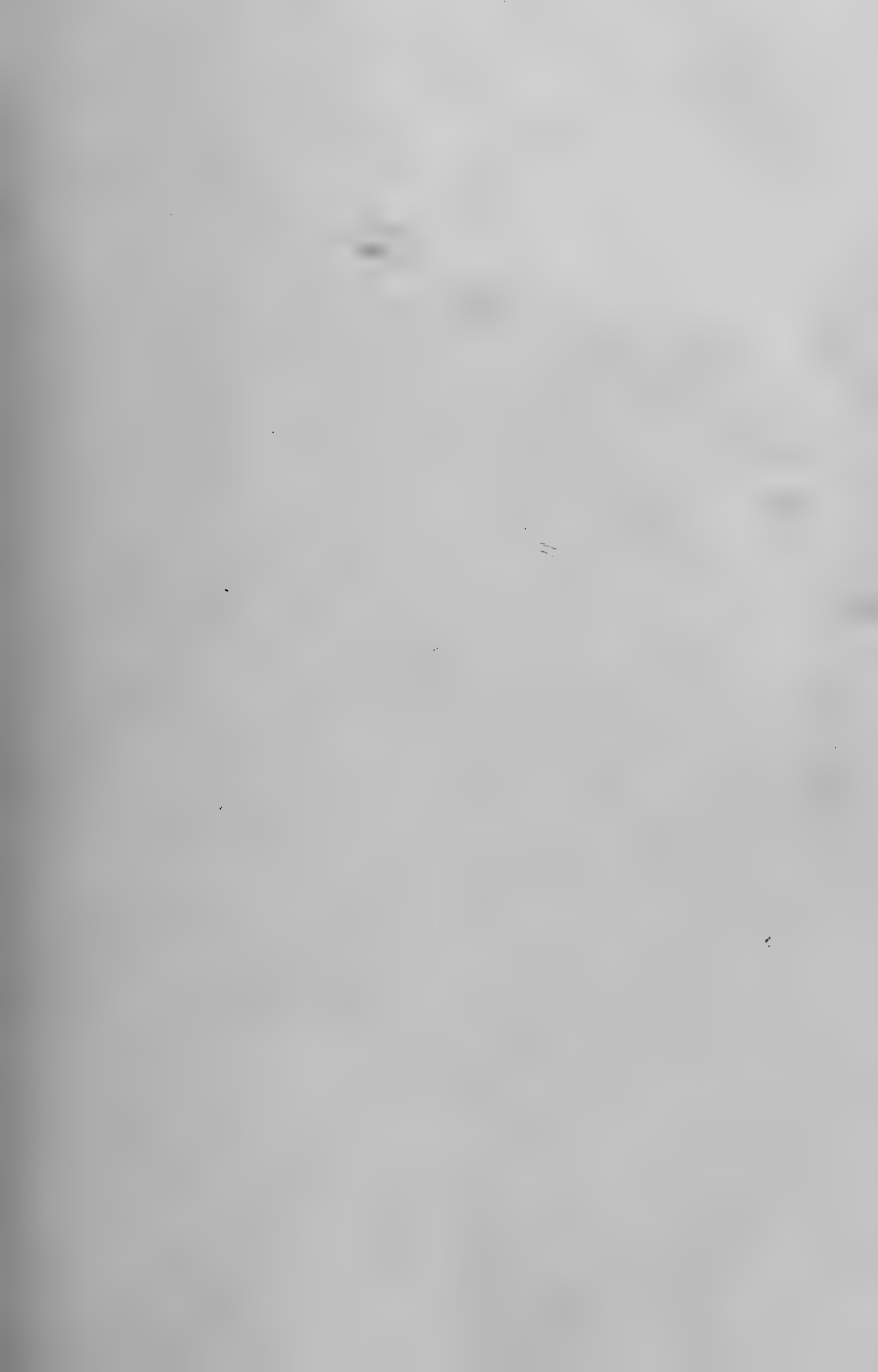
- PLATE XXI.—*Thylacoleo carnifex* (Ow.).
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DECADE IV.

- PLATES XXXI., XXXII., and XXXIII.—*Diprotodon longiceps* (McCoy).—*Nototherium*.
PLATE XXXIV.—*Pecten Yahlensis* (Woods).—Var. *Semi-lævis* (McCoy).
PLATE XXXV.—*Favosites Goldfussi* (d'Orb.).—*Spirifera lævicosta* (Val.).—*Chonetes Australis* (McCoy).—*Phragmoceras subtrigonum* (McCoy).—*Asterolepis ornata* (Eichwald). Var. *Australis* (McCoy).
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PLATE XXXVIII.—*Spondylus gaderopoides* (McCoy).
PLATE XXXIX.—*Eucalyptus Pluti* (McCoy).
PLATE XL.—*Cinnamomum polymorphoides* (McCoy).—*Laurus Werribeensis* (McCoy).

DECADE V.

- PLATES XLI. and XLII.—*Arctocephalus Williamsi* (McCoy).
PLATE XLIII.—*Waldheimia Corioensis* (McCoy).—*Waldheimia macropora* (McCoy).
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PLATE XLVI.—*Leptæna* (*Leptagonia*) *rhomboidalis* (Wilck. sp.).—*Trematospira liopleura* (McCoy).—*Trematospira formosa* (Hall).—*Spirifera plicatella* (Lin.). Var. *Macropileura* (Conrad).—*Spirifera sulcata* (His.).
PLATE XLVII.—*Spirigerina reticularis* (Lin. sp.).—*Rhynchonella* (*Hemithyris*) *decemplicata* (Sow.).—*Nucleospira Australis* (McCoy).—*Pentamerus Australis* (McCoy).
PLATE XLVIII.—*Tethya Newberyi* (McCoy).—*Graphularia Robinæ* (McCoy).
PLATE XLIX.—*Cypræa* (*Luponia*) *leptorhyncha* (McCoy).—*Cypræa* (*Aricia*) *consobrina* (McCoy).—*Cypræa* (*Luponia*) *contusa* (McCoy).
PLATE L.—*Graptolites* (*Didymograpsus*) *Thureaui* (McCoy).—*Graptolites* (*Didymograpsus*) *Headi* (Hall).









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