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RECORDS

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E. P. RAMSAY, LL.D.,

Curator.

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ADDENDA ET CORRIGENDA.

PAGE	LINE	
8.	1.	Omit "Re-."
8.	1.	For "an" read "a new."
8.		Omit foot-note *
9.	30.	For "44" read "48."
10.	1.	Omit "Re-."
10.	1.	For "an" read "a new."
10.		Omit foot-note.
18.		Foot-note † for "1877" read "1887."
20.	32.	For "milee" read "miles."
23.	33.	For "viverinus" read "viverrinus."
24.	36.	For "Lymnodynastes" read "Limnodynastes."
27.	30.	For "Barwon" read "Barron."
30.	20.	For "nalabatus" read "ualabatus."
30.	42.	For "Scenoæpus" read "Scenopœus."
31.	10.	Omit "Ptilotis" and substitute ,,
31.	17.	For "epioletus" read "epicletus."
31.	17.	For "Agavista" read "Agarista."
31.	36.	For "Gonyodactylus" read "Gonyocephalus."
31.	38.	For "Myxophies" read "Mixophyes."
36.		Omit foot-note.
37.		Omit foot-note.
38.		Omit foot-note.
41.	6.	For "Lucodore" read "Leucodore."
49.	23.	Add "4" after "Ser."
51.	24.	For "moveable" read "movable."
52.	6.	Add "4" after "Ser."
61.	30.	For "macroscopic" read "microscopic."
65.	30.	For "mising" read "mosing."
69.	5.	For "cresentic" read "crescentic."
78.	2.	For "(155)" read "(15·5),"
81.	23.	For "of the total" read "in the total."
81.	23.	For "four-sevenths of" read "four-sevenths in."
81.		Omit "and is" in foot-note.
86.	8.	For "artica" read "arctica."
86.	19.	Add "Herd." after "viridis."
87.	6.	Omit "," before "ovum."
91.	40.	For "subtymppanal" read "subtympanal."
98.	41.	For "mnch" read "much."
99.	18.	For "this" read "thus."
99.	30.	For "percepttble" read "perceptible."
123.	2.	For "Madroporaceæ" read "Madreporaceæ."
123.	8.	For "cænenchyma" read "cœnenchyma."
Pl.	xi.	The figures are reversed.
,,	xxi.	(Explanation) For "Microcystina" read "Microcystis."

Note "DOTICUS PESTILENS: *A correction.*—From a communication kindly forwarded by Mr. F. P. Pascoe, it appears that the genus for which I adopted the MS. name *Metodoticus* (see p. 75), has been described under the name *Doticus* (Ann. Mag. Nat. Hist. ix. p. 27, 1882). The Victorian Apple-pest should, therefore, be known as *Doticus pestilens,* instead of *Metadoticus pestilens*, as at first suggested. A figure of the insect, and some account of its life-history, are contained in Mr. French's recently published 'Handbook of the Destructive Insects of Victoria.'—A. S. O."

The rapid increase in the Collections of the Australian Museum, and the gradual acquisition of extensive series of new, or little known forms from Australia, New Guinea, and the Pacific Islands, have forcibly brought under the notice of the Trustees the necessity of officially publishing the investigations of their Scientific Staff. Hitherto this has been accomplished to a considerable extent through the medium of the local Scientific Societies, but the Trustees now propose to publish under the title of the *RECORDS OF THE AUSTRALIAN MUSEUM*, an occasional periodical, to contain the Results of Original Researches by the Staff, Reports of Collecting Expeditions, and other matter relating to the work of the Museum.

E. P. RAMSAY, Curator.

REPORT ON A ZOOLOGICAL COLLECTION FROM THE SOLOMON ISLANDS.

Part I.

By E. P. Ramsay.

During the month of November, 1889, the Museum acquired by purchase a mixed Zoological Collection from the Solomon Islands, in which the species mentioned below are represented.

Howla Island, on which the collection was made, belongs to the Shortland Group, and therefore to the western section of the Archipelago, to the fauna of which, as was to be expected, we find that with few exceptions the terrestrial vertebrates belong.* The exceptions referred to are *Enygrus bibroni*, *Dendrophis calligaster*, and *Hyla macrops*.

The following list conveys a general idea of the Collection :—

Mammalia.

Cynonycteris brachyotis, *Dobson.* Two adult specimens.

Cephalotes peroni, *Geoffr.* Four specimens.

Phyllorhina diadema, *Geoffr.* Seven specimens.

Aves.

The specimens received are represented by seven species, which, although only one is new to science, may be enumerated to show the range of the species throughout the group. All were obtained from the Island of Howla.

Halcyon leucopygialis, *Verr.*

This exceedingly beautiful and rare species has been hitherto, so far as I am aware, only recorded from the Island of Gaudalcanar (see Notes on the Zoology of the Solomon Islands, in the P.L.S., N.S.W., (1) iv. p. 67 (1879), where it was re-discovered by Mr. James Cockerell, Junr., in 1878.

*This conclusion is principally based on the excellent papers of Messrs. Thomas and Boulenger (P.Z.S., 1887-8).

Halcyon albicilla, *Cuv.*

This remarkable species has a wide range all over the Solomon Group, South-East of New Guinea, New Britain, New Ireland, and the Duke of York Islands.

Edoliisoma salomonensis, *Ramsay.*

Graucalus salomonensis, Ramsay, P.L.S., N.S.W., (1) iv p. 314; id. (1) vii. p. 22 (1882), sp. 20.

Graucalus pusillus, Ramsay, P.L.S., N.S.W., (1) iv. p. 71. (1879).

An interesting species allied to *Graucalus swainsoni*, var. *lineatus*.

Sauloprocta tricolor, *Vieill.*; *Ramsay*, P.L.S., N.S.W., (1) iv. p. 82 (1879).

This is a large form of the well known Australian species, *S. motacilloides*; the young just from the nest resemble the adults, but have the feathers of the shoulders, upper wing-coverts and scapulars tipped with dull brown.

Pomarea leucophthalmus, *sp. nov.*

The present species of *Pomarea* I believe to be undescribed, as I have not been able to find any description with which it agrees. It comes near *Pomarea castaneiventris* (Verr.), but is a slightly larger bird.

Head, neck, throat, chest, and all the upper surface shiny black, the feathers of the throat in the female (?) elongated, under surface of the wings and tail feathers dark brown, the inner margins of the primaries below dull ashy-white, abdomen, under wing- and tail-coverts dark chestnut, a conspicuous crescent-shaped spot of white in front of the eye of the female (♀ ?); in the male (?) this spot is light *rufous*, but may have been stained by the spirits in which the specimens were preserved; bill black, margins of the mandibles horn-white, legs and feet black. Total length 6·6 – 6·8 inches, wings 5·25 – 5·5 inches, tail 3 inches, tarsus 0·7 – 0·81 inch, bill from forehead 0·7 – 0·75 inch, from nostril 0·5 inch, height at nostril 0·25 – 0·3 inch, width at nostril 0·25 – 0·3 inch.

This species differs from *Pomarea castaneiventris* (Verr.) in having a crescent-shaped white mark on the lores in front of the eye, the tail and wings above shining blue-black, the under surface blackish-brown, with the margins of the quills shading into ashy white on their inner webs, there is also a greater extent of black on the sides of the chest. In one specimen ♀ there is just the slightest tip of white on some of the outer tail feathers, and the chestnut or chocolate tint of the under surface is darker and of a more coppery hue than in those figured in the British Museum Catalogue, Vol. iv., pl. xi., representing *P. castaneiventris* (Verr.).

Dicœum æneum, *Pucher. et Jacq.*

This handsome species was first described from a female by Hombron & Jacquinot, in Voy. au Pôle Sud., pl. 22, fig. 4, 1845, under the name of *Dicée bronzé*, and afterwards by Pucheran and Jacquinot, Voy. au Pôle Sud. Zool. p. 97 (1853), as *D. æneum.*

Dendrochelidon mystacea, *Less.*

A peculiar and interesting form which seems to be dispersed over the whole of the Solomon Islands, the Louisiades, South-eastern New Guinea, the New Britain Group, and also in the Malay Archipelago. It nests in trees, much after the habit of the Wood-Swallows *(Artamus)*, and the nest is made of sticks and twigs; the eggs, 3 or 4 in number, are oblong, and white without any markings.

Part II.

By J. Douglas Ogilby.

Reptilia.

Crocodilus porosus, *Schn.* One immature example.

Gehyra oceanica, *Less.* One specimen.

Gecko vittatus, *Houtt.* Seven specimens.

Varanus indicus, *Daud.* Two specimens.

Corucia zebrata, *Gray.* One specimen.

Lygosoma smaragdinum, *Less.* Six specimens.

,, cyanurum, *Less.* Two specimens.

,, cyanogaster, *Less.* Two specimens.

Lygosoma striato-fasciatum, *sp. nov.*

Habit stout; the distance between the end of the snout and the fore limb is contained once and two-fifths in the distance between the axilla and groin. Snout short, obtusely rounded. Loreal region vertical. Lower eyelid scaly. Nostril pierced between a nasal and a supra-nasal, the latter being the smaller. Fronto-nasal one-fourth broader than long, forming an equally broad suture with the rostral and the frontal; prefrontals small; frontal heptagonal, the two posterior sides forming a right angle, in contact with the two anterior supraoculars, and rather shorter than the frontoparietals and parietals together; four supraoculars, the second slightly larger than the third; eight supraciliaries, the first the largest; frontoparietals distinct, equal in length to the interparietal; parietals forming a suture behind the interparietal; a pair of nuchals and a pair of temporals bordering the parietals; sixth upper labial beneath the middle of the eye, and not larger than the others; upper labials completely separated from the lower eyelid by a row of scales equal in size to the supraciliaries. Ear-opening oval, vertical, about one half of the size of the eye-opening, with five small lobules anteriorly. Thirty-three smooth scales round the middle of the body; dorsal scales much larger than the laterals and ventrals, which are of equal size; preanals not enlarged. The adpressed hind-limb overlaps the wrist; digits moderate, compressed; sub-digital lamellæ twenty-three under the fourth toe. Tail rather short and stout, not much longer than the head and body. *Colours*—Above yellowish-brown, below creamy-white; a series of vertical violet bars on the labials; a violet band from the angle of the mouth, inclining inwards along the throat, and not reaching quite so far backward as the fore limb; a similar, but shorter and more indistinct, parallel band from the sixth upper labial; upper surface with seven narrow dark-blue longitudinal bands, which cease about half way along the tail, and correspond to the intersection of the series of scales; a few similar, but less conspicuous bands between the limbs; fifteen rather irregular broad dark brown transverse bands on the body continued for some distance down the sides; outer surfaces of limbs with narrow dark blue longitudinal lines.

	Inches.	Millim.
Total length...	14·66 ...	372
Length of head	1·22 ...	31
Width of head	0·88 ...	22
Length of body	5·59 ...	142
Length of fore limb... ...	1·75 ...	44
Length of hind limb ...	2·35 ...	60
Length of tail	7·85 ...	199

This Lizard belongs to the sub-genus *Riopa*, and though undeniably closely allied to Dr. Gunther's *Eumeces albofasciolatus*, hitherto recorded from Northern Australia, New Ireland, and the Duke of York and Solomon groups, still, putting aside the very distinct pattern of coloration, I consider that the differences cited sufficiently justify me in describing the species as new. These differences are as follows:—(1) The greater comparative length between the tip of the snout and the fore limb; (2) the reduced number of supraoculars; (3) the equality in size between the interparietal and either frontoparietal;* (4) the non-enlargment of the sixth upper labial; and (5) the distinct overlapping of the adpressed limbs.

* This character is not prominently brought out in the figure of the head shields in the latest British Museum Catalogue.

Enygrus carinatus, *Schn.* One specimen.

" bibroni, *H. & J.* Two specimens.

Dendrophis calligaster, *Gnth.* One immature example.

Dipsas irregularis, *Merr.* Six specimens.

Hoplocephalus par, *Blgr.* Three specimens.

Batrachia.

Rana guppii, *Blgr.* One specimen.

" opisthodon, *Blgr.* Four specimens. The very interesting account given by Mr. Boulenger of the curious breeding habits of this Frog will well repay perusal. (See Trans. Zool. Soc. xii. p. 51.)

Ceratobatrachus guentheri, *Blgr.* Three specimens.

Hyla macrops, *Blgr.* One specimen.

Pisces.

Chætodon vittatus, *Bl.* One specimen.

Gobiodon rivulatus, *Rüpp.* One specimen.

Amphisile strigata. *Gnth.* Nineteen specimens.

Heliastes lepidurus, *C. V.* One specimen.

Fierasfer homii, *Rich.* One specimen.

Ophichthys colubrinus, *Bodd.* One specimen.

Crustacea.

Mr. Whitelegge has determined the members of this Class as follows :—

Gelasimus vocans, *Fabr.* Seventy-five specimens.

Matuta victrix, *Fabr.* Thirteen specimens.

Calappa hepatica, *Linn.* Three specimens.

Thalassina maxima, *Hess.* One specimen.

Birgus latro, *Herbst.* One specimen.

Insecta.

Mr. Olliff reports as follows :—"The Collection contains a few interesting Longicorns, chiefly belonging to the genus *Batocera*, and one or two *Dynastidæ* which are new to the Collection, but the majority are well-known forms."

Echinodermata.

The only species represented is—

Archaster typicus, *M. & T.* Four specimens.

~~RE~~DESCRIPTION OF A~~N~~ AUSTRALIAN SKINK.

BY E. P. RAMSAY & J. DOUGLAS OGILBY.

LYGOSOMA MACCOOEYI, *sp. nov.**

HABIT lacertiform; the distance between the end of the snout and the fore limb is contained once and two-fifths in the distance between the axilla and groin. Snout short, obtusely rounded. Lower eyelid with an undivided transparent disc. Nostril pierced in the nasal; no supra-nasals;† fronto-nasal much broader than long, forming a broad suture with the rostral, and a narrow one with the frontal; prefrontals large, much bent down on the sides;‡ frontal pentagonal, forming a rounded angle posteriorly, equal in length to or but little shorter than the frontoparietal, and in contact with the two anterior supraoculars; four supraoculars, the second the largest; seven supraciliaries; frontoparietal single, followed by a small interparietal; parietals forming a median suture behind the interparietal; a pair of nuchals and a pair of temporals bordering the parietals; fifth upper labial much the largest, entering the eye. Ear-opening oval, slightly smaller than the transparent palpebral disc, with a single obtuse lobule anteriorly. Thirty-two scales round the middle of the body, the dorsals very indistinctly bi- or tricarinate, the laterals a little smaller than the dorsals or ventrals; preanal scales slightly enlarged. The hind limb when stretched forward reaches the elbow; fingers four, toes five; sub-digital lamellæ twenty to twenty three under the fourth toe. Tail one-third longer than the head and body. *Colors*—Above rich olive-brown, most of the scales from the shoulders to nearly the end of the tail with two or three light-blue longitudinal pencillings which are generally edged with black; these are absent on the sides of the body, but present on those of the tail; in some specimens there are two broad orange lateral bands between the limbs, separated by a blue band; in others a single orange band bordered above and below by blue, while in a third section the orange is

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*Since publishing the description of the original specimen in the Proc. Linn. Soc., N.S. Wales, Dec., 1889, several fine specimens have been received, the examination of which necessitates the amplification of that description as here given.

†In one specimen there is a large supra-nasal on one side, which is wanting on the other.

‡In one specimen these shields are in contact with the second upper labial.

entirely wanting, leaving the sides blue; sides of head bluish-brown; labials and chin greyish-white; throat, abdomen, and under surface of tail light greenish-blue, each scale of the hinder two-thirds of the latter with a distinct posterior brown margin, which becomes more accentuated towards the tip; limbs blue, the outer scales broadly brown-edged, and with an occasional orange spot.

	Inches.		Millim.
Total length	5·65	...	143
Length of head	0·52	...	13
Width of head	0·41	. .	9
Body	1·88	...	48
Fore limb	0·67	...	17
Hind limb	0·91	...	23
Tail	3·25	...	82

The Lizard above described was obtained by Mr. H. J. McCooey at Brawlin near Cootamundra, where it does not appear to be scarce; the Museum is indebted to this gentleman for many interesting and valuable specimens both zoological and ethnological, and we have therefore much pleasure in dedicating this well marked and interesting species to its discoverer.

The species belongs to the small section of Duméril and Bibron's genus *Liolepisma*, which is characterized by the absence of a fifth finger and the conjunction of the fronto-parietals, its nearest ally being apparently *Mocoa tetradactyla*, O'Shaughn.; the most obvious distinctions between the two forms, as taken from Mr. Boulenger's description of O'Shaughnessy's species and from that given above are as follows:—In *L. tetradactylum* (1) the head is much larger, both as to length and breadth, in comparison with the body (14 and 10 to 41 against 13 and 9 to ~~41~~ mm.); 8/ (2) the prefrontals are in contact; (3) the frontal is much shorter than the fronto-parietal; (4) the scales have no trace of carination; (5) the non-enlargement of the preanals; (6) the shorter tail; and (7) the different pattern of coloration. Even, however, should future investigation prove *Lygosoma maccooeyi* to be a handsome variety of *L. tetradactylum*, much will have been gained by fixing indisputably the habitat of that species; and should this conclusion be arrived at we have little doubt that *L. pectorale* (*Heteropus pectoralis*, De Vis) will also have to become a synonym of *L. tetradactylum*, but the description is unfortunately so inadequate that it is quite impossible to determine this question without an examination of the original type.

37 ~~XV~~-DESCRIPTION OF A~~N~~ *ABLEPHARUS* FROM AUSTRALIA. 37

By J. Douglas Ogilby.

Ablepharus boulengeri, *sp. nov.**

Habit lacertiform; the distance between the end of the snout and the fore limb is rather less than one-half the distance between the axilla and groin. Head small; snout moderate, obtuse; rostral not projecting. Eye incompletely surrounded by granules. Nostril pierced in a nasal; supra-nasals present. Fronto-nasal large, forming a narrow suture with the rostral and a slightly broader one with the frontal; pre-frontals small; frontal pentagonal, forming a rounded angle posteriorly, not so long as the fronto-parietal and inter-parietal together, much larger than the prefrontals, and in contact with the two anterior supra-oculars; four supra-oculars, the second much the largest; six supra-ciliaries, the first large the last minute; fronto-parietal single, cordiform, followed by a moderate inter-parietal; parietals forming a median suture behind the inter-parietal; a pair of enlarged nuchals on either side; fifth upper labial beneath the eye, much larger than the others. Ear-opening large, oval, oblique, with no distinct anterior lobules. Thirty smooth scales round the middle of the body. Limbs moderately developed, pentadactyle; the adpressed limbs do not meet; subdigital lamellæ sixteen beneath the fourth toe. Tail not quite so long as head and body. *Colours*—Bronzy above, each of the scales of the back with a dull blackish spot, which on either side of the vertebral column form an indistinct darker band; tail without spots; a pale salmon-colored lateral band extending from the angle of the mouth, through the ear-opening, and passing above the fore limb to the groin, bordered above by a broader, below by a narrower black band; lips and cheeks freckled with black; upper surface of the limbs bronzy, with lighter and darker spots; lower sides of head and body white tinted with green, of tail salmon color, the last fifth silvery, spotted with black.

	Inches.	Millim.
Total length	3·57 ...	90
Length of head	0·33 ...	8
Width of head	0·24 ...	6
Length of body	1·52 ...	38
Length of fore limb... ...	0·40 ...	9
Length of hind limb ...	0·65 ...	16
Length of tail	1·72 ...	44

The beautiful Lizard described above is another of Mr. McCooey's discoveries at Brawlin. I have taken the liberty of dedicating

*See foot-note * p. 8.

the species to Mr. Boulenger, as a slight recognition of the impetus which he has given to herpetological science by formulating a definite method for the description of the species belonging to this interesting sub-order.

REPORT OF A COLLECTING TRIP TO MOUNT KOSCIUSKO.

By Richard Helms.

(Abridged from his Report to the Curator.)

Leaving Sydney on the 5th February by night train, and reaching Michelago about 7 a.m., I proceeded without delay by coach to Cooma. On account of the boisterous weather of the previous night the roads were very bad, and the prospect of success in my undertaking, which almost entirely depended on fine weather, was therefore not very hopeful. All my boxes got saturated, which compelled me to unpack them to prevent the contents getting spoiled. This increased my discomfort, for anxious as I was to make my tour a success, particularly as it was my first for your Institution, the outset was so discouraging that it almost disheartened me. Moreover everyone predicted a long continuance of bad weather, this having been the usual experience in that part of the country after the breaking up of a long dry season. It is pleasing to relate, therefore, that since I left Cooma only a few rainy days have stopped my collecting, but I was at a great disadvantage in reaching the field of operations at such a late time of the season, when most of the shrubs and trees were past flowering. Another disadvantage was that I reached Jindabyne, the last settlement near the mountains at a time when everyone was engaged in harvesting, and consequently a considerable difficulty arose about getting a guide and packhorses to enable me to push on at once to the highest peaks of the range. I am however doubtful whether after all much has been lost, for whilst waiting to get a guide, &c., I put my time in well at another place, and what I missed from the highest altitudes, I gained in extra numbers where I collected, many of which also proved highly interesting. To collect successfully at these high altidudes, it is my opinion one ought to be there before the beginning of January, and stay at least during the whole of that month, when the floral development displays its greatest luxuriance. The high winds which commonly prevail at altitudes above 4,000 feet, are very detrimental to successful collecting; but occasionally almost dead calms are experienced, and during such periods insect life appears abundant.

After three days stay at Cooma, where I collected as much as the broken weather would permit, I started on Saturday, 9th February, for Jindabyne, which was reached at 3 a.m. on Sunday, 10th February. Jindabyne is very pleasantly situated on the eastern bank of the Snowy River, about 26 miles from the highest peaks of the Australian Alps. The neighbourhood at one time must have been excellent collecting ground, but at present is much deteriorated owing to the denudation of the forest lands, and by ring-barking; however, a good number of insects of all the orders were obtained, particularly some fine *Hymenoptera*. After a few days collecting about Jindabyne, I went to a place on the upper Moonbar River, having been informed of the occurrence of numbers of butterflies. This information proved correct, but although the *Lepidoptera* were much knocked about and many quite worthless, a fair number of good specimens, and many other interesting Insects were obtained. My instructions being to ascend the ranges, brought me back to Jindabyne.

After several unsuccessful attempts I obtained a good guide, with packhorses, &c., and started on Sunday, 3rd March. The road, after crossing the Snowy River, leads through Mr. Body's run till the Crackenbac, better known as the Threadbow River, is crossed, not far from its junction with the former. Here at Mr. Spencer's old station "Westpoint," mentioned in Dr. Lendenfeld's Report, a rest was made, and from thence for a considerable time we followed his route. For some seven miles there is a splendid track, formerly used by bullock drays, and this part of the journey must have been in Dr. Lendenfeld's mind when he made the assertion that he could drive a carriage to Mt. Kosciusko. At a place called Wilson's Valley this fine track ceases, and from thence it is utterly impossible to proceed except on foot or horseback. The rises, hitherto with but few exceptions having been gradual, occasionally now got very abrupt for short distances, while intervening bogs and thick scrub made it rather difficult to bring a pack on safely. We got on pretty well however, as the guide was a very careful man and the horse very docile. Just before sundown we reached Tom's Flat, and camped for the night. During the day I dismounted many times and obtained a few good insects, and at night I got several specimens of *Galaxias* in the creek near the camp by the aid of a lantern. Next morning an early start was made, and we reached a camping place at an altitude of about 6,600 feet, and the next day reached the highest peaks. The place we camped at was on the margin of the scantily timbered part of the country, opposite the eastern "butt" of the "Perisher," a desolate rugged mountain range nearly surrounded by water, two different branches of the Snowy River closely flanking it. In ascending to Mts. Townsend and Kosciusko the scrub gets more and more stunted, and the open is covered with a thick sward of tussock grass, at times quite dense and from six to eight inches in height. Where the ground is not swampy and sour, it yields splendid pasturage, particularly for cattle. Only now and again some of the pretty alpine flowers are met with, mostly Gentians *(G. montana)* and Heliochrysums. The Celmisias, of which large patches are found, like many other alpine plants were past flowering, and had already shed their seeds. I managed to collect the seeds of about a dozen kinds, mostly *Compositæ.* On the whole with such a bleak day as we had, and at the time of the year, the higher parts of the ranges did not look very attractive. Much of the almost desert-like look was undoubtedly caused through the firing which had been carried on to an unusual extent during the long dry summer. On every peak half burned and dead scrub stared us in the face. We reached Mt. Townsend about half-past eleven, and Mt. Kosciusko an hour later.

Mt. Townsend is easily accessible, and in a northerly direction is connected with Mt. Clarke by a saddle. By turning to the left from Mt. Clarke over another saddle Mt. Kosciusko, or, as called by Dr. Lendenfeld, "Mueller's Peak," is reached. This peak, surmounted by a large cairn, affords a fine view and is the most frequently visited. It is somewhat surprising therefore that the error in Townsend's map of this interesting part has not been rectified (unless it has been done quite recently). I regretted very much that I had left Dr. Lendenfeld's Report at the camp, and therefore could not compare the map on the spot and correct it, which I would not care to do from memory. The error is that the Snowy River is made to flow from the saddle connecting Mt. Clarke with Mt. Kosciusko, whilst in reality it is plainly seen to flow into the Murray from the peak. Mt. Clarke on the contrary connects in a northerly direction by various lower peaks and saddles with the "Big Boogong," a very prominent mountain dividing the Snowy and Murray waters.

I was very desirous to obtain specimens of Natural History from these high elevations, but owing no doubt to the cold weather nothing was visible. Over the highest waterhole of Australia (7,000 feet altitude), at the foot of Mt. Kosciusko, a few dipterous insects were hovering, of which I secured about half-a-dozen, and in a pool a little lower in Wilkinson's Valley I found two species of frogs in a young state. Besides these only several kinds of seeds were collected here. The absence of *Galaxias* at this elevation struck me as peculiar. It is, however, remarkable that on the Snowy River side these fishes are met with almost everywhere.

From Mt. Kosciusko we somewhat retraced our steps through Wilkinson's Valley, and leaving Mt. Townsend on our right crossed one of the permanent snowfields which are hanging everywhere on the south-east side of the highest ranges. Crossing a saddle that again divides the Snowy and Murray waters, by turning slightly to the left we reached the highest peak of the Ramshead Range, which from our position extends almost in a true easterly direction, and divides the Snowy and Crackenbac Rivers.

My aim was to obtain some "Boogongs," the native name for the moths which so abundantly occur on this range, and no doubt have given it its name. From descriptions I expected to find a large Sphinx, and was puzzled how such an insect could exist in such masses at this altitude and in a comparatively barren country. What I found was a Noctuid moth, an *Agrotis*,* probably the same as is found in New Zealand, and likely to be a cosmopolitan species. The first I discovered was sitting in a crevice, and as soon as I saw it I knew where to look for more. On lifting some of the stone slabs, split from the rock by frost, dozens scrambled away in all directions. I secured some fifty specimens, and but for the high wind might perhaps have caught many more. Why, at such an elevation (from 6,000 to 7,000 feet), millions of these insects should be found, is perhaps one of the most remarkable problems in the insect world. The conditions are by no means favorable, because sometimes during nearly seven months of the year the country is covered with snow, and when the summer comes immense numbers of birds pursue them, particularly the crows which may always be found by thousands about the rocks where the "Boogongs" congregate. In former years before rum and disease had diminished the aborigines, hundreds of them went regularly to the ranges "Boogonging," and lived for months on almost nothing but these insects, returning fat and with a polished skin. An informant, who has lived in Monaro for over forty-five years, told me as follows:—In October, as soon as the snow had melted on the lower ranges, small parties of blackfellows would in fine weather start for the rocks on the summit to get "Boogongs" (most likely hybernated examples), and perhaps return if the weather changed; but a great gathering usually took place about Christmas on the highest ranges, and for about two months a great feast of roasted moths would be held. He assured me he has seen corroborees of 500 to 700 aboriginals on the mountains, in which the various tribes that took part were friendly, some of them coming from a great distance. Their method of catching these insects was both simple and effective. With a burning or smoldering bush they entered as far as possible the rents in the rocks, and by the heat and smoke stifle the thickly congregated insects sitting in the upper parts of the

*This species has been identified by Mr. Olliff as *Agrotis spina*, Gu., immense swarms of which appeared on the sea-board of Victoria and New South Wales in the early part of the present summer.—Ed.

cracks. The stupified and half singed insects were gathered on outstretched kangaroo skins, or on fine nets made of the fibre of the "Currajong" tree or the bark of a *Pimelia*, prepared with great care, expanded on two poles, and then conveyed to hot ashes wherein they were well stirred till done. The bodies would then be shrivelled to the size of a grain of wheat, and the number consumed by such an assemblage must have been considerable. The larvæ, from what I can see, must principally live upon the tussock grass, since that is the only plant in these regions which could possibly outlive the attack of such numbers of these voracious insects.

Towards evening we reached a place just below Pretty Point, which I had selected on my up journey, and in the choice of which I was not disappointed. On my way when crossing Tom's Flat I gave the glacier marked rock, spoken of in Dr. Lendenfeld's Report, a rapid but still careful examination, and cannot say that I discovered any distinct striæ, such, for instance, as I had seen in New Zealand, nor had I seen any previously on the rocks in Wilkinson's Valley. There are certainly patches of polished surface to be found, but these in my opinion may easily be produced by less heavy friction than glacier action. I have found polished patches on several rocks, though not so large as those on the rock on Tom's Flat, and almost feel inclined to attribute them to cleavage in the granite where some quartz or quartzose veins or perhaps micacious veins occur. The absence, so far as I can see, of any old moraines leaves the glacier question very doubtful. If any remnants of a moraine were found at the base of Wilkinson's Valley, the matter might fairly be considered settled, but unless this be the case there seems to me not much ground for it. The aspect of Wilkinson's Valley undoubtedly favors a glacial formation, but then in my opinion the moraine should also be there. It was not within the scope of my researches to spend any time over this interesting question, but a few days' careful examination and search in the right places would, I believe, settle the matter beyond dispute.

My first night camping near Pretty Point was again very unpleasant, the strong wind blowing the tent down and breaking the ridge-pole. After a perishing night the sun rose bright, and the wind abated considerably, I therefore selected a better sheltered place, and improved it by a breakwind made of felled trees. This precaution made me fairly comfortable for the remainder of my stay at this camp, from the 7th to the 23rd March. As anticipated this place proved a fine collecting ground, and it is not likely a better locality could be found in the ranges. Forest scrub, swamp, plains, and small watercourses are more or less approximate, and only for the lateness of the season I should have done still better. Here I obtained the greater number of my Alpine *Lepidoptera*, and also many interesting *Coleoptera*, besides many specimens of other orders of insects. The only species of *Mus* obtained by me was caught here in my tent. But perhaps the most interesting contribution to my Collection was made on Sunday, 10th March, in the shape of a specimen of *Peripatus*. This interesting find was later on augmented by two others, and one specimen was obtained on the 19th at an elevation of at least 5,700 feet. This is the highest altitude at which I obtained this interesting Myriapod, and as far as I am aware none have been previously found at such an elevation. It must be remembered that this locality for at least from four to five months is frequently covered with several feet of snow. During my stay there I experienced several frosty nights.

After a few rough and cold nights, which made insects very scarce, I shifted on the 23rd of March to a well sheltered place called Wilson's Valley, at an altitude of about 5,000 feet, and stayed there for the remainder of my time. Being favored with exceptionally fine weather for the time of the year, I was lucky enough to obtain in this locality many fine insects, particularly some interesting *Coleoptera*, *Diptera*, &c., and the greater number of the *Peripatus* was also obtained here, but only one variety which I did not get amongst the four specimens from the higher altitude. There are in my opinion three distinct species in the collection brought by me, and one doubtful species or variety. In this place were also obtained a good number of Planarian worms, and some Mollusks, including an interesting (most likely new) naked species.

The comparatively short stay amongst the mountains scarcely enabled me to thoroughly explore even those parts of the immediate neighbourhood of my camping places, and still less the whole of the mountain ranges. If with this is taken into consideration that my collections are made from the autumnal fauna, and that I secured none of those animals that make their appearance in spring or early summer, it stands to reason that the result of my captures cannot give anything like a fair representation of the extremely interesting mountain fauna. Considering that the Kosciusko plateau alone is estimated to contain upwards of 160 square miles, there is an immense tract of country still waiting for a thorough zoological examination. Already vast stretches of country are annually burnt off to improve the pasturage, and during summer, when through the devastation of forests, the water gets scarcer in the low lying parts, and consequently the pasturage parched up, the mountains will be more resorted to.

The finish of my trip, like the beginning, was a wet one. Rain just started the morning of the day I had appointed to break up camp, and lasted for several days, giving me some trouble to get things dry again. It is, however, very satisfactory to me to be able to report that in spite of this and of rough coaching over some 75 miles, I have brought all my collections without mishap to Sydney.

GENERAL NOTES MADE DURING A VISIT TO MOUNT SASSAFRAS, SHOALHAVEN DISTRICT, BY MESSRS. R. ETHERIDGE JUNR., AND J. A. THORPE.

BY R. ETHERIDGE, JUNR., Palæontologist to the Australian Museum and Geological Survey of N. S. Wales.

THE following "Notes" were collected during a ten days' trip from Tarago, on the Cooma Branch of the Southern Railway to Mayfield, the residence of Mr. C. H. Roberts, J.P., on Boro Creek, a tributary of the Shoalhaven River, and thence to Mount Sassafras, in the Parish of Sassafras, County St. Vincent. The rapid movements of the party render the "Notes" but imperfect and tentative at the best, but as such, it is hoped they may be found of some service to future travellers in that district.

Geology.—Between Tarago and Mayfield the country is gently undulating, speaking generally, and but little rock is visible in place, the aspect of the ground, however, is that generally assumed by rocks of Silurian age, hidden by a surfacing of local drift or wash.

At Mayfield the configuration of the ground is more rugged, grits, greywackes, and altered mudstones being exposed along the flanks and summits of the ranges, and these I take to be without doubt of Silurian age. The average height of these ranges, taking the Mayfield Trignometrical Station as an example, is about 500 feet above the flat, although of course some of the hills ascend to a much greater altitude.

Immediately opposite Mayfield Homestead pinkish ternary granite occurs in the creek bed, and is traceable along the alluvial flat for some little distance down the creek.

In the home paddock to the west of the homestead occurs a low hillock of ironstone. An opportunity did not permit of my ascertaining the precise relations of this deposit to the surrounding Silurian rocks. It may be a reef in them, or form a capping of Tertiary ironstone, unconformable to the former, and I am rather inclined to favour this view. In the Boro Creek, in a direct north-easterly line from this point occurs a highly altered white siliceous grit of a very remarkable character. The soil on the western side of the Boro Creek is of a very sandy nature, of that peculiar appearance assumed by drift derived from granite disintegration, and it is possible that a considerable area of that rock may be concealed here.

The track from Mayfield towards the Sassafras passes over much of this sandy country, extending as far as the crossing over the Boro Creek at Virginia Water, the residence of Mr. Peter Roberts. Here a fine alluvial flat has been formed. From this point onwards rough Silurian country is traversed as far as

Tomboye, the station of Mr. P. A. Stuart, although the homestead stands on a patch of basalt, but whether an outlier or portion of a large flow, time did not permit me to ascertain. Descending gradually again over Silurian ground the track joins the main Braidwood coach road, and continues onward until immediately before crossing the Ningie Nimble Creek another outcrop of basalt occurs, near the local post-receiving office. Onwards from this point Silurian rocks seem to predominate in the valley of the Coorong River, which is crossed, until east of the Nerriga Hotel, near the village of Nerriga, a third patch of basalt is observable in the road cutting. After leaving Nerriga the country becomes much more rugged, and a few miles further a rapid descent takes place to the bed of the Endrick or Bulee River, a rocky, well-watered stream, also like the preceding watercourses a tributary of the Shoalhaven River. Overlooking it, on the west side, is again a basaltic escarpment. The road, a main one by-the-bye, immediately after crossing the river leads up the latter on the east side, partially in the bed, and a more disgraceful piece of road planning could not have been devised. The four basaltic outliers I have here recorded do not appear to be shown on the "Geological Sketch Map of N. S. Wales."

Throughout the whole of the district so far passed over, the strongest evidence exists of its probably auriferous character, especially from Boro Creek at Virginia Water onwards. Large quantities of scattered quartz are observable, and a few defined reefs were seen. As early as 1851 this district was reported by the Rev. W. B. Clarke* as an auriferous area. He says, "It" (*i.e.* gold) "also occurs . . . . in all the creeks falling to the Shoalhaven from the Nerriga district." Mr. Clarke also states that gold was found at Boro Flat. Nerriga now seems to be the centre of a promising little goldfield, as several large claims are being worked for alluvial gold along the Shoalhaven River and some of its tributaries. Encouraging reports of these are given in the "Annual Reports of the Department of Mines" for 1886 and 1887† by Mr. James Galway, Mining Registrar. He there describes the operations of the Coorong Sluicing Company, who have probably "made the most complete and extensive race in the Colony." This race, a portion of which came under our notice, takes its supply from the Coorong River, and is some twenty-four miles in length.

From the Endrick or Bulee River a very rapid ascent takes place up the steep short spurs of Mount Bulee, as the western portion of the Sassafras plateau is called, the road ultimately

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* Votes & Proc. Leg. Council N. S. Wales, 1851, 121-a (Geol. Surveys), p. 86; also Researches in the Southern Goldfields of N. S. Wales, 1860, p. 20.

1887/ † Ann. Report Dept. Mines N. S. Wales for 1886 (1887), p. 73, and *Ibid* for ~~1847~~ (1888), p. 79.

passing through the "Gap," a break in the precipitous and rugged escarpment of Hawkesbury Sandstone, which here unconformably overlies the untilted Silurian rocks. The latter can be seen almost vertical along the river-bed road previously mentioned, with a general north and south strike, the junction of the Silurian and Hawkesbury rocks taking place a little below the escarpment.

The plateau now reached, and of which Mounts Bulee and Sassafras only form portions, consists of a high tableland of Hawkesbury Sandstone, and possesses many features in common with the physical aspect of the district north of Port Jackson. The Bulee escarpment exhibits some grand examples of rock weathering, the particular form here taken being the castellated, producing large detached buttresses gradually decreasing upwards, and disintegrating in thin layers or laminæ, like so many pancakes piled one on the other.

From above Bulee Gap the road proceeds over the tableland, now rising, now descending, but never to any great extent, until the summit of Mt. Sassafras is insensibly reached. A short distance before Mr. Greg's accommodation house comes into view, a marked change takes place in the appearance of the ground, which suddenly passes from the glistening sandy soil of the Hawkesbury Sandstone to a rich red and brown loam, resulting from the decomposition of the basaltic rock of which the summit of the mount is composed, but when first struck the latter rock appears only as cappings to the low spurs of sandstone. The basalt is described by Mr. C. S. Wilkinson as intrusive,* and I have been favoured by my colleague, Mr. W. Anderson, of the Geological Survey, with the following notes on this rock from specimens collected by us. "It is a dolerite consisting of triclinic felspar, augite, olivine, and magnetite, but none of the minerals showing much decomposition. The olivine contains many included crystals of magnetite, and neither it nor the augite show distinctly crystalline outlines, the latter occurring as large irregular shaped pieces, in which are embedded both felspar and olivine, showing that it was one of the latest minerals to crystallize out."

At the Gap our attention was called by Mr. C. H. Roberts to a large branch of fossil wood, which had been obtained *in situ* in the Hawkesbury Sandstone. It is silicified, microscopic sections failing to yield more definite details than the fact that the wood is probably coniferous.

Mt. Sassafras is the highest point on the watershed between the heads of the Clyde River on the south, and the Ettrema and Danjera Creeks, branches of the Yalwal Creek, a tributary of the Shoalhaven River, on the north. It is stated to be 3,125 feet above sea level, and rises considerably higher than the tableland around it.

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* Ann. Report Dept. Mines, N. S. Wales, for 1885 (1886) p. 132.

The general physical features of the Sassafras Tableland, on either side the watershed are simple but marked, shallow, open, basin-like gullies, and wide flats, surrounded by low steep scarps of weathered rock, the dividing ridges covered with stunted timber, or forming open heaths and scrubby spaces, and the flats usually swampy and clothed with coarse grass. These spots are in fact swamps and feeders for the headwaters of the creeks previously named. On the south, in addition to the Clyde River, the Endrick branch known as the Bulee Creek, takes its rise in offshoots from Mt. Sassafras, a long narrow north and south ridge separating the former from the two latter. The Clyde River, two or three miles from its source forms a precipitous ravine, or gorge, 600 feet deep. The basaltic spurs and summit of Mt. Sassafras support a vigorous growth of Messmate, the change to a more stunted form of Eucalypt, the moment the Hawkesbury Sandstone is reached, being a most marked one.

The gullies on the north and north-easterly aspect of the Sassafras present quite a different character, being very deep, with steep sides, clothed by a dense subtropical vegetation of vines, creepers, tree ferns, various large Eucalypts, and the handsome Sassafras tree *(Doryphora sassafras)*, from which the general plateau takes its name. This beautiful tree occurs throughout the Illawarra country, following the coast region, but it is particularly abundant hereabouts. A magnificent view is obtained from the higher parts of Mt. Sassafras where the ground has been cleared, over the Shoalhaven Valley and Jervis Bay, with Mount Cooloomgatta in the distance, frequently seen above the floating clouds of the low ground. The course of the creeks previously mentioned, flowing to the northward, is particularly well marked, from the scarp-like outline assumed by the Hawkesbury rocks at the margin of the deep gorges which they have cut.

The Clyde River,* about three miles from its source in the Sassafras swamps, in a fine deep ravine, with similar branch gullies presenting high perpendicular precipices of sandstone, producing scenery closely resembling that of the Blue Mountains, supporting a subtropical growth, which renders progression very difficult. Deep waterholes and falls are numerous, and the bed of the river is generally rocky and encumbered with huge boulders and fallen blocks. A few years ago the Coal Measures were discovered in this river underlying the Hawkesbury Sandstone, and the seams of coal were reported† on by Mr. N. Taylor, of the Victorian Geological Survey. We visited the seams in question, situated in the Parish of Endrick, three 640 acre blocks

*A short shetch of the Geology of the Clyde River was given many years ago by Mr. Alexander Berry, in a paper entitled "On the Geology of part of the Coast of New South Wales." [Barron Field's Geographical Memoirs of N.S. Wales, pp. 246-248 (8vo, London, 1825).]

†His Report appeared in the *Milton and Ulladulla Times*.

having been taken up for the purpose of prospecting the measures. A full report was subsequently made by the Government Geologist, Mr. C. S. Wilkinson,* in which he gives the following general section :—

Hawkesbury Sandstone and conglomerates ...	300ft.
Marine beds, conglomerate, sandstone and shales..	200ft.
Coal Measures, bituminous shales, sandstones, coals, and kerosene shale	120ft.
	620ft.

He mentions three coal seams, two of which only came under our notice. The lowest, including its bituminous and shaly partings, is sixteen feet thick ; fifty feet above this are Nos. 2 and 3, which we saw. The immediate coal-bearing measures seemed to me to be about fifty feet thick above these seams at the point where we struck them, the uppermost or No. 3 being three feet, and the lower or No. 2 about two feet in thickness, separated by a few feet of strata. The fifty feet of measures above are generally seamed with thin irregular bands of coal of no workable value. The kerosene shale is poor in quality. The measures are very flat, not dipping at a greater angle than 4° to 6° in a south-westerly direction.

Mr. Wilkinson remarks that the upper part of No. 1, or the lowest seam, which contains four feet nine inches of workable coal, will yield after due allowance for loss and waste in getting, at the rate of 3,778 tons of large coal, and 1,259 tons of small coal per acre.

In the present condition of the country the working of these seams is hopeless, the simplest method would probably be by sinking from a convenient spot on the Hawkesbury plateau above. Mr. Wilkinson states that to the westward the Coal Measures do not extend beyond Narriga, where the Siluro-Devonian gold-bearing formation rises to the surface. So far as our rapid movements would allow me to judge, the area to the westward of the Clyde River occupied by this formation must be much curtailed. So far no indications presented themselves of an outcrop of Coal Measures during the ascent of Mt. Bulee, and the probability is that in this direction they have thinned out. The presence of the kerosene shale enables the position of these beds to be ascertained with tolerable accuracy. The researches of the Geological Survey Officers appear now to have placed it beyond a doubt, that the Lower Coal Measures at Greta, Port Stephens, Hartley, Joadja Creek, and other places, are always accompanied by bands of this mineral. The presence of the latter in the Clyde section will therefore support the reference of the coal-bearing beds exposed there to the Lower Coal Measures likewise, in

* Ann. Report Dep. Mines, N.S. Wales, for 1885 (1886), pp. 131–2.

which case the fossiliferous marine beds above will fall into the Upper Marine Group of our Permo-Carboniferous System.

Ethnology.—Mr. C. H. Roberts informs me that the neighbourhood of the Sassafras was at one time a great refuge ground for those aborigines who had offended against their own unwritten laws, especially those referring to the connubial state. The main offence was that of lubra stealing, great enmity then existing between the Braidwood blacks and their neighbours the Maneroo tribe.* One of their customs appears to have been this :—Should the offending party be caught by the pursuing tribe, when travelling in company with the kidnapped gin, the guilty pair were simply brought back to their place of departure, and the male was then forced to undergo the ordeal of spear-throwing.† This consisted in having one hundred spears cast at him when stationary, by five men as fast as possible, when the dexterity displayed by the culprit in avoiding them is said to have been marvellous. Should the man succeed in escaping without fatal injury, the matter was considered as settled, honour satisfied, and the woman was allowed to remain with him as his wife. On the other hand, should the runaways be found cohabiting at the haven of refuge, dire vengeance was at once administered, the man killed, and his body disposed of in the manner we found the object of our search at the Sassafras. Mr. Roberts states that from some superstitious custom the legs were severed at the knee, but in this particular case it had not been done. Instead, the femora had been cleanly divided high up on the body of the bones, and then the legs doubled up on the trunk, following a *post mortem* method of preparation customary with several tribes of the aborigines. The right femur, however, had been divided by a direct oblique clean cut about the commencement of the body, and the left tibia had been smashed by a direct heavy blow with a blunt instrument just above the lower end of the body of the bone, and the injury presents the appearance of having been done previous to death.

We hoped to have found these remains in the mummified state, the condition in which they were seen by Mr. Roberts some years ago, but the lapse of time, notwithstanding protection from the elements, had almost completely destroyed the dried sinews. Nevertheless, the whole of the upper part of the trunk is osteologically entire, held together by portions of the soft tissues. The body was deposited in a small recess in the Hawkesbury Sandstone escarpment at the Round Hill, about six miles north

*The sea-board of this part of N. S. Wales was occupied, according to Dr. J. Fraser, B.A., by the Murring tribe. (*Journ. R. Soc. N. S. Wales*, 1882, xvi., p. 206, *note.*)

†A similar custom appears to exist in a more or less modified form in several tribes, Mr. Froggatt mentions it as practised by the Kimberley blacks. (*Proc. Linn. Soc. N. S. Wales*, 1888, iii. (2), p. 653.)

of the Sassafras, at one of the head gullies of a tributary of the Yalwal Creek, probably the Bundundah Creek. It would appear to have been placed on its back, a rather uncommon position amongst the aborigines of N. S. Wales, lying on the 'possum cloak, the pattern of which Mr. Roberts says was at one time plainly visible. The corpse was disembowelled, and the abdominal cavity filled with Eucalyptus leaves, a constant custom with the Braidwood blacks. The recess containing the remains was some five to six feet from the ground, and of small dimensions, and the bones of the limbs had to some extent been disturbed, but considering the long number of years since the body was placed in its then position, it was surprisingly perfect, all the bones being present except the left fibula, part of the sternum, and most of the hand and foot bones. The skull is in excellent preservation, and the teeth very sound. In addition to the severance above the knee of the right femur, the left ramus of the lower jaw, under the last molar, and in advance of the angle, is fractured. The fracture seems too clear to be the result of a blow, still it may have been. The right zygomatic arch has unquestionably been smashed in by a blow, as the malar bone is caved-in longitudinally in its widest part, just posterior to the orbit.

No implements or weapons were found with the skeleton. Two excellent tomahawks found in the district were presented; one from the Endrick River, by Mr. Mark Piercy; the other from the Sassafras itself by Mr. F. West. The former is a narrow oblong weapon of a dioritic rock, ground to a cutting edge on both faces. The latter is much heavier and larger, of the same material, similarly ground, and oval and smooth on one face, fashioned on the other. Both were pebbles.

Zoology.—The neighbourhood of Mayfield, hitherto so prolific in Marsupial life, was found to be practically deserted. We saw individuals of *Macropus major*, Shaw, and *Halmaturus ruficollis*, Desm. We obtained the black variety of *Dasyurus viverinus*, r/ Shaw, a female with five young in the pouch in an early stage of development. The Wombat (*Phascolomys Mitchelli*, Owen) was at one time an inhabitant of the Saassafras Tableland, a few burrows being observed here and there, but it is reported not to exist now. In the dense scrub a Paddymelon (*Halmaturus thetidis*, F. Cuv.) was secured, and its young with it. These small graceful Wallabies appear to keep closely within the thick vine scrub, and are difficult to obtain. This specimen is of great interest as illustrating the large size, as compared with that of the mother, to which the young grows before quitting the pouch, in this case twenty inches from the snout to the tip of the tail.

Throughout the journey Birds were not found to be by any means plentiful. At Mayfield the Cuckoo (*Cuculus inornatus*, Gould) was observed, and this would appear to be rather early for this bird, as frosty nights still prevailed, and even snow fell at least fourteen days after its arrival. One of the Black Cockatoos (*Calyptorhynchus funereus* Shaw) was seen, and from the general behaviour and noise made by the flock, preparations were clearly being made for breeding. The Rosehill Paroquet (*Platycercus eximius*, Shaw) was very plentiful and in fine feather.

The Sassafras Tableland, and more particularly the immediate neighbourhood of the Mount itself, is a well known locality for certain birds. For instance, the Cang-Gang (*Callocephalon galeatum*, Latham) in small flocks of five to seven individuals was seen on several occasions, and specimens obtained; the King Parrot (*Aprosmictus scapulatus*, Bechst.) seen but not captured, and evidently now rare there. The Laughing Jackass (*Dacelo gigas*, Bodd.) was found to be very plentiful, and in good feather. The specimens shot appear to be finer and of larger size than those usually met with in more open forest country. The Wonga-Wonga (*Leucosarcia picata*, Latham) was well known here, but this fine pigeon has been almost exterminated. One example of the rarer Scrub-Thrush (*Geocichla lunulata*, Latham) was shot in the vine scrub by Mr. Alfred Stuart. The White-winged Corcorax (*Corcorax melanorhamphus*, Vieillot) was common in large flocks, and very tame. The pleasant note of the Brown Thrush (*Collyriocincla harmonica*, Latham) betrayed its presence throughout the more open ground near the summit of the Mount; and the Coach-Whip (*Psophodes crepitans*, V. & H.) was equally noticeable by its peculiar and characteristic note. The Satin Bird (*Ptilonorhynchus violaceus*, Vieillot) frequents this locality in large flocks, feeding on the berries of the wild raspberry, and always accompanied by a few old full plumaged males. Lastly, the rocky gullies and escarpments afford excellent cover for the Lyre Bird (*Menura superba*, Davies), which undoubtedly exists here in certain spots in large numbers, and I would more particularly point out the neighbourhood of the Bulee Gap. We heard them in great force here when passing through on our way up from Nerriga.

Little need be said of the Reptilia. Our specimens have been named by Mr. J. Douglas Ogilby, who has determined amongst the frogs *Lymodynastes dorsalis*, Gray, from Mayfield, and *L. tasmaniensis*, Keferst., from the Sassafras. Numerous examples of *Pseudophryne bibronii*, D. & B., from both localities, and a few individuals of the rarer frog *Crinia signifera*, Girard, also from Mayfield, and the Sassafras. The Lacertilia are numerously represented by *Lygosoma mustelinum*, O'Shaun., a number of other forms of the same genus, at present unnamed, and an example of *Egernia kingi*, Gray.

Insecta.—Throughout the whole Silurian area between Tarago, Mayfield, and the Bulee River, the prevalence of white-ant hills is a very marked feature, some reaching as much as seven feet high. They are conical in shape, spreading at the base, and usually of a light yellow colour. On the Sassafras Tableland the "hills" become much less frequent, and only occur in sheltered situations. This is probably due to the more exposed situation, and possibly also to the less favourable medium, in the gritty tableland soil, for constructing their nests.

The following Coleoptera have been determined by Mr. A. Sidney Olliff, Entomologist to the Australian Museum, from our gatherings :—

Carabidæ—		
Notonomus variicollis, *Chaud.*	...Sassafras	
Prosopogmus Boisduvali, *Cast.* ...	,,	
,, sp. (probably new) ...	,,	
Nov. gen. et sp. (Broscinæ) ...	,,	
Cleridæ—		
Stigmatium Mastersi, *Macl.*	...Sassafras	
Tenebrionidæ—		
Cardiothorax Castelnaudi, *Pasc.*	...Sassafras	
,, sp.	,,	
Promethis angulata, *Erich.*	...Sassafras &	Mayfield
,, sp.	,,	,,
Meneristes laticollis, *Bois.*... ...	,,	,,
Toxicum, sp. nov. ?...		,,
Meniphilus nigerrimus, *Boisd.* ...	,,	
Dædrosis ambigua, *Bates*		,,
Adelium calosomoides, *Kirby* ...	,,	,,
,, porcatum, *Fab.*	,,	,,
Curculionidæ—		
Psalidura abnormis, *Macl.*...	...Sassafras &	Mayfield
Sclerorrhinus interruptus, *Macl.* ...	,,	,,
Acantholophus echinatus, *Guér.* ...	,,	,,
Apertus tuberculatus, *Gyll.* ...	,,	,,
Poropterus ellipticus, *Pasc.* ...	,,	,,
Lucanidæ—		
Passalus, sp...	...Sassafras	
Cerambycidæ—		
Coptocercus rubripes, *Bois.*	...Sassafras	
Elateridæ—		
Monocrepidius, sp. nov. ? ...	...Sassafras	
,, sp.	,,	
Lacon caliginosus, *Guér.*	,,	

The new genus of Carabidæ is a very interesting form only previously known from the Australian Alps. *Stigmatium Mastersi*, Macl., is common at the Sassafras. Amongst Orthoptera two species of *Blatta*, and *Anatostoma australasiæ*, Serv., were obtained at Mayfield.

The Mollusca, named by Mr. J. Brazier, C.M.Z.S., consist of Helices and a few shells from Boro Creek. Although there was abundance of water and weed in the latter we only obtained an *Ancylus*, perhaps a narrow variety of *A. australica*, Tate, and *Physa ciliata*, Ten. Woods. On the flat below Mayfield here and there we found *Helix (Charopra) funerea*, Cox, plentiful under logs and split wood. On the Sassafras Tableland three species were met with, either under old logs or bark, or in old stumps between the bark and the wood. They are *Helix (Pomatia) gulosa*, Gld., *H. (Dorcasia) brevipila*, Pf., and *H. (Rhytida) capillacea*, Fer.

Botany.—Time did not permit of much attention being paid to matters botanical. Scattered over the open low scrubby portions of the Sassafras Tableland we found a most beautiful reticulate lichen, which Mr. T. Whitelegge provisionally referred to *Cladonia retipora*, Sprengel, a reference subsequently obligingly confirmed by the Rev. Dr. W. Woolls, F.L.S.

The latter, in his "Contribution to the Flora of Australia," refers to it as follows:—"The most interesting lichen that I have seen in Australia is *C. retipora*, ... from the vicinity of Berrima, ... but as the species was described by Sprengel many years since, I think that it must occur somewhere nearer the coast. It grows to the height of several inches. . . As it becomes old, it assumes somewhat a coralline appearance, becoming nearly white. My learned friend, Dr. F. Mueller, informs me that *C. retipora* is common in the glacial regions of Tasmania and New Zealand." It forms one of the most attractive plants growing on the more open and usually dry flat spaces on the tableland, usually sheltered by a few low bushes. It is locally called 'Coral,' but botanically is evidently little known, and it is, therefore, with much pleasure that we are able to fix a well marked habitat. It grows at heights between 2,000ft. and 3,000ft., and in masses from nine inches to one foot in length,

On the heights near Mayfield Trignometrical Station, we found a very peculiar fungus protruding from the ground only within the shade of the She-oaks *(Casuarina)*. It is to be regretted that it was met with only in the dead state, and in consequence Baron von Mueller, who was kind enough to examine specimens, would not venture to name it. It was, however, pointed out to the writer by the Rev. Dr. Woolls, F.L.S., that the fungus in question has many points in common with the genus *Phallus*. The stipe is elongated, simple or bifurcate, each portion bearing at its apex a capsule.

The Sassafras *(Doryphora sassafras)* is remarkable for the pleasant aromatic odour emanating from the leaves when bruised, and a bitter principle, which can be extracted from the bark by infusion and used as a tonic. The tree grows to a height of one hundred and twenty feet, with a diameter at the butt of about three feet.

REPORT OF A COLLECTING TRIP TO NORTH-EASTERN QUEENSLAND DURING APRIL TO SEPTEMBER, 1889.

By Messrs. E. J. Cairn & R. Grant.

(Abridged from their Report to the Curator.)

Dr. Ramsay's instructions to us on leaving Sydney were to make our way if possible to the higher peaks of the Bellenden-Ker range and Mt. Bartle-Frere on the eastern fall, and to endeavour to obtain specimens of all Mammals, especially *Dendrolagus*, and to collect Birds, Insects, &c.

We left Sydney on the 12th April, and arrived at Cairns on the 20th inst. The rain was exceptionally late this season, for instead of commencing as usual in December, it had only really set in a fortnight or so before our arrival, so that to have gone into the ranges would have been useless. We therefore collected in the neighbourhood of Cairns for some weeks when the weather would permit, and made a camp about sixteen miles north of Cairns (Double Island) for a fortnight, hoping to get a new Lyre-Bird that was reported to have been shot there. We obtained a fair number of Birds and Insects, several amongst the latter we understand will prove new. The *P. archeri* however was the only Mammal shot or seen.

On the 30th June we returned to Cairns, where we shipped all our gear and started for Boar Pocket on the Cairns-Herberton Road. We fixed on this place for a camp, as provisions are obtainable near, and the rivers Russell, Mulgrave, Johnson, and Barron head at no great distance. It is a patch of forest country about a square mile in extent surrounded by a dense vine scrub.

On making enquiries we found that the natives had been brought in by the police at Atherton, a township on the other side of the ~~Barwon~~ River, ten miles from our camp, and they were also in on the Russell River diggings. We obtained the assistance of two or three with their gins, and had them attached to the camp until the murders on the Russell were committed. They proved exceedingly useful, and without their help we could not have collected so large a number and variety of animals. We never saw *Pseudochirus lemuroides* and *P. herbertensis* until they hunted them out, these species being apparently strictly nocturnal. Barron /

We found *Pseudochirus lemuroides* (native name "Yappi) in holes high up, usually on good sized trees. They are exceedingly active when disturbed, running and jumping along the tree tops, at times taking prodigious leaps from tree to tree. In this they resemble a flying squirrel but do not make such an easy slope, and falling down much more quickly. They appear to flatten themselves out, and when skinning them we found a small flap or fold of skin from the thigh to the ribs, and the same behind the forelegs, but not so noticeable. This fold or parachute does not extend along the body, but no doubt it is of assistance in their movements from tree to tree. The eyes of this species protrude in a very remarkable manner, and both sexes have a strong disagreeable odor, which, even in a young one that we attempted to rear, was very pronounced; it appears to proceed from the sexual organs.

The habitat of *P. herbertensis* (native name "Oŏta") is similar to that of *P. lemuroides*, but it is hardly so numerous. The white markings on this species vary very much, two specimens being obtained with one foreleg completely white. The two species were occasionally found sleeping in the stag-horn ferns, but generally in holes in trees.

P. archeri (native name "Tula"). These animals are occasionally seen moving about in the daytime, or seated in a branch or fork. They differ from the rest of the *Pseudochirus* in having the pupil of the eye elongated like that of a cat.

Trichosurus johnstonii (native name "Bong-ā") is also found in the scrubs on the tableland, frequently amongst the masses of staghorn ferns growing high up, but they have the peculiarity of coming out at night into the forest to feed on the gum leaves, and we obtained our specimens by moonlight on the tall gums at the edge of the scrub, but never any distance away. None of the other varieties were seen on these occasions.

All the mammals collected, with the exception of the Tree Kangaroos, were obtained on the tableland at Boar Pocket, with the aid of the natives, they simply walk up saplings with hands and feet, but for the larger trees they use a cane, known as the "lawyer's" (a species of *Calamus*) about ten or twelve feet in length; they tie a knot on one end and swing it round the tree, get a grip with the other hand, then leaning well back walk up, lifting the cane about two feet every step. Unfortunately they are not to be trusted, and after the Russell River murders we got very little help from them.

Dendrolagus lumholtzi (native name "Map-pi"). The specimens brought down were obtained on a special trip, by Mr. Cairn in August, to the Dividing Range about eight miles eastward of Herberton. Through the kindness of Inspector Stewart, Mr. Hanson and the native police accompanied him. It rained the whole time they were out, or they would possibly have obtained something new in the way of Birds. Mr. Cairn saw the bower of *P. newtoniana* but none of the birds. The party, however, was fortunate in getting fine perfect specimens of *D. lumholtzi*, and had an opportunity of seeing the aboriginal style of hunting them. Their method is on finding one in a tree, to build a sort of brush yard round it a few feet from the roots; one of the natives then climbs up until he is above the animal, which he compels by pelting it with sticks to descend to the ground, where being unable to jump any height it is easily killed with waddies. The natives say they will bite, but we are inclined to think the fence is rather to prevent their getting away, or as a protection against their fore paws, of which the claws are very strong and sharp. The habits and movements of this animal appear to be like those of the native bear; so far as we saw they did not show any great activity amongst the branches, and they come down a tree backwards making no use of their very long tail. Their tracks were generally seen on leaning trees, but one animal was shot from a tree that was practically perpendicular. We had no means of ascertaining the altitude of the ranges where the specimens were obtained, but should say not less than 4,000 feet, and they appear to frequent very rough country.

There was nothing in the paunch of any of the specimens but leaves.

D. lumholtzi and the various *Pseudochirus* were in splendid condition up to August, after which the fur on the latter began to get ragged and worn.

On the 25th August Mr Cairn left the camp for the Upper Russell River diggings, situated 28 miles S.E. of Boar Pocket, and being joined there by Mr. Hanson with his native troopers and four "myalls,"* started all heavily packed for a trip to the top of Mount Bartle-Frere. The country is exceedingly rough, and being all scrub a track had to be cut, but they made a camp within a few hundred feet of the top of the mountains on the 28th, but not without difficulty as two of the natives gave in. They were again unfortunate in the weather, being enveloped in mist nearly all the time. They obtained seven of the new Bower Bird *Prionodura newtoniana*, and saw several of their bowers. The sides of the bowers are built round two saplings chosen about two feet apart, and are constructed of small twigs laid horizontally and loosely built together; the walls are raised to a height of from three to seven feet, and are semi-oval in shape. In two of the bowers at a height of about nine inches from the ground, was a sort of hedge from wall to wall. The flat inner sides of the walls of the bower were decorated in each instance with white orchid blossoms. In two cases one of the walls was raised considerably higher than the other. Accompanying is a rough sketch of one of the bowers, which will give a fair idea of the construction.

The rainfall is very heavy on Mts. Bartle-Frere and Bellenden-Ker.

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* Wild aborigines.

Dendrolagus is said by the natives to be on the ranges, and no doubt occurs there, but none were obtained by us.

The ground birds started nesting in August, and we obtained nests and eggs of *Heteromyias cincreifrons* and *Orthonyx spaldingi.* The former lays two eggs and builds a nest on the "lawyer" vines about four feet from the ground. *Orthonyx spaldingi* lays but one egg for a sitting, and usually builds at the root of a tree or vine, but we found some nests as high from the ground as twelve feet on staghorn ferns.

The majority of birds on the tableland and ranges do not nest until towards the end of the year.

We obtained a mummy and some native implements, &c., from camps at the heads of the Johnson and Mulgrave Rivers. The dilly bags and water buckets are made by the old men.

List of Specimens Collected.

Mammals [Skins] 98 Specimens :—

Pseudochirus lemuroides "Yappi"
,, *herbertensis* "Oŏta"
,, *archeri* "Tula"
Petaurus cinereus
Trichosurus johnstoni "Bonga"
Halmaturus stigmaticus
,, *malabatus* var. *apicalis* 4/
Dendrolagus lumholtzi

Birds, 233 Specimens, 64 Species :—

Astur cinereus
Podargus papuensis
,, *phalænoides*
Caprimulgus macrourus
Dacelo gigas
,, *leachi*
Halcyon macleayi
Alcyone pulchra
,, *pusilla*
Pardalotus melanocephalus
,, *punctatus*
Strepera graculina
Cracticus quoyi
,, *rufescens*
Graucalus lineatus
Lalage leucomelæna
,, *tricolor*
Pachycephala gutturalis
,, *rufiventris*
Collyriocincla boweri
Chibia bracteata
Ophryzone kaupi
Machærirrhynchus flaviventer
Piezorhynchus gouldi
,, *nitidus*
Gerygone culicivora
Pœcilodryas, sp.
Heteromyias cinereifrons
Eopsaltria chrysorrhous
,, *nana*
Psophodes crepitans
Malurus cruentatus
Sericornis gutturalis
,, *citreogularis*
Acanthiza sp. (?)
Pitta strepitans
Geocichla lunulata, var.
~~Scenocapus~~ dentirostris
Scenop[illegible]us

BIRDS, *Continued* :—

Ailurœdus maculosus	*Sittella striata*
Ptilorhis victoriæ	*Chrysococcyx minutilla*
Prionodura newtoniana	*Centropus phasianus*
Mimeta affinis	*Aprosmictus scapulatus*
Sphecotheres maxillaris	*Platycercus* var. *nigrescens*
Ptilotis chrysops	*Cyclopsitta macleayana*
,, *notata*	*Ptilinopus swainsoni*
,, *macleayana*	*Chalcophaps chrysochlora*
Ptilotis frenata	*Macropygia phasianella*
Acanthorhynchus tenuirostris	*Geopelia placida*
Myzomela obscura	*Synoicus australis*
Climacteris leucophæa, var.	*Casuarius australis* (juv.)
Orthonyx spaldingi	*Nycticorax caledonicus*

INSECTA :—

160 Specimens of Lepidoptera, including *Mynes geoffroyi*, *Atella propinqua*, *Hypochrysops epicletus*, *Agarista*, *Hypsa*, *Ophideres*, &c. c/r/

35 Specimens Coleoptera, &c.

ETHNOLOGY :—

1 Mummy Child	5 Dilly Bags
6 Water Buckets	Net
3 Bundles Needles	Ochre, &c.
1 Shield	

SPIRIT SPECIMENS.

MAMMALS, 39, including the following :—

Perameles, sp.	*Pseudochirus archeri*, juv.
Perameles, sp., from pouch	*Antechinus, sp.*
Dactylopsila trivirgata	*Mus, sp.*
Dactylopsila, from pouch	,, *caudimaculata*
Pseudochirus herbertensis, juv.	*Pseudochirus, &c., Skeletons*

REPTILES, 26 Specimens :—

Gymnodactylus platurus Northern form	*Physignathus lesueuri*
	Varanus acanthurus
Gehyra variegata	*Lygosoma quoyi*
Gonyo~~dactylus~~ boydi cephalus	,, *rhomboidale*

BATRACHIA, 7 Specimens :—

~~Myxophies~~ fasciolatus and *Hyla, sp.*

Mixophyes

ON A SPECIES OF MOTH *(EPICROCIS TEREBRANS)* DESTRUCTIVE TO RED CEDAR AND OTHER TIMBER TREES IN NEW SOUTH WALES.

By A. Sidney Olliff.

Early in March, 1889, the young Red Cedar trees (*Cedrela toona*, Roxb.) in the State Forest Nursery, at Gosford, were found to be suffering from the attack of some insect, which seriously interfered with their growth, and as the evil appeared to be upon the increase, the matter was brought before the notice of the Colonial Secretary's Office, to which Department the Forest Nursery is attached, with a view to obtaining accurate information as to the nature of the pest, and the best means of checking its ravages. For this purpose the Principal Under-Secretary, Mr. Critchett Walker, communicated with Dr. E. P. Ramsay, the Curator of the Australian Museum, forwarding specimens of a moth, and portions of the trees containing a number of larvæ or caterpillars, presumed to be the early stage of the accompanying moths, and the real cause of the injuries. Unfortunately these specimens could not be identified owing to their poor condition, but Dr. Ramsay recommended that the trees should be carefully examined, and all the infected parts cut off and burnt, and subsequently he handed the larvæ to me for investigation, with the request that I should endeavour to breed the moth. This I failed to do although I had more than one consignment of larvæ from the Nursery, owing to the dry condition in which the cedar twigs were received, so it was determined that I should visit Gosford, and if possible obtain a better supply of material. Accordingly on 22nd August I made a careful examination of the plantations, and with the assistance of Mr. J. McCoig, the Overseer of the Nursery, succeeded in obtaining a number of larvæ in various stages of growth. I found that the injury is caused by the larvæ burrowing into the main stems or "leaders" of the trees for the purpose of eating the pith and soft tissues, which has the effect of arresting the natural growth of the tree, and thus seriously affecting its value for forestry purposes. At the time of my visit to Gosford a large number of the infected trees had been freed from the pest by the energy of the Overseer, who had used the pruning-knife with excellent results, but a few of the larvæ were still to be found by careful searching in an outlying plantation at some distance from the Nursery. A number of the "leaders" containing the burrows of these larvæ were cut and afterwards placed in a jar, partly filled with earth and sand which was kept moist to prevent the wood from shrinking. By this means a number of the moths were reared during October, and they proved to belong to the Phycitidæ, a family of Lepidoptera containing a large number of species, which in their larval state are internal feeders, and nearly related to certain species included in Zeller's genus *Epicrocis*. In general form, and in its habits, the Gosford moth also greatly resembles a species (*Magiria robusta*, Mre.*) from Ceylon, observed by Dr. Thwaites feeding within "branchlets of mahogany," but as it appears to differ in certain points from this species and from *Epicrocis patulalis*, Wlk., the form which it most nearly approaches, I have ventured to characterize it under the name *Epicrocis terebrans*. From the latest account (13th January) it appears that the pest is gradually disappearing from the Nursery. Mr. McCoig reports that it is now very scarce, and that no opportunity of destroying the larvæ is neglected.

Epicrocis, *Zell.*

The species here characterized as *Epicrocis terebrans* is in my opinion congeneric with *E. sublignalis*, Wlk. (*E. strigiferella* Meyr.), and *E. mesembrina*, Meyr., as it agrees in every particular with specimens of those species kindly identified by Mr. E. Meyrick. In one important point, however, none of these species agree with Mr. Meyrick's descriptions† of *Epicrocis* or the allied genera, inasmuch as the hindwings are provided with *nine* (see pl. ii., fig. 3) instead of eight veins, a condition which appears to be unusual in the Phycitidæ. There is no doubt of the accuracy of the observation, as I have made a microscopical examination of the wings of the three species mounted in oil of cloves, a proceeding I venture to think which might be followed by lepidopterists with advantage in cases where the venation is difficult to follow.

Fam. PHYCITIDÆ.

Epicrocis terebrans, *sp. n.*

♂ ♀. Head dull reddish-ochreous; thorax and abdomen greyish-ochreous, the former paler in front. Labial palpi whitish, inclining to fuscous externally, not reaching above upper margin of eye. Antennæ brownish-ochreous, very finely ciliated, basal joint large, thickly clothed with scales. Forewing elongate, moderately broad, dilated, greyish-ochreous, suffused on disc and on inner margin with brownish-fuscous, thickly clothed with white scales near anterior margin and towards apex from basal two-thirds, and dusted with fuscous and dull carmine scales; an

* Moore, Lepidoptera of Ceylon, iii., p. 365, pl. 184, fig. 4 ♂, 4a larva, (1887).

†Proc. Linn. Soc. N.S. Wales, vii., p. 157 (1883), and Trans. Ent. Soc. Lond., 1887, p. 257.

indistinct dark longitudinal fuscous line near costa extending from base to just before apex, an irregular fuscous patch at extremity of cell bordered externally with white ; a second very indistinct fuscous line on disc extending to middle ; vein 1 dull fuscous, veins 2 – 6 at apical fourth streaked with black, the streaks short, reaching the margin, interrupted in their middle ; two inconspicuous dark fuscous spots on costa before apex, and another similar but smaller spot on inner margin before anal angle ; cilia dull carmine, ochreous at base, with a distinct fuscous parting line, interrupted by a row of ochreous whitish points. Hindwing whitish, suffused with fuscous towards apex and at costa ; hind-margin narrowly edged with fuscous ; cilia whitish, inclining to fuscous near anal angle, a dark fuscous parting line near base. Expanse ♂ 28 – 33 mm. ; ♀ 34 – 36 mm.

Gosford, Hawkesbury River, New South Wales ; larvæ feeding in twigs of *Cedrela* and *Casuarina.*

♂ Antennæ feebly dentate ; ♀ simple ; in form similar to those of *Epicrocis sublignalis*, Wlk.

This species appears to be nearly allied to *Epicrocis patulalis*, Wlk. (*E. rufitinctella*, Meyr.), but the markings are even less definite than in that form, judging from the detailed description published by Mr. Meyrick (Proc. Linn. Soc. N.S. Wales, iii., p. 203, 1879). It may be recognised by the presence of the dark patch at the end of the discoidal cell, relieved outwardly by a patch of white scales, by the characteristic streaking at the apical extremity of the wings, and by its generally larger size.

The adult larva elongate, rather robust, with sixteen legs, and nine pairs of lateral stigmata, of which the first is pro-thoracic. Head and dorsal surface of 1st thoracic segment black ; 2nd and 3rd thoracic segments and body pale sea-green, inclining to purplish in certain lights especially at the sides, an ill-defined salmon coloured streak on each side in the region of the stigmata extending from the 4th to 11th segment inclusive, this marking less conspicuous on thoracic segments ; with two dorsal and three lateral rows of rather large black tubercles, each giving rise to a long outstanding seta, the dorsal rows are somewhat irregular owing to the presence on the segmental folds of similar tubercles which are a little nearer the sides, of these rows of tubercles that just above the legs is the least conspicuous ; the 1st thoracic segment is sea-green at the sides, and is provided with two lateral tubercles being a continuation of the lower lateral rows ; 12th segment rounded, without tubercles ; stigmata or spiracles ochreous, placed beneath the 1st, and above the 2nd and 3rd rows of lateral tubercles ; thoracic legs pitchy, abdominal legs sea-green, inclining to fuscous. Length 16 – 20 mm.

Up to the time when the larva is about two-thirds grown it is of a more sombre colour than the above description would imply, being of an obscure greyish-brown tinged with green, and having the head dark brown, the tubercles, both dorsal and lateral, brownish-black, and the last abdominal segment (that bearing the anal claspers) ochreous. In form it is more attenuated and less robust. My observations go to show that throughout the life of the animal its tendency is to increase in width, the adult larva being proportionately of greater girth, and capable of less extension than the young. In its fully grown state, particularly when about to change to the pupa, it bears a striking resemblance to the larvæ of certain Saw-flies or Tenthredinidæ, many of which, like the moth under consideration, are internal feeders, but this likeness is only superficial, as the number of the feet, and the position of the spiracles, clearly indicate its lepidopterous nature; and I may add its general structure accords with what we know of the larvæ of the family Phycitidæ.

The pupa or chrysalis is reddish-brown, and is enclosed in an elongate tough cocoon, composed of coarse grey silk. Usually the cocoon is placed at the entrance to the burrow in which the larva has lived, but sometimes it is found attached to the stem of the food-plant. In no case did I observe them upon the leaves, although in a few instances I saw three or four cocoons spun together in a mass and attached to a twig; in every instance, however, they were found near the burrows from which the larvæ had made their escape.

EXPLANATION OF PLATE II.

Fig. 1. *Epicrocis terebrans*, Olliff ♂.
,, 2. Outline of same showing natural size.
,, 3. Venation of same. Forewing 11 veins; hindwing 9 veins.
,, 4. Larva of same about two-thirds grown.
,, 5. Larva of same about to pupate.
,, 6. Pupa of same, and portion of cocoon.
,, 7, 8, and 9. Stems or "leaders" of Red Cedar showing borings of larvæ, cocoons, and pupa *in situ*.

NOTE ON *PIEZORHYNCHUS LEUCOTIS*, GOULD, *PYCNOPTILUS FLOCCOSUS*, GOULD, AND OTHERS RARE TO NEW SOUTH WALES.

By E. P. Ramsay.

Piezorhynchus leucotis has hitherto been recorded only from Queensland and northwards therefrom, but I have recently had an opportunity of examining a fresh specimen shot in a dense part of a damp scrubby gully in one of the gorges of the Blue

Mountains. The specimen is an adult male in full plumage. Several years ago I searched for this bird in the Richmond and Clarence Rivers scrubs, but found it not, although *P. gouldii*, Gray, was by no means rare. There is no difference in the size of the New South Wales bird and those from Port Denison, the wings and tail being in both cases respectively from 2·7 to 2·8.

Pycnoptilus floccosus, Gould, is this season (1889) particularly plentiful in the valleys of the Blue Mountains; I noticed also flocks of *Estrelda bella* and *E. bichenovii*, which had been liberated some six years ago and have taken kindly to their new home.

NOTES ON THE NIDIFICATION OF *MERULA VINITINCTA*, GOULD, AND *OCYDROMUS SYLVESTRIS*, SCLATER, FROM LORD HOWE ISLAND.

By A. J. North.

Mr. J. R. Icely, the Visiting Magistrate of Lord Howe Island, has lately returned to Sydney, bringing with him a number of specimens acquired on behalf of the Trustees of the Australian Museum, among which are the nest and eggs of *Merula vinitincta*, and the eggs of *Ocydromus sylvestris*, and from which the following descriptions are taken :—

Merula vinitincta, *Gould*. Vinous-tinted Blackbird.

"*Doctor Bird.*" Inhabitants of Lord Howe Island.

A nest of this species, taken during the month of October, 1889, is elliptical in form, with a small cup-shaped depression in the top, and is composed throughout of strips of palm leaves and fibre of one of the species of *Kentia* peculiar to the Island, together with skeletons of leaves, but without any special lining, it measures exteriorly seven inches in diameter by five inches in depth; internally, three inches in depth by two and a half inches across. Mr. Icely states that the nest was built in the branches of a shrub not far from the ground. The eggs are two in number for a sitting, inclining to elongated ovals in form, slightly pointed at one end, of a pale greenish-grey ground colour, with freckles, dots, and longitudinal markings of reddish-brown dispersed over the entire surface of the shell, in some places a few nearly obsolete blotches of purplish-grey appear. Length (A) 1·15 x 0·77 inch; (B) 1·12 x 0·77 inch.* Plate i., fig. 5.

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* ~~P.L.S., N.S.W., 2nd Ser., Vol. iv., Dec., 1889.~~

Ocydromus sylvestris, *Sclater.* The Wood-hen.

" *Wood-hen.*" Inhabitants of Lord Howe Island.

This bird is found breeding in the most rugged and inaccessible portions of the Island, such as the Erskine Valley, between Mount Ledgbird and Mount Gower. Here the rough character of the country, consisting of huge boulders of granite almost hidden in a dense and luxuriant mass of sub-tropical vegetation, affords it a secure retreat. The nest in question, was found last October at the head of the Erskine Valley, and consisted merely of a depression in a thick débris of fallen leaves, under the shelter of a low bush. The eggs four in number vary in shape from ovals to lengthened ovals, being slightly pointed at one end, and are of a dull white, with minute dots and large irregular shaped markings of light chestnut-red more or less scattered over the surface of the shell, obsolete markings of the same colour predominating towards the larger end, they are not unlike very large specimens of *Hypotænidia philippensis (Rallus pectoralis),* but the markings are paler and not so well defined. Length (A) 1·9 x 1·32 inch; (B) 1·88 x 1·36 inch; (C) 1·95 x 1·3 inch; (D) 2 inches x 1·32 inch. Mr. Icely remarks that this is the first time that any of the present inhabitants of the Island have seen the eggs of the Wood-hen, or had heard of them being taken.* Plate i., fig. 3.

NOTES ON THE NIDIFICATION OF *HETEROMYIAS CINEREIFRONS* AND *ORTHONYX SPALDINGI*, RAMSAY, FROM THE CAIRNS DISTRICT, NORTH-EASTERN QUEENSLAND; AND ON *STERNULA SINENSIS*, GMELIN, FROM THE TWEED RIVER, NEW SOUTH WALES.

By A. J. North.

Heteromyias cinereifrons, *Ramsay.* Ashy-fronted Flycatcher.

" *Win-dan.*" Aborigines of Cairns District.

During September and October of 1889, several nests of this species were obtained by Messrs. Cairn and Grant, in the scrubs of the Herberton tableland, in every instance they were found in the " lawyer vines " (a species of *Calamus*), about four or

~~*P.L.S., N.S.W., 2nd Ser., Vol. iv., Dec., 1889.~~

five feet from the ground, several of these nests now before me have been built between the forked stems, or where several vines cross each other, in other instances they have been placed at the base of leaves on the thin horizontal stems, to which the nest is attached. The outside of the nest is formed of thin twigs, wiry rootlets, skeletons of leaves, and the fibre of the "lawyer vine," the inside which is cup-shaped, being neatly lined with finer materials, while the exterior portion of the nest is ornamented with mosses and lichens, which gives it a pleasing appearance. Exterior diameter 4·5 inches, depth 4 inches, internal diameter 2·75 inches, depth 1·1 inch. The eggs are two in number for a sitting, and closely resemble in shape and colour large specimens of *Artamus superciliosus*, being of a dull buffy-white ground colour, thickly covered, especially towards the larger end with clouded markings of umber-brown, in some instances they are more clearly defined and boldly blotched, and have markings of deep bluish-grey appearing as if beneath the surface of the shell. A set taken on the 18th September measures as follows:—Length (A) 1·05 x 0·75 inch; (B) 1·07 x 0·77 inch.* Plate i., fig. 4.

ORTHONYX SPALDINGI, *Ramsay*. Spalding's Orthonyx.

"*Chowchilla.*" Aborigines of Cairns District.

This species has recently been met with rather freely dispersed through the dense brushes of the coastal range, chiefly in the neighbourhood of the Mulgrave and Russell Rivers, in North-Eastern Queensland. Mr. Cairn, who found several nests of this species, states they are usually built in the tangled roots of "lawyer vines," but not unfrequently on the top of the elk's-horn fern, as high as twelve feet from the ground. The nest is a large bulky dome-shaped structure with an entrance on one side, it is composed of twigs, roots and mosses, chiefly a species of *Hypnum*, so loosely put together that it will not bear removal. Unlike its southern ally *O. spinicaudus*, it appears that only one egg is laid for a sitting. A nest found near "Boar Pocket," on the 20th June last, contained but one egg in an advanced state of incubation, others were found as late as the middle of August. The breeding season this year (1889) would appear to be from May till the end of September, young birds being procured in June, but as in other parts of Australia the breeding season of birds is greatly influenced by the rains. The eggs, which are pure white, vary from elongated to swollen ovals, some being equal in size at each end. Two average sized specimens measure:—(A) 1·45 x 1 inch; (B) 1·38 x 1·1 inch.* Plate i., fig. 2.

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* ~~P.L.S., N.S.W., 2nd Ser., Vol. iv., Dec., 1889.~~

STERNULA SINENSIS, *Gmelin.* (S. PLACENS, *Gould.*) Chinese Tern, White-shafted Ternlet, &c.

This bird was found breeding by Messrs. Grime & Yardley, during a visit to the Tweed River Heads on the 7th October, 1889. The eggs two in number for a sitting were laid in a slight depression in the sand, all the eggs taken at that time being in an advanced stage of incubation ; in form they vary from true ovals to swollen ovals, terminating somewhat abruptly at one end, some of them being of a stone-grey ground colour, others a light coffee-brown, with rounded spots and irregular shaped penumbral blotches of umber-brown and dark slaty-grey, the latter colour in some instances predominating and appearing as if beneath the surface of the shell. Four specimens measure as follows :—(A) 1·28 x 0·95 inch ; (B) 1·27 x 0·94 inch ; (C) 1·18 x 0·95 inch ; (D) 1·25 x 0·9 inch. Skins of the parent birds were obtained and forwarded with the eggs for identification.* Plate i., fig. 1.

* P.L.S., N.S.W., 2nd Ser., Vol. iv., Dec., 1889.

EXPLANATION OF PLATE I.

Fig. 1. *Sternula sinensis*, Gmelin.
,, 2. *Orthonyx spaldingi*, Ramsay.
,, 3. *Ocydromus sylvestris*, Sclater.
,, 4. *Heteromyias cinereifrons*, Ramsay.
,, 5. *Merula vinitincta*, Gould.

The figures are all of the natural size.

REPORT ON THE WORM DISEASE AFFECTING THE OYSTERS ON THE COAST OF NEW SOUTH WALES.

By Thomas Whitelegge,
Fellow of the Royal Microscopical Society; Zoologist, Australian Museum.

At the request of the members of the Fisheries Commission, I, by permission of the Trustees of the Australian Museum, recently paid a visit to Newcastle with a view to inquire into the so-called oyster disease, which is caused by the presence of a small marine worm, identified by Prof. Haswell, of the Sydney University, as *Polydora (Leucodore) ciliata* (Johnston). On my arrival at Newcastle I was taken over the various oyster beds by Mr. Curan, the local Inspector of Fisheries, who did everything in his power to assist me. I am also indebted to Messrs. Gibbons and Anderson, two of the principal oyster lessees, for their kindness in providing me with boats and dredges.

The Infected Area.

Although the worm is very generally distributed, having been met with in various situations, from about half-tide line to moderately deep water, still the principal home of the worm appears to be on the mud flats about low-water mark. The oysters from this region were invariably infected with the worm, particularly those which lay loose on the surface or partially buried in the mud. Whilst those oysters which were fixed to some solid substance, and elevated ever so little above the surface of the mud were comparatively free from the pest.

During my stay I examined about fourteen oyster beds, which I need not particularize, suffice it to say that the worst are the bare mud-flats and the artificial beds in deep water. The latter are composed of oysters collected on the banks of the river, and probably the majority were obtained from the mangrove flats, as they would be more easily gathered, inasmuch as they are not, in that locality, fixed to any solid substance. From an examination of a very large series of these oysters, I am convinced that they were infested with the worm before their removal, as the evidence of disease was in nearly all cases deep-seated and below the lines of growth made after being laid down. The natural beds —only a short distance from the artificial ones—are fairly free from disease; and, further, they appear to overcome the worm when attacked, quickly enclosing it with a thick layer of shelly matter before it has time to establish itself. From what I ascertained of the habits of the worm, it appears that a large amount of mud is necessary to its existence, and that the more muddy the place, the better the worm thrives; such being the case, it is reasonable to suppose that those oysters which are fixed on some solid body, and somewhat above the surface of the mud, will have a better chance of escaping the ravages of the worm, than those which are partially buried in mud or lying loose on the surface. I conclude, therefore, that if some loose material, such as stones, old shells, &c., was placed on the mud-flats for the spat to set upon, removing it from direct contact with the mud, that the prevalence of the worm would be considerably diminished. In the absence of such material, the worms have no other alternative but to fix on the oysters as a place of refuge.

Symptoms of the Disease.

Oysters which are badly infested with worms may be detected at a glance by their thick rounded outline, and the absence of thin sharp edges. Moreover, by looking along the anterior margins of the valves, the entrances to the worm tubes will, on close inspection, be readily seen; those openings furthest removed from the edges of the shell having a *keyhole-like outline,* whilst those on the actual margins are *semicircular*. In the majority of cases the worms are found on the anterior margins of both the upper and lower valves, and frequently on the posterior margins, but rarely on other parts. On opening the diseased oyster, the valves will be seen to possess a series of blister-like structures, which are very variable in shape and extent, usually they are more evident on the lower valve than on the upper. On pressing the surface of these blisters with the point of a knife, it readily yields, and underneath will be seen a quantity of light brown mud in which the worms are embedded. Each worm has its own collection of mud, and from it a membranous tube often extends a short distance beyond the edge of the shell. The tube is invariably curved, but it is usually curved in such a way that the entrance and the outlet are in close proximity to each other, the inlet and outlet being often inclosed by the thin layer of shell deposited by the oyster. When viewed in section the opening of the tube is semicircular, the older part of the shell forming the base, and the newer layer the half-circle; or there are two openings, each consisting of three-fourths of a circle, with a space connecting them together, and bounded above and below by linear layers of shell. On removing the thin shelly matter it will be seen that the inner surface retains all the inequalities of the mud over which it was deposited, and forms a sort of mould of the inclosed mud, and rarely exhibits any distinct groove except near the edge. The older parts of the valves upon which the worm rests, exhibit grooves of certain depths, varying according to the length of time the worm has been in the shell. The grooves are deepest near the edges, and gradually get shallower inwards. During my observations I found about twenty examples in which very young worms had just entered the shells, and in all these cases, the worms were surrounded by large patches of mud, and a thin membranous covering deposited by the oyster. On the removal of this mud, the surface of the old shell was quite smooth, without any trace of a groove—a lens when applied to the spot failing to show any erosion. The only means by which the place occupied by the worm could be detected was by the presence of the edges of the thin membrane formed by the oyster. The above mentioned facts have an important bearing on the question as to how the worm gets into the shell, which is a much simpler process than has hitherto been supposed, inasmuch that it does not entail any far-fetched theories about the worm boring into the shell, with the assistance of an acid secretion from the body, or mechanically by means of its bristles. My opinion is that the worm does not bore into the substance of the shell at all in the strict sense of the word.

How the Worms effect an entrance into the Oysters.

Before entering into details it will be necessary to take into consideration the habits of the young worm, which will, when fully stated, show that the boring theory is out of the question; and, further, that sections of the shell, if carefully examined, furnish sufficient evidence to show that all the appearances presented may be accounted for without supposing that the worm deliberately drills an opening into the solid shell. On the third day after my arrival at Newcastle, I found several clusters of ova, which I concluded were those of the *Polydora ciliata*. They were found on the sides of the membranous tubes of the worm, in little transparent sacs, each cluster somewhat less in diameter than the body of the worm, and each sac containing between 50 and 60 eggs. I placed some of these egg-sacs in a test tube and kept them for six days, during which time most of the eggs hatched out. On examining a cluster under the microscope, I observed the newly hatched larvæ swimming about in the egg-bag, and by means of a dissecting needle, I ruptured the wall and allowed them to escape. They swim very rapidly by means of the oral and anal wreaths of ciliæ and the tufts of long stiff setæ, which they only used occasionally. They appear to jump or skip when the bristles are brought into play, and are consequently very difficult to follow under the microscope. At birth the body is about twice as long as broad, and consists of six segments. The antennæ are represented by small rounded lobes, the eyes are four in number, two near the mesial line, and two a little further forward and widely separated. On each side of the body there are a series of bristles, on the first segment there are about 9 on each side, on the remaining segments the bristles diminish in size and number posteriorly.

The early stages of this worm have been dealt with by A. Agassiz in the Annals & Magazine of Natural History, Vol. XIX., ser. 3, 1867, page 203, the figures given representing larvæ from about five days old and upwards. In the course of his remarks he refers to a work by Claparède (Beobachtungun) which is not obtainable in Sydney, and states that his examples were considerably more advanced than those figured by Claparède, "having already lost, if ever they possessed them, the bunches of ringed bristles so characteristic of the younger stages of many Annelids." I may say that the only bristles seen by me were the lateral tufts already mentioned. For the first six days the larvæ swim about vigorously, after which they begin to settle down, and appear to be in search of some suitable place to commence life in earnest. At this stage it is very difficult to transfer them from one vessel to another by means of the dipping tube, from the fact that the moment they feel the current of water, they suddenly fix themselves on the sides of the tube, and no amount of shaking will move them. They hold on to the glass by the head with leech-like tenacity, whilst the rest of the body moves up and down with the water. The only way to get them on to a glass slide is to wait until they settle down to the bottom of the tube. This peculiar habit of being able to fix on an object suddenly, when caught in a current of water, is a very important factor in enabling the worm to select any spot it chooses for its abode. If the place first chosen is not convenient, it can move to another more favourably situated, even in the face of a strong current of water.

In the early part of this report I mentioned the fact that the attacks of the worm are usually confined to the anterior and posterior margins. The reason for this is obvious. The main current of water drawn in by the oyster enters at the anterior margin, and passes out at the posterior margin. It is evident that if the worms possess the power of selecting their future place of abode, those which fix on the anterior margin will benefit by being situated in the inflowing current, which is a means of supplying them with food ; and those fixing on the posterior margin will also be similarly benefited, only in a lesser degree.

From what I have seen of the habits of the young worm in its free swimming state, and also of those already mentioned as having just settled down, I am of opinion that the young worm simply swims into the open oyster, and fixes itself by its head on the margin of the shell. If the position is suitable it immediately begins to construct a tube and collect a large quantity of mud. It may possibly be guided to the most favourable spot by the current of water drawn in by the oyster. If so, then we have the explanation why it is that the anterior margin is more often infested than any other part of the shell. The worms appear to have the power of collecting a large quantity of mud in a very short time. Some which I kept in confinement in moderately clear water added fully one-quarter of an inch to the length of their tubes in about an hour, and I have frequently removed the projecting tubes at night, and in the morning they had been repaired and projected beyond the edges of the shell fully half an inch; so that a vigorous young worm on entering an oyster can soon accumulate a large quantity of mud, which is immediately covered over by the oyster with a thin layer of shelly matter, and if the oyster is healthy, the deposit is laid down quickly, confining the worm with its patch of mud to a very small space. On the other hand, if the oyster is unhealthy and already infested, the shelly deposition is slower and the worm collects a large patch of mud before the layer is solidified. Hence it is that the size of these accumulations of mud get larger as the worms increase and the oyster gets weaker. In some very severe cases the whole of the lower valves were covered with freshly collected mud, and the oysters were reduced to a mere skin, and utterly incapable of secreting any shelly matter. The effect of these blister-like structures, which increase in number and size as the disease progresses, is to practically fill up the whole of the lower valve and to bulge out the upper, so that there is no room left for the oyster.

In all cases the recently collected mud is of a light brown colour, and was found to be the work of young worms varying in length from one-eighth to half an inch, the patches of mud on the larger examples varying from one to one and a half inch in length, by one-half to three-quarters of an inch wide. In most of the examples mentioned the surface of the mud was covered by a thin pliable membrane. The mud surrounding the adult worm is usually more compact and darker in tint, often inclining to slate colour; whilst the mud which the worms have left is frequently black. No doubt it is partly due to the decomposition of this black mud that so many oysters die. The parts of the oysters overlying these putrefying patches are always discoloured by yellowish spots.

When the habits of the young worm are considered in connection with the evidence derived from the examination of oysters, in which the worm has just established itself, it points to the conclusion that the larvæ simply swim into the open shell; and there is no evidence of any boring having taken place from without from the fact that the place occupied by the worm is quite smooth, and even in those cases in which the worm is full grown, the surface is often devoid of any grooves. It is only in old-established eases that grooves and tubular openings are found, and there they only exist on the margins as a rule. The above remarks apply to the old or thick parts of the valves; the newer thin deposit over the mud, as before mentioned, merely exhibits the irregularities of the surface over which it was laid whilst in a soft pliable condition, and is usually without any trace of grooves, except near the margin. Even these grooves, when examined with a lens, show a mould of what was beneath, without exhibiting any signs of having been bored. Another feature is the entire cavity occupied by the mud and worm, whieh cannot be accounted for by the boring theory. If the worm bores into the substance of the shell, how are the blister-like cavities formed? It is not reasonable to suppose that the worm has the power of raising a rigid layer of shelly matter and forming a blister. To do this the layer must be rendered pliable, otherwise there would be evidenee of such raising in the shape of eracks, etc. If the blisters are formed by the disintegration of the shell, there ought to be some evidence on the inner surfaees; but there is nothing to show that disintegration had taken plaee. One surface is eomparatively smooth, and the other a perfect mould of the enelosed mud.

Is it not more reasonable to suppose that the upper layer is deposited over the mud whilst in a soft state, simply covering the mud and worms, than to suppose that the worm bores into the shell and then forms the blister? If the blisters were formed by the disintegration of the shell, there ought to be some variation in the thickness of the layer, inasmuch as the disintegration would be unequal, and be most evident immediately over the worm. Such, however, is not the case; the deposited layer is pretty uniform in thickness over each blister.

From an examination of a large number of shells in sections, it appears to me that the cavities when once formed are never enlarged in any perceptible degree. Frequently, when viewed in section, cavities may be seen one above another in tiers, each one distinct, but regulated in form by the one below. These various cavities simply represent the entrance of so many worms into the open shell at different times, each worm in turn being eovered over by a thin deposit.

Mr. A. Oliver, in an artiele in the "Centennial Magazine" for September, 1889, suggests that the death of the oyster takes plaee from being unable to elose the valves on account of the undermining of the attachment of the abductor muscle. I may say that during the whole of my investigations I never met with sueh a ease, a faet which militates against the boring view. I, however, met with many instances in which the muscular spot was considerably lessened, not by its being undermined, but by the encroaehment of the worm around the point of museular attachment and deposits of shelly matter all round, so that the spot, after the removal of the muscle, appeared to be in a deep hole owing to fresh deposits being laid down all around it.

The death of the oyster is brought about chiefly by the decomposition of the mud after the death of the worms; but no doubt the imperfect closing of the valves has its effect. In all cases in which the worms are numerous, the edges of the valves are defective, from the fact that the worms occupy the edge and that the shelly deposits are used in lining the shell. Oysters that are infested with worms are much more sensitive than those which are free from them—at least those which I kept under observation were so. If the vessel containing them was disturbed, the diseased oysters were the first to close and the last to open. This sensitiveness will tend to deprive them of a large quantity of food. In addition there are the worms placed in the current which carries the food to the oyster, and which in bad cases may number from twenty to thirty, each feeding on the food drawn from the supply of the oyster.

During my stay at Newcastle I was much surprised at the absence of the worms from the dead shells; but after keeping some oysters under observation for about six weeks, I began to see the reason for this. The fact is the worm is a sort of commensal and partly parasitic on the oyster, in so far that it only appears to thrive when in the currents of water created by the oyster. If the oyster can succeed in forming sufficient shell to force the entrance of the worm-tube away from the edge, so that the opening is out of the current, the worm appears to leave the shell. I opened some badly infested shells, took out the oysters, and then replaced the valves in the water. In the course of a few days the worms deserted the valves, which to my mind tends to prove that unless they are in such a position as to partake of the food drawn in the current by the oyster, they leave their position and seek some other abode. During my observations I never saw the adult worms attempt to obtain an entrance into a fresh oyster. I selected a young oyster and placed it in a vessel by itself. With it I repeatedly placed a number of adult worms, with a view to determine if they would attack the oyster; but in all cases the worms appeared quite incapable of getting into the shell, and they invariably died within a very short time. They seemed to make no effort to gain an entry into the oyster, although placed near the edge of the shell and often on the surface. They rolled about in a very helpless sort of way, collecting small particles of floculent matter around them for concealment.

Evidence as to Boring, from an examination of the Shell.

One frequent appearance of the interior of the valves tells very forcibly against the boring theory. In many cases the worm occupies an elevated position in the shell, projecting above its surface as much as half an inch. The heap of mud surrounding such worms is covered by a thin layer of shelly matter, and both the entrance and the outlet to the worm-tube stand up at right angles to the oyster-shell valve, so that the worm lives within the shell completely, and the ends of the tube have no connection with the outer water, except when the oyster is open. (See Plate 6, fig. 5). Instances of this kind can only be explained by supposing that the worm and the mud have been enclosed by the shelly matter deposited by the oyster.

There appear to be three well marked stages in the appearance of sections of the shell when viewed from the outside and looking into the ends of the tubes. (See Plate 6, figs. 7, 8, 9.)

In the first stage we have the flattened solid part of the shell upon which the worm rests. Immediately over this is the thin layer formed by the oyster, which forms a semicircular outline (fig. 7). In this stage there are no grooves where the worm is in contact with the shell. In the second stage the basal surface is slightly grooved and the upper layer less of a semicircle, and somewhat flattened (fig. 8). In the third stage the grooves are so sunken in the basal surface that they appear somewhat like a keyhole, and consist of two openings, each forming three-fourths of a circle, with a space connecting them together. It is the appearance presented in the third stage that has led to the idea that the worm bores into the shell. At first sight such openings certainly look as if they had been bored ; but if the various stages are carefully examined, with due regard to the time the worm has been in the shell —which may be determined by the colour of the enclosed mud, the size of the worm, the thickness of the shelly deposit, and the condition of the surface upon which the worm rests—the different phases presented may be traced easily, and the only way to get at the facts is to follow up what are evidently the early stages of the disease. In the first place the worm swims into the open shell, and settling down on the surface, near the margin, it at once collects a quantity of mud. The oyster, the moment it feels the presence of a foreign body, begins to deposit a layer of shelly matter, which determines or limits the extent of the muddy patch, according to the rapidity with which it is laid down and solidified. At this stage the worm rests on a smooth surface, and is covered over by a thin layer of shell. The oyster still continues to deposit shelly matter, and the growth at the edge tends to force the opening occupied by the worm further out. The body of the worm, resting on the shell, has by reason of the constant movements in and out, a tendency to wear away the surface.

Whether this is accomplished by strictly mechanical means, or by a corrosive acid, I am unable to say ; but the fact remains that it is worn away. If the worm has been long in the shell, the grooves formed are deep, and the longer they remain the deeper they become. When measured from the outside inwards they are longer and more tubular; but this is owing to the fact that the growth or increase in the size of the shell forces the entrances further outwards and upwards, or downwards, as the case may be, according to whether it is the upper or lower valve which is affected. Ultimately the openings have the keyhole-like aspect which look as if they had been bored, but which, if carefully examined, will show that they have passed through the various phases before mentioned, *becoming shallower inwards and ceasing to be grooved at all.* With regard to the worm boring into limestone, shale, &c., mentioned by English writers, I think it is quite possible that a young worm may take possession of a small depression, and as it grows gradually enlarge it by its constant movements in and out, until it has formed its tube in the same Such tubes may serve for a succession of generations, being still increased in size by each occupant, as is the case with some of our sea-urchins which form holes in the sandstone of Port Jackson. But still there would be an absence of boring in the sense used with reference to this worm. Professor McIntosh, in the Ann. and Mag. of Nat. Hist., vol. 24, 4/ ser. 1868, p. 278, speaks of its boring into any shell that is thick enough to be bored.

The Remedy.

There are several ways in which to deal with the worms, with a view to their destruction. Those which I am about to give are the result of direct experiment, and if carried out in a proper manner, will prove effectual. When I returned to Sydney, after my fortnight's sojourn at Newcastle, I brought back a large quantity of diseased oysters. These I experimented on in various ways during a period of two months, having them under observation daily during the whole of that time. Some of the worst cases were placed in fresh water, which had the effect of killing the worms and some of the oysters; the latter were no doubt killed by the putrescent germs developed in the mud after the death of the worms. Others which were kept without water for fourteen days, were afterwards placed in salt water for several days, and in all cases the worms were destroyed, whilst the oysters appeared to be in a healthy condition. Some which were kept in an extempore aquarium for over two months, were cultivated until the whole of the worms had died out. This I attribute to the water supplied, not on account of its being bad, but from the fact that it was moderately clear and free from mud, which seems so essential to the life of the worm.

From the above series of experiments we may conclude that placing the oysters in fresh water for a few days will destroy the worms. But this method has its drawbacks from the difficulty of transporting them over long distances, and could only be used in favourable localities. The most effective as well as the quickest method would be the drying process. The oysters should be removed from the beds, freed from mud by washing, and then placed under a shed or cover of some kind, to protect them from the sun's rays. The oysters should be spread out in thin layers, and occasionally turned over, so as to ensure the thorough drying of the shells externally. The process may be continued for ten days or longer—if the oysters would stand it. They might after wards be relaid on the beds, if suitable ground exists on which to lay them—that is to say ground having a stony or shelly bottom. If they are laid on a mud surface, they will very soon be infested again. Another method which might be useful would be to remove the oysters into prepared ponds, into which none but moderately clear water is allowed to enter, or place them on a sandy or pebbly beach in such a position that they would be exposed to the sun, and get partially dry between every rise and fall of the tide. No doubt if either course was adopted and continued for some months, the worms already in the oysters would be destroyed. The above mentioned remedies can only be applied to oysters that are loose or attached to small objects, such as shells, &c.

So long as oysters are cultivated on the bare surface of the mud, they will be liable to the attacks of the worm; but if some solid substratum be provided for the spat to fix upon, and so remove them from direct contact with the mud, the oysters will have a chance of escaping the disease.

It would be much to the advantage of men engaged in dredging and of the lessees, if they made themselves familiar with the worm as it exists in the oyster in a living state. This is comparatively an easy matter. All that is required is a small magnifying glass and a vessel containing sea water. If a diseased oyster is put in a shallow basin, the worms may be easily seen projecting out of their tubes, and the pair of feelers playing to and fro in search of food. If a practical knowledge be obtained of the appearance of the diseased oyster and the living worm, then the shells can be examined during any process carried on for the destruction of the worms, and the observer will be able to judge as to the effects of the remedy. If after placing a diseased oyster in water, and after the lapse of some hours the worms are not to be seen protruding their tentacles, it may be safely concluded that they are dead; but to make sure the oyster should be opened carefully, and some of the worms taken out and placed in a saucer of clean sea water, to see if there is any power of movement left in them.

The following is Dr. Johnston's description, as given in the British Museum Catalogue of the British Non-Parasitical Worms, page 205 :—

LEUCODORE CILIATUS.

"Worm from 6 to 8 lines long, linear-elongate or slightly tapered to the tail, somewhat quadrangular, of a yellowish or flesh colour, with a dark red line down the middle. Head small, depressed, in the form of a short cylindrical proboscis, encircled with a raised hood or membrane. Mouth edentulous, eyes four, minute, placed in a square at the base of the antennæ, which are more than a fifth of the length of the body, tapered, wrinkled, and clothed along their inferior sides with short cilia. Segments numerous, narrow, distinct, the first four with an inferior papillary cirrus on each side, and a brush of retractile bristles; the fifth with a series of bristles curved like an italic *f*, obtuse, not capable apparently of being protruded like the others, and having rather a more ventral position; the following segments have on each side an obtuse branchial cirrus, originating from the dorsal margin, as long as half of the diameter of the body, held either erect or reflected across the back to meet its fellow on the mesial line; beneath it a small mammillary foot, armed with five or six sharp slightly curved bristles (crotchets?) with a small conical cirrus with a still more ventral position. The branchial cirrus is clothed on its lower aspect with rather long moveable cilia; it becomes very small or entirely disappears on the posterior segments, in which the bristles, on the contrary, appear to be longer and more developed. Bristles simple, unjointed. Anal segment conformed into a circular cup or sucker, in the centre of which the anus opens by a small round aperture. In this worm the cilia, which cover the under side of the branchial processes, are remarkable for their size and length, for they can be seen with a common magnifier fanning the water with equal and rapid beats, and driving the current along their surface. Their analogy with the cilia of Zoophytes is obvious; but here their motion is certainly dependant on the will of the animal, for I have repeatedly seen it begin and stop, and be again renewed after an interval of repose, and again be checked in a manner that could leave no doubt but that the play of the organs was entirely voluntary. The cilia of the antennæ, notwithstanding the larger size of the organs, are less than half the length of those of the branchiæ.

Leucodore ciliatus lives between the seams of slaty rocks, near low-water mark, burrowing in the fine soft mud which lines the fissures. Its motions are slow. When placed in a saucer it keeps itself rolled up in an imperfectly circular manner, lying on its side, and the painful efforts made to change its position, with little or no success, show too plainly that it is not organised to creep about like the *Annelides errantes*, but, on the contrary, that its proper habitat must be a furrow similar to those of the Tubiculous worms, to which in structure it evidently approximates in several particulars."

Dr. Johnston's description is wanting in detail in some respects, and Prof. McIntosh, in the Annals and Magazine of Natural History, vol. 2, series 1868, p. 282, gives a very lengthy description of the tentacles, bristles, hooks and the anal segment, accompanied by a plate, which is reproduced and will be found at the end of this report. As far as I can ascertain, nothing has yet been published in reference to the eggs of the worm, and the following, if new, may be of interest :—The ova appear to be matured in the body of the worm and commence on about the thirtieth segment. Each succeeding segment to about the fiftieth bears a pair of egg-sacs, each of which contains between fifty and sixty eggs. The egg-cases are deposited on the sides of the membranous tubes inhabited by the worm, and remain in this position until the young worms are hatched. (Fig. 10, plate 3). It appears to me that the brood-pouches are formed within the body of the worm, and at the period of deposition the outer cuticle is ruptured, and the egg-sacs fixed on the sides of the tube. Before the eggs are deposited, the body of the worm is plump and of a cream colour, with a central line varying in colour from bright red to a very dark brown. Afterwards the body appears thin and of a chocolate colour, and appears almost like another species. In fact until I carefully examined those which had laid their eggs, I thought there was a second species inhabiting the oysters. The period during which the worms produce ova may be stated to be the months of October, November and December. How far the breeding extends beyond these months I am unable to say; but it probably is within the mark to say that it may extend for a month or six weeks on each side.

The following is a list of the principal writers who have written on the worm and its habits :—

Leucodore ciliatus—Johnston, Magazine of Zoology and Botany, 1838, ii., p. 66, pl. 3, f. 1-6.

" " Dr. T. Williams, Report of the British Association, 1851, p. 208.

" " Dr. Johnston, Catalogue of Non-Parasitical Worms in the British Museum, 1865, p. 205, pl. 18, f. 6.

" " Prof. E. Ray Lankester, Annals and Magazine of Natural History, 1868, vol. 1, ser. 4, p. 233, pl. xi.

" " Prof. W. C. McIntosh, Annals and Magazine of Natural History, vol. 2, ser. 4, 1868, p. 276, pls. xviii. and xix.

Leucodore ciliatus—Prof. T. H. Huxley, The English Illustrated Magazine, No. 1, Oct. 1883, pp. 46 to 55; No. 2, Nov. 1883, pp. 112 to 121.

,, ,, Dr. W. A. Haswell, Centennial Magazine, Sept. 1889, p. 148.

Polydora (Leucodore) ciliata (Johnston)—Alexr. Agassiz, Annals and Magazine of Natural History, vol. xix, ser. 3, 1867, p, 242, pls. v. and vi.

Polydora (Leucodore) ciliata—Dr. W. A. Haswell, Proceedings of the Linnæan Society of New South Wales, vol. x, p. 273.

There are very many other papers bearing on the habits of the worm, amongst which may be mentioned one by Dr. Wright in the Edinburgh New Philosophical Journal, 1857, vol vi, p. 90; another by Mr. Alexander Oliver in the Centennial Magazine for September, 1889, pp. 134 to 148; and some details of the habits of the worm are given by Sir J. Dalyell in his work on the Powers of the Creator Displayed in Creation, 1851, vol. ii, p. 159.

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SUPPLEMENTARY NOTE.

Since the foregoing was written, I have received a number of oysters through the Department of Fisheries, from the Clarence River, which had been in fresh-water for 13 days, owing to the flood waters spreading over the beds. An examination of these oysters tends to confirm the opinion already expressed in the body of this report.

Out of 200 oysters, 50 were found to have been attacked by the worm, and 25 of these exhibited the early stages of the disease. The area occupied by the worms was of variable extent, but mostly small; the patches of mud being covered by deposits formed by the oysters; 15 out of the 25 specimens were in the membranous stage, and in the rest the deposits were partially calcified. In the whole of the 50 specimens the position occupied by the worms was on the anterior margin of the shell, about mid-way between the hinge and the ventral edge. On clearing away the patches of mud, which were covered with membrane only, the surface on which the body of the worm rested was found to be perfectly smooth, and without any trace of erosion; whilst in those in which the deposited layers were thick and fully calcified, slight traces of grooves were visible near the margin. In every case the worms were dead, having been killed by the fresh-water. The mud contained in the blister-like cavities had become putrid. and its colour of an inky blackness, and the stench unbearable, In every instance where the mud was only covered by a thin deposit, the oysters were either dead or dying, from the attacks of the putrescent germs developed in the mud; while those in which the deposit was thick appeared to be in a healthy condition.

The worm does not seem to confine itself to the oyster; I have seen it in *Pinna Menkei* and *Pectunculus Dunkeri* from Shoalhaven. It is common in *Chione calophylla*, *Venus laqueata*, and other bivales in Port Jackson. The distribution of the worm appears to be world-wide. It is found in Europe, North America, Australia, and the Philippine Islands. There is also a species described by Schmarda from the Chilian coast of South America, which may prove to be the same.

DESCRIPTIONS OF TWO NEW SPECIES OF AUSTRALIAN LOPHOBRANCHIATE FISHES.

By J. Douglas Ogilby.

Syngnathus altirostris, *sp. nov.*

D. 28. A. 2. P. 16. C. 10? Osseous rings 17/40.

Length of head about one-seventh of the total length, and one-third of the distance between the tip of the snout and the vent, which distance is two and two-fifths in the total length. Snout of moderate length, strongly compressed, much deeper than broad, curved upwards at the tip, and from five-ninths to one-half of the length of the head : postorbital space from two-thirds to three-fifths of the length of the snout. Body much deeper than broad, with the abdominal profile not dilated. A low, but well defined, ridge along the middle of the upper surface of the snout, sometimes ceasing on the middle of the interorbital space, sometimes bifurcated, and joining the supraciliary ridges, which are moderately developed, and are continued backwards on to the nape : nuchal ridge present : a low straight ridge across the middle of the opercle, not reaching the posterior margin : all the body ridges well defined : lateral ridges ceasing on the middle of the ventral ring : lower caudal ridge continuous with the ventral ridge : abdominal ridge prominent and acute. No lateral rostral groove. Ovisac extending over eighteen rings, one-half of the length of the tail without the short caudal fin. Dorsal fin not elevated above the level of the back, standing upon the seven anterior caudal rings. *Colors*—Uniform brown, with a dark lateral stripe from the tip of the snout through the eye to the lower half of the opercle, where it is broken up into blotches : dorsal fin speckled with brown.

Two specimens, a male and a female, measuring respectively five and three-quarters and five and one-third inches, are in the collection of the Australian Museum, the former having been received in exchange from the Queensland Museum, and obtained in Moreton Bay, while the latter was sent from the Clarence River, N.S.W., by Mr. T. Temperley.

In many respects this species resembles *S. spicifer*, Rüpp., but the slighter prominence of the opercular ridge, the interruption of the lateral line, and the increased number of rings on which the dorsal fin stands, separate it from that species.

Ichthyocampus tryoni, *sp. nov.*

D. 18.? A.? P. 8. C. 8. Osseous rings 17/36.

Length of head ten and one-sixth in the total length, and three and four-fifths in the distance between the tip of the snout and the vent, which distance is two and four-fifths in the total length. Snout very short, three-eights of the length of the head, and five-sixths of the postorbital space. Body compressed, much deeper than broad. Snout turned upwards at the tip; its posterior half bearing a high sharp arcuate ridge bifurcated behind, the divergent branches meeting the supraciliary ridges, which are moderately developed: interorbital space traversed by a low median ridge, which is continuous with the rather indistinct nuchal ridge: a low curved opercular ridge: all the body ridges acute, those of the dorsal profile so much so as to cause a deep concavity along the whole length of the trunk and tail: lateral ridges straight, ceasing on the second or third caudal ring: abdominal ridge well developed. Ovisac extending over sixteen rings, and rather more than two-fifths of the length of the tail without the small caudal fin. The dorsal fin stands upon the five anterior caudal rings. *Colors*—Head, back, and sides brown, faintly mottled with lighter; under surface pale yellowish-brown with the exception of the marsupial region which is black.

The unique example on which this species is founded was dredged in Moreton Bay, Queensland, in my presence early in May, 1886, and I embrace this opportunity of naming the species after my friend, Mr. Henry Tryon, in remembrance of the very pleasant collecting trip which we enjoyed together there. The specimen measures but two and three-fourths inches, but from the perfect development of the egg-pouch I believe it to be fully adult. The high rostral ridge separates this species at a glance from *I. cinctus*, while the interrupted lateral ridge equally distinguishes it from *I. carce*, in which that ridge is curved downwards opposite to the vent so as to join the inferior caudal ridge.

DESCRIPTION OF A NEW AUSTRALIAN TORTOISE.

By J. Douglas Ogilby.

Chelodina rugosa, *sp. nov.*

(Plate vii.)

Carapace ovate, somewhat pyriform, narrower anteriorly, slightly emarginate behind, without vertebral keel, deeply sculptured. Nuchal plate between two marginal plates: eighth and ninth marginal plates laterally expanded, twice as broad as those above the bridge. Profile of back considerably elevated and rounded, deepest in front of the bridge on second vertebral plate. A deep curvature above and beyond the bridge from the fifth to eighth lateral plates. Nuchal plate one-seventh longer than broad, quadrilateral: margino-nuchal plates much longer on the outer than the inner edge, the latter being equal to the breadth: margino-brachial plates quadrangular, the breadth of the first pair four-sevenths of the length, with the anterior and posterior margins equal; second pair with the anterior margin nearly twice as long as the posterior: first pair of margino-lateral plates very narrow, more than three times as long as broad, and much longer but not so broad as the second margino-brachial; second and third pairs nearly rectangular; fourth pair longer externally and posteriorly; fifth pair quadrilateral and rectangular, slightly longer than broad: first pair of margino-femorals as broad as the inner edge, which is slightly less than the outer; second and third pairs quadrilateral, longer than broad, with the inner edges the shorter: supra-caudals convex on the outer edge, forming a shallow notch at the symphysis, about two-thirds as broad as long, and very distinctly arched at the suture. First vertebral plate octagonal,* larger than the others, in conjunction with the nuchal, margino-nuchal, and anterior half of the first margino-brachial; posterior edge deeply concave: second and third hexagonal: fourth† hexagonal (?) with the anterior edge twice as long as the posterior: fifth plate quadrilateral, its anterior edge but one-third of the length of the posterior, which barely touches the last margino-femoral, and is not perceptibly angulated. Posterior costal plates as high as the lower edge; anterior plates very large, the outer edge nearly one-half longer than the first vertebral plate, measured along its central line. All the plates of the carapace densely and, with the exception of the marginal plates, deeply sculptured; for the most part this sculpturation is most eccentric in character, consisting chiefly of a network of deep grooves enclosing nodules of many shapes and sizes; on the middle vertebral plates, however, it takes a more or less regular longitudinal form, while on the lower half of some of the costal plates, a tendency to a transverse ornamentation may be traced: plates of the plastron and bridge distinctly marked by a network of grooves, scarcely perceptible to the touch.

* In the type specimen, which is as yet unique, there is on the left side a small plate intercalated between the first vertebral and first costal plates, and standing on the anterior margino-brachial plate, but from an examination of the opposite facies it is evident that this is accidental.

† This plate in our specimen is broken up into two parts, evidently by an accidental fracture, the hinder part being small and subcircular.

Plastron equally broad in front and behind, its breadth being but little less than half its length measured along the median line from the origin of the suture between the gular plates to the end of that between the anals ; rounded in front and with a deep semi-ovate notch behind. Intragular plate moderate, octagonal, the hinder edges being distinctly though very obtusely angulated ; posterior angle very acute : gular plates quadrilateral, the sutural edge very short, about one-third of the hinder edge, which is one-half of the length of the plate : humerals with the outer and hinder edges produced backwards, and meeting at an acute angle ; hinder edge concave : pectorals large, pentagonal, the sutural edge about two-thirds of the length of the intragular plate, and rather less than the outer edge of the humeral plate : abdominal plates rectangular, one-fifth broader than long : femoral plates quadrilateral, the sutural edge half as long as the breadth, and but little less than the external edge, which is convex and laterally expanded, but not to so great an extent as the corresponding eighth and ninth marginal plates of the carapace ; anal plates quadrilateral, the anterior edge straight and longer than the exterior, which with the posterior forms a very acute angle ; these plates are bent strongly upwards towards the carapace, the distance between their tips being much greater than that between a tip and the nearest point of the carapace. *Colors*—Carapace rich dark brown with a reddish tinge on the sides ; plastron, bridge, and lower surface of marginal plates pale yellow, the sutures with a light brown edging.

Measurements.

					Inches.
Length of carapace				...	10·00
Greatest width at last margino-lateral plate				...	7·25
Depth below middle of second vertebral plate				...	3·80
Length of nuchal plate...				...	0·75
Width of same in front...				...	0·58
Length of outer edge of		1st marginal	plate	...	1·15
,,	,,	2nd	,,	...	1·35
,,	,,	3rd	,,	...	1·15
,,	,,	4th	,,	...	1·33
,,	,,	5th	,,	...	1·05
,,	,,	6th	,,	...	0·95
,,	,,	7th	,,	...	1·10
,,	,,	8th	,,	...	1·00
,,	,,	9th	,,	...	1·05
,,	,,	10th	,,	...	1·10
,,	,,	11th	,,	...	1·05
,,	,,	each caudal plate		...	1·10

Length of first vertebral plate along median line	2·25
Greatest width of same in front, about* ...	2·85
Width of same behind	1·20
Length of second vertebral plate	2 25
Greatest width of same	2·00
Length of third vertebral plate	1·50
Greatest width of same	1·90
Length of fourth vertebral plate†	1·75
Greatest width of same	1·40
Length of fifth vertebral plate	1·65
Width of same in front...	0·55
Greatest width of same behind	1·90
Length of intragular plate	2·25
Greatest width of same	1·25
Length of interpectoral suture...	1·55
Length of outer edge of each gular plate ...	1·20
" " humeral plate...	1·60
" " pectoral plate ...	1·80
" " abdominal plate	1·45
" " femoral plate ...	2·00
" " anal plate ...	1·35
Width of plastron across ends of posterior outer angles of humeral plates	3·50
Width of plastron across posterior fifth of pectoral plates	3·70
Width of plastron across middle of femoral plates	3·70
Width of plastron across tips of caudal plates	1·40
Distance between tip of caudal plate and nearest point of carapace...	1·10

The description is taken from a single example—of which the shields alone have been preserved—in the collection of the Australian Museum, Sydney, collected in the year 1869 at Cape York, Q., by Mr. J. A. Thorpe.

* Owing to the fracture mentioned in a preceding note (p. 57), it is impossible to give this measurement with perfect accuracy, but by measuring the length of the suture with the normal anterior margino-brachial, and then measuring the same distance along the fractured plates from the inner posterior angle of the margino-nuchal, the distance between the two points thus obtained should be the greatest width, or closely approximate thereto.

† In measuring the length of the fourth vertebral plate we have included the small posterior intercalated plate (see note p. 57), believing it to be an accidental fracture from this rather than from the succeeding plate.

DESCRIPTIONS OF UPPER SILURIAN FOSSILS FROM THE LILYDALE LIMESTONE, UPPER YARRA DISTRICT, VICTORIA.

By R. Etheridge., Junr.

(Palæontologist to the Australian Museum, and Geological Survey of New South Wales.)

The fossils about to be described were collected at the Cave-hill Quarries, Lilydale, Upper Yarra District, near Melbourne, Victoria, by Mr. A. J North, of the Australian Museum.*

I am informed by Mr. R. A. F. Murray, Government Geologist of Victoria, that no description of this limestone has been published, and that beyond the fact that it is a member of the Upper Silurian of that Colony, little is known of it. I hope to be able to show, by the determination of the following fossils, that the Lilydale Limestone is a portion of the Upper Silurian, known as the Wenlock Series.

The limestone, judging simply from the specimens which have passed through my hands, varies in colour from light grey to dark bluish-grey, and is highly fossiliferous. In places it is crystalline and homogenous, with scattered rather flesh coloured patches; in parts minutely brecciated, with here and there patches of a more or less oolitic character; in fact no two specimens exactly agree with one another in appearance and mechanical composition. It weathers and decomposes to an almost pure white colour and becomes very friable. The fossils so far recognised are at least three forms of Stromatoporidea; a peculiar *Favosites*, to be described under the name of *F. grandipora*; and three species of Gasteropoda.

The Stromatoporidea will require a more prolonged study than I am able to give them at the present moment, and must be relegated to a future report. Besides the univalves described, there is a *Bellerophon*, but not sufficiently well preserved to be determinable. Lastly a Rugose coral, which will probably prove to be one of the Cyathophyllidæ.

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* Supplemented by a small series presented by Mr. J. Campbell, of the Lilydale Quarries.

The following are the systematic descriptions :—

Class ACTINOZOA.

Order ZOANTHARIA.

Section ZOANTHARIA SCLERODERMATA (Madreporaria).

Family FAVOSITIDÆ.

Genus Favosites, *Lamarck* (pars.), 1816.

FAVOSITES GRANDIPORA, *sp. nov.*

(Pl. viii., Figs. 6 – 9.)

Sp. Char.—Corallum generally forming sublobate, ramose masses, but variable in size, apparently dichotomously branched, the whole free surface occupied by the calices of the corallites, the axial portion of the corallum being much in excess of the peripheral. Corallites long and slender, in the axial region polygonal, but from the deposition of secondary matter, or sclerenchyma, becoming oval or irregular in outline ; usually equal in size, but with smaller angular calices interspersed throughout ; the larger are one millimeter in diameter, the tubes gradually curving outwards to the narrow periphery, and then becoming almost horizontally inflected ; opercula not observed. Walls thin, but more or less thickened by a deposit of sclerenchyma. Septa obsolete. Pores very large, regular, round, usually forming a single row in the median line of each face of the corallites. Tabulæ simple, complete, as fine hair-like lines, mostly horizontal, but at times a little arched upwards, and seldom oblique.

Obs.—*Favosites grandipora* is by far the most representative fossil of the deposit. Its growth was certainly ramose, the largest stem observed being two and a quarter inches in diameter, but this was probably exceeded, as other examples, massive and non-ramose, and corresponding in macroscopic characters to the above, are probably only the interior portions of large stems.

The remarkable size, regularity, and contiguity of the pores is a very prominent feature. Other uniserial forms of *Favosites*, as to the position of the pores, are known, but are chiefly Devonian in age, *F. turbinata*, Billings, *F. hamiltonensis*, Rominger, *F. intella*, Winchell, &c. The close serial arrangement of these large pores gives rise to a very peculiar appearance in longitudinal sections, when erosion of the corallite wall has just commenced, and sufficient to render the pores partially confluent. The breaking up of the wall thus brought about simulates so many thick incomplete tabulæ, after the manner of those of *Favosites (Emmonsia) hemispherica*, Yandell.* The pores are as conspicuous on the

* Nicholson, Tab. Corals Pal. Period, 1879, t. 3, f. 3*b*.

fractured surfaces of specimens as in microscopic sections; and the margins are apparently plain.

The tabulæ on the other hand are perfectly complete, thin, delicate, and about three in the space of one millimeter to three in that of two millimeters, but irregularly placed as a rule. The original form of the corallites was undoubtedly polygonal, but from the deposition of sclerenchyma they have become more or less cylindrical and oval, or irregular in section. I have not seen any good examples of the surface, but so far as observed the mouths appear to be simply at right angles to longer axes of the corallites, to be without opercula, and not to have either lip raised above the other.

A very marked difference exists in ramose portions in the width of the axial and peripheral portions, the former largely predominating, whilst the non-amalgamation of the walls in the same region is usually very apparent. Septa seem to be absolutely absent, whether as spines or tubercles. I have adopted the character of the mural pores as the distinguishing feature of *F. grandipora*, notwithstanding the fact that in some species of *Favosites* the number of pores on each corallite face is variable. In the present instance, however, the arrangement of the pores appears a constant feature throughout a suite of fifty specimens, and it may therefore be justifiably used for specific distinction in this case. In Pl. viii., Fig. 7, is represented the horizontal section of the axial region taken from a polished specimen, and therein will be noticed the broken-up condition of the primordial wall. It is, however, nearly always visible at the angles of the cells, to the exclusion of the sides, and then has a more or less stellate appearance. In some thin sections prepared for the microscope, on the other hand, now before me, this wall is tolerably continuous and regular. The secondary deposit remains very constant in its thickness, and does not appear to attain the inordinate growth towards the final period of increase of the corallites, so characteristic of the genus *Pachypora*.

Class GASTEROPODA.

Order PROSOBRANCHIATA.

Family Eulimidæ.

Genus Niso, Risso, 1826.

(Nist. Nat. Europe, Mérid., iv., p. 218.)

Niso (Vetotuba) brazieri, *sp. nov.*

(Pl. viii., Figs. 4 & 5; Pl. ix., Figs. 2 & 3.)

Sp. Char.—Shell turriculate, polygyrate, subulate, elongately conical, and very slowly tapering, straight sided, and no more than twelve whorls; the latter are flat, narrow, with closely fitting sutures; umbilical cavity large extending the entire length of the spire; aperture unknown; ornament not preserved, probably a nearly smooth shell. Length (average) two and a half inches.

Obs.—In the internal cast the whorls are more convex, and the sutures well defined. (Pl. viii., Fig. 5.)

Under the name of *Niso ? darwinii*, the late Prof. de Koninck described* a small shell from the Upper Silurian, probably Wenlock, beds of Yass, possessing the peculiar continuous umbelical tube of the recent and Tertiary genus *Niso*. We now have from Lilydale a similar although much larger shell, possessing the same character. I have made a longitudinal section of a *Niso* from the Muddy Creek beds in Victoria (Pl. ix., Fig. 1), and a comparison with that of our more ancient fossil, will at once indicate their close resemblance. In the vertical section of both the umbilical tube is visible, and this can also be seen in one of Prof. de Koninck's figures† of the Yass species. There is a like correspondence between the cross sections of the two shells (Pl. viii., Figs. 3 & 4), bearing in mind that the section of the recent species is near the apex, and that of the fossil near the base.

Niso is known in time as far back as the Middle or Lower Tertiaries, and its connection with the Palæozoic forms is continued through the Secondary rocks by the genus *Palæoniso*, Gemmellaro.

The material before me is not sufficient to enable me to work this species out in its entirety, but I find myself in the same difficulty as did Prof. de Koninck, in definitely referring so old a form to a recent and comparatively young genus, geologically speaking. I suspect that the ultimate examination of more perfect specimens will reveal an organization differing from *Niso*, in which case I would propose for it the name *Vetotuba*.‡

Family TURBINIDÆ.

Genus Cyclonema, *Hall*, 1852.
(Pal. N. York, ii., p. 89.)

CYCLONEMA ? AUSTRALIS, *sp. nov.*

(Pl. ix., Figs. 4 & 5.)

Sp. Char.—Shell turbinate, moderatey elongated, much expanded below,—whorls six, ventricose, the body whorl disproportionately larger than the others,—aperture more or less circular; umbilicus not visible; operculum unknown; whorls traversed by successive spiral keels, which are always

* Rech. Foss. Pal. Nouv. Galles du Sud, 1876, Pts. 1 & 2, p. 127, t. 4, f. 11.

† *Loc. cit.*, f. 11c.

‡ Vetus, old; tubus, a tube or pipe.

simple, and nearly always equidistant, except on the ventral surface where they become rather closer, leaving very regular valleys between them, usually equal in width to that of three keels; the whole of the keels and valleys are crossed by fine, regular, oblique, equidistant, continuous, longitudinal striæ. Length (average) one and a half inches.

Obs.—The spiral keels are remarkably regular, and simple in structure, at least twenty and perhaps more traversing the body whorl; they retain their size as a rule, but instances have occurred where they are alternately larger and smaller. The oblique transverse striæ are uniform in size throughout their course, and do not in themselves enlarge on crossing the keels, but the mere intersection of the two does give rise to a slight nodular appearance. The spaces thus enclosed between the two series of lines are oblong.

It cannot be denied that both this shell and those usually referred to *Cyclonema* by authors, materially differ in appearance from Hall's types of the genus. If a *Cyclonema*, it is a very large form, but at first sight it appeared to me referable to the allied genus *Oriostoma*, M. Chalmas, as defined by Dr. G. Lindström,* but the lengthened spire gives rise to a marked difference in the appearance of the two shells, nor does *C.? australis* appear to have that laxity of coil seen in species of *Oriostoma*.

C.? australis is allied to the shell termed *C. carinatum*, var. *multicarinatum*, by Lindström,† but which I should have taken to be a species distinct from the other Gotland forms. Our species is a larger shell, with coarser and more numerous revolving keels on the whorls. The operculum should be sought for, as this will probably afford a means of accurately determining the genus.

Genus Oriostoma, *M. Chalmas*, 1876.

(Journ. Conch., Paris, xxiv., p. 103.)

ORIOSTOMA NORTHI, *sp. nov.*

(Pl. ix., Figs. 6 and 7.)

Sp. Char.—Shell discoid or ammonitiform, biconcave, non-alate; back unsymmetrically convex; spire very short, depressed below the plane of the body whorl; whorls about six, all exposed; body whorl generally convex on the upper surface, sloping downwards and inwards, bounded exteriorly by a strong spiral keel, from whence the surface gradually slopes away outwards to form the unsymmetrical convex back; the

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* Silurian Gastropoda and Pteropoda of Gotland (*K. Svenska Vet. Akad. Handlingar*, 1884, xix., No. 6), p. 156.

† *Loc. cit.*, p. 179, t. 18, f. 31-32.

keel is continuous, forming the periphery of the inner whorls on the upper surface, the innermost ones rising slightly above the plane of the second to form the low spire ; ventral surface generally concave as a whole, except the body whorl which is convex, with an ill-defined spiral obtuse keel. Upper surface of the whorls crossed by direct, or very slightly sigmoidal, transverse, simple, or occasionally bifurcating costæ, crenulating the spiral keel, and passing on to the back where they either become lost or faint, reappearing at the obtuse keel of the inferior side and passing similarly across the remaining portion of the whorls. Form of mouth and operculum unknown.

Obs.—In mature individuals the back broadens, the sides of the body whorl become more rounded, the costæ towards the aperture broaden out into folds, and the whole shell puts on a nautiloid appearance. Furthermore the costæ on the lower surface become obliterated. These changes have been already noticed by Dr. Lindström in *Oriostoma discors*, of which he remarks that " the spiral ridges are more prominent in small specimens, or on the old whorls of the larger ones, and are apt to disappear on the larger and younger whorls." The costæ bifurcate both at the suture and the bounding keel, and are as a rule about their own distance apart, but in passing over the keel of the body-whorl they very distinctly impart a crenulated appearance.

Although resembling *Oriostoma discors* in general appearance, the present species differs from it in the presence of only one keel on the body-whorl. This, on the inner whorls is sutural, instead of being median. The ornamentation is also very different, that of *O. discors*, consisting of close, thin, anastomising lamellæ, in place of the previously described costæ of *O. northi*.

The groups of shells so characteristic of the Wenlock strata, to which *O. northi* belongs has not, to my knowledge, been before described from Australian Silurian rocks, although a note attached to one of the Quarter Sheets of the Victorian Geological Survey,* published many years ago, records the occurrence of a somewhat allied shell, *Oriostoma sculptum*, J. de C. Sby., sp., in the neighbourhood of Kilmore.

One word on the genus. According to M. Munier Chalmas' original definition, the spire is said to be an uncoiled one, and the whorls free. On the other hand Dr. Lindström says, " whorls . . . . joined, seldom a little disjointed near the aperture." It seems to me that a more particularised diagnosis than this would be advantageous. Dr. Paul Fischer † goes even further and says the whorls are contiguous.

* Quarter Sheet 4, S.W. Geol. Survey Victoria, (Note Bb20).

† Man. Conchyl. 1887, p. 813.

Family Trochidæ.

Genus Trochus, *Linnæus.*

Trochus (Scalætrochus) lindströmi, *sp. nov.*

(Pl. viii., Figs. 1 and 2.)

Sp. Char.—Shell pyramidal-conical, of more than six whorls, with an acuminating sharp spire; under surface flattened, not concave, but depressed immediately around the columellar centre, which is quite devoid of an umbilicus; whorls concave or concavely-biangulate, close sutured; body whorl with a very sharp peripheral edge, dividing the upper superior from the inferior surface of the shell, aperture transversely ovate; inner lip sharp, probably bevelled inwards; surface ornamented by obliquely-curved, somewhat rough and irregular, subimbricating laminar striæ.

Obs —" It is with great diffidence the following species have been described as belonging to the old genus *Trochus.* The only reason for placing them there is the general exterior shape of the shell, it having not been possible to find any evidences from the microscopic structure of the shell nor from any traces of a nacreous stratum or an operculum. On the other hand there are so many genera of shells which have persisted from the Silurian age through all the following and so still continue, and it may therefore not be thought an impossibility that also the *Trochi* existed already in the Silurian times."

So writes Dr. G. Lindström* on the Trochidæ of the Wenlock rocks of Gotland, but the union of the perforate and non-perforate forms made by this author, seems to me manifestly a retrograde movement, more especially when several genera have already been proposed for the reception of the perforate *Trochi*, such as *Palæotrochus* Hall, *Eotrochus* Whitfield, *Flemingia* de Koninck, and probably *Pycnomphalus*, Lindst. The entire absence of an umbilicus at once separates *Trochus lindströmi* from all these genera, and places it more in accord with *Trochus niloticus*, Linn., I do not, however, feel at all satisfied that this species, and its probable ally *Euomphalus clarkei*, de Kon.,† from the Wenlock rocks of Yass can with certainty be referred to *Trochus.* Indeed, the step-like outline of the whorls reminds us of Meek's genus *Omphalotrochus*, but this is umbilicate, like the others mentioned above. On the whole it seems to me that we have the indication of a further unrecognised genus, for which I would suggest the provisional name of *Scalætrochus.*‡

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* *Loc. cit.*, p. 145.

† Rech. Foss. Pal. Nouv. Galles du Sud, 1876, Pt. 1, p. 41, t. 1, f. 7, 7*a.*

‡ Scalæ, a flight of steps.

The essential characters, as apart from *Trochus*, will be the columellar depression, the step-like form of the whorls, a simple columella, and an aperture without plicæ or teeth.

Trochus (Scalætrochus) lindströmi is unquestionably allied to the shell called by de Koninck *Euomphalus bigsbyi*, but the apical angle of the two shells is very different. The step-like form of the whorls is met with in some species of De Koninck's genus *Flemingia*, but this genus is also umbilicate.

RE-DESCRIPTION OF *PSEUDAPHRITIS BASSI*, CASTELN.

By J. Douglas Ogilby.

The Museum having had the good fortune to receive lately, through the Department of Fisheries, a fine example of this little-known species within a day or two of its capture, I think that a full description thereof will not be out of place.

It is due to the discernment of Mr. Frederick Smithers, Travelling Inspector of Fisheries, that I am enabled to add this interesting fish to the already rich ichthyological fauna of the colony.

The example described below was obtained by that gentleman at Bega in fresh water, and he is of opinion that it is not uncommon there, and descends also into brackish water; the present specimen is six and a quarter inches in length, but Mr. Smithers tells me that it grows to a larger size.

In 1872 Count Castelnau published a description of this fish from a single specimen taken in Bass' Straits, and formed for its reception a new genus, *Pseudaphritis*, on grounds however which prove to be entirely inadequate; these grounds he himself defines as follows: "the scales are rather large; the first dorsal has seven rays, (*i.e.* eight spines), and just in front of the anal there is a short fin composed of two spines." These three reasons for constituting a new genus may be disposed of as follows: in our specimens of *Pseudaphritis bassi* the number of scales on the lateral line varies between sixty-one and sixty-three; in *Aphritis urvillii* between sixty-three and sixty-five; and in all our examples of the latter the first dorsal fin possesses seven spines, and the anal is preceded by two small semi-detached spines. It follows therefore, as a matter of course, that Castlenau's name becomes a mere synonym of *Aphritis*.

In the "Zoological Record" for 1872, Dr. Günther remarks: "*Aphritis dumerili.* To this species appears to belong *Pseudaphritis bassii.* . . ." As I am unable to find any description of the former species, I am not in a position to verify or contravene this supposition.

It is strange that neither of these fishes have as yet been recorded from the coast of Victoria, since, while both species are found in Tasmania, *A. urvillii* extends westward to South Australia, and as is here shewn *A. bassi* ranges north-eastward to New South Wales.

With the exception of the fin and scale formulæ the description is taken from the fresh specimen.

From the examination of the examples in this Museum a revision of the generic diagnosis, as defined by Dr. Günther, becomes necessary, and would stand as below:—

Aphritis.

Aphritis, Cuv. & Val., Hist. Nat. Poiss. viii. p. 483 (1831).

Pseudaphritis, Casteln., P.Z.S. Vic. i. p. 92 (1872).

Branchiostegals six: pseudobranchiæ present. Body elongate, cylindrical. Opercle with a small spine: preopercle entire. Cleft of the mouth oblique: lower jaw the longer. Eye lateral. Teeth villiform, on the jaws, vomer, and palatines. Two separate dorsals, the first with seven or eight spines: the anal with two semi-detached spines: ventrals jugular: all the pectoral rays branched. Scales moderate, finely ctenoid, entirely covering the head. Air-bladder wanting: pyloric appendages in small number.

Fresh and brackish waters of Tasmania, South Australia, and the southern rivers of New South Wales.

Aphritis bassi.

Pseudaphritis bassii, Casteln., loc. cit.; Macleay, Catal. Austr. Fish. i. p. 200.

B. vi. D. 7–8. 19–22. A. 2/22. V. 1/5. P. 18. C. 14.
L. l. 61–63. L. tr. 6/15.

The length of the head is four and two-fifths, the height of the body, which is greatest beneath the middle of the first dorsal, six and four-fifths in the total length. The diameter of the eye is five and one-third in the length of the head, and equal to that of the snout, which is obtusely rounded; the slightly grooved interorbital space is four-ninths of the diameter of the eye. The greatest width of the head is rather less than half its length. The cleft of the mouth is moderately oblique, and the lower jaw is slightly the longer. The maxilla reaches to beneath the anterior third of the eye, and is abruptly truncated posteriorly, so that the upper and hinder margins form a right angle. The opercle is armed with an inconspicuous flattened spine; preopercle entire. A band of villiform teeth in the jaws without an outer enlarged row; a sub-cresentic patch on the vomer; and a narrow band on the anterior half of the palatine bones. Dorsal spines weak; the third the longest, three-sevenths of the length of the head: anal fin commencing opposite to the middle of the intradorsal space, with two semi-detached spines in front, the anterior of which is the longer: ventral fins not reaching to the vent, and three-fifths of the length of the head: pectorals well developed, pointed, five-sevenths of the same, and reaching to below the origin of the second dorsal: caudal fin crescentic, the middle rays being considerably shorter than the marginal rays, six and three-fifths in the total length. Head entirely covered with scales, which are much smaller and more finely ciliated than those of the body. *Colors*—Upper half of head and body deep purple, lower half pearly white, the line of demarcation on the body being well defined, but above the vent distinctly scalloped, while on the sides of the head there is an intermediate zone freckled with white and violet; two rather obscure black bands run obliquely backwards and downwards from the postero-inferior margin of the eye; isthmus and edges of the lower lip purple; dorsal fins hyaline, the rays only freckled with purple; upper half of the pectorals purplish, dotted with white; ventral and anal fins white; caudal purple with two transverse white bars on the posterior half.

RE-DESCRIPTION OF *ANOMALOPS PALPEBRATUS.* (BODD.)

By J. Douglas Ogilby.

To Capt. Braithwaite, of the Mission schooner "Dayspring," the Museum is indebted for two examples of this very rare and valuable deep sea fish; so little known is it that according to Dr. Günther (Voy. "Challenger" l.c. infra), who states that he has never personally had an opportunity of examining specimens, only six examples have been recorded, four of which are from Amboina and Manado, one from the Fiji Islands, and one from the Paumoto Archipelago; these specimens therefore, which were obtained at the New Hebrides, raise the number known to exist in various Museums to eight, and help to shew the wide geographical range of this interesting fish. The same authority also mentions that "the largest is twelve inches," but neither of the specimens under consideration exceed five inches in length; one of them, however, being in a very perfect condition, I am enabled to draw up a more detailed description than I have yet seen, which should prove of interest to Australasian ichthyologists.

Misled by its outward superficial resemblance, and perhaps in some degree influenced by the knowledge that it evidently resides normally at a considerable depth, Drs. Bleeker and Kner placed it among the *Berycidæ*, but as Dr. Günther very rightly observes "the different character of the fins," and, I may add, the number of the branchiostegal rays, preclude the possibility of its admission into that family, but no more am I able to agree with Dr. Günther as to its Carangoid affinities.

Appended is a full generic and specific diagnosis.

Anomalops.

Heterophthalmus,* Bleek., Faun. Ichth. Ins. Manado, p. 42 (1856).
Anomalops, Kner, Sitz. Ak. Wien, lviii. p. 294 (1868).

Branchiostegals seven: pseudobranchiæ well developed. Body oblong, more or less compressed. Cleft of mouth of moderate depth. Eyes lateral, very large: an oblong, elongate, glandular, free, luminous organ occupies a depresion in the infraorbital ring. Villiform teeth on the jaws and palatine bones: vomer toothless. Two dorsal fins; the first short with weak spines, the second and the anal of moderate length: anal with two short spines. Scales small and rough.

Anomalops palpebratus.†

Sparus palpebratus, Bodd., in Pallas N. Nord. Beitr. ii. p. 55, tab. iv. ff. 1, 2.
Bodianus palpebratus, Lacep., iv. p. 286.
Heterophthalmus katoptron, Bleek., Faun. Ichth. Ins. Manado, l.c.; Faun. Ichth. Ins. Amboina, p. 9; Atl. Ichth. tab. ccclv. fig. 1.
Anomalops græffii, Kner, Sitz. Ak. Wien, l. c., tab. i. fig. 1.
Anomalops palpebratus, Günth., Fisch. d. Südsee, p. 142, taf. xci. fig. A; Voy. Challenger, Deep-sea Fishes, xxii. p. 41.

B. vii. D. 5. 1/13–15 (16).‡ A. 2/11–13. V. 1/5. P. 18. C. 20.

Length of head four, height of body below intradorsal space three and four-fifths in the total length; breadth of head

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* Having been used by Blanchard for a genus of Coleopterous Insects five years previously, the name is inadmissable.

† I am indebted to Dr. Günther for kindly correcting by letter my mistake of name, even though I had previously discovered the original name. (See P.L.S. N.S.W. iv. (2) p. 312.)

‡ Günther, op. cit.

two-thirds of its length. Eye very large, reaching to the upper surface of the head, its diameter one-half the length of the head; several tubular lobules border the eye posteriorly; luminous organ partially free, reaching to behind the eye, and four-fifths of its diameter. Snout very short, convex, not projecting beyond the mouth. Interorbital space flat, broad, three-fourths of the diameter of the eye. Nostril large, not separated from the eye by an osseous interspace. Jaws equal; maxilla slender anteriorly, becoming abruptly expanded in its posterior third, and reaching to behind the vertical from the centre of the eye. All the bones of the head entire, scaleless, and finely sculptured; on the upper surface most of the bones are divided by naked tubiferous interspaces; clavicle very large, semicircular; supraclavicle and post-temporal elongate, arcuate. Bands of villiform teeth on the jaws and palatine bones; vomer and tongue toothless. Dorsal spines weak, the last small, and separated from the fourth by a considerable interspace;* soft dorsal rather higher than the spinous, with a distinct, though small and weak, spine: anal similar to soft dorsal, with two small inconspicuous spines: ventrals well developed, four-sevenths of the length of the head, and five-sevenths of the distance between their origin and the vent: pectorals pointed, equal in length to the ventrals: caudal elongate, and deeply forked, four and four-fifths in the total length. Least height of caudal pedicle three and two-thirds in the height of the body. Abdomen with a distinct serrated ridge. Scales† small, each one with several rows of strong, though minute, spines, those on the posterior margin being the longest; base of caudal fin scaly. The lateral line commences near the upper angle of the post-temporal, and runs parallel to the dorsal profile during its entire length.‡ *Colors*—Purplish-brown; luminous organ externally bright yellow with a raised black border, internally black: all the fins much darker than the body: soft dorsal with a white basal band gradually narrowing from the front; all the vertical fins narrowly margined with white.

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* The fifth spine has by some chance been omitted in the otherwise excellent figure in the Fische der Sudsee.

† The scales have a great resemblance individually to those of *Tetragonurus*.

‡ In Dr. Günther's figure this line is much too straight and commences too far down; Dr. Bleeker's is more accurate.

ADDITIONS TO THE INSECT-FAUNA OF LORD HOWE ISLAND, AND DESCRIPTIONS OF TWO NEW AUSTRALIAN COLEOPTERA.

By A. Sidney Olliff,
Entomologist at the Australian Museum and Department of Agriculture, New South Wales.

The present paper contains descriptions of two Longicorn beetles from Lord Howe Island, obtained since the publication of my report on the insect-fauna of that island,* and of two Coleoptera from the Australian Continent which, for various reasons, it is desirable to name. Opportunity has been also taken to publish figures of the following recently described Longicorns :—*Toxeutes rasilis*, from Norfolk Island ; *Rhytiphora rosei*, from Coonamble, N S. Wales ; *Monohammus æstheticus*, from Cloncurry ; and *M. artius* and *Nothophysis barnardi*, from Duaringa, Queensland.

RUTELIDÆ.

Anoplognathus punctulatus, *sp. n.*

(Pl. x., Figs. 8, 8*a*, 8*b*.)

Ovate, bronze-green, shining, finely and closely punctured ; front of head and margins of the prothorax and elytra inclining to coppery, the latter with the striæ almost obsolete ; pygidium densely pubescent and setose. Head finely and very closely punctured ; clypeus narrowed behind, with the anterior margin strongly reflexed in the male, the angles prominent ; in the female regularly rounded. Antennæ reddish testaceous. Prothorax strongly rounded in front, the punctuation fine and exceedingly close at the sides. Scutellum very finely and sparingly punctured. Elytra ample, arcuately narrowed behind, finely and closely punctured, the punctuation rather finer at the sides. Legs and underside bronzy-green, clothed with long silky grey pubescence. Length 21–23 mm.

Mt. Bellenden-Ker, Queensland.

This species evidently belongs to that division of the genus *Anoplognathus* in which the pygidium in both sexes is clothed with hair. In general *facies* it is near *Calloodes prasinus*, Macl.,

* Lord Howe Island : its Zoology, Geology, and Physical Characters.—Memoirs Aust. Mus. No. 2, 1889.

and like that species it has the anterior tibiæ armed with one obscure and two distinct teeth; it may be distinguished by its dull bronze-green hue, and its similarly and comparatively distinctly punctured head, prothorax, and elytra. *Calloodes mastersi*, Macl., has the anterior tibiæ armed with spines like those of *A. punctulatus* and *C. prasinus*. I am, therefore, inclined to refer all these species to *Anoplognathus*, as true *Calloodes* has edentate anterior tibiæ.

CERAMBYCIDÆ.

Elasmostoma, *gen. nov.*

Labial palpi with the apical and penultimate joints of about equal lengths, the former narrowed both anteriorly and posteriorly, the latter slightly narrowed behind. Mandibles rather prominent, very robust, strongly incurved, flattened above. Head strongly concave between the antennal tubercles, which are moderately prominent, with a clearly defined median line. Eyes very strongly granulated. Antennæ widely separated at the point of insertion, rather robust, somewhat tapering towards the extremity, finely ciliate beneath, especially near the base; basal joint very robust, almost pyriform, truncate at the apex; 2nd joint short; 3rd and 4th subequal, rather longer than the succeeding ones, which are gradually reduced in length. Prothorax transverse, flat above, armed on each side in the middle with a lateral tooth, and before the middle on the dorsal surface, near the margin, with two teeth. Scutellum transverse, rounded behind. Elytra at the base considerably broader than the prothorax, elongate-ovate, narrowed behind, the apex simple; each elytron with a longitudinal row of tubercles at the base. Mesosternal process raised, rounded behind; prosternal process rather narrower. Legs rather long, robust; femora greatly thickened, almost ovate towards the apex; tibiæ somewhat slender, the intermediate pair with a conspicuous sulcus just beyond the middle; tarsi moderately robust; claws simple.

This well-defined genus of Doreadioninæ is evidently allied to *Athemistus* and *Lepromoris*, but is sufficiently distinguished by the presence of four tubercle-like teeth on the prothorax (two on each side above the lateral spines), the comparatively large scutellum, the greatly enlarged femora, and the less convex surface, particularly of the elytra. From *Athemistus*, its nearest ally, it differs in having the extremity of the elytra simply rounded, without a trace of apical spines; but the antennæ in their structure and mode of insertion agree very closely with those of the genus in question.

A single winged species is known to me which is probably peculiar to its island locality.

Elasmostoma insulana, *sp. n.*

(Pl. x., Fig. 7.)

Elongate-ovate, dark fuscous, densely clothed with very fine decumbent griseous brown pubescence, and sparingly covered with long erect hairs of the same colour. Head with a distinct median line, slightly depressed behind the eyes; face with a few rather strong punctures. Antennæ rather longer than the entire body, densely pubescent; the basal joint robust, the 2nd very short, the 4th rather longer than the 3rd, the rest gradually shorter. Prothorax transverse, very sparingly and rather strongly punctured in front, almost impunctate behind, with two very strong obtuse posteriorly curved tubercle-like spines in front on each side; beneath the second or hindermost of these spines the lateral spine is situated; the anterior margin slightly impressed, the posterior somewhat raised. Elytra rather more than twice as long as the head and prothorax together, narrowed behind, strongly, irregularly, and very sparingly punctured; the humeral angles minutely tuberculate; the sides arcuately rounded at the apex; each elytron with a longitudinal row of five tubercles at the base, midway between the suture and the lateral margin. Underside densely pubescent. Legs densely pubescent, and sparingly setose, except on the external margins of the apical half of the tibiæ, where the setæ are decumbent and dense. Length 20 mm.

Lord Howe Island.

Ceresium procerum, *sp. n.*

(Pl. x., Fig. 3.)

Elongate, moderately convex, finely clothed with grey pubescence; head, prothorax and underside piceous; antennæ, elytra, and legs dark reddish testaceous. Head rather strongly and irregularly punctured, the punctuation effaced in the middle at the base. Antennæ considerably longer than the body, clothed with very fine reddish testaceous pubescence, the 1st joint somewhat enlarged. Prothorax nearly as long as broad, narrowed both in front and behind, finely, irregularly, and sparingly punctured at the sides, more finely and very sparingly punctured in the middle, with an obscure transverse impression near the anterior margin. Scutellum closely pubescent. Elytra parallel-sided, rather closely punctuate, the punctuation arranged in irregular rows, coarse for the basal two-thirds, and gradually decreasing in strength posteriorly, with indistinct indications of three costæ. Underside with the abdominal segments piceous, highly polished, and sparingly pubescent. Legs sparingly setose. Length 20–22 mm.

Lord Howe Island.

Allied to *Ceresium pachymerum*, Pasc., but with the prothorax broader and the legs darker in colour.

ANTHRIBIDÆ.

Metadoticus, *gen. nov.* (Pascoe *in litt.*)

Head almost as broad as long; rostrum a little shorter than the head, robust, slightly narrowed at the base, truncate in front, the dorsal surface very slightly convex; antennal scrobes short, lateral and oblique. Eyes simple, very large and convex, the granulation coarse. Antennæ about as long as the rostrum, head, and prothorax together, slender, 11-jointed; the first two enlarged, the 3rd to 8th slender, the last three broadly dilated and depressed, forming a loose-jointed club, the terminal joint somewhat pointed at the apex. Prothorax broadly transverse, greatly narrowed in front, the sides for the basal half of their length and posterior margin strongly elevated, the posterior angles acute. Scutellum small, rounded behind. Elytra very short, strongly convex, somewhat narrowed behind, at their base a little broader than the prothorax, with a large elongate crest-like elevation near the base on each side of the scutellum, the humeral angles elevated. Legs rather long, enlarged towards their extremity, the anterior pair in both sexes compressed and longer than the others; tarsi with the 1st joint much longer than the 2nd, the 3rd small, bilobed; claws with a small arcuate tooth near the base. In the female the anterior legs are longer than in the male; the tarsi are greatly enlarged and dilated. Pygidium triangular.

This genus appears to be very distinct from any known Australian form, and I have some hesitation in indicating its affinities; it seems, however, to approach Lacordaire's group Phlœophilides, especially to that portion of the group containing the genus *Ethneca* and allies. A species in the Australian Museum bearing the MS. name *Metadoticus mastersi*, Pasc., is evidently closely related to the species here described, and I propose to retain the generic name, as it does not appear to have been appropriated in any other group.

* Doticus

~~Metadoticus~~ pestilens, *sp. n.*

Ovate, strongly convex, pitchy-brown, rather closely covered with ferruginous-grey pubescence. Head moderately convex, densely pubescent, with an indistinct impression in front; a feeble median line. Antennæ testaceous, the three terminal

* See Corrigenda.

joints forming the club pitchy, joints 3–8 slender and gradually decreasing in length towards the extremity. Prothorax slightly depressed both in front and behind, with three slight elevations in the middle, of which the outer ones are a little in advance of the others; the sides not very strongly pubescent. Elytra densely pubescent, finely punctate-striate; the interstices broad, each alternate one raised and provided with a row of small tubercles which are covered with black pubescence; each elytron provided near the scutellar angle, between the 3rd to 7th interstices, with a large regularly-arched elevation. Legs pitchy; the tibiæ barred with greyish testaceous. Length 5–5½ mm.

Melbourne. Received from Mr. C. French, who informs me that the species is very destructive to apples in Victoria.

ON A NEW SPECIES OF *PETAURIDES* FROM THE BELLENDEN-KER RANGE, N. E. QUEENSLAND.

BY DR. E. P. RAMSAY.

PETAURIDES CINEREUS, *sp. nov.*

$$\text{I. } \frac{3-3}{1-1}. \quad \text{C. } \frac{1-1}{0}. \quad \text{P. } \frac{3-3}{1-1}. \quad \text{M. } \frac{4-4}{4-4} = \frac{22}{12}$$

Adult male. The whole of the upper surface of the body ashy-gray, the face long and fluffy or silky to the touch, slightly darker on the dorsal region, and with an indistinct stripe of blackish-gray down the occiput; head, chin, ears and face slightly darker in tint than the back. The fur of the back and sides tipped with ashy-white, that of the fore and hind limbs darker; hands and feet blackish, hair on the former short, on the latter long and silky; base of the tail like the back in some specimens, creamy or ashy for about one-fourth of its length, gradually becoming darker until almost black at the tip; all the under surface from the chin, underside of the limbs, and parachute white. Ears rounded, about half as long again as wide, clothed with long hair on the outside, flesh-coloured and almost bare within. The parachute or "wing membrane" commences a little in front of the elbow-joint, extends to about half-way below the knee-joint, and is not very wide. Hair longest and most silky on the posterior parts of the body and the hind legs, shortest on the under side on the belly.

Dimensions

	In.	Mm.
Head and body	12·00	300
Tail	18·00	450
Tip of snout to eye	1·05	26
Head	2·40	60
Tip of snout to ear	1·80	45
Ear	1·20	30
Breadth of head at base ...	0·90	22
Breadth of head at middle ...	0·75	19
Hand	1·00	25
Foot	1·60	40
Ulna and radius	2·40	60
Tibia and fibula	3·70	92

Skull.—Total length 2·20 (55), across the forehead in front of the zygomatic arches 0·48 (12), across the head at base of arches

1·30 (33), length of zygomatic arch 1·20 (30), inside above 1 (25), below 0·62 (15·5), extent of range from 2nd premolar to last molar in upper jaw 0·62 (15·5), of molars and premolars in lower jaw 0·60 (15), width outside at 2nd molar—upper jaw 0·56 (14), lower jaw 0·45 (11), length of mandible from condyle 1·35 (34), height to point of ascending ramus 0·8 (20), extent of symphysis of lower jaw 0·35 (9), length of free portion of lower incisors 0·35 (9), anterior palatal foramen opposite canine and first premolar, length 0·15 (4), canines tubercular, equal in size to first premolar, three incisors of the upper jaw 0·2 (5), space between last upper incisor and first premolar 0·28 (7), between canine and first premolar 0·1 (2·5).

This species approaches most nearly to *Petaurides volans*, var. *minor* of Oldfield Thomas. (Brit. Mus. Cat. C.)

Two specimens were obtained by Messrs. Cairn and Grant in 1889, on one of the spurs of the Bellenden-Ker Range, N.E. Queensland.

ON *PARMELLA ETHERIDGEI*, BRAZIER.

By C. Hedley, F.L.S.,

Zoologist, Queensland Museum, Brisbane.

(Communicated by J. Brazier.)

(Plate xi.)

In Mr. Etheridge's account of the Museum Expedition to Lord Howe Island, published last year by the Trustees of the Australian Museum, we read (p. 26) that "A fine new species of Vitrina was found on the stems and leaf sheaths of the palms growing on the lower grounds (*Kentia belmoreana* the curly palm, and *Kentia forsteriana* the thatch palm), and is called by Mr. Brazier *Vitrina etheridgei*.

A specimen of this mollusk was courteously communicated to me for anatomical examination by Mr. Brazier, who pointed out how closely it answered to the figure and description of *Parmella planata*, H. Adams, from Fiji (P.Z.S., 1867, p. 308, pl. xix., fig. 20). The smaller size and lighter colour of the shell, added to the difference in habitat, though stress must not be laid upon the latter, incline me to rank Mr. Brazier's species apart from that of Adams'. Whilst the very peculiar shell with its veil of epidermis, like gold beater's skin, descending from the periphery confirms me in Mr. Brazier's opinion that we have here a second species of this long lost genus.

Fischer states (Man. de Conch., p. 460) that no information of the animal has ever been recorded, and that its systematic position is uncertain. My study of the animal induces me to classify Parmella as a distinct and well defined genus of the Helicarioninæ, allied to Parmarion and Parmacochlea but more closely to Cystopelta. The slender foot and the bag-like visceral hump give it externally a strong resemblance to the latter.

The length of the animal (a spirit specimen) from muzzle to tail is 14 mm., from muzzle to posterior end of visceral hump 16 mm. Visceral hump very large, detached from and overlapping in length and breadth the slender foot, above protected by the shell, which gives to it a flattened outline, beneath enclosed in a thin transparent membrane through which the liver and intestines are plainly visible. Mantle reddish-brown dotted with black, finely papillate entire, free anterior to the pulmonary orifice, with a loose fold on the neck, covering the shell for 4 mm. anteriorly and for 2 mm. on either side; posteriorly the shell is bare to the periphery. A few millemetres below the shell the mantle loses its papillate aspect, becomes thinner and about the periphery of the visceral mass merges into the thin membrane. The tail is furnished with a terminal mucous pore not cleft to the sole and apparently overhung by a horn, but the shrunken specimen did not permit this detail to be clearly observed. A pedal line runs from this pore to the lips Anterior to the pore the tail is (apparently) keeled, and then broadens into the usual saddle-like space. The tail and muzzle are reddish-brown, a black line runs from beneath the anterior angle of the mantle to the mucous pore and another along the pedal line. Of the shell I add a rough sketch, but I leave the description to the abler pen of Mr. Brazier. So limp is the fringe of epidermis that I could not extract it untorn, and to expand it for drawing I had to float it out in water. *Africarion ater*, Austen (L. & F. W. Moll. of India, pl. 57, fig. 1), possesses a similar fringe. The initial whorls were occupied by the testicle.

To my great regret I destroyed the jaw in dissecting it out, but succeeded in preserving a remarkable radula. This is longer than broad, somewhat cordate in outline, the rows nearly flat until on reaching a central crest they curve to meet at an acute angle. The graceful rachidian rather resembles that of *Durgella khasica*, as figured by Col. Godwin-Austen; the basal plate is hidden by the reflection which arises in an oval, then contracts and again expanding presents a tricuspid cutting point. The laterals are much curved, armed with a round blunt point and a small proximal cusp, they retreat from the rachidian at an angle of 15°, and after a series of fifteen, pass through a few transition forms into the minute marginals. These have a straight cusp, and are so contorted that the base of each is beneath the blade of its distal neighbour. I estimated that the odontophore contained 145 rows, whose formula was 300.15.1.15.300, making a total of over ninty thousand. The accompanying sketches show firstly the general disposition of the teeth upon the lingual ribbon, as viewed under a 2-inch lens, then the structure of the individual teeth as demonstrated by $\frac{1}{8}$th power.

Of the genitalia the penis sac is subcylindrical, performing a half revolution at its apex, from which is continued a narrow tube containing the spermatophore at its junction with the vas deferens, and terminating in a flagellum. The genital bladder is small, seated on a short duct which communicates with the vagina near the common orifice.

DESCRIPTION OF *VERMICELLA BERTHOLDI.*

By J. Douglas Ogilby.

Vermicella bertholdi, *Jan. Icon. gén. des Ophid.*

Scales in fifteen rows ; abdominal plates 122 ; two anal plates ; sub-caudal plates in two rows, 21/21. Body stout, rounded, the tail very slightly compressed and short, about one-tenth of the total length, and terminating in a blunt conical scale. Head small, not distinct from the trunk. Rostral shield large, obtusely angulated posteriorly, and conspicuously produced backwards on the upper surface of the head : nostril oval, pierced in the middle of an acutely angulated cuneiform nasal : anterior frontals* quadrangular or pentagonal, rounded, or very obtusely angulated anteriorly ; posterior frontals pentagonal, bent downwards on the side of the head, so as to form a suture with the nasal, thus replacing the loreal : vertical hexagonal much longer than broad, obtusely angular in front and acutely so behind : supra-ocular large, pentagonal : one anterior and two posterior oculars : occipital shields large, pentagonal or hexagonal, much broader in front than behind : three temporal shields, the first the largest, in contact with the two posterior oculars, and produced downwards so much as almost to divide the two last upper labials : six upper labials, the third and fourth entering the eye, the last the largest : six lower labials, the first elongate, forming a broad suture behind the triangular mental, the second small, the third and fourth the largest : two chin shields on each side : numerous scales between the chin shields and the first abdominal plate. Scales smooth. *Colors*—All the anterior and lateral head-shields cream color with or without black freckles ; occipital shields with

* In one specimen the anterior and posterior frontal on the right side are fused into one large shield.

a light anterior and lateral margin, and a cream colored spot near the sutural margin; body white, with from 31 to 34 annular black cross-bands, which are much broader on the back than on the abdomen; lower surface of the head with longitudinal dark streaks.

Of the three specimens examined in the preparation of this description, two were obtained through the kindness of Mr. A. Zietz, of the South Australian Museum, Adelaide, who collected them in the neighbourhood of Port Augusta, S.A., and who further informs me by letter that he has since received specimens from Port Pirie, S.A. The third specimen was collected by Mr. A. J. Campbell, of Melbourne, in West Australia, and forwarded to the Institution for identification. As the Museum Library does not at present possess a copy of the letterpress of Jan's *Iconographie générale des Ophidiens*, I have taken this opportunity of describing in detail this very distinct species. The largest specimen examined measured nearly ten inches.

DESCRIPTION OF A NEW *TETRODON* FROM NEW SOUTH WALES.

By J. Douglas Ogilby.

TETRODON AURANTIUS, *sp. nov.*

D. 11. A. 10. P. 17. C. 9.

The length of the head is three and two-fifths ~~of~~ the total length. in/ The eyes are situated at an equal distance from the tip of the snout and the superior angle of the gill-opening, and their diameter is one-half of the length of the snout, and four-sevenths (see corrigenda) of the interorbital space, which is slightly concave. Nasal organs pierced in the lower half of a bifid papilla, with only one opening on each side. Dorsal profile broad. The distance between the tip of the snout and the origin of the dorsal fin is four-sevenths of in (see corrigenda) the total length: the snout is two-thirds of the distance between the posterior dorsal ray and the origin of the caudal fin, and is equal to the height of the caudal pedicle immediately behind the anal fin, which is situated entirely behind the dorsal:* the pectoral fins are short and rounded: the caudal, which is also rounded, is five-sevenths of the length of the head. The entire body and head, with the exception of the lips, armed with long blunt spines with a slightly nodular termination; these spines materially

* The origin of the anal fin is perpendicularly beneath a point behind the dorsal fin, ~~and is~~ equal to the base of that fin.

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diminish in number and size on the caudal pedicle. *Colors*—Body and head orange, paler below ; a very few irregularly scattered black spots on the body ; lips brown ; dorsal, anal and caudal fins with the outer half dusky ; pectorals orange at the base, pale yellow on the outer margin, with a black median band, broader superiorly ; gill-opening black, with an occasional milk-white spot ; nasal papillæ and tips of the body spines black.

The species described above belongs to Section ii. B. of Dr. Gunthers' Catalogue, it measures ten and three-fourths inches, and was obtained in the Shoalhaven District.

ON A FRESH WATER ALGA AT WEST MAITLAND WATERWORKS.

By T. Whitelegge.

Geological Survey Branch,
31st July, 1890.

The Acting Curator, Australian Museum.

Sir,—I have already forwarded to you a sample of the minute vegetable organism, which has of late spread with such alarming rapidity through the main reservoir and the settling tanks at the West Maitland Waterworks.

The engineer in charge, Mr. Nicholson, informed me that he was obliged to keep men constantly employed in removing this vegetable growth, as unless kept constantly in check it chokes the supply pipes and obstructs the percolation of water through the filter beds. The plant appears to me, upon microscopic examination, to be a variety of fresh-water Alga, but as I am quite unable to offer any suggestions as to the best means for its eradication, I ventured to forward you the samples of this Alga, in the hope perhaps that you might consider the matter of sufficient importance to have a thorough investigation made to determine (1) the nature of the Alga, and (2) the best specifics for checking or entirely preventing its growth. Mr. Nicholson, the engineer in charge of the Waterworks at West Maitland, would be pleased to furnish any details you may require with regard to the occurrence of the Alga.

The discovery of an efficient remedy for this pest would be a great public benefit.

I have the honor to be, Sir,

Your Obedient Servant,

(Signed) T. W. E. David,

Actg. Geol. Surveyor in charge.

5th August, 1890.

Gentlemen,—I have the honor to transmit Progress Report by Mr. Whitelegge on Algæ received from the Geological Survey Department, and handed to him for examination, and to recommend that it be published in the "Records," and a copy forwarded to the Department.

I have the honor to be, Gentlemen,

Your Obedient Servant,

Ed. P. Ramsay, Curator.

To the Trustees of the Australian Museum.

Australian Museum,

4th August, 1890.

To the Curator.

Sir,—I have the honor to report that some time ago I received from the Acting Curator a bottle containing a green unicellular Alga, obtained by Mr. David, the Acting Government Geologist, from the Maitland Waterworks, with instructions from the former to send in a Progress Report for the information of the Trustees.

It appears that this particular Alga exists at certain seasons in such numbers as to seriously interfere with the pumping of the water, which it would probably render unpalatable, if not unfit for consumption.

The plants are exceedingly small, somewhat ovoid in shape, and of a light pea-green colour. When found in large numbers they give off a very unpleasant and fœtid odor, like that of many other plants rich in protoplasm, such as Nitella and Chara. The plant is evidently closely allied to, if not identical with *Chlamydomonas pulvisculus* of Ehrenberg, but until the various stages of its life-history are known, it would be unsafe to give a definite opinion as to its specific identity. From what I have seen of the same plant near Sydney, it passses some weeks in a free swimming condition, afterwards it loses its cilia and rises to the surface of the water, forming a thick scum of green powder. This phase evidently represents one of the resting stages of the plant. When found in this condition it seems to repel the water and appears quite dry; by the action of the wind it is blown to the sides of the dam, where it often accumulates to a depth of several inches. It is probable, that before the plants resume active growth again, a kind of drying process is necessary, and that they rest on the mud until the ensuing rainy season.

Without a thorough knowledge of the conditions under which the Alga occurs in the Maitland district, it is difficult to say what steps should be taken with a view to its destruction. Under the circumstances I can only make a few suggestions which might, if carried out, tend to reduce its numbers.

In the first place it is a well known fact that the Rotifera or Wheel-animalculæ feed on small unicellular Algæ such as the one in question. The Unio or Fresh-water Mussel might also be tried, its introduction would not be injurious to the water supply. But I consider the best plan would be to take advantage of the resting stage of the plant, and engage a staff of men to skim the surface of the water. With suitable wire gauze frames vast quantities might be collected and destroyed. If this method were adopted for several seasons in succession the organism might ultimately be eradicated. The following are a few of the more important works in which this Alga is dealt with :—

Chlamydomonas pulvisculus, Ehrenberg; Die Infusions thierchen, 1838, p. 64.

Chlamydomonas pulvisculus, Pritchard; Infusoria, 1861, p. 521, pl. 18, f. 40, 51 – 54.

Chlamydomonas pulvisculus, Cooke; British Freshwater Algæ, 1882–4, p. 56, pl. 21, f. 3.

Chlamydomonas pulvisculus, Bennett & Murray; Handbook of Cryptogamic Botany, 1889, pp. 186, 299, 300, 409, 417, 419.

I have the honor to be,

Your Obedient Servant,

THOMAS WHITELEGGE.

SPECIMENS OBTAINED ON A DREDGING TRIP IN PORT JACKSON, SATURDAY, 30TH MAY, 1890.

As an instance of the very extensive Marine Fauna of Port Jackson, the following list of the various species obtained in one day's dredging is given. The specimens have been determined by Members of the Museum Staff, viz.: —Mollusca by Mr. Brazier, General Invertebrata by Mr. Whitelegge:—

MOLLUSCA (6 to 8 fathoms).

Green Point, Watson's Bay.

Octopus granulatus, Lam.
Murex Brazieri, Angas †
Typhis arcuatus, Hinds †
Triton fusiformis, Kiener †
Fusus Hanleyi, Angas *
Eburna (Zemira) australis, Sowb.
Nassa jacksoniana, Quoy, small var.
,, *paupera*, Gould
Cominella tritoniformis, Bl.
Neritula lucida, Ad. & Ang.†
Olivella exquisita, Ang.†
,, *nympha*, Ad. & Ang.
Amalda marginata, Lam.
,, *oblonga*, Sowb.
Mitra strangii, Angas *
Columbella eximia, Reeve *
,, *filosa*, Angas
,, *lincolnensis*, Reeve
Marginella ovulum, Reeve
,, *turbinata*, Sowb.
,, *Metcalfii*, Angas †
,, *olivella*, Reeve
,, *translucida*, Sowb.
Volvarina mustellina, Angas †
Natica euzona, Recluz
,, *subcostata*, Ten.-Woods†
Neritina sowerbiana, Mont.*
Scalaria jukesiana, Forbes
,, *aculeata*, Sowb.
Crosseia concinna, Angas *
Turbonella nitida, Angas
Odostomia laevis, Angas
Terebra bicolor, Angas
Drillia Metcalfii, Angas
Clathurella bicolor, Angas
,, *sp.?*
,, *sculptilis*, Angas
Mangilia lineata, Reeve
Trivia globosa, Gray †
Pelicaria scutulata, Martyn
Bittium granarium, Kiener
Cerithiopsis crocea, var., Ang.*
Triforis nigrofuscus, A. Ad.
Rissoina Smithi, Angas
,, *sp.*
Turritella sinuata, Reeve
Trochita calyptraeformis, Lam.
Crypta unguiformis, Lam.*
Capulus violaceus, Angas *
Vanikoro gaimardi, Adams *
Australium tentoriformis, Jonas
Liotia Kieneri, Philippi †
Clanculus clangulus, Gray
Elenchus badius, Wood
Trochus decoratus, Philippi
Leiopyrga picturata, H. & A. Ad.
Minolia prodictus, Fischer
,, *vitiligenia*, Menke
Gibbula Coxi, Angas
,, *strangii*, A. Ad.
Gena nigra, Quoy & G.
Lucapina lineata, Sowb.
Emarginula candida, A. Ad.
Hemitoma rugosa, Quoy
Tugalia parmophoidea, Quoy
Buccinulus affinis, Ad.
,, *nireus*, Angas *
Cadulus acuminatus. Desh.
Myonia concinna, A. Ad.
,, *sinuata*, Angas *
Ringicula doliaris, Gould
Bullina lineata, Gray
Cylichna arachis, Quoy
,, *regularis*, Gould *
,, *pyramidata*, Ad.†
,, *pygmaea*, A. Ad.†
Tornatina fusiformis, A. Ad.
,, *Hofmani*, Angas

* Rare. † Very rare.

Bulla australis, Gray
,, *ampulla*, Linne
Haminea cuticulifera, E. A. Sm.
Philine Angasi, Crosse
Humphreyia Strangii, A. Ad.*
,, *multiangulare*, Tate†
Solen Sloani, Gray
c/ *Saxicara artica*, Linne
Corbula tunicata, Hinds
,, *Smithiana*, Braz.*
Neæra Brazieri, E. A. Smith†
Myodora pandoræformis, Stuch
Mactra jacksonensis, E. A. Sm.*
,, *ovalina*, Lam.
Lutraria oblonga, Gmelin
Psammobia modesta, Desh.
Tellina, sp. ?
Chione striatissima, Sowb.
Circe Angasi, E. A. Smith
Tapes inflata, Desh.
,, *turgida*, Lam.
Lucina, sp. ?
Modiola Australis, Gray
Modiolaria barbata, Reeve
,, *Cumingiana*, Dunker
Trigonia Strangei, Ad. (2 valves)
Arca gubernaculum, Reeve
Megerlia pulchella, Sowb.*

General Invertebrata, exclusive of Mollusca.

Tunicata.

Boltenia pachydermatina, Herd.
Polycarpa tinctor, Qy. & Gaim.
,, *viridis*, Herd.

Polyzoa.

Notamia gracilis, McGillivray
Beania conferta, ,,
Flustra militaris, Waters
Membranipora spinosa, Q. & G.
Cribrilina radiata, Möll.
,, *dithridata*, Waters
Microporella ciliata, Pallas
,, *diadema*, McGill.
,, *malusii*, Savigny
Schizoporella divisopora, Waters
Lepralia elimata, Waters
,, *poissoni*, Savigny
,, *vestita*, Hincks
,, *depressa*, Busk
Smittia praestans, Waters
,, *signata*, Waters
Porella inversa, Waters
Cellepora mammillaris, Busk
Selenaria punctata, Ten.-Woods
,, *concinna*, ,,
Bipora philippinensis, Busk
,, *elegans*, D'Orbigny

Amathia Lendigeri, Linn.
,, *tortuosa*, Ten.-Woods

Crustacea.

Micippa parvirostris, Miers
,, *spinosa*, Stimpson
Paramithrax Peroni, M. Edw.
Pilumnus rufo-punctatus, Stim.
Dromia excavata, Haswell
Cryptodromia sculpta, Haswell
Clibanarius, sp.

Cirripedia.

Balanus trigonus, Darwin
Dichelaspis orthogonia, Darwin

Vermes, Gephyrea.

Phymosoma japonica, Grube
Phascolosoma Australis, Keffer.

Echinodermata.

Antedon pumila, Bell
Pectinura gorgonia, Lutken
Ophiactis resiliens, Lyman
Ophionereis schayeri, Mull. & T.
Ophiothrix caespitosa, Lyman
,, *fumaria*, Mull. & T.
Astropecten polyacanthus, ,,
Anthenea acuta, Perrier

* Rare. † Very rare.

Stichaster polyplax, Mull. & T.
Asterias calamaria, Gray
Centrostephanus rodgersii, A. Agassiz
Salmacis alexandri, Bell
Amblypneustes ovum, Agassiz & Dessor
Echinocardium australe, Gray
Colochirus spinosa, Q. & Gaim.
Phyllophorus perspicillum, Sel.
Synapta dolabrifera, Stimpson

ACTINOZOA.

ALCYONACEA.

Spongodes florida, Esper
Sarcophyllum grande, Gray
Clavella australasiæ, Gray

ZOANTHARIA.

MADREPORARIA.

Conocyathus zealandiæ, Dunc.
,, *compressus*, T.-W.
Cylicia quinaria, Ten.-Woods
Heteropsammia elliptica, T.-W.

The above list by no means includes all the species obtained, there are many more which require identifying, but time does not admit of them being dealt with at present.

The Polyzoa obtained are very interesting, inasmuch as there are amongst them many of the species lately described as new by Mr. A Waters, and others described by the late Rev. J. E. Tenison-Woods, the whole of which are additions to the collection. *Selenaria punctata*, Ten.-Woods, and *S. concinna*, Ten.-Woods, were obtained in quantity and in good condition, no doubt many of them were alive when caught in the dredge, but owing to the subsequent washing and drying the vibracular organs were destroyed. *Amathia lendigeri*, Linn., is recorded from Port Phillip, but has not previously been observed in Port Jackson.

Among the Crustacea two species are worthy of notice: *Paramithrax peroni*, M. Edwards (new to our local fauna), and *Dromia sculpta*, Haswell, a rare and interesting species. The specimens obtained have enabled me to settle the question regarding the identity of *Cryptodromia nodulifera*, Henderson, described in Vol. xxvii. of the "Challenger Report" with *Dromia sculpta*, Haswell. After a careful examination of the type and a dozen other specimens, I cannot see any valid reason why they should be regarded as distinct; the specimens exhibit a considerable amount of variation in the number and size of the nodules, and in the areolation of the surface of the carapace; in the female and in young males the regions are ill-defined, but in adult males the regional depressions are well marked. The "Challenger" specimens are evidently immature as the following measurements will show: (1) Adult male—length of carapace 12 mm., breadth 13 mm.; (2) adult female—length 9 mm., breadth 11 mm.

The two Cirripedes obtained were both interesting, *Balanus trigonus*, Darwin, on account of its being full of ova, a fact worth recording, as little is known regarding the breeding season of our Cirripedes; the vitality exhibited by this species is remarkable, some hundreds were obtained attached to the branch of a tree; after being out of water for two days the branch was soaked in fresh water for about five hours and afterwards hung up to dry, at the expiration of three days they were found to be still alive, and many of them had ejected the ova through the valves at the summit. The *Dichelaspis orthogonia*, Darwin, was like five or six other clusters previously obtained, attached to the axis of a species of Virgularia, which seems to be the favourite habitat for this rare species.

REPORT ON A ZOOLOGICAL COLLECTION FROM BRITISH NEW GUINEA.

The following Report deals with certain Reptiles, Batrachians, Fishes, and Insects forwarded for identification to the Australian Museum by Sir William Macgregor, K.C.M.G., Administrator of British New Guinea, who had caused them to be collected in the St. Joseph's River District; this river flows into the Papuan Gulf opposite to Yule Island, about eighty miles to the north-west of Port Moresby, and is said to take its rise in the range which culminates to the eastward in Mount Yule.

Part I.

REPTILES, BATRACHIANS, AND FISHES.

By J. Douglas Ogilby.

This portion of the collection contained in all nineteen species, belonging to twelve genera; these are divided as follows:—one Emydosaurian *(Crocodilus)*: six Lacertilians *(Lialis* 1, *Gonyocephalus* 2, *Lygosoma* 3*)*: three Ophidians *(Morelia* 1, *Brachysoma* 1, *Acanthophis* 1*)*: one Batrachian *(Hyla* 4*)*: and four genera of Fishes *(Eleotris* 2, *Salarias* 1, *Plotosus* 1: *Syngnathus* 1*)*.

Unfortunately all the Fishes and two of the Batrachians were too young to be recognizable.

Full particulars are given below:—

REPTILIA.

EMYDOSAURIA.

This Order is represented by a single young example of *Crocodilus porosus*, Schn.

LACERTILIA.

The Lacertilian Reptiles are represented by six species, and comprise a *Lialis*, two species of *Gonyocephalus*, and three of *Lygosoma*. Of the correct identification of neither species of *Gonyocephalus* am I absolutely certain, but I consider it preferable to name them as below, those being the species to which indubitably they are most nearly allied, than to risk a possible multiplication of synonyms by describing them as new. In this uncertainty, however, I have thought it advisable to describe both species in detail, so as to afford an opportunity to herpetologists of forming their own opinion as to the identity, or otherwise, of the species under consideration. The Skinks are also interesting, inasmuch as it has been found necessary to describe one new species, while, from an examination of the type specimens, I am enabled to restore the earlier name of *L. bicarinatum* (Macleay) to the species described under the name of *L. albertisii* (Peters & Doria) by Mr. Boulenger (Brit. Mus. Cat. (Ed. 2) iii. p. 286), who, however, suggested the probable identity of the two forms; it is in any case a most variable species, and the two diagnoses quoted might well be described as the poles of the species, but leading insensibly by numerous intervening grades from the soberly attired *L. bicarinatum* to the handsomely marked *L. albertisii*. The species described as *L. atrogulare* is noteworthy as having a possibly sexual difference in coloration, the adult males (?) being provided with a black chin and throat, while the females,(?) and probably the young males, have these parts merely spotted. It is somewhat remarkable that no less than two of the three Skinks belong to the small section of Duméril and Bibron's genus *Liolepisma*, characterized by the presence of four fingers and five toes, and a single frontoparietal followed by a small interparietal, so that northern Australia and Papuasia appear to be the metropolis of this section of the genus *Lygosoma*. In connection with the marked variability in this species I am more than ever inclined to believe that *L. tetradactylum* (O'Shaughn.), *L. pectorale* (De Vis), and *L. maccooeyi* (Rms. & Ogl.), are correlative varieties of an allied species.

Lialis burtoni.

Lialis bicatenata, *Gray, Brit. Mus. Cat. Lizards,* p. 69 (1845).

While temporarily accepting Mr. Boulenger's dictum that the various forms of *Lialis* hitherto described "should be united into one species," I may remark that, setting aside the wide differences in color, the equally marked variation in the length and tenuity of the snout appears sufficiently important to justify the retention of at the least two of Dr. Gray's species. Our New Guinea specimen agrees most closely with Mr. Boulenger's "Var. H", but it possesses a distinct, though narrow, cream-colored lateral band, extending from the angle of the mouth to the tip of the tail.

Gonyocephalus modestus.

Gonyocephalus *(Hypsilurus)* modestus, *Meyer, Mon. Berl. Ac.* 1874, p. 130.

Snout pointed, equal to, or a little longer than, the diameter of the orbit; nostril lateral much closer to the tip of the snout than to the eye; canthus rostralis and supraciliary edge acute and projecting; tympanum distinct, oval, its greatest diameter as large as the eye-opening; interorbital space deeply concave; upper head-scales small, keeled, not enlarged on the supraorbital region; canthus rostralis and supraciliary edge with a row of enlarged, elongate, strongly keeled, raised scales, overlapping one another on the inside, and decreasing posteriorly to the normal size; occipital scale enlarged; most of the lateral scales of the head enlarged, smooth; a single enlarged granular scale present or absent below the tympanum; eleven or twelve upper, and nine or ten lower labials, each row bordered by a series of enlarged smooth scales. Gular sac moderate, with no enlarged scales in front; gular scales small and granular, very much smaller than the ventrals. Nuchal crest formed of five low widely separated triangular scales, the anterior one situated above the centre of the tympanum, its height about one-fourth of the length of the snout; dorsal crest represented by a series of slightly enlarged keeled scales; dorsal scales small and keeled, the points being directed upwards and backwards; ventral scales much larger, triangular, keeled. Limbs with strongly keeled scales of unequal size; fourth finger a little longer than the third; the adpressed hind limb reaches to the anterior margin of the eye or a little further. Tail feebly compressed anteriorly, more strongly so posteriorly, the serrated upper ridge not extending beyond the anterior third; it is long and tapering; all the caudal scales are keeled, and grow larger posteriorly; the lower series the largest, longer than broad, those on the front part terminating in a strong spine; tail long and tapering, its length from two and two-fifths to two and three-fifths of that of the head and body. *Colors*—Head greenish-olive, the forehead, supraciliary ridge, sides of neck, and upper edge of gular sac dark purplish-brown; lower edge of gular sac pale yellow or green, all the intervening space with bands of bright yellow and black; enlarged subtympanal scale yellow; nuchal region green marbled with purple; nuchal crest pale blue or brown; body from shoulder to groin, and upper surface of fore limbs, pale green, the latter faintly cross-banded with yellow; lower surface greenish-white clouded with pale brown; hind limbs above and entire tail purplish-brown, with or without light bands.

From the examination of the five specimens forwarded, the above would appear to be the most common coloration, but on two of the specimens the general color is purplish-brown with scarcely a trace of green, one of these being entirely without cross-bands on the limbs and tail, while on the second these markings are much accentuated, forming distinct annuli on the tail; in both, however, the coloration of the gular sac and the subtymp~~p~~anal scale is constant.

			Inches.		Millim.
Total length...	...	...	12·80	...	320
Length of head	...	...	·95	...	24
Width of head	...	...	·56	...	14
Length of body	...	...	2·70	...	67
Length of fore limb...		...	2·00	...	50
Length of hind limb		...	3·25	...	81
Length of tail	...	...	9·15	...	229

The subtympanal scale is absent in one specimen only, and as the gular sac is both much smaller and much less brightly colored in the same individual, it is at least possible that these may be sexual characters.

GONYOCEPHALUS DILOPHUS?

Lophyrus dilophus, *Dum. & Bibr.*, *Herp. Gen.* iv. p. 419, pl. xlvi.

Snout rather pointed, shorter than the diameter of the orbit; nostril lateral, much nearer to the tip of the snout than to the eye; canthus rostralis and supraciliary edge projecting; tympanum distinct, round, not nearly so large as the eye-opening; upper head scales small, keeled, more strongly so on the supraorbital region, along the inner margin of which there is a semicircular row of enlarged scales; an oval band of enlarged raised scales on the middle of the snout, the keeling of which is radiate; the occipital region is bounded on all sides except the anterior by a raised ridge; it is arcuate behind, and similar in shape and size to the upper surface of the snout, and the enlarged occipital scale is situated near its hinder margin; most of the scales between the orbit and the tympanum, and an interrupted row round the tympanum much enlarged; a row of enlarged keeled scales bordering the upper labials; eleven or twelve upper and a similar number of lower labials; a row of enlarged scales from the mental shield to beyond the angle of the mouth, anteriorly smooth and forming a suture with the first four lower labials, posteriorly strongly keeled and separated from those shields by from one to four rows of smaller scales. Gular sac large, with five large foliate scales in front; gular scales small, much smaller than the ventrals, strongly keeled, with a few scattered enlarged ones intermixed on the sides. Nuchal crest not continuous with the dorsal, formed of four large blunt foliaceous scales, with a few much smaller and more pointed ones in front, and with several rows of enlarged lateral basal scales of unequal size, the anterior of which are keeled, the posterior smooth; its height is five-ninths of the length of the snout; dorsal crest formed of equal sized foliaceous scales, similar to, but a little lower than, the nuchal crest. Dorsal scales small, strongly keeled, the points being directed upwards and, in a lesser degree, backwards; enlarged pyramidal scales on the sides, forming irregular vertical series; ventral scales much larger than the dorsals, strongly keeled. Limbs with keeled scales of unequal size; fourth finger a little longer than the third; the adpressed hind limb reaches beyond the snout. Tail strongly compressed, with an upper series of enlarged scales similar, and on its anterior half equal in size, to those forming the dorsal crest; all the caudal scales keeled, the inferior series largest and elongated, with their keels terminating in a strong sharp spine; tail of moderate length, with an abruptly truncated tip, once and two-thirds of that of the head and body.

Colors—Greenish-olive above, the enlarged tubercles lighter than the ground color; back, tail, and upper surface of the limbs with numerous purplish cross-bands; gular sac purple with a lighter inferior margin; lower surface yellow, in some places clouded with brown.

		Inches.		Millim.
Total length...	... ...	10·40	...	260
Length of head	... ...	1·20	...	30
Width of head	... ...	0·73	...	18
Length of body	... ...	2·70	...	67
Length of fore limb...	...	2·22	...	55
Length of hind limb	...	3·93	...	98
Length of tail	... ...	6·50	...	163

One specimen only is in the collection, and I am in considerable doubt as to whether I have correctly identified the species.

LYGOSOMA *(Liolepisma)* BICARINATUM.

Heteropus bicarinatus, *Macleay*, *Proc. Linn. Soc. N.S.W.* ii. 1877, p. 68.

? Heteropus bicarinatus, *Blg.*, *Catal. Liz. (Ed. 2)* iii. p. 286.

Heteropus albertisii, *Peters & Doria*, *Ann. Mus. Gen.* xiii. 1878, p. 362.

Lygosoma albertisii, *Blg.*, *loc. cit.*

Colors—Upper surface of head uniform brown, the sides yellowish profusely ornamented with black spots; back and sides brown with numerous darker and lighter spots; tail light reddish-brown with a series of transverse black spots superiorly, and a few lateral spots, which are more numerous near the base; under surface yellow, the tail with a reddish tinge, the chin and throat with a few scattered black spots; *(L. bicarinatum.)*

Colors—Upper surface of head brown, with or without a few scattered black spots, the sides yellow, clouded with light brown or with a few spots; back olive-brown with scattered black spots, and with or without two narrow faint longitudinal light bands; sides with two yellow black-edged longitudinal bands, separated by a broader black or dark brown band, which commences at the nostril, and, passing through the orbit, is continuous to the very tip of the tail; rest of tail as in *L. bicarinatum;* under surface uniform yellow; *(L. albertisi).*

Of the ten specimens now before me four belong to the latter form and three to the former, while the remaining three, though differing considerably *inter se*, are distinctly intermediate between the two described, which may therefore be taken to be the extreme forms of the species; there is not the slightest difference in even minutest details of outward structure.

Sir William Macleay's types, which are now deposited in the Museum of the Sydney University, have been personally examined and compared with our recent specimens.

Lygosoma *(Liolepisma)* atrogulare, *sp. nov.*

Habit lacertiform and rather robust: the distance between the end of the snout and the fore limb is contained from once and one-sixth to once and one-third in male (?), and from once and one-third to once and one-half in female (?) specimens, in the distance between the axilla and groin. Snout of moderate length, obtuse. Lower eyelid with an undivided transparent disc. Nostril pierced in a nasal which is sometimes divided at its postero-superior angle, sometimes with a deep groove posteriorly: no supranasals: frontonasal much broader than long, hexagonal, forming a broad truncate suture with the rostral and a truncate or rounded one with the frontal; prefrontals of moderate size, sometimes forming a suture with the second upper labial: frontal pentagonal or hexagonal, abruptly truncate or concave in front, truncate or angular behind, shorter than the frontoparietal, and in contact with the two anterior supraoculars: four supraoculars, the two middle ones the largest and laterally expanded: seven or eight supraciliaries,* the first and the fourth the largest: frontoparietal single, followed by a small interparietal: parietals forming a short median suture behind the interparietal: a pair of enlarged nuchals and a pair of temporals bordering the parietals; fourth and fifth, or fifth and sixth, upper labials below the eye, the anterior the larger, the posterior separated from the eyelid by a series of small scales. Ear-opening round, about twice the size of the transparent palpebral disc, bordered all round by acute lobules, of which the middle one anteriorly is much the largest. Thirty-six to thirty-eight scales round the middle of the body, the dorsals quinque- the laterals tri-carinate, the ridges being much more marked in young specimens: lateral scales smaller than the dorsals or ventrals: marginal pre-anal scales but slightly enlarged: the median series of scales on the tail both above and below transversely dilated. The hind limb when stretched forward reaches to the axilla or shoulder: fingers four, toes five: subdigital lamellæ twenty-nine to thirty-four under the fourth toe. Tail from two-thirds to four-fifths longer than the head and body. *Colors*—Head and body dark brown, the latter occasionally with some of the scales black edged; upper surface of the tail lighter brown, every third or fourth scale of the upper median dilated series with a broad black anterior and white posterior margin, forming together conspicuous double crossbands; lower half of the sides and under surface of tail pale blue; upper surface of limbs similar to the back, lower surface salmon color: under surface and sides of the head and the throat black with a strong metallic bluish gloss in the males (?), yellowish-white with a light blue gloss in the females(?), the labials and

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* In one example there are only six supraciliaries, the fourth being greatly enlarged, and formed by its fusion with the fifth and sixth.

sometimes the throat in the latter with round or longitudinally elongate black spots.

The number of specimens at my disposal is not sufficient to warrant an anatomical dissection of two examples, with the view of verifying the sex, but, judging from analogy, I consider that the black-throated specimens are the adult males. Except where special mention is made there is absolutely no difference between the two forms.

The specimens examined measured from three and one-third to eight inches.

	Inches.	Millin.
Total length	7·40 ...	185
Length of head...	0·65 ...	16
Width of head	0·48 ...	12
Length of body...	2·10 ...	52·5
Length of fore limb	0·97 ...	24
Length of hind limb	1·45 ...	36
Length of tail	4·67 ...	116·5

The above are the dimensions of an adult male (?).

LYGOSOMA *(Emoa)* BAUDINI.

Mabouya baudinii, *Gray, Catal.* p. 95.

Several specimens of this Skink are in the collection.

OPHIDIA.

The Ophidian Reptiles included in the collection are unfortunately but few in number, four specimens only, belonging to three genera, having been forwarded; they are, however, of no little interest. Of the Carpet Snake *(Morelia variegata)* there are two examples, an adult and a young one, the latter being described below, as I do not know of any description of the species in this stage: it appears to be the common Python of south-eastern New Guinea as there are several specimens in the Macleay Museum from Katow. The second species represented consists of a fine example of the rare *Brachysoma triste*, now, so far as can be ascertained, recorded for the first time from New Guinea, and interesting as affording another proof of the close alliance between the fauna of northern Australia and that of southern New Guinea: and lastly of a very handsome *Acanthophis* which is provisionally referred to the species described by Sir Wm. Macleay from New Guinea. It has in any case been considered advisable to give a detailed description here of this supposed species, and an attempt made to point out the differences between what may be called the northern and southern forms of this anomalous genus, which differences, should they prove constant, would, even though slight, suffice to constitute a valid species. The types of *A. lævis*, Macleay, from Katow, New Guinea, and of *A. prælongus*, Ramsay, from

Somerset, Cape York, have been carefully compared with the present example and with a series of *A. antarcticus* from New South Wales.

MORELIA VARIEGATA.

Gray, Brit. Mus. Catal. p. 86.

Scales in from forty-two to forty-eight series round the middle of the body; abdominal plates from two hundred and sixty-seven to two hundred and seventy-one; anal plate single; subcaudal plates in two rows from seventy-seven to seventy-nine in each. body elongate and compressed; head very distinct from the trunk, flattened superiorly; tail short, sharply defined from the body, the upper surface and sides rounded, the lower surface flat, prehensile; muzzle short, broad, and obtuse; eye lateral, the pupil elliptical and erect. Nostril pierced in a large nasal, which is deeply grooved behind; rostral as high as broad, with a deep oblique pit on either side; three pairs of frontals, the two anterior pairs the larger; behind these there is a longitudinal series of three slightly enlarged scales, the last of which is in contaet with a pair of small vertical shields, behind which and partially dividing them is a third shield of similar size which is absent in the larger example; two pre- and three post-oculars; five supraciliaries; the rest of the upper surface and sides of the head covered with numerous irregularly-sized and -shaped scales, the largest being in a series of three on each side above the temporal region; the smallest between these series; twelve or thirteen upper labials, the anterior three pitted, the sixth and seventh entering the eye; seventeen lower labials, the six preceding the last four deeply pitted, the first pair nót forming a suture behind the quadrangular mental, the posterior margin of which is not more than one-seventh of the anterior; numerous small elongate, non-imbricate scales between the mental and the first abdominal plate. Scales on the fore part of the body small and elongate, those on the hinder part and tail larger and rhomboidal; the series bordering the abdominal plates larger. Rudiments of hind limb minute, scarcely distinguishable from the surrounding scales; two series of scales between the vent and the first pair of subcaudal plates. *Colors*—Nasal shields, front part of anterior frontals, and rostral ridge violet; inner margin of the two posterior pairs of frontals; a median band from thence broadening out behind so as to cover the three vertical shields; three bands, the outer two originating at the antero-superior angle of the orbit, and joining the transverse occipital band, the middle one narrower and not extending so far back; a band from the nasal shield, through the eye, skirting the upper labials, and curving round behind the temporal region to meet the corresponding band on the occiput, rich purplish-brown; an elongate median and two shorter lateral spots of the same color on the neck; second, third, fourth, and seventh upper, and the eleventh to thirteenth lower labials with a brown spot; rest of the head brown above, pale yellow beneath, as is also the ground color of the body and tail; body with sixty-two irregular and greatly interrupted transverse dark-brown bands, twice or thrice as broad as the interspaces, and frequently broken up into large irregularly-shaped spots; abdominal shields ornamented with scattered small paler brown spots, which become more accentuated posteriorly; tail with sixteen much more regular transverse bands and the sub-caudal plates with a narrow sutural dark-brown band.

The larger specimen of the two examined is a rather roughly prepared skin measuring four feet ten inches, of which the tail is about ten inches; the smaller specimen measures twenty-two inches, the tail being slightly over three inches.

Brachysoma triste.

Glyphodon tristis, *Gnth., Brit. Mus. Catal. Colubr. Snakes*, p. 211 (1858).

Scales in seventeen series; abdominal plates one-hundred and seventy-one to one hundred and seventy-nine; anal plate double; sub caudal plates in two rows, forty-five to fifty-two in each. Body moderately elongate and cylindrical; head small, depressed, scarcely distinct from the neck; tail of moderate length, slightly compressed especially posteriorly, and terminating in an elongate blunt pointed scale; muzzle short, broad, and obtuse; eye very small, looking outward and partially upward, the pupil round. Nostril pierced between two nasals, the posterior small; rostral more than twice as broad as high, rounded or very obtusely angular above; anterior frontals small, posterior large, sharply bent downward on the side of the head so as to form a broad suture with the second upper labial, and thus replace the loreal; vertical hexagonal, one-third longer than broad, obtusely angular anteriorly and rather less than rectangular posteriorly, the lateral margins very slightly convergent; occipitals much longer than the vertical and equally, or less, broad, their length twice their breadth, angular behind; a rather small supraciliary; a single preocular entering the upper half of the eye only, the lower half being margined by the large third upper labial; two small, equal-sized postoculars; four series of temporal shields, the anterior pair not much larger than the others, the upper in contact with both post-oculars, the lower partially dividing the two posterior upper labials; six upper labials, the third and fourth entering the eye; six lower labials, the first forming a broad suture behind the triangular mental; two pairs of elongated chin-shields. *Colors*—Upper surface of head brown, the sides with a tinge of chestnut, especially on the anterior temporal region; sometimes with a broad light brown collar behind the occipitals; lower surface pale brown, gradually shading into the dirty yellow of the abdominal region; dorsal scales nearly black, all the scales with a narrow brownish-yellow edging, becoming more prominent posteriorly, and giving the appearance of oblique duplicate cross-bands ; lateral scales black with a broad white margin ; abdominal and sub-caudal scales with a black spot on the outer margin.

The single specimen sent by Sir Wm. Macgregor, measures twenty-six and a half inches, of which the head measures three-fifths of an inch—to the posterior angle of the occipital shield—and the tail three and nine-tenths inches, or about five and three-fourths of the length of the head and body together. A second example, from Somerset, Cape York, in the collection of the Australian Museum, to which it was presented by Walter Powell Esq., differs in no respect whatever from the specimen described above, except in the comparatively longer tail, which is five and two-fifths in the length of the head and body.

The ascertained range of this seemingly uncommon species is North-eastern Australia, *(Günther, fide Macgillivray)*, Cape York, *(Ramsay, fide Powell)*, and St. Joseph's River, British New Guinea *(Macgregor)*.

It should be noted that in the specimen described which has been little more than a month in spirits, there is no trace of the "broad, lighter, brownish collar" mentioned by Drs. Günther and Ramsay, unless the faint chestnut tinge on the anterior temporals are to be taken as an indication of it ; also that it is a very handsome snake, and certainly does not merit its specific name.

The only points worth noting in Dr. Günther's original description are that in neither of the specimens now examined does the posterior frontal form a suture with *two* upper labials, nor are the lateral margins of the vertical shield "much convergent."

Since writing the above I have discovered in the Museum Collection a third specimen forwarded by the Rev. S. Macfarlane from South-east Cape, New Guinea, and measuring about thirty-one inches.

Acanthophis.

The principal differences which I can discern between Sir Wm. Macleay's *A. lævis*, and the common Australian Death Adder lie (1) in the slightly weaker carination of the dorsal scales in the former, a character which however is plainly visible at least as far as the middle of the back, both in the single specimen forwarded by Sir William Macgregor, and since returned to him, and the type specimen now deposited in the Museum of the Sydney University ; (2) in the much more prominent suborbital shield ; u/ (3) in the smaller number (113 – 117) of abdominal plates ; and (4) in the less robust habit of the northern form. It is stated by Mr. Gerard Krefft in his diagnosis of the genus that the nostrils are pierced "between two shields," but in the examination of several specimens belonging to the three described forms I can find but one large nasal shield on each side, near the centre of which the nostril is pierced, and which is grooved both below and behind the nostril, while similarly in all there are one pre- and two post-oculars, and the eye is separated from the upper labials by two well-developed scales There is however one difference of importance which leads me to consider the Death Adder of northern Australia as specifically separable from the southern Australian form and from that of New Guinea, namely, the diversity in the shape of the pupil, which is erect and elliptical in *A. antarcticus*, and *A. lævis*, but round in *A. prælongus*. In all other respects the three forms differ but slightly.

Acanthophis lævis.

Acanthophis lævis, *Macleay*, *Proc. Linn. Soc. N.S. Wales*, ii. p. 40 (1877).

Scales in twenty-one series ; abdominal plates from one-hundred and thirteen to one-hundred and seventeen ; anal plate entire ; sub-caudal plates forty-eight to fifty, sometimes all entire, sometimes a part divided. Body short and but moderately robust, this giving it a rather elongate appearance as compared with *A. antarcticus;* head broad, very distinct from the trunk; tail distinct from body, compressed into a blunt keel above, and terminating in a curved spur-like scale, which is bent upwards; muzzle short, broad, and obtuse; eye small, lateral, the pupil elliptical and erect. Nostril pierced in a single large nasal, which extends so far backwards as, in conjunction with the posterior frontal, to replace the loreal shield; rostral about three times as broad as high, rounded behind and extending well on to the upper surface of the head ; anterior and posterior frontals well developed, and sub-equal in size ; vertical shield large, the anterior facies obtusely angular, the posterior broadly rounded, the lateral margins parallel, or with a slight, scarcely perceptible, convergence ; occipitals a little longer than the vertical, and very much broader ; supraciliary large, about equal in size to the vertical, the outer margin prominent and erect; a single large preocular ; two postoculars, the upper somewhat the larger ; two or three enlarged scales between the eye and the upper labials ; temporal shields in three series, the lower one of the first pair very large, and completely separating the two posterior upper labials, six upper labials, the third and fifth the largest, the third and fourth beneath the eye ; eight lower labials the first forming a broad suture behind the triangular mental, the second and last much smaller than the others ; the fourth the largest ; two pairs of elongate chin-shields ; a large lateral shield bordering the fourth and fifth lower labials. Scales of the head rugose ; about ten median series of dorsal scales unicarinate, the carinations extending even so far as the root of the tail, but growing faint posteriorly. *Colors*—Ashy-gray above, white below ; some of the upper head-shields washed with chestnut ; anterior upper labials closely mottled with black, white, and ash ; the two posterior upper labials, the enlarged temporal, all the lower labials, the mental, the chin shields, and the margino-labial shields beneath white, each with a large black spot; most of the small scale-like shields between the chin-shields and the abdominal plates with a small round dark spot; upper surface with thirty-four transverse rows of black spots, each row preceded by a narrow chestnut band, this color predominating on the tail which bears eight rows of the thirty-four; the outer row of scales on each side black with a narrow white margin; abdominal and subcaudal plates with numerous brown blotches; posterior third of tail bright yellow.

BATRACHIA.

Examples of four species of Tree Frog are included in this section of the collection, but unfortunately all the specimens of two of these are so small and so much shrivelled that I have found it impossible to determine their identity with any of the species in the latest British Museum Catalogue. One of the remaining species is described as new under the name of *Hyla macgregori.*

Hyla dolichopsis.

Calamita dolichopsis, *Cope, Journ. Acad. Philad.* (2) vi. p. 204 (1867).

There are a few specimens of this fine Frog in the collection.

Hyla macgregori, *sp. nov.*

Tongue subcordiform, slightly free behind. Vomerine teeth in two small oval oblique patches, behind the level of the choanæ. Head small, as broad as long; snout rounded, slightly longer than the diameter of the orbit; canthus rostralis distinct; loreal region nearly vertical, not concave; interorbital space as broad as the upper eyelid; tympanum rather indistinct, half the diameter of the eye; a distinct fold across the chest between the fore limbs. Outer fingers about one-third webbed, the others not so much; no projecting rudiment of pollex; toes nearly entirely webbed; disks of fingers equal in size to the tympanum, much larger than those of the toes; subarticular tubercles small. The hind limb being carried forward along the body, the tibio-tarsal articulation reaches the tip of the snout. Skin smooth, finely granulate on the belly and under surface of the thighs. *Colors*—Variable, those of the two extreme forms being as follows; (*a*) upper surface of head and body dark brown, the former with small yellow spots, the latter with three broad yellow longitudinal bands; the median band commences generally between the eyes, but is sometimes produced forwards to the tip of the snout, and terminates on the rump; the lateral bands are broader, commence at the postero-superior angle of the orbit, and terminate abruptly at a point beyond the middle of the sides; a row of yellow spots between the bands present or absent; sometimes a well-marked cross-band on the rump; sides dark brown with yellow spots; upper surface of limbs lighter brown with yellow spots, sometimes of moderate size and scattered, but more commonly in small freckles; lower parts creamy white. The yellow markings are frequently replaced by white; (*b*) general color much lighter brown, the yellow or white spots or bands being replaced by pale brown or dirty white; otherwise as in var. *a*. In some young examples the upper parts are so profusely blotched with white as to almost entirely hide the dark ground color, but as a rule the pattern of coloration as given in the description of var. *a* is not materially departed from.

This Tree Frog appears to be common in the St. Joseph's River district, since no less than twenty-six specimens were sent down by Sir Wm. Macgregor, to whom I have much pleasure in dedicating this handsome species. The largest example measures 30 mm. from snout to vent.

PISCES.

I regret to say that of the ten specimens forwarded all are either too young, or in too bad a condition to admit of accurate specific identification; they belong however to the following genera:

ELEOTRIS, *sp.*

Two examples of what may possibly be the young of *Eleotris porocephalus*, C.V.

ELEOTRIS, *sp.*

A single very young specimen.

SALARIAS, *sp.*

A single very young specimen.

PLOTOSUS, *sp.*

Five specimens, the largest of which is little more than one inch in length; they are in all probability the young of *P. canius*, Ham. Buch.

SYNGNATHUS, *sp.*

One example, which is perhaps the young of *S. spicifer*, Rüpp.*

* Owing to my non-reception of a second proof of my paper on a new Tetrodon (see page 81) the error in the foot-note has been overlooked: my meaning would be better shown thus—read after "dorsal fin," *which is equal to the distance between that point and the termination of the dorsal fin.*" The *lapsus calami* in the first line of the description, viz. the substitution of "of" for "*in*" must be apparent to all.

Part II.

COLEOPTERA *(CICINDELIDÆ, CARABIDÆ,* AND *BUPRESTIDÆ).*

By Thomas G. Sloane.

A portion of the collection of Coleoptera, comprising the *Cicindelidæ*, *Carabidæ*, and *Buprestidæ* has been placed in my hands for determination. These consist of :—

CICINDELIDÆ.

Therates basalis, Dej, ; 1 specimen.

Tricondyla aptera, Olivier ; 3 specimens.

CARABIDÆ.

Pseudozæna tenebrosa, n. sp. ; 1 specimen.

Chalænius binotatus, Dej. ; 1 specimen.

This species, of which *Ch. maculifer*, Casteln., is a synonym, is also found in Australia, extending as far south as the Clarence River.

Platynus papuensis, n. sp. ; 1 specimen.

Perigona ? sp. ? ; 1 specimen.

A small black Feronid belonging to the *Platynini* ; I am not certain of the genus.

BUPRESTIDÆ.

Cyphogaster venerea, Thom. ; 1 specimen.

The following are descriptions of the two new species of *Carabidæ*.

Pseudozæna tenebrosa, *sp. nov*

Black, opaque. Head large, (3 x 4 mm.), mandibles, labrum, and anterior part of forehead smooth, vertex punctate ; clypeal suture lightly marked ; eyes prominent, inclosed behind by strong processes, these extending beyond the eyes in a blunt projection ; antennæ thick, moniliform, incrassate, joints finely punctate. Prothorax hardly broader than head, transverse, ($2\frac{1}{2}$ x $4\frac{1}{4}$ mm.), subcordate; anterior angles rounded, posterior sharply rectangular;

base lightly sinuate on each side, the median part truncate and projecting slightly behind the marginal parts; lateral margins broad and upturned behind, narrower in front, without reflexed border or setigerous punctures; disc rugulose and punctate; an arcuate transverse impression in front; median line lightly marked. Elytra parallel, ovate, ($8\frac{3}{4}$ x 5 mm.), costate; the costæ (8 on each elytron) shining, subequal, not strong or carinate, sparsely and very finely punctate, 8th rather obliterate on the sides, but conspicuous and strongly marked towards the apex; base truncate, declivous; apex subsinuate; marginal border carinate, interrupted towards apex, extending on base to the peduncle, more prominent, though rounded, at humeral angles; border of apex rising at end of lateral border, between it and 8th costa, in a short grooved carina, the inner edge of the groove extending almost to the tips of the elytra; a row of thinly placed shallow umbilical punctures on the sides between 8th costa and border. Under surface thinly covered with short hairs, these hairs placed in rugulose punctures on the legs and segments of abdomen. Anterior tibiæ strongly bent on outer edge and very strongly excavate on inner side. Length 15, breadth 5 mm.

Platynus papuensis, *sp. nov.*

Male.—Black, shining; undersurface, legs, and antennæ pitchy black. Head small, smooth, a faint impression on each side behind the suture; clypeal suture not visible; mandibles long, acute at apex, scrobe without a setigerous puncture; labrum prominent, truncate; clypeus short with a setigerous puncture on each side; eyes prominent; labial palpi with last joint shorter than penultimate, slender, narrowed to apex; maxillary palpi with last joint narrow, elongate, pointed, about equal to penultimate in length. Prothorax transverse, ($1\frac{1}{2}$ x $2\frac{1}{4}$ mm.), not convex, rounded on the sides, hardly narrowed behind, anterior margin broadly emarginate, bordered; base with median part truncate, narrowly bordered; anterior angles rounded, posterior angles rounded, but marked; lateral margins narrowed in front, broad and upturned behind; the usual lateral impressions of the base almost obsolete; a setigerous puncture on the edge of the margin at each posterior angle; median line very lightly marked. Elytra broader than prothorax, ($5\frac{1}{2}$ x $3\frac{1}{2}$ mm.), rather flat on the disc, declivous towards the sides, sinuate behind, finely striate; the interstices flat, equal, 3rd finely bipunctate on apical half, the punctures near the 2nd stria; 9th sparingly punctate, the punctures interrupted in the middle, an abbreviated stria near scutellum; basal border arcuate behind, continuous with lateral border, this narrowly reflexed. Legs slender; anterior femora short, thickened in the middle, canaliculate below; anterior tibiæ distinctly sulcate on outer side, apex with an acute spine projecting forward on inner side, and a shorter oblique spine externally ; tarsi sulcate externally, anterior in male with three basal joints dilatate, and furnished below with an oblique row of squamulæ on each side; 4th joint of anterior tarsi decidedly bilobed, of middle emarginate, hardly bilobed, of posterior not emarginate, the projecting hairs on each side equal. Length 9, breadth $3\frac{1}{2}$ mm.

This insect is winged ; it does not appear to differ in any character from *Platynus*, but I have described it more fully than usual in regard to features more of generic than specific value, so that its exact position in regard to *Colpodes*, a genus I am unacquainted with, may be evident.

ON A NEW SPECIES OF PTEROPINE BAT FROM THE NEW BRITAIN GROUP.

By E. Pierson Ramsay.

The species at present under consideration appears to have been overlooked by previous writers on the *Chiroptera*. Several specimens occur in a large collection made in the year 1875 by the Rev. George Brown in the New Britain Group of Islands. Judging by the measurements given by Messrs. Dobson and Thomas respectively for *Pt. edulis* and *Pt. grandis*, the present species is considerably the largest of the family as yet discovered, the total length of the head and body of the largest examples being fourteen and a-half inches, and the expanse of the wings sixty-two inches, as against twelve and about sixty in *Pt. edulis*, and thirteen in *Pt. grandis*.* The forearms of the three species measure, however, as follows :—

Pteropus rufus ...	...	7·24 Inches	... 181 Millim.
,, *edulis* ...	...	8·80 ,,	... 220 ,,
,, *grandis*	...	6·5 ,,	... 163 ,,

Pteropus rufus, *sp. nov.*

Adult female. The general colour is an uniform rusty-red above and below, with a narrow streak of a darker shade along the margin of the wing-membranes at their attachment to the body. The arm (*humerus*) is clothed at the base with hair similar to that on the body, but towards the distal end it becomes scanty and of a dull brown tint ; the membrane adjacent to the arm-bones below is sparsely sprinkled with dull blackish-brown hair : the basal portion of the legs *(femora)* is also clothed with hair similar to that on the body ; on the back the hair is very much compressed, and even more so on a narrow line between the shoulders where it is almost black, like the wing-membrane itself ; the hair on the hind neck, chest, and breast is longest and grisly ; on the face shorter ; the ears, a small space in front of the orbits, and the muzzle, naked ; a few straggling long black hairs on the face and round the mouth ; the hair on the forehead between the orbits, and that on the occiput, is short, slightly compressed, and of a lighter sandy yellow tint ; on the throat a darker rufous than that of the body. Wing-membranes nearest the back almost black, the remaining portions blackish-brown.

* Mr. Oldfield Thomas does not mention the expanse of the wings in this species.

Adult female—Dimensions :—

Skin—Head and body, 14·50 inches (362);* head, 3·75 inches inches (94); muzzle, 1·52 inch (38); ear, above crown, 0·84 inch (21); fore-arm, 7·24 inch (181); thumb, 2·52 inches (63); free portion of thumb, 0·82 inch (20·5); first joint of index finger, 5·84 inch (146); tibia, 3·24 inches (81); calcaneum, 1·00 inch (25).

Skull—Greatest length, 3·36 inches (84); greatest breadth across zygomatic arches, 1·81 inches (45); length from supra-orbital foramen and tip of nasals, 1·10 inch (27·5); interorbital breadth, 0·44 inch (11); from interorbital foramen to tip of nasals 1·60 inch (40); from anterior foramen to tip of nasals 1·15 inch (29); intertemporal breadth, 0·39 inch (10); breadth from tip to tip of postorbital processes, about 1·25 inch (31); diameter of orbit. 0·70 inch (17·5); length of zygomatic arch from anterior foramen to base, 1·65 inch (41); width of zygo-bone 0·20 inch (5); palatal length, 1·60 inch (40); length of lower jaw from condyle 2·70 inches (67·5); height at base, 1·35 inch (34); at last molar, 0·45 inch (11); at first, 0·40 inch (10); distance between condyle and tip of ascending ramus, 0·70 inch (17·5); width of skull at base of arch, 1·10 inch (37·5); base of the skull, 0·93 inch (23).

Dentition—Upper incisors not in contact; the combined breadth of the four, 0·28 inch (7); distance from anterior margin of upper canine to posterior margin of premolar, 0·58 inch (14·5); of the three molars, 0·61 inch (14); length of upper canine, 0·36 inch (9); of the lower, 0·30 inch (7·5); of the two lower premolars, 0·36 (9); of the four molars, 0·84 inch (21); combined length of the three largest cheek teeth, 0·75 inch (19); breadth of the central one, 0·15 inch (4); last molar much larger than one of the outer incisors, its antero-posterior diameter, 0·12 inch (3). Outer incisors of the lower jaw slightly larger than the inner; second premolar distant from the canine; the first premolar equal to the diastemata in front of and behind it, 0·08 inch (2) in diameter; molar much larger than one of the middle *upper* incisors, or than the outer *lower* incisors.

Dental formula—I. $\frac{2-2}{2-2}$; C. $\frac{1-1}{1-1}$; Pm. $\frac{1-1}{2-2}$; M. $\frac{3-3}{4-4}$ = 32.

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* The bracketed figures represent the length in millimetres.

NOTES ON THE DISAPPEARANCE—TOTAL OR PARTIAL—OF CERTAIN SPECIES OF BIRDS IN THE LOWER LACHLAN DISTRICT.

BY K. H. BENNETT, F.L.S., &c.

WHILE collecting for the Australian Museum some years ago, I was asked by the Curator to make a few notes on the migration of birds, their arrival and disappearance, shortly after my notes were mislaid, but recently on their turning up again, I thought perhaps a few remarks on the rarer forms would prove interesting to Ornithologists.

It is a noticeable fact, and one that must strike an observer, that great changes have taken place in the avifauna of this part of the Colony during the last eighteen or twenty years. Species that were formerly numerous, have for many years past entirely disappeared; others that were numerous, during certain portions of each year are now represented at long and uncertain intervals by a few stragglers. Whilst on the other hand species that were at that time few in numbers have now become plentiful and permanent. Amongst those that have entirely vanished may be mentioned *Phaps histrionica*, *Geophaps scripta*, *Pedionomus torquatus* and *Oreoica cristata*. Whilst amongst the now occasional visitants (once plentiful) are *Falco subniger*, *Milvus affinis*, *Coturnix pectoralis*, *Turnix velox*, and *Synoicus australis*. There can, I think, be little doubt, but that in most cases this disappearance is due to the occupation and stocking of the country with sheep, whilst the prevalence of the domestic cat (gone wild) has doubtless in some cases proved another factor. In former years the whole of these vast plains were covered with a dense mass of vegetation in the shape of dwarf saltbush, herbaceous plants and grass, affording at the same time a safe cover, and a plentiful supply of food in the large quantities of their various seeds. For many years past, this state of things has been entirely changed by stocking with sheep, and as a rule the country is bare, or at best affording but a scanty covering and an equally scanty supply of food. The disappearance of *Pedionomus torquatus*, I think, is due to other causes, for this bird (never very numerous) had disappeared long before the country became bare or thinly clothed with herbage. It is from the shortness of its wings a very poor flier, and always reluctantly takes flight during the day time, instinct teaching it that it would become an easy prey to any predatory feathered foe. Its journeys on the wing, as I am assured by the natives, and which my own observations tend to confirm, are for this reason only performed at night. The large flocks of sheep constantly roaming over the plains during the day-time, compelled it to take wing and as was always the case, these moving flocks of sheep were attended by numerous raptorial birds, ever on the watch for any quarry that may be flushed, *P. torquatus*, falling an easy victim, whilst the domestic cat wrought havoc amongst those on the the ground, with the much to be regretted result that in this part of the country at any rate, this beautiful and interesting bird is now nearly extinct, and I think the time is not far distant when it will be completely so.

The disappearance of *Oreoica cristata* is however not so easily accounted for, as this bird feeds on insects and its habitats were exclusively the belts and clumps of timber and scrub dotted over the plains, into which stock seldom went. Yet this species has entirely disappeared for many years, whilst in the timbered and scrubby country bordering the plains, some fifty or sixty miles to the northward they are quite numerous, and always have been. If this bird had been only an occasional visitant its disappearance would not be so strange, but it was numerous when the country was occupied and remained so for some eight or nine years after, and in fact would have been regarded as a stationary species ; yet they have entirely vanished from the plain country as completely as if they had never existed. Another bird that has also departed for many years past is the Pied robin, *Melanodryas bicolor*, which formerly and for several years was very numerous here. The disappearance of this bird is also impossible to account for, as the conditions suitable for its existence remain apparently unchanged. A few stragglers of *Phaps histrionica* were here in the year 1880, but none have been seen since, and I have not seen an example of *Geophaps scripta* for over twenty years.

The disappearance of *Falco subniger* is probably due to the absenceof birds of the quail family, which constituted its chief prey, but in the case of *Milvus affinis*, one of those mysterious influences seems to prevail, which guides the actions of many Australian animals, for its food (chiefly offal) is as abundant as in bygone years, whilst "grass-hoppers," another of its favourite articles of diet, have on many occasions been here in countless swarms, but unattended by the Kites.

That fine raptorial bird *Gypoictinia melanosternon* is now becoming rare in this district, where formerly it was tolerably abundant. In former years examples could have been seen on any day, and the nests were to be frequently found. Now months may elapse without a solitary individual being seen ; whilst for a radius of fifty miles I do not know of an occupied nest. I am of opinion that their decrease is due to increase of population in this part of the country, not that the birds have been destroyed, for they are exceeding shy and wary, and most difficult to shoot, but being so shy they naturally retreat from the presence of man, and another cause is the rapid denudation of timber in this part of the country consequent upon increased population. Timber never was plentiful here, being chiefly in the shape of small clumps of a few acres in extent, dotted in long and irregular intervals (often miles between) over the plains. These clumps were the places in which their nests were constructed, and as a rule not more than two or three of the trees in any of the clumps were suitable for the construction of their large nests, the generality of the trees being too small and their branches too weak to sustain the weight. As a natural consequence these larger trees were the first to fall before the selector's axe, as affording the larger quantity of timber or firewood, and the birds had therefore another reason for betaking themselves to more secluded localities, probably the yet untrodden wilds of Western Australia. The favourite resort of this species is evidently open country such as above mentioned, for some fifty or sixty miles to the northward heavily timbered country commences, extending for over one hundred miles with thousands of trees suitable for the construction of their nests, yet it is only a passing straggler that is ever seen there, and I have never known or heard of an instance of their breeding in that locality.

There are on the other hand three species of birds that have become much more numerous since we first occupied this country in the year 1864, and the cause of their increase is by no means obvious, it might be thought that the conservation of water in what was in former years for six to seven months in each year a waterless land, has something to do with it, but at least two out of the three species are quite independent of water. The three species are *Gymnorhina tibicen*, *Myzantha flavigula*, and *Ephthianura albifrons*, the latter has however only appeared here during the last six or seven years, and the increase of water may have something to do with its advent as it drinks daily, but I have never known *Gymnorhina tibicen* to drink, and *Myzanthia flavigula* but seldom.

DESCRIPTION OF A NEW FISH FROM LORD HOWE ISLAND.

By J. Douglas Ogilby.

Tetrodon altipinnis, *sp. nov.*

D. 10. A. 8. P. 16. C. 8.

The length of the head is three and three-fourths in that of the body. The eyes are situated at an equal distance from the tip of the snout and the upper pectoral ray, and the diameter is two-thirds of the length of the snout: interorbital space slightly concave, three-fifths of the diameter of the eye. Nasal openings two on each side placed in a moderately prominent papilla. Dorsal profile of moderate breadth and very slightly concave. The distance between the tip of the snout and the origin of the dorsal fin is one and six-sevenths in the total length: the snout is five-sevenths of the distance between the posterior dorsal ray and the origin of the caudal fin, and is rather longer than the height of the caudal pedicle immediately behind the anal fin, the greater portion of which is situated behind the dorsal: both dorsal and anal fins are high and falcate, the second or highest ray of the former being two and a half times the height of the last ray, while in the latter there is a corresponding difference though in a lesser degree: the pectoral fins are short, rounded, and but slightly longer than the snout: the caudal is long, five-sixths of the length of the head, and truncate with the outer rays produced. No lateral fold on the tail. The upper surface of the head, the light coloured part of the sides, and the under surface of the body with acute scattered spines; anterior moiety of the dorsal profile covered with densely crowded sinuous rugosities, and with a few irregularly placed smaller spines; rest of the back and the tail, above and below, with similar rugosities, but spineless. *Colors*—The upper surface of the head yellowish-brown, the lips and sides of the head much darker; the back and upper half of the sides gray, ornamented with numerous milk-white spots, a few of which have a dark centre; lower half of sides, entire under surface, and fins bright yellow.

The species above described was brought from Lord Howe Island by Mr. Icely, the Visiting Magistrate, and measures nine inches in length.

To the under jaw of this specimen there was attached a Cirriped belonging or allied to the genus *Anelasma*, possessing ramose appendages near the base of the peduncle. The cirrhi are however fully developed, and not rudimentary as in *Anelasma squalicola*, of Loven. This specimen has been examined by Mr. Brazier, who tells me that it is quite unknown to him and will probably turn out to be a new species. Should such, on future investigation, prove to be the case, a description from Mr. Brazier's pen will probably appear in "The Records" in due time.

SUPPLEMENT TO THE CATALOGUE OF "NESTS AND EGGS OF BIRDS FOUND BREEDING IN AUSTRALIA AND TASMANIA."

By A. J. North.

[Part I., March, 1891.]

Ninox connivens, *Latham.* Winking Owl.

Gould, Handbk. Bds. Austr., Vol. i., sp. 34, p. 71.

Although the present species is widely distributed over the Australian continent, but little knowledge has been gained of its nidification and eggs, and it is due to the exertions of Mr. George Barnard and his sons, of Duaringa, Queensland, that I am enabled to give a description of this rare egg, taken at Coomooboolaroo, during September 1886. The nesting place was in a *Eucalyptus* the entrance of which was through the end of a small hollow spout opening into the main trunk of the tree; here Mr. Barnard's sons made an aperture with an axe, and the eggs two in number, were found deposited on the decaying wood near the bottom of the tree. Last year three more eggs of the same species were taken from this tree, in both instances being perfectly fresh. The egg of *Ninox connivens* is rounded in form, and pure white, the texture of the shell being very fine and the surface slightly glossy. Long diameter 1·84 inch, short diameter 1·61 inch.

Mr. W. B. Barnard informs me that he found a nest of this species, about eighteen inches down the hollow limb of a large Encalyptus, containing three young ones, from which it may be inferred that like *N. boobook*, three eggs is the usual number laid by this bird for a sitting.

Hab. Australia, with the exception of North-west.

Ailurœdus viridis, *Latham.* The Cat-bird.

Gould, Handbk. Bds. Austr., Vol. i., sp. 277, p. 446.

The habitat of the Cat-bird is the dense scrubs of the coastal ranges of New South Wales. It is particularly plentiful at Cambewarra and the Kangaroo Valley, in the Illawarra District, and is found in favourable localities all through the southern portions of the coast ranges, becoming scarcer however as the boundary of the colony is approached. The rich brushes in the neighbourhood of the Clarence, Richmond, and Tweed Rivers are also strongholds of this species, and it is also found, but not so freely dispersed in the extreme south of Queensland. Although a common and well known bird for many years, being described by Latham in 1802, as *Gracula viridis*, from specimens brought to England by Captain King, which were procured at Port Jackson, the authentic nest and eggs of this species appear until lately to have been unknown. Dr. Ramsay described a nest and eggs, said to belong to this species, in the Proceedings of the Linnean Society of New South Wales,* upon the authority of the late Mr. Ralph Hargrave who had taken them near Stanwell, in the Illawarra District, but Dr. Ramsay himself had some misgivings at the time as to their authenticity, on account of the comparatively small dimensions of the eggs for the size of the bird, doubts which I fully shared with him when I saw the specimens referred to some years afterwards.

The finding of the nest and eggs of a closely allied species, the Queensland Cat-bird, *Ailurœdus maculosus*, Ramsay, by Messrs. Cairn and Grant, from which the parent birds were shot, and which were described by me in the Proceedings of the Linnean Society of New South Wales,† dispelled at once any idea as to the nest and eggs of the so-called *A. viridis*, taken by Mr. Hargrave being authentic.

For an opportunity of examining an authentic nest and egg of the New South Wales, Cat-bird, *Ailurœdus viridis*, Latham, I am indebted to Mr. W. J. Grime, a most enthusiastic and persevering oologist, who recently procured two nests of this species on the Tweed River, and sent the following notes relative to the taking of them :—

"On the 4th of October, 1890, I was out looking for nests accompanied by a boy. I left him for a little while to go further in the scrub, and on my return he informed me he had found a Cat-bird's nest with two eggs in, one of which he showed me, the other one he broke descending the tree. I went with him to the nest and found the old birds very savage, flying at us, and fluttering along the ground. The nest was built in a three pronged fork of a tree, about fourteen feet from the ground. The tree was only four inches in diameter, and was in a jungle or light scrub, about fifty yards from the edge of the open country. I felled the tree and secured the nest, of which there is no doubt as to its being authentic, as the old birds strongly objected to my taking it. The eggs had been sat on for a few days and were partially incubated."

In a subsequent letter dated November the 8th, Mr. Grime writes, "To day I found another Cat-bird's nest and drove the parent bird off it myself. I thought I had more eggs as the Catbird would not leave the nest until fairly *shaken* out, but when I examined the nest found two young birds in it, apparently just hatched a couple of days."

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* Proc. Linn. Soc. N.S.W., Vol. ii., (1877) p. 107.

† Proc. Linn. Soc., N.S.W., Vol. iii., Second Series, (1888) p. 147.

The nest of *Ailurœdus viridis*, is a beautiful structure, being bowl-shaped, and composed exteriorly of long twigs, entwined around the large broad leaves of *Ptarietia argyrodendron*, and other broad-leaved trees, some of the leaves measuring eleven inches in length by four inches in breadth. The leaves appear to have been picked when green, so beautifully do they fit the rounded form of the nest, one side of which is almost hidden by them. The interior of the nest is lined entirely with fine twigs. The nest of *Ailurœdus viridis* is similar to that of *A. maculosus*, but larger, and both of them can readily be distinguished from those of any other Australian bird by the peculiarity of having large broad leaves used in the construction of the exterior portion of the nest.

The eggs of *A. viridis* are two in number for a sitting, oval in form, being but slightly compressed at the smaller end, of a uniform creamy-white very faintly tinged with green, the shell being comparatively smooth and slightly glossy. Length 1·66 inch x 1·2 inch.

Although the Cat-birds are usually included in the family of Bower-building birds, I have never known or heard of either species constructing a bower. This will cancel Dr. Ramsay's description of the nest and eggs of the Cat-bird, which I have given in the Australian Museum Catalogue of the "Nests and Eggs of Birds found breeding in Australia and Tasmania," p. 176.

Hab. Coastal Ranges of New South Wales and Southern Queensland.

Sphecotheres maxillaris, *Latham*. Southern Sphecotheres.

Gould, Handbk. Bds. Austr., Vol. i., sp. 286, p. 467.

This species is widely dispersed through the brushes of the eastern coast of Australia, it is a well known species on the Richmond and Clarence Rivers, and Mr. Grime informs me it is fairly common on the Tweed River where it is locally known as the "Mulberry-bird," from the decided preference it evinces for that species of fruit amongst many others attacked by this bird. Mr. Grime has forwarded a nest and two eggs, taken on the 8th of November, 1890, together with the following notes. "I have found two nests this season of *S. maxillaris*, they were built in each instance on the "Swamp Tea-tree," at a height of about forty feet from the ground, the nests are attached by the rim to the thin branches of an outspreading bough, and what surprises me is how the eggs are not shaken out of the nest by the wind. The last nest I found, after climbing the tree to the limb on which the nest was placed, I reached out as far as I could on it and attached a piece of rope and then drew the limb to the main trunk and secured it, this brought the nest nearer, but above my head, so when I climbed farther up I could reach it, there were three eggs in the nest, but I broke one before reaching the ground."

The above nest is an open shallow structure rather irregularly and roughly formed on the exterior, but neatly rounded on the inside, and is composed entirely of the long pliant stems of a species of *Kennedya*, it measures exteriorly seven inches and a-half in diameter by three inches and a-half in depth, internal diameter four inches, depth one inch and three-quarters. Eggs three in number for a sitting, oval in form of a dull apple-green, regularly spotted and blotched over the surface of the shell with different shades of reddish and purplish-brown, underlying blotches of purple appearing as if beneath the shell. Length (A) 1·25 x 0·9, (B) 1·25 x 0·89 inch. These eggs are paler, but more heavily blotched than the specimens taken by Mr. R. D. Fitzgerald on the Richmond River in November 1887, and subsequently described by him in the Proceedings of the Linnean Society of New South Wales, Vol. ii., Second Series, 1887, p. 970.

Hab. Eastern Queensland, Eastern New South Wales.

Ptilotis flavicollis, *Vieillot.* Yellow-throated Honey-eater. *Gould, Handbk. Bds. Austr.*, Vol. i., sp. 310, p. 508.

The habitat of the Yellow-throated Honey-eater is confined I believe to Tasmania and the islands of Bass's Straits, although it has been recorded from Victoria, I have never met with this bird anywhere on the mainland of Australia. Dr. L. Holden has kindly forwarded a nest and two eggs of this species, which he found on the 29th of November, 1890, at Circular Head, on the North-west Coast of Tasmania, accompanied with the following note :—"The nest of *P. flavicollis*, I send you was built against the main stem of a low, scraggy, and scanty box shrub, about three feet and a-half from the ground ; the shrub was draped with vines of a climbing plant, some alive and green, others dead and brown, the latter serving to conceal by similarity the exterior of the nest. The Yellow-throated Honey-eater has been seen here gathering hair for its nest from the backs of cows and a pony belonging to me." The nest is an open cup shaped structure, outwardly composed of strips of bark, grasses, weeds, and sheep's wool, all matted together, and thickly lined inside with a layer of cow-hair, the walls of the nest being very much thicker than any I have met with belonging to other members of the genus *Ptilotis*, it measures exteriorly five inches in diameter, by three inches and a-half in depth ; internal diameter two inches and a-half, by two inches in depth.

Eggs in this instance, two in number for a sitting, oval in form of a fleshy-buff ground colour, becoming darker towards the larger end where they are irregularly spotted with rounded clouded markings of reddish-chestnut, and underlying spots of purple appearing as if beneath the surface of the shell. Length (A) 0·95 x 0·7 ; (B) 0·91 x 0·7 inch.

Hab. Tasmania, Islands of Bass's Straits.

Calyptorhynchus solandri, *Temminck.* Solander's Black Cockatoo.

Gould, Handbk. Bds. Austr., Vol. ii., sp. 400, p. 18.

This, the smallest species of Black Cockatoo, has a most extensive range of habitat, being found alike in the dense scrubs of the coastal ranges of tropical and eastern Australia, as well as the open forest lands on the eastern margins of the plains of New South Wales. For an opportunity of examining an egg of this species I am indebted to Mr. E. H. Lane, who has taken several nests of this species near Dubbo, about two hundred and fifty miles North-west of Sydney, and has also sent a skin of the bird for identification. The eggs were laid on the dry pulverized wood in the hollow main trunks of the Eucalypts, at a height varying from twenty to forty feet from the ground. Several of the nests were about three feet down the trunk, and apertures had to be made in the trees with an axe, so as to secure the eggs, In no instance were the nests found in the limbs or spouts, but always in the main trunk of the tree. Mr. Lane has obtained in all six nests, four of which contained a single egg in each, the other two single young birds. Five nests were found during the months of March and April, and one in May; they were all obtained on the Springs and Wambangalang Stations, about twenty-six miles South-west of Dubbo.

The egg is an ellipse in form, slightly swollen at one end, pure white, the texture of the shell fine but lustreless; upon looking closely into the shell very minute pittings may be observed. Length 1·82 x 1·37 inch. Taken on the Springs Station at the latter end of April, 1880.

Hab. Eastern and South-eastern Australia.

Euphema petrophila, *Gould.* Rock-Parrakeet.

Gould, Handbk., Bds. Austr., Vol. ii., sp. 435, p. 76.

This species is plentifully dispersed over the coast line of South and South-western Australia, and the contiguous islands. Gilbert found it breeding "in the holes of the most precipitous cliffs," on Rottnest and other islands near Swan River in Western Australia. Mr. A. H. C. Zietz, the Assistant Director of the Adelaide Museum, was also successful in procuring specimens of these birds as well as the eggs in September 1890, on Spilsby Island, one of the Sir Joseph Bank's Group in Spencer's Gulf, South Australia, where he found this species breeding in holes in the flat, sandy, soil. Mr. Zietz also informs me that he has observed these birds on the tops of the rocks near the shore at Aldinga Bay, and that at the present time live specimens are exhibited for sale in the bird dealer's shops at Adelaide. The Trustees of the Australian Museum have recently received from the Adelaide Museum, some of the specimens procured by Mr. Zietz. An average egg is rounded in form, white, earth stained, and measures 0·94 inch in length by 0·78 inch in breadth.

Hab. South Australia, and South-western Australia.

MYRISTICIVORA SPILORRHOA, *G. R. Gray.* White Nutmeg-Pigeon.

Gould, Handbk. Bds. Austr., Vol. ii., sp. 457, p. 114.

From the month of October until the end of March the Torres Straits or White Nutmeg Pigeon, during most seasons, is freely dispersed over the dense brushes and mangrove-lined mouths of the rivers of the North-eastern coast of Queensland. Mr. J. A. Boyd, of the Herbert River, has kindly forwarded me the eggs of this species, taken on North Barnard Island by Captain Proctor, at the latter end of last season, also the accompanying notes kindly communicated by Mr. Wm. T. White, of Greenfield, relative to the nidification of this fine pigeon.

"A few years ago these birds came to the scrubs on the Herbert River in great numbers, generally arriving about the beginning of September and remaining until the end of March, but during the last three or four years they have become very scarce, in fact, I did not see a score altogether last year. The decrease in their numbers is no doubt due to the wholesale slaughter of these poor birds during the breeding season, and, unless this is prevented, the Torres Straits pigeons will entirely disappear from this district within the next four or five years. I have found the eggs of these birds during November and December. The nest is a very rude structure, consisting simply of a few twigs laid across each other in the fork of a horizontal branch, generally not more than fifteen or twenty feet from the ground, and so open that the eggs (two in number) are visible from below. The birds appear to prefer Mangroves and Tea-trees, and do not crowd their nests together, although three or four pairs may sometimes build in the same tree. I have frequently found their nests fully twenty miles inland, but think most of them build very close to the sea."

Mr. Boyd also informs me that they breed sometimes in the open forest Eucalypti, and that he has obtained very young pigeons miles from the coast. Last year he did not observe any pigeons till after Christmas, but obtained two specimens this season on the 14th of September, and has since seen several small flocks. Mr. Boyd is of opinion that the cause of the pigeons not frequenting the Herbert River district so much as formerly is due to the felling of hundreds of acres of scrub that contained the berry-bearing trees on which they fed.

It is worthy of note that the nests of *Myristicivora spilorrhoa*, found by Captain Proctor, Mr. W. T. White, and the late Mr. John Macgillivray, each contained two eggs for a full sitting, while those found by Gilbert at Port Essington either contained a single egg or a single young bird.

The eggs vary in shape from an ellipse to an elongated oval, are pure white, the texture of the shell being fine, one specimen being lustreless, the other slightly glossy. Length (A) 1·8 x 1·3 inch ; (B) 1·83 x 1·2 inch.

It may not be out of place to mention here that migratorial birds are in some seasons more abundant in the localities they usually visit than others, which is not always due to climatic influences or an abundance of food. The Top-knot Pigeons *(Lopholaimus antarcticus)*, especially, have been very numerous this season in New South Wales, my attention first being drawn to the fact by the unusually large number of these pigeons that were exposed for sale in the poulterers' shops about Sydney during July and August.

On the 9th of August some notes were contributed to the "Sydney Mail," referring to the unusual number of Top-knot Pigeons which were on the brushes at that time in the neighbourhood of Gosford, several of which had made nests and laid their eggs. Mr. W. J. Grime also informs me that "the Top-knot Pigeons were particularly plentiful this season in the neighbourhood of the Tweed River, and that flocks of them, numbering some thousands, could be seen during September, flying round at any time through the day from the mountains to the coast, and back." Mr. Boyd writes, "The Top-knot Pigeons have been very plentiful this season ; they have not been so numerous since 1882."

This season has not been a better one than the last for the berry-bearing trees that provide the food for these pigeons, yet in both colonies has the Top-knot Pigeon been more than usually abundant this year.*

Hab. South Coast of New Guinea, Islands of Torres Straits, and off the Coast of North-eastern Queensland, Northern and North-eastern Queensland.

MACROPYGIA PHASIANELLA, *Temminck.* The Large-tailed Pigeon.

Gould, Handbk. Bds. Austr., Vol. ii., sp. 475, p. 148.

The Large-tailed Pigeon is freely dispersed throughout the rich brushes of the Eastern coast of Australia, from Cape York to the southern boundary of New South Wales. Young birds were obtained by Messrs. Cairn and Grant in the scrubs that clothe the sides of the Mulgrave and Russell Rivers in tropical Queensland during November 1887, and Meston in his Report of the Scientific Expedition to Bellenden-Ker Range in the near vicinity

* North, Proc. Linn. Soc., N.S.W., Vol. v., Second Series, (1890) p. 880.

records finding it breeding during February 1889, on the South Peak of the range at an elevation of from 4,000 to 5,000 feet, in the tops of Tree-ferns, each nest containing a single egg or young pigeon.

For an opportunity of examining an egg of this species I am indebted to Mr. W. J. Grime, who, in the brushes of the Tweed River, found a nest placed on a mass of "Lawyer Vines," *(Calamus australis)*, about six feet from the ground from which he flushed the bird; the nest was a very primitive structure, being simply a few sticks placed crosswise, without any cavity, and barely sufficient to retain the egg in position. The egg is a true ellipse in form, pure white, the texture of the shell being fine and slightly glossy, length 1·35 x 0·97 inch. Mr. Grime informs me that in the neighbourhood of the Tweed River this pigeon feeds principally on the ink-weed or dye-berry, a species of *Phytolacca*.

Hab. Eastern Australia.

THRESKIORNIS STRICTIPENNIS, *Gould.* White Ibis.

Gould, Handbk. Bds. Austr., Vol. ii., sp. 539, p. 284.

Although by no means a common bird, the present species is widely distributed over nearly the whole of the Australian continent. Mr. K. H. Bennett has lately found the White Ibis breeding in a large extent of flooded country overgrown with tall dense Polygonum bushes, situated near the Lachlan River in New South Wales, and from some interesting notes made upon the spot I have extracted the following :—

"On the 30th of November 1890, I started with the intention of visiting the breeding place of *Geronticus spinicollis*, which to reach I had to ride through nearly three miles of flooded country, where the depth of water varied from a few inches to six feet. Some time before reaching my destination, I could see thousands of *G. spinicollis*, flying about and over the breeding place, but what chiefly attracted my attention was two white objects appearing as if the two large *Polygonum* bushes were covered with snow. As I approached I could see that they were colonies of the White Ibis, *Threskiornis strictipennis*, and when at last I reached the spot, I found it was a breeding place, but to my disappointment the nests only contained young ones in various stages, from just hatched to partly fledged. As I rode up to the bushes on which the nests were placed, the old birds of course flew off, and such of the young ones that were strong enough to do so scrambled out of the nests and attempted to conceal themselves in the dense tangled mass of *Polygonum* stems on which the nests were placed, but in doing so it was evident that numbers would perish, for I could see them suspended by the neck, wings, or legs in all directions, in their clumsy efforts to hide themselves. On a further search of the *Polygonum* scrub, which was of immense extent, I had the good luck to discover several other colonies, many of the nests containing eggs, though young birds were far more numerous. The various nests I examined contained from one to three eggs, but strange to say they were all in an advanced stage of incubation, no matter what the number was. I succeeded however, in obtaining nine eggs, three from one nest and two each from three others. In no instance did I observe more than three eggs or three young birds in any nest. The nests are similar in construction and material to those of *Geronticus spinicollis*, being nearly flat structures composed of long spiny sticks and twigs interlaced through one another, measuring about eighteen inches in diameter by six in height, the colonies however are smaller and more separated, each containing from ten to fifteen nests, whilst those of *Geronticus spinicollis*, are from fifty to a hundred and even more, this possibly is accounted for by the fact of the latter being infinitely more numerous.

"Having thus obtained the eggs of *Threskiornis strictipennis*, I went on to the breeding place of *Geronticus spinicollis*, several hundred yards distant, here as with the White Ibis, I found the young birds far more numerous than the eggs, but as the nests were in such numbers I had no difficulty in obtaining as many eggs as I required. This breeding place was of great extent, and there must have been thousands of young ones, the whole place being fairly alive with them as they scrambled off on my near approach, so much so, that the moving mass quite frightened my horse, and I had some difficulty in getting him near enough to the nests to reach the eggs. In trying to secrete themselves, I observed that numbers of the young birds shared the same fate as their white *confrères*, whilst numbers of dead ones in the same fix showed plainly that they had been disturbed on some previous occasion."

Amongst several sets of the eggs of *Geronticus spinicollis* and *Threskiornis strictipennis*, now before me, specimens of the eggs of each bird could be picked out that for shape, size, and colour it would be impossible to distinguish those of one species from the other. The eggs of *Threskiornis strictipennis*, vary in shape from oval to pointed ovals, and are of a very faint greenish-white on the outer surface and of a dark green tint on the inner surface when held up against the light, the shell being minutely pitted all over, and lustreless.

A set of two measures as follows :—(A) 2·57 x 1·82 inch ; (B) 2·57 x 1·75 inch. Another set of three measure :—(A) 2·55 x 1·76 inch ; (B) 2·58 x 1·77 inch ; (C) an elongate oval 2·67 x 1·7 inch.

Hab. The whole of Australia, except South-west.

Pelecanoides urinatrix, *Gmelin.* The Diving Petrel.
Gould, Handbk. Bds. Austr., Vol. ii., sp. 650, p. 483.

John Reinhold Forster and his son George Forster, who accompanied Captain Cook as naturalists during his second voyage in 1772 made drawings of this bird to which the native name of Tee-tee was applied; in Forster's Voyage, Vol. i., p. 189, it is referred to as the little Diving Petrel, a name by which it was subsequently described under, by Dr. Latham in 1785.* Later on †Gmelin inserted it in his Systema Naturæ, under the designation of *Procellaria urinatrix*, and in 1800 ‡Lacepede substituted the generic term *Pelecanoides* for that of *Procellaria*, which is generally used by authors for this species at the present time. The Diving Petrel has a most extensive range of habitat, and of no pelagic species found in the extreme southern seas, does so much doubt and difference of opinion exist amongst authors as to which, if any of the two so called allied species, *P. berardi* from Chili, and *P. garnotii* from Peru, should be included in its synonymy, in fact in both instances it is only a matter of the colour of the feet, a point in which all writers differ in describing them, and a slight difference in the size, characters which have been proved even in the same species not to be constant.

Temminck in his Planche Coloriées§ figures and describes *P. berardi*, and writes as follows:—"On doit réunir avec cette espèce, non-seulement le *Procellaria urinatrix* des auteurs, mais encore un autre, figuré trés-récemment par M. Lesson, dans l'atlas du voyage du capitaine Duperrey, et publié, pl. 46, sous le nom de *Puffin* ou *Puffinure de Garnot.* On trouve cette espèce sur les mers qui baignent les côtes du Chili; le *Pélécanoïde plongeur* ou *Haladroma urinatrix* vit á l'extrémité méridionale des terres de la Nouvelle-Hollande et de la Nouvelle Zélande."

Gould in his Birds of Australia includes *P. garnotii* from Peru as a synonym of *P. urinatrix*, in which he is followed by Dr. Elliot Coues, who has written as follows in the Bulletin of the U.S. National Museum, after closely examining a large series of *Pelecanoides urinatrix*, brought to America by Dr. Kidder, from Kerguelen Island in 1875:—‖"As very strongly intimated in my paper, satisfactory diagnosis of the three currently reported species of this genus is wanting. Nor is my faith in their distinctness increased on finding that these specimens, which from the locality undoubtedly represent the original *P. urinatrix*, are fully up to the dimensions of the supposed larger *P. garnoti*, from the west coast of South America. Observed variation in the colour

* Latham, Gen. Syn. Bds., Vol. iii., pt. 2, p. 413 (1785).

† Gmelin, Systema Naturæ, I., p. 560 (1788).

‡ Lacepede, Mém. de l'Inst., p. 517 (1800).

§ Temminck, Planche Coloriées, Vol. v., pl. 517 (1838).

‖ Coues, Bull. U.S. Nat. Mus. No. 2, "Contributions to the Natural History of Kerguelen Island made in connection with the American Transit of Venus Expedition, 1874-5, p. 36." (1875).

of the feet, which is one point that has been relied upon, lessens the probability of distinctness, especially as the ascribed colouration does not coincide in every case with the dimensions. The size and proportions of the examples examined, as carefully measured in the flesh by Dr. Kidder, warrant me in adducing the *P. garnoti* of Lesson as a synonym of *P. urinatrix;* to which I still refrain from adding the *P. berardi* of Quoy and Gaimard."

Mr. R B. Sharpe however, holds a contrary opinion and in the "Account of the Collections made in Kerguelen's Land,"* after giving the measurements of a number of the so-called species from different localities, writes "My conclusions differ from those of Dr. Coues, insomuch that I consider that *P. berardi* is nothing but the young of *P. urinatrix*, and that *P. garnoti* on the contrary must be held to be distinct on account of its very much larger size; at all events the examples from Western South America indicate a distinct race." Dr. Coppinger in the Cruise of the Alert,† records capturing a specimen of *Pelecanoides urinatrix* on the west coast of Patagonia.

However obscured the synonymy of *Pelecanoides urinatrix* appears to be at present, it is interesting to know that its habits and mode of nidification are not, owing chiefly to the many scientific expeditions that have been sent to Kerguelen Island to make observations during the Transit of Venus. During the voyage of H.M.S. Challenger, in 1874, Sir C. Wyville Thomson‡ writes:—"It is to be seen on the surface of the water in Royal Sound when the water is calm in very large flocks. On two days when excursions were made in the steam pinnace, the water was seen to be covered with these birds in flocks, extending over acres, which were black with them."

Dr. Kidder, who accompanied the United States Transit of Venus Expedition sent to Kerguelen Island§ in the same year, gives an account of their nesting habits, the eggs which he describes measure as follows:—1·62 x 1·15; 1·62 x 1·27; 1·66 x 1·26; 1·65 x 1·25. The Rev. A. E. Eaton‖ who accompanied the expedition sent to the same island by Her Majesty's Government, for the purpose of making observations during the Transit of Venus, writes as follows respecting the nidification of this species:—"They had begun to pair when we reached Kerguelen

* Sharpe, "Account of the collections made in Kerguelen's Land and Rodriguez during the Transit of Venus Expeditions, in the years 1874-5, p. 116." (1879).

† Coppinger, Cruise of the Alert, pp. 105-106, (1883).

‡ Thomson, Voy. H.M.S. Challenger, Narr. of the Cruise, Vol. I., part i., p. 359 (1885).

§ Kidder and Coues, Bull. U.S. Nat. Mus. Nat. Hist. No. 2, of Kerguelen Island, made in connection with the American Transit of Venus Expedition, 1874-5, p. 38, (1875); *id.* part ii., pp. 17, 18 (1876).

‖ Eaton, Account of the collections made in Kerguelen's Land and Rodriguez during the Transit of Venus Expeditions in the year 1874-5, p. 117 (1879).

Island. The first egg was found on the 31st of October. Their burrows are about as small in diameter as the holes of Bank Martins *(Cotyle riparia)* or Kingfishers *(Alcedo ispida)*. They are made in dry banks and slopes where the ground is easily penetrable, and terminate in a large chamber on whose floor the egg is deposited. There is no specially constructed nest. Some of the burrows are branched, but the branches are without terminal enlargements, and do not appear to be put to any use by the birds. Before the egg is laid, both of the parents may be found in the nest-chamber, and may often be heard moaning in the day-time; but when the females begin to sit, their call is seldom heard, excepting at night, when the male in his flight to and from the hole, and his mate on the nest make a considerable noise."

Mr. Howard Saunders,* who described the eggs of this species obtained there amongst those of other birds frequenting the Australian Coast, writes:—"Ten eggs are all pure white, except where peat-stained, nearly equal at each end, or but very slightly pointed. Dimensions 1·5 x 1·1 inch."

Sir Walter Laurie Buller† in his Birds of New Zealand, records that "Mr. Burton found this Petrel breeding on Stephens Island in Cook's Strait. It also breeds on Karewa Island (off Tauranga) on the small islands of the Great Barrier, and on the Hen and Chickens."

In Australian waters this bird is most frequently found between Victoria and Tasmania, likewise in the seas washing the shores of South Australia and New South Wales, but in neither of the latter localities is it so plentiful as in Bass's Straits and the Tasmanian waters. The eggs of this species have been known to Australian oologists for some years past from numerous specimens taken on the smaller islands of Bass's Straits, they show no difference either in size and shape from those previously described by various authors. They are rounded ovals in form, some specimens being slightly pointed at the smaller end, others being nearly equal in size at each end, pure white when newly laid, but like those of other members of the *Procellaridæ*, soon becoming more or less stained and soiled as they approach the time of hatching. Average specimens measure as follows:—(A) 1·48 x 1·23 inch; (B) 1·6 x 1·2 inch; (C) 1·53 x 1·2 inch.

These birds were recently found breeding on North-East Island by the members of a party from the Field Naturalist's Club of Victoria, who paid a visit to the Kent Group in Bass's Straits, during November 1890; they were too late however to obtain any eggs the burrows at that time containing only young birds nearly fledged.

* Howard Saunders, Account of the collections made in Kerguelen's Land and Rodriguez during the Transit of Venus Expeditions in the year 1874-5, p. 174, (1879).

† Buller, Birds of New Zealand, Vol. ii., Second edition, p. 207, (1888).

NOTES ON NEW AND LITTLE KNOWN AUSTRALIAN MADREPORACEÆ.

E/

By W. Saville-Kent, F.L.S., F.Z.S., Commissioner of Fisheries, Queensland.

Goniopora fruticosa, *sp. nov.*

Corallum subdendroid, forming small shrubby growths; the branches subdigitate, somewhat complanate, shortly furcate or palmate at their distal extremities; cœnenchyma highly porous and trabeculate; calicles uneven, very shallow, not exceeding 2 millimetres in diameter; septa representing 3 cycles, those of the primary cycle frequently developed centrally in a paliform manner and forming an irregular hexradiate star. Polypites highly extensile, with 24 elongate subulate tentacles; oral disk white, tentacles and column clear liver-brown. Height of coralla 6 - 8 centimetres, diameter of branches 1 centimetre. æ/

Hab. Warrior Reef, Torres Straits. Co-type in the Australian Museum, Sydney.

This species differs from previously described members of the genus *Goniopora* in the subdendroid character of the corallum, and which in all other known types is massive or lobate. It was collected by the author at extreme low water on the reef in the neighbourhood of Tud or Warrior Island, Torres Straits.

Alveopora spongiosa, *Dana.*

This species first described by Dana, Zooph., p. 513, pl. xlviii., fig. 3, is referred by Milne Edwards and Haime to the *Alveopora viridis* of Quoy and Gaimard, but from which on reference to Quoy and Gaimard's original figures and description it is found to be essentially distinct. The last named species is represented by these authors as forming compound frondose or subdigitate expansions, and the polypites are green and brown. In Dana's type the coralla are represented by solid lobate masses and the polypites, as examined by the author, are clear brown throughout with white tips to the tentacles. A form corresponding with *Alveopora viridis* has been also obtained by the author in Torres Straits, and the corallites in the two species are found to differ essentially in the character of their component calicles. In

Alveopora viridis the upper margins of the walls of the calicles are relatively smooth and the rudimentary septal spines are slender and very deeply set. In *A. spongiosa*, on the contrary, the corresponding spines are short and thick and conspicuously developed near the calicinal orifice. Collected by the author in the neighbourhood of Thursday Island, Torres Straits.

Tridacophyllia rectifolia, *sp. nov.*

Corallum exceedingly fragile, forming a subeven hemisphere; calicinal centres confined to the bottoms of the valleys, the external distal edges of the calicles even and uninterrupted, slightly perforate, not lacinulate; valleys 5 – 6 centimetres wide; septa forming 3 or 4 cycles, subeven, their edges very finely denticulate, the distal termini of the first to third cycles slightly excurrent and somewhat echinulate. Diameter of entire corallum 44 centimetres; height 18 centimetres.

Hab. New Hebrides.

The great depth of the calicinal valleys, their perpendicular walls and subeven non-lacinulate distal edges, distinguish this species from *Tridacophyllia lactuca*, which in other details it most nearly resembles. The magnificent specimen constituting the type of this species, and of which a reduced photographic representation is appended, is contained in the Australian Museum, Sydney.

FURTHER DESCRIPTIONS OF UPPER SILURIAN FOSSILS FROM THE LILYDALE LIMESTONE, UPPER YARRA DISTRICT, VICTORIA.

By R. Etheridge, Junr.,

(Palæontologist to the Australian Museum, and Palæontologist and Librarian, Geological Survey of New South Wales.)

(Plates xviii. – xix.)

The additional fossils about to be described, are like the former collection,* obtained by Mr. A. J. North, from the Cave-hill Quarries, Lilydale, Victoria.

When publishing the former descriptions I overlooked a short account of the Lilydale Limestone by the Rev. A. W. Cresswell,† who gives the following particulars regarding it. The limestone is about one hundred feet thick, interstratified with the Upper Silurian rocks of the district. It is believed to be a lenticular patch, the prevailing colour being cream. As regards the fossil contents Mr. Cresswell makes the following remarks :—"Several specimens of a sub-genus of Turbo, one of them being as large as a good sized recent *Turbo undulatus*. The form appears to me to be close to *Euchelus*, there being no umbilicus or the columella showing trace of being toothed, it is very like our common recent *Euchelus canaliculatus*, but has finer and more numerous liræ. The nearest shell to it in Murchison's "Siluria," appears to be *Cyclonema corallii* of the Upper Ludlow, with which it is perhaps identical. Several specimens of *Murchisonia*, apparently corresponding to *M. corallii* of the Upper Ludlow, as figured in Murchison's "Siluria." A *Bellerophon* . . . . . . ; and several specimens of the common Upper Silurian species of Favosites called *Favosites aspera* . . . ; a single joint of *Crinoid* stem, probably an *Actinocrinus*." The strike of the beds is meridional.

I have not seen any shells which could be regarded as co-specific with *Cyclonema corallii*, or *Murchisonia corallii*, from the British Ludlow rocks. These are small species and not to be compared to those herein afterwards described.

Prof. R. Tate, F.L.S., has been kind enough to supplement my previous descriptions by notes from specimens in his Collection, which will be found in their proper places. He however remarks of *Niso ? brazieri* :—"I imperfectly observe that the aperture is rounded in front, and not angulated as in the Recent and Tertiary species of *Niso*."

* Records Australian Museum, 1890, I., pt. iii., p. 60.

† The Queen's Birthday Excursion to Lilydale, *Victorian Naturalist*, 1885, II., No. 3, p. 35.

Description of the species :—

Class BRACHIOPODA.

Order CLISTENTERATA.

Family Spiriferidæ.

Genus Atrypa, *Dalman*, 1828.

(K. Vet. Acad. Handl., 1827, p. 102.)

Atrypa reticularis, *Linn.*

A. reticularis (Linn.), Davidson, Mon. Brit. Sil. Brachiopoda, 1867 Pt. ii., p. 129 (for synonomy), t. 14, f. 1 – 22.

Obs.—This protean species is numerously represented in the Lilydale Limestone, Prof. Tate informs me. We have one example.

Class PELECYPODA.

Order MYTILACEA.

Family Aviculidæ.

Genus Ambonychia, *Hall*, 1847.

(Pal. N. York, I., p. 163,)

Ambonychia ? poststriata, *sp. nov.*

(Pl. xviii., figs. 1 and 2.)

Sp. Char.—Shell deltoid, or triangularly-mytiliform, alate posteriorly, truncate anteriorly. Valves convex in the umbonal region ; hinge line straight ; ventral margin convex, rounding fore and aft insensibly into the anterior and posterior margins ; anterior alation wanting, the margin truncated, and somewhat incurved, straight walled, and with a large, deeply excavated byssal notch, cordate when the valves are in apposition ; posterior end alate, more or less flattened, but no concavity along the posterior slope; umbones sharp, prominent, and elevated above the hinge line, slightly incurved ; body of the shell gently convex from the umbones downwards to the ventral margin. Sculpture consisting of coarse concentric laminæ of growth, uncrossed by any radiating or decussating striæ, except on the posterior slope, which is finely radiate, the intersection with the concentric laminæ giving rise to a fine fimbriation.

Obs.—The genus *Ambonychia* possesses two allies, *Anomalodonta*, Miller, and *Opisthoptera*, Meek, greatly resembling it in external appearance, but differing in the internal structure of the hinge, and to either of which the present species might equally well be referred, but as we are quite ignorant of the characters of the dorsal margin, I have thought it better to provisionally place the shell in the genus in chief. It differs, however, from all three, in the surface of the valves being only partially, instead of wholly radiate, but the deltoid outline, truncate anterior end, and elevated beaks are very characteristic features of all three genera and the present species.

In dealing with the mollusca of a comparatively new region, and an almost unworked horizon, it is difficult to adopt many known genera, on imperfect and incomplete materials, and it is possible, therefore, that *A.? poststriata* may represent an undescribed and peculiarly Australian genus.

When the shell is viewed looking at the anterior end, the latter is seen to be flattened, or as I have described it above, straight-walled, and the byssal opening to be large and somewhat cordate. The form of this opening is quite in keeping with the structure of *Ambonychia*, an excellent figure being given by Hall in his "Supplementary note on the Genus Ambonychia,"* which exemplifies it. The figured valve of *A.? poststriata*, the left one, is three and three-quarter inches long, by three inches high, and with a diagonal measurement of three and three-quarter inches. The concentric sculpture of our species is similar to that of *Ambonychia? triton*, Salter,† and so is the outline, but the posterior slope of the latter is not radiate.

Prof. Tate writes me that he possesses an Ambonychia-like shell from Lilydale, with fenestrated ornament. It can hardly be *A.? poststriata*, which is fenestrate only on the posterior slope. He also informs me that the Rev. Mr. Cresswell gave him a small, neat *Conocardium* from the same locality.

Class GASTEROPODA.

Order PROSOBRANCHIATA.

Family LITTORINIDÆ.

Genus Cyclonema, *Hall*, 1852.

(Pal. N. York, II., p. 89.)

CYCLONEMA AUSTRALIS, *Eth. fil.*

(Pl. xix., figs. 1 and 2.)

C.? australis, Eth. fil., Records Austr. Mus., 1890, I., pt. iii., p. 63, t. xix., f. 4 and 5.

Obs.—I take this opportunity of figuring a far better specimen of this species than I was formerly able to do. From it the following characters are deduceable. The whorls are six in number, the body whorl being somewhat inflated. The spiral ridges in this particular specimen are alternately larger and smaller, and

* Pal. N. York, III., pt. i., p. 523, f. 2.

† Mem. Geol. Survey Gt. Brit., II., pt. i., t. 23, f. 5.

with the intervening valleys roughened by oblique finer striæ, passing from before backwards. The peristome is round, sharp at the edge, and bevelled inwards. The columellar margin is somewhat flattened, and a decided callosity is present.

Prof. R. Tate writes me as follows regarding this shell :—"The shell is imperforate, and the columella is large and medially depressed—it is related to *Littorina*, and not to *Turbo*." Dr. Paul Fisher,* describes *Cyclonema* as imperforate, or slightly umbilicate; on the other hand Mr. G. W. Tryon, Junr.,† places *Cyclonema* in the Littorinidæ. As the specimen now figured favours this view, it is so assigned.

Cyclonema lilydalensis, *sp. nov.*

(Pl. xix., fig. 3.)

Sp. Char.—Shell with the general characters of the preceding species but the upper whorl smaller in proportion to the size of the body whorl, with a much larger number, and finer spiral ridges, their rounded outline, and a more channeled appearance to the intervening valleys. The oblique decussating striæ are finer and less distinct.

Obs.—This is either a distinct species, or a very well marked variety. I am inclined to the former opinion, fortified by that of my colleague Mr. C. Hedley, F.L.S. In form and character of the spiral sculpture *C. lilydalensis* resembles *C. Guilleri*, Œhlert‡ from the Devonian of Ebray, France, and equally so in the last named character *C. zonatum*, Lindström,§ from the Wenlock rocks of Gotland.

Family Pleurotomariidæ.

Genus Phanerotrema, *Fischer*, 1885.‖

Phanerotrema australis, *sp. nov.*

(Pl. xix., figs. 4 and 5.)

Sp. Char.—Shell rhomboid-ovate, spire short, whorls four, the upper small, the last or body whorl inflated; sutures channeled; band wide, flattened, bordered by fine keels, and ornamented with equidistant backwardly-concave rugæ, on the upper whorls just above the suture, and on the body whorl almost median in position,

* Man. Conchyl. et de Pal. Conchyl., 1887, p. 814.
† Struct. and Syst. Cohnchology. 1883, II., p. 241.
‡ Faune du Calcaire d'Erbray, 1889, p. 220, t. 15, f. 10.
§ Sil. Gastropoda and Pteropoda of Gotland, 1884, p. 178, t. 18, f. 43, 44.
‖ See Fischer's Man. Conchyl. et de Pal. Conchyl., 1887, p. 851.

the lower bounding keel forming the greatest periphery of the shell. Sculpture of equal, equidistant, primary spiral ridges, with intermediate finer secondary ones, and the valleys concave, the whole crossed by slightly oblique lines, dividing the surface into a decussation of unequal rhomboidal spaces.

Obs.—*Phanerotrema* is a genus established by Dr. Paul Fischer to receive *Pleurotomaria labrosa*, Hall,* and other Pleurotomaroid shells resembling it, such as *Pleurotomaria balteata*, Phill.† It would appear to be a very necessary and good subdivision of the larger and more comprehensive genus *Pleurotomaria*, and will include those species with a rhomboidally ovate form, and more or less carinate body whorl, arising from the prominence of the band.

Like *P. labrosa*, Hall, sp., our species attained a considerable size, as evinced by the well marked, but imperfectly preserved shell represented in Pl. xix., fig. 4. It appears to be a more obliquely elongated shell than *P. labrosa*, with a narrower band, although larger in size, and a finer ornament. The American species is from the Upper Pentamerus Limestone of New York State, an horizon equivalent to that of the British Ludlow rocks.

As regards the British species, *P. australis*, is decidedly a more depressed shell with smaller upper whorls. The former is from the Wenlock Limestone.

Genus Murchisonia, *d'Archiac and De Verneuil*, 1841.

(Bull. Soc. Géol. France, XII., p. 154.)

Murchisonia, *sp. ind.*

Obs.—Ill-preserved examples, either too imperfect, or too much defaced with matrix, to be determinable, are in the Collection. The species has some points of resemblance with *Murchisonia cingulata*, Hisinger,‡ but the angularity of the whorls and position of the band do not coincide with those features of that species. The same may be said of another allied shell *M. sinuosa*, Sby., sp.§ Our species appears to me, on the other hand, to be allied to *Murchisonia attenuata*, His.,|| in which the band is nearly median in position; the only point of difference I am able to indicate being the somewhat more angular whorls on the Gotland shell. Otherwise the latter and our *Murchisonia* appear to be closely allied.

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* Pal. N. York, 1859, III., p. 339, Atlas t. 66, f. 1 - 5.

† Mem. Geol. Survey Gt. Brit., 1848, II., Pt. i., p. 358, t. 15, f. 1—2.

‡ See Murchison's Geol. Russia, 1845, Pt. iii., t. 22, f. 7a and b; Lindström's Sil. Gastropoda and Pteropoda of Gotland, 1884, t. 12, f. 9.

§ Salter, Mem. Geol. Survey Gt. Brit., 1848, II., Pt. i., p. 357, t. 14, f. 2.

|| Lindström, *loc. cit.*, t. 12, f. 20 and 21.

Family Bellerophontidæ.

Genus Bellerophon, *De Montfort*, 1808.

(Conch. Systématique, I., p. 51.)

Bellerophon cresswelli, *sp. nov.*

(Pl. xix., figs. 6 – 8.)

Sp. Char.—Shell globular, but little compressed at the sides, carinate, the mouth expanded, more so transversely than vertically. Whorls five or six, the inner concealed by the body whorl, which expands rapidly. Mouth rhomboidal; outer lip rather thickened above, increasing at the sides, the thickened edge rounded or bevelled slightly outwards; inner lip much reflected, forming a deep callosity; band raised and flattened, narrow, bordered by fine keels; sinus long and narrow, rendering the outer lip slightly emarginate in the middle line; umbilicus probably a little open. Sculpture of irregular, fine, transverse laminæ of growth, but without spiral lines, and in consequence the surface unfenestrate.

Obs.—A *Bellerophon* without specific name is recorded by Mr. Cresswell, and I find much pleasure, therefore, in associating his name with this shell. *B. cresswelli* resembles in general form and sculpture *B. squamosus*, Lindström,* from the Wenlock rocks of Gotland, but differs from that species in the outline of the mouth, the lips less reflected, the sculpture is finer, and the surface unfenestrate.

A MUCH-THICKENED VARIETY OF *BULIMUS BIVARICOSUS*, GASKOIN, FROM LORD HOWE ISLAND.

By R. Etheridge, Junr.,

(Palæontologist to the Australian Museum, and Palæontologist and Librarian, Dept. of Mines, Sydney.]

(Plate xx.)

In the general Zoology of Lord Howe Island,† I applied the varietal name *solida* to a peculiar form of *Bulimus bivaricosus*, Gaskoin, one of the most characteristic species in the land molluscan fauna of the island in question. In the living state, there are already known two well marked varieties *Bulimus cuniculinsulæ*, Cox,‡ and *B. etheridgei*, Brazier,§ the former being less in size, the latter with a much thinner shell than the species in chief.

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* Sil. Gastropoda and Pteropoda of Gotland, 1884, p. 78, t. 5, f. 17 – 24.

† Lord Howe Island, Its Zoology, Geology, and Physical Characters, *Mem. Austr. Mus.*, No. 2, 1889, p. 27.

‡ Proc. Zool. Soc., 1872, p. 19, t. 4, f. 3.

§ Lord Howe Island, *loc. cit.*, t. 5, f. 1, 2, 7, 8.

The variety now about to be described was referred to in the following words:—"This variation in the thickness is carried to the extreme condition in the sub-fossil examples of *B. bivaricosus*, in which the shell becomes thickened to an enormous extent, but in this case even gradations can be traced to the existing condition of the species. This variety I purpose calling *B. bivaricosus*, var *solida.*"

Placostylus, Beck, is usually adopted by authors as a section* of *Bulimulus*, but I am quite in accord with others† who use the term in a full generic sense. The characters of the lingual ribbon, are I think sufficient grounds for this, and that this portion of *Bulimus bivaricosus*, Gaskoin, supports such a view will be amply demonstrated by Mr. Charles Hedley in his descriptions of the Lord Howe Island land shells.

Genus Placostylus, *Beck.*

PLACOSTYLUS BIVARICOSUS, *Gaskoin, sp.*

var. SOLIDUS, *Eth. fil.*

(Plate xx., figs. 1 - 7.)

Bulimus bivaricosus, Gaskoin, Proc. Zool. Soc., 1854, XX., p. 152, t. 29, f. 4 and 5.

Bulimus bivaricosus, var. *solida*, Eth. fil., Mem. Austr. Mus., No. 2, 1889, p. 27.

Var. Char.—Shell larger than the species proper, thick, and to some extent rugged from the roughness of the oblique semi-imbricating sculpture, which irregularly crenulates the edges of the sutures. Spire relatively longer, and to some extent more acute; sutures at times somewhat channeled ; last whorl more inflated. Peristome enormously thickened, the callosity extending between the outer and pillar lips across the body of the whorl in a very marked manner, exposing many concentric laminæ of growth, the outer edge of such thickening often projecting like a varex ; inner edges of the lips sinuous and sometimes deeply emarginate, or channeled at the anterior and posterior ends of the peristome, the latter more or less sharply angled ; callosity of the pillar lip rising into tubercles, usually well pronounced, opposite the anterior emargination and posterior angle of the aperture, the posterior tubercle being the largest.

Obs.—The above characters are, to a very much less extent, visible in some one or other of a large assemblage of the species proper, but in the var. *solidus*, all are of a very pronounced nature, so much so, that had these shells been met with in an older fossiliferous formation, they would at once have been erected into a separate species. No doubt there is a tendency to occasionally

* Fischer, Man. Conchyl. et de Pal. Conchyl., 1887, p. 474.

† Hutton, Trans. N. Zealand Inst., 1881, xiv., p. 152.

thicken the shell in some living examples, in fact one such is before me; but the extent to which this extra-secretion of lime proceeds is not often met with in recent specimens of *P. bivaricosus*. The most marked differences, however, between the latter and var. *solidus* lie in the peristome, where the outer and inner lips broaden, exposing repeated laminæ of growth, the callosity on the body whorl thickens greatly, supporting strong tubercles and emarginations, whilst a roughening of the surface occurs on the outer, almost amounting to an immature denticulation, and the posterior angle of the peristome becomes much more acute, and is deeply channeled. Great variability is also noticed in the state of the umbilicus, this aperture in some cases becoming completely closed and overlapped by the spreading laminæ of the pillar lip.

The similarity of the var. *solidus* with some New Caledonian recent and fossil species, and a sub-fossil form from the Loyalty Islands is very marked, and demonstrates the fact that it must be regarded as a link between *P. bivaricosus*, on the one hand, and such species as *P. caledonicus*, Petit, and *P. porphyrostomus*, Pfeiffer, on the other. In both the latter the entire peristome is similarly thickened, the outer lip has a marked emargination or channel on the inner margin, more especially in *P. caledonicus*, whilst the pillar lip exhibits in both, an equally well marked, if smaller, callosity, and what is not visible in var. *solidus*, a deep emargination. Lastly, the twisting of the pillar lip seen in both the New Caledonian species is also faintly marked in some specimens of var. *solidus* from Lord Howe Island. Similar features are also traceable in the allied species *P. alexander*, Crosse, and *P. souvillei*, Morelet. There is, however, one marked difference between all these shells and *P. bivaricosus*, var. *solidus*, the much rounder anterior margin of the peristome, and absence of the channel so characteristic of the posterior.

Another ally of our species is *P. bovinus*, Brug.,* from New Zealand, more particularly in the modified presence of this anterior channel, and in the irregular inner margin of the outer lip, which it will be remembered was above dwelt on as a character as the Lord Howe Island fossil.

Mr. H. Crosse has proposed† a triple sub-division of the auriculiform mouthed *Bulimi*. The first section is *Placostylus*, as typified by *B. fibratus*, Martyn, *B. caledonicus*, *B. alexander*, *B. souvillei*, &c., in which the peristome is thick, the pillar lip (columella) twisted, and the callosity of the body whorl supporting a tubercle. The second section is *Placostyli* without a tubercle on the callosity, and a plain columella, typified by *P. bovinus* from New Zealand, and *P. bivaricosus* of Lord Howe Island, &c.

* = *P. shongii*, Lesson.

† "Etude critique aur les *Bulimus auriculiformes* de la Nouvelle Calédonie et des Terres voisines," *Journ. Conchyl.*, 1864, XII., p. 107.

The third section does not concern us, and need not be further referred to.

Now, it will be at once seen that the characters of the peristome as displayed in var. *solidus* will tend to place this shell in the first rather than the second section, which is strengthened by the fact that living examples collected by myself and Colleagues do show a tendency to a twisting of the columella.

Equally remarkable is the affinity of *P. bivaricosus* var. *solidus* with the heavy and fine fossil species *P. senilis*, Gassies,* and *P. subsenilis*, Gassies,† from New Caledonia. These are apparently a ponderous edition of the local shell *P. caledonicus*, enormously thickened in a similar manner to our var. *solidus*, only more so. The outwardly reflected peristome is very thick and laminated, the outer lip bearing a similar emargination to var. *solidus*. The tubercle on the callosity is equally proportionately larger, but there is again the difference, in the form of the anterior outline of the mouth, which is rounded and almost effuse rather than angular, and there is no anterior channel.

My colleague, Mr. J. Brazier, to whom I am indebted for the loan of specimens of *P. senilis*, has also communicated two fossil *Placostyli* from Mare Island, Loyalty Group, collected by himself. These show precisely the same thickening of the shell, and in particular of the peristome. To me they appear to have a closer relation to *P. caledonicus*, than to either *P. senilis*, or the local species known at the Loyalty Group, *P. edwarsianus*,‡ although they have the posterior portion of the peristome inflated as in the last named, rather than contracted to some extent as in *P. caledonicus*. Mr. Brazier met with this shell in the sand beds accompanying the coral-rock of the island at the time this was being quarried by Missionary Jones for use in the building of his Church.

In the "Geological and Physical Structure of Lord Howe Island,"§ I drew attention to facts tending on the one hand to prove a former union of that island with New Zealand, and on the other an extension northwards, and perhaps also in a north-easterly direction, of this same old land, chiefly deduced from soundings. Our knowledge of the conformation and physical features of land formerly existing in the South Pacific is but in its infancy, and it will be particularly interesting to ascertain in the future, if other portions of the fauna of either New Caledonia or the Loyalty Islands, confirm the indication of this land extension and continuity in their direction also. It must not be forgotten

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* Faune Conchyl. Terr. et Fluvio-lac. Nouv.-Calédonie, 1871, Pt. ii., p. 63, t. 4, f. 2.

† *Ibid*, 1880, Pt. iii., p. 39, t. 2, f. 1.

‡ Gassies, *loc. cit.*, 1871, Pt. ii., p. 63, t. 4, f. 2.

§ Mem. Austr. Mus., No. 2, 1889, p. 122.

that *P. bivaricosus*, and the other species, herein touched on, do not resemble any of the *Bulimi* of New Guinea so far as known.

Placostylus is not known to occur on Norfolk Island ; and considering the position of the latter between New Zealand, Lord Howe Island, and New Caledonia, with the numerical preponderance of *Placostylus* where it is found, we are afforded further food for reflection on this important subject.

It is interesting to note that the geological occurrence of *P. senilis*, Gassies, in the Isle of Pines and Koutoumo Island, New Caledonia, is very similar to that of var. *senilis* at Lord Howe Island, in a sand-rock overlying an upheaved coral reef, and inferior to the present surface soil of the islands.*

In the course of these investigations I have been assisted with several important suggestions by Messrs. J. Brazier and C. Hedley, which have led up to the views enunciated.

THE LAND AND FRESH-WATER SHELLS OF LORD HOWE ISLAND.

By C. Hedley, F.L.S.

(Plates xxi. – xxii.)

In the Memoirs of the Australian Museum, No. 2, "Lord Howe Island," a sketch will be found on pp. 22 – 30 of the molluscan fauna of the island, illustrated by plates 4 and 5, which were, by an unfortunate accident, reversed. Stress of professional duties has prevented Mr. Brazier from completing this outline by detailed descriptions of the species there enumerated, and, greatly to the disadvantage of conchological science, that portion of the work dealing with fluviatile and terrestrial shells is now undertaken by the present writer.

On glancing over the species inhabiting the island, the most noticeable feature is that they are all endemic, while the absence of ubiquitous species like the Truncatellæ indicate that further search would augment the roll. To the eye of an Australian student the types are unfamiliar, and old acquaintances are conspicuous by their absence. Here, the operculates are largely represented, in Australia they are a foreign intrusive element confined to the north-east border, where they increase with every degree of latitude as Torres Straits are approached. Neither are

* Gassies, *loc. cit.*, Pt. ii., p. 67.

the characteristic Queensland operculates, *Pupina* and *Helicina*, present. Among the inoperculates the *Placostylus* claims affinity with the New Zealand and New Caledonian forms, and utterly repudiates kinship with Australian life.

1. NANINA SOPHIÆ, *Gaskoin*, 1854.

Illustrations. Reeve, Conch. Icon. vii., pl. 196, fig. 1377; Cox, P.L.S., N.S.W., ser. 2, Vol. ii., pl. 20, figs. 8, 9; Tryon, Man. Conch. ser. 2, Vol. ii., pl. 16, fig. 26.

Descriptions. Gaskoin, P.Z.S., 1854, p. 152; Pfr., Mon. Hel. Viv., Vol. iv., p. 59; Tryon, Man. Conch., 2-2-83.

Type. British Museum. (?)

Hab. The lower and wooded portions of the island, where it is plentiful.

var. CONICA, *Brazier*, 1889.

Illustration. Brazier, Aust. Mus. Mem., 2, pp. 26, 29, pl. 5, figs, 5, 6, (reversed).

Type. Australian Museum.

Hab. Rabbit Island; plentiful under stones.

Shell smaller and more elevated than the type, globosely conical, scarcely perforate, base rounded. Diam. maj. 25, min. 23, alt. 19 mill. Jaw (pl. xxi., fig. 3) lunate, with central rostriform limb, smooth, ends rounded. Radula (pl. xxii., fig. 7) tongue-shaped, three times as long as broad; formula, 140 rows of 70 : 26 : 1 : 26 : 70; the rows are nearly straight in the centre of the ribbon, the laterals curving back slightly from the centre, after the transition teeth are passed the marginals sweep back in a parabolic curve; the rachidian possesses a slender lanciform cusp whose apex barely surpasses the basal plate, at one-third of its length it is furnished with two small auxiliary cusps; the laterals are slightly larger than the rachidian and equal each other in size, alate angle of basal plate hardly expanded, the inner accessory cusp is suppressed and the main cusp just surpasses the base of attachment; the marginals succeed three or four transition teeth, they are minute, diminishing rapidly, cusp bicapitate, base bisinuate.

2. N. HOWINSULÆ, *Cox*, 1873.

Illustration. Cox, P.L.S., N.S.W., ser. 2, Vol. iv., pl. 19, figs. 10, 11.

Descriptions. Cox, P.Z.S., 1873, p. 140; Pfr., Mon. Hel. Viv., Vol. vii., p. 205.

Type. The original of the description is in the Cox Collection, that of the figure in the Australian Museum.

Hab. Replaces the preceding species on the summit of the mountains.

Jaw (pl. xxi., fig. 7) lunate, with stout central rostriform projection, smooth, ends square. Radula (pl. xxii., fig. 8) tongue-shaped, twice as long as broad; formula, 120 rows of 90 : 24 : 1 : 24 : 90; rachidian with a slender lance-shaped median cusp, whose cutting point projects beyond the basal plate, bearing two small auxiliary cusps half-way along the reflection; the laterals resemble it, except that the outer auxiliary cusp only is developed, alate margin of the basal plate rounded; the numerous marginals succeed after one or two transition teeth, and are slender, minute, oblique and bicuspidate. The genital system is figured on pl. xxii., fig. 5. The spirit specimens before me exhibit a pedal line, well developed caudal mucous pore and mantle lobes.*

3. N. HILLI, *Cox*, 1873.

Illustrations. Cox, P.Z.S., 1873, pl. 16, figs. 7*a*, 7*b*; Tryon, Man. Conch., ser. 2, Vol. i., pl. 38, figs. 57, 58.

Descriptions. Cox, P.Z.S., 1873, p. 151; Pfr., Mon. Hel. Viv., Vol. vii., p. 26; Tryon, Man. Conch. 2-1-170.

Type. The Cox Collection.

Hab. The summit of Mount Gower.

Jaw (pl. xxii., fig. 6) lunate with median projection, smooth, ends rounded. Radula (pl. xxii., fig. 2) somewhat wedge-shaped, almost as broad as long; formula, 163 rows of 430:24:1:24:430; save that the main cusps appear rather longer and more slender and project further past the basal margin, the structure of the teeth is the same as described for the two preceeding species; the feature of the membrane being the excessive number of minute marginals.

Sophiæ, *howinsulæ* and *hilli* are allied species, and are rather too dissimilar to the type of *Helicarion* to be admitted into that genus. Much critical examination of the *Naninidæ* of the South Seas remains to be done before the genera of that family can be suitably defined. The species in question are probably allied to the Fijian *godeffroyi* and to the Papuan *hunsteini*, I prefer to leave them at present under *Nanina*, using the name in its widest significance.

4. PARMELLA ETHERIDGEI, *Brazier*, 1889.

Illustrations. Brazier, Aust. Mus. Mem. 2, pl. 5, fig. 9 (reversed); Hedley, Records of the Australian Museum, Vol. i., pl. 11 (reversed).

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* Since the above was in type I have learnt from Prof. H. A. Pilsbry, of Philadelphia, that he has simultaneously with myself, examined the anatomy of *N. howinsulæ*, and that he has independently arrived at the same conclusions regarding its systematic position. His observations will probably appear about the time of the issue of this paper.

Descriptions. A.M.M., pp. 26, 30 ; R.A.M., Vol. i., pp. 78-80.

Type. Australian Museum.

Hab. On palms at the lower levels below 400 ft.

Jaw (pl. xxii., fig. 4) small, rudimentary, thin, transparent, lunate, emarginate on anterior margin, with slight median projection on lower margin, ends rounded. Larger specimens are contained in the collection than the one described in the 'Records,' one measures 27 mill. in length.

5. Microcystis catletti, *Brazier*, 1872.

(Plate xxi., fig. 5.)

Descriptions. Brazier, P.Z.S., 1872, p. 617 ; Pfr., Mon. Hel. Viv., Vol. vii., p. 61 ; Brazier, Aust. Mus. Mem. 2, pp. 26, 29.

Type. Australian Museum.

Hab. Rabbit Island.

var. major, *nov. var.*

Larger than type, columellar margin furnished with a tubercle. Diam. maj. 11, min. 10, alt. 6 mill.

Type. Australian Museum.

Hab. The Old Settlement.

6. Charopa textrix, *Pfeiffer*, 1855.

Illustrations. Küster's Conch. Cab. pl. 162, figs. 14-17 ; Tryon, Man. Conch. ser. 2, Vol. iii., pl. 7, figs. 2–4.

Descriptions. Pfr., P.Z.S., 1855, p. 92 ; Pfr., Mon. Hel. Viv., Vol. iv., p. 87 ; Tryon, Man. Conch. 2-3-35 ; Brazier, Aust. Mus. Mem. 2, pp. 26, 30.

Type. British Museum.

Hab. The summit of Mount Gower.

H. pinicola, Pfr., from the Isle of Pines, a dependency of New Caledonia, is a near ally of the preceding species, and supports the argument advanced under the head of *P. bivaricosus* on behalf of a recent land connection with New Caledonia. It is incorrectly (Mon. Hel. Viv., Vol. iv., p. 106) stated to inhabit Lord Howe.

7. C. cimex, *Pfeiffer*, 1854.

Illustrations. Reeve, Conch. Icon. vii., pl. 201, fig. 1411 ; Tryon, Man. Conch., ser. 2, Vol. 3, pl. 52, fig. 4.

Descriptions. Pfr., P.Z.S., 1854, p. 288 ; Pfr., Mon. Hel. Viv., Vol. iv., p. 104 ; Tryon, Man. Conch. 2-2-170 ; Brazier, Aust. Mus. Mem. 2, pp. 26, 30.

Type. British Museum.

Hab. Lord Howe. (?)

8. C. (?) IGNAVA, *Pfeiffer*, 1855.

Descriptions. Pfr., P.Z.S., 1855, p. 92 ; Pfr., Mon. Hel. Viv., Vol. iv., p. 98.

Type. British Museum.

Hab. Lord Howe. (?)

9. C. (?) CÆCILIA, *Pfeiffer*, 1855.

Descriptions. Pfr., P.Z.S., 1855, p. 92 ; Pfr., Mon. Hel. Viv., Vol. iv., p. 107.

Type. British Museum.

Hab. Lord Howe. (?)

More evidence is required before *cimex, ignava,* and *cæcilia* can be recognised as members of this fauna.

10. C. WILKINSONI, *Brazier*, 1889.

Illustration. Brazier, Aust. Mus. Mem. 2, pl. 5, figs. 4, 5, (reversed).

Type. Australian Museum.

Shell small, discoidal, obtusely carinate, thin, translucent, colour pale yellow alternating with red radiating dashes ; whorls $4\frac{1}{2}$, convex, slowly increasing; sculpture fine regular miscroscopic costæ decussated by similar spiral lyræ ; suture impressed ; spire plane ; umbilicus wide, one-third of diameter ; aperture vertical, ovate lunate, peristome sharp, thin. Diam. maj. $2\frac{1}{2}$, min. 2, alt. 1 mill.

Hab. Between the North Ridge and Old Settlement.

11. C. UNWINI, *Brazier*, 1889.

Illustration. Brazier, Aust. Mus. Mem. 2, pl. 4, figs. 5, 6, (reversed).

Type. Australian Museum.

Shell small, depressed, thin, translucent, umbilicate ; colour uniform pale yellow ; whorls four, rounded, gradually increasing ; sculpture oblique radiate striæ ; spire slightly elevated, apex obtuse ; suture impressed ; umbilicus wide, one-third of diameter, deep, perspective ; aperture not descending, roundly lunate, peristome thin, straight. Diam. maj. $2\frac{1}{2}$, min. 2, alt. $1\frac{1}{2}$ mill.

Hab. The low grounds at the north end of the island.

12. PATULA WHITELEGGEI, *Brazier*, 1889.

Illustration. Brazier, Aust. Mus. Mem. 2, pl. 4, figs. 23, 24, 25, (reversed).

Type. Australian Museum.

Shell discoidal umbilicate, thin, translucent ; colour chestnut painted with zig-zag straw flames, interior subnacreous with a bluish lustre; whorls $3\frac{1}{2}$, rapidly increasing, flattened between the periphery and the suture, subangled at the periphery, slightly descending at the aperture; sculpture numerous irregular oblique sinuate sharp costæ which are smaller and closer on the last whorl, in their interstices and parallel to them are close fine hair lines, there is a decided break in the sculpture on reaching the embryonic whorls which faintly repeat the adult sculpture; suture deep, acutely impressed; spire sunk, embryonic whorls $1\frac{1}{2}$, distinct; epidermis glistening; base rather flattened, umbilicus about one-sixth of major diameter, perspectively exhibiting all the earlier whorls; aperture diagonal, peristome straight, sharp, body whorl overlaid by a thin callus. Diam. maj. 16, min. 13, alt. 6 mill.

Hab. Summit of Mount Ledgbird.

Jaw (pl. xxi., fig. 6) thin membranous, emarginate on the convex margin, projecting on the concave, ends angled, finely transversely striate. Radula (pl. xxii., fig. 1) small, strap shaped, three mill. long by one broad, rows curving slowly backward (posteriorly with relation to the animal), till the marginals are reached, when they run straight across the ribbon until the extreme marginals which sweep slightly forwards; formula, 150 rows of 21 : 10 : 1 : 10 : 21; the rachidian is small, two-thirds the size of the immediate laterals, cusp ovate, extending along three-fourths of the basal plate and bearing at half its length two minute accessory cusps; the cusps of the laterals increase in magnitude as they retreat from the centre, and are supplied with both distal and proximal accessory cusps, the main cusps of the inner laterals fall short of, and those of the outer exceed, their basal plates, whose alate angle is scarcely expanded; the outer four laterals are modified by transition to the marginal type, whose proximal accessory cusp assumes a sabre shape, and increases to nearly the size of the main cusp, the extreme marginals offer a short tridentate blade. The shell of this species resembles that of *R. sinclairi*, of Tasmania, and before examining the unexpected dentition, I quite concurred with Mr. Brazier in referring this species to *Rhytida.*

var. BALLI, *Brazier*, 1889.

Illustration. Brazier, Aust. Mus. Mem. 2, pl. 4, figs. 13, 14, 26, (reversed).

Type. Australian Museum.

Shell depressedly globose, often eroded, whorls rounded, spire slightly raised, base rounded, umbilicus narrow but exhibiting the previons volutions. Diam. maj. 11, min. 10, alt. 6 mill.

Hab. Summit of Mount Ledgbird.

var. LEDGBIRDI, *Brazier*, 1889.

Illustration. Brazier, Aus. Mus. Mem. 2, pl. 4, figs. 19, 20 (reversed).

Type. Australian Museum.

Shell globosely conoid, whorls rounded, spire elevated, base rounded, aperture subcircular, umbilicus narrow. Diam. maj. 8, min. 7, alt. 6, mill.

Hab. The western flanks of Mount Ledgbird.

The two latter forms are considered by Mr. Brazier to be species, an opinion from which I differ with much reluctance.

13. Placostylus bivaricosus, *Gaskoin*, 1854.

Illustrations. Gaskoin, P.Z.S., 1854, pl. 29, figs. 4, 5; Gassies, Faune conchyliologique de la Nouvelle Calédonie. pl. 3, fig. 2.

Descriptions. Gaskoin, P.Z.S., 1854, p. 152; Gassies, Faune conch. de N. Cal., p. 47; Pfr., Mon. Hel. Viv., Vol. iv., p. 447; Crosse, Journ. de Conch. 1864, p. 128; Brazier, Aust. Mus. Mem. 2, p. 27.

Type. British Museum (?)

Hab. All over the island in sheltered places under stones; abundant.

The auriculoid Bulimi form so natural a group, limited in geographical range, bearing a most characteristic shell and sharply defined by its dentition from the typical Bulimi that it appears more convenient to accord *Placostylus* specific rank than to reduce it as in Fischer's Manual to a section of *Bulimulus.* This species speaks eloquently of a recent land connection extending on the one side to New Caledonia and on the other to New Zealand. It is confined to Lord Howe Island and, the Loyalty Island habitat quoted by Crosse is erroneous. This shell is as variable as any of its polymorphic genus; were the extreme forms only available for study, two recent and another extinct species would be recognised by all schools of conchologists.

Jaw (pl. xxi., fig. 4) folded, kidney-shaped, thin, membranous, margins recurved, ends angled, folds asymmetrical, about 14 on each side, oblique, enclosing a triangular median space, scarcely denticulating either margin. Radula (pl. xxii., fig 3) tongue shaped three times as long as broad; formula, 127 rows of 35 : 22 : 1 : 22 : 35; rachidian furnished with a slender median lance cusp whose cutting point projects beyond the basal plate, half way along the reflection are seated two small auxiliary cusps; the lateral main cusp is ovate, stouter and blunter than that of the rachidian and also surpasses the posterior margin of the basal plate, the inner auxiliary cusp is suppressed and the outer increased, the alate margin of the basal plate is almost falcate; the laterals pass gradually into the marginals whose main cusp diminishes and becomes double headed.

These observations agree with those of Fischer on *P. porphyrostomus* and *P. scarabus*, Journ. de Conch., 1871, Vol. xix., pp.

161 - 166, pl. 7, and with those of Hutton on *P. bovinus*, Trans. N. Z. Institute, 1881, Vol. xiv., p. 152, pl. 3, figs. D. O.

var. CUNICULINSULÆ, *Cox*, 1872.

Illustration. Cox, P.Z.S., 1872. pl. 4, fig. 3.

Description. Op. cit., p. 19; Brazier, Aust. Mus. Mem. 2, p. 27.

Type. The Cox Collection

Hab. Rabbit Island.

A local race from a satellite isle, differing in being rather smaller thinner and narrower than the type; the rimation upon which the author lays stress, appears of slight importance since all Placostyli possess or lack it indifferently.

var. ETHERIDGEI, *Brazier*, 1889.

Illustration. Brazier, Aust. Mus. Mem. 2, pl. 5, figs. 1, 2, 7, 8 (reversed).

Type. Australian Museum.

A large thin elongate form, exhibiting transverse malleated furrows, on the last whorl the epidermis is nearly black, the bright cherry red of the typical aperture has almost disappeared, only the columellar plication retaining a trace, the nacreous lining of the interior and the callus on the body-whorl are tinged a greenish-blue. Length 65, breadth 27, length of aperture 30, breadth of aperture 20 mill.

Hab. Under the wall of Mount Ledgbird.

Several recent specimens approach the interesting fossil variety *solidus* which is exhaustively described by Mr. Etheridge in an accompanying paper. All the dominant forms of Lord Howe possess that instability of character which seems inherent in insular faunæ.

14. SIMPULOSIS (?) MASTERSI, *Brazier*, 1872.

(Plate xxi., fig. 9.)

Description. Brazier, P.Z.S., 1872, p. 619; Pfr., Mon. Hel. Viv., Vol. vii., p. 29; Brazier, Aust. Mus. Mem. 2, p. 27.

Type. Australian Museum.

Hab. A gully on the North Ridge, among dead leaves; rare.

The animal of the single specimen procured by the expedition is so shrunk by the action of the alcohol in which it is preserved, that I am unable, even with the aid of the microscope, to determine any details of its external anatomy, and I do not feel justified in dissecting the solitary example possessed by the Museum. Except by adding a figure of the shell I cannot therefore increase our knowledge of this obscure form.

15. TORNATELLINA INCONSPICUA, *Brazier*, 1872.

Description. Brazier, P.Z.S., 1872, p. 619 ; Pfeiffer, Mon. Hel. Viv., Vol. viii., p. 319 ; Aust. Mus. Mem. 2, p. 27.

Type. Was deposited in the Australian Museum, but has been accidentally destroyed.

Hab. A gully on the North Ridge, among dead leaves ; rare.

The broken shell collected by the expedition is too incomplete to figure, which is to be regretted, as no illustration has been published.

16. DIPLOMMATINA MACGILLIVRAYI, *Pfeiffer*, 1854.

(Plate xxi., fig. 1.)

Descriptions. Pfr., P.Z S., 1854, p. 303 ; Pfr., Mon. Pneu. Viv., Vol. ii., p. 11 ; Brazier, Aust. Mus. Mem. 2, p. 27.

Type. British Museum.

Hab. The Old Settlement, among dead leaves on the ground and under stones, abundant.

var. BETA, *Pfeiffer*, 1854.

A slight colour variation possessing a peripheral band shown in my illustration.

17. D. CAPILLACEA, *Pfeiffer*, 1854.

(Plate xxi., fig. 2.)

Descriptions. Pfr., P.Z.S., 1854, p. 303 ; Pfr., Mon. Pneu. Viv., Vol. ii., p. 12 ; Brazier, Aust. Mus. Mem. 2, p. 27.

Type. British Museum.

Of the smaller Diplommatina I have three lots before me, No. 1, collected by Mr. Masters on Lord Howe, from which the example figured was selected ; No. 2, collected by the expedition on Lord Howe ; No. 3, collected by the expedition on Rabbit Island. These range in length from 3½ (No. 1) to 4½ mill. (No. 2) in length. Some individuals are more closely costulate than others, sometimes the ultimate, sometimes the penultimate whorl is the most densely ribbed ; the coloration varies from light yellow to pale purple, and some specimens are considerably narrower than others. Though none correspond to Pfeiffer's description of *chordata*, this instability of character inclines me to suppose that a larger collection from different parts of the island would supply links to connect that species with *capillacea.* Indeed the large form *macgillivrayi* may also prove but an extreme variation of the same type.*

* Dr. Macdonald has figured (Ann. Mag. Nat. Hist. (4), iv. pl. 4, fig. 9) the radula of one of the Lord Howe Diplommatinæ, which one he does not say.

18. D. CHORDATA, *Pfeiffer, var.* BETA, *Pfr*, 1855.

Descriptions. Pfr., P.Z.S., 1855, p. 105; Pfr., Mon. Pneu. Viv., Vol. ii., p. 13; Hutton, Manual N. Z. Mollusca, p. 88; Hutton, Trans. N.Z. Institute, 1883, Vol. xvi., p. 210.

Type. British Museum.

Hab. Lord Howe Island.

The type was originally reported from New Zealand, but modern collectors have not confirmed the statement.

19. D. CANTORI, *Pfeiffer*, 1856.

Descriptions. Pfr., P.Z.S., 1856, p. 336; Pfr., Mon. Pneu. Viv., Vol. ii., p. 12.

Type. British Museum.

Hab. Lord Howe Island.

I have no knowledge of this species.

20. OMPHALOTROPIS PFEIFFERI, Crosse, 1868.

Illustration. Crosse, Journ. de Conch., Vol. xvii., 1869, pl. 12, figs. 7, 7.

Description. Op. cit. Vol. xvi., p. 178; Pfr., Mon. Pneu. Viv., Vol. iv., p. 226; Brazier, Aust. Mus. Mem. 2, p. 30.

Type. Crosse's Collection.

Hab. On leaves of trees and on palm fronds, very plentiful.

21. REALIA EXQUISITA, *Pfeiffer*, 1854.
(Plate xxi., fig. 8.)

Descriptions. Pfr., P.Z.S., 1854, p. 307; Pfr., Mon. Pneu. Viv. Vol. ii., p, 162.

Type. British Museum.

Hab. Lord Howe Island.

This is the *Realia* to which allusion is made on p. 27 of "Lord Howe Island." Mr. Brazier informs me that *Hydrocena acutilirata*, Pfr., and *Helicina zebriolata*, Pfr. are natives of the New Hebrides, and were wrongly assigned to Lord Howe Island. The error probably originated with Cuming who confused the localities furnished by MacGillivray.

22. BYTHINELLA WHITELEGGEI, *Brazier*, 1889.

Illustration. Brazier, Aust. Mus. Mem. 2, pl. 4, figs. 17, 18, (reversed).

Type. Australian Museum.

Shell elliptical, subcylindrical, perforate ; colour, the two latter whorls pale yellow, the former purple ; whorls 4½, flattened, angled below the suture, the last exceeding the rest in length ; sculpture, last whorl encircled by five, the penultimate by three, wide flat-topped lyræ, crossed longitudinally by fine striæ; suture impressed; umbilical chink oblique, narrow ; spire obtuse ; peristome free, entire, ovate, expanded. Length 2½, breadth 1 mill.

Hab. The creek to the north of the Old Settlement.

23. B. RAMSAYI, *Brazier*, 1889.

Illustration. Brazier, Aust. Mus. Mem. 2, pl. 4, figs. 15, 16, (reversed).

Type. Australian Museum.

Shell narrowly ovate, perforate ; colour corneous ; whorls 4½, convex, the last two-thirds of the total length ; sculpture faint oblique striæ ; suture impressed ; spire obtuse ; umbilical chink narrow oblique ; aperture obliquely ovate, effuse below, angled above, peristome entire, slightly expanded and reflected. Length 4, breadth 2 mill.

Hab. Running streams on the eastern flanks of Mt. Ledgbird.

ON THE ORGANISM DISCOLOURING THE WATERS OF PORT JACKSON.

By Thos. Whitelegge.

[The following report on the discolouration of the waters of the harbour has been prepared by authority of the Trustees of the Australian Museum, at the request of the Commissioners of Fisheries for New South Wales.

It is a preliminary report, and has already appeared in some of the Sydney daily papers. Mr. Whitelegge is still engaged in the investigation, and in the preparation of a paper on the subject.—Ed.]

Australian Museum, 13th April, 1891.

To Dr. E. P. Ramsay, F.R.S.,E , Curator.

Sir,—I have the honour to report that, in accordance with your instructions, I have visited various parts of the harbour, with the view of ascertaining the probable effects of the Peridinium

—which is the cause of the discolouration of the water—on fish and other organisms. The effect on the shore fauna has been very destructive; I find that the oysters, mussels, and other bivalves have been nearly all destroyed. At all the places I have visited, from Hunter's Hill, on the Parramatta River, down to Watson's Bay, the bivalves are killed, and at Little Sirius Cove the limpets and periwinkles are lying about with the animals still in the shells, mostly in a state of putrefaction; the stench from the bed of mussels is almost unbearable. During my examination of the shore I searched carefully for fish, but failed to find any dead ones, nor could I gain any information of any having been seen floating about in a dead or dying condition. The effect on the other kinds of life besides the mollusca has been very destructive, and there seems to be almost a total absence of the usual forms which live under stones, such as worms, ascidians, starfish, polyzoa and zoophytes—all seem to have suffered more or less.

The question as to how this vast destruction of shore life has been brought about is a rather difficult one to decide, and could only be satisfactorily determined by direct experiment in a well-appointed biological laboratory. I, however, submit the following as the result of my investigations in the matter, and in doing so I wish it to be distinctly understood that the conclusions are put forward tentatively, as a reasonable explanation of the phenomena.

In the first place, there cannot be the least doubt but that the Peridinium appears regularly each year in larger or smaller quantities; and I have been assured by various people that this discolouration of the water has been noticed on many occasions from 1856 down to the present time. But why has it appeared in such vast numbers during the last few weeks? It is highly probable that all the conditions favourable to its development have been nearly perfect, and the influences which might act injuriously have been reduced to a minimum. The very large rainfall may have affected the salinity of the water favourably, and the lengthened period of calm weather which has prevailed since its appearance might also contribute to its development. From what is known of the chemical composition of the Peridinia there is no reason why they should be regarded as injurious food for fish or any other organisms. The following account from the "Encyclopaedia Britannica," 9th edition, Vol. xix., p. 859, is given to show that the composition of these organisms is very similar to that of diatoms, desmids, &c., which are known to constitute a highly nutritious food for fish, oysters, and other forms of animal life:—"The Dinoflagellata are either enclosed in a cuticular shell (Ceratium, Peridinium, Dinophysis, Diplopsalis, Glenodinium, Prorocentrum, &c.) or naked (Gymnodinium and Polykrikos). The cuticular membrane (or shell) consists of cellulose, or of a similar substance (cf. Labyrinthulidea), and not, as has been supposed, of silica, nor of chiton-like substance. . .

The medullary protoplasm contains often chlorophyll, and also diatomin and starch or other amyloid substance. . . . The constitution of the cell-wall or cuticle from cellulose, as well as the presence of chlorophyll and diatomin, and the holophytic nutrition of many forms recently demonstrated by Bergh, has led to the suggestion that the dinoflagellata are to be regarded as plants, and allied to the Diatomaceæ and Desmidiaceæ. Physiological grounds of this kind have, however, as has been pointed out above, little importance in determining the affinities of Protozoa."

Another reason why the organism in question should not be regarded as injurious is that it does not appear to die and undergo decay. Some of those which I collected on 2nd April have been in a small bottle for ten days without change of water; and although the water swarms with bacteria and infusoria, they show no traces of decomposition; they are, in fact, still alive, but motionless. After remaining in the bottle for about four days they settled down to the bottom, and ever since they have been undergoing certain changes; the necleus acquired a bright red colour, and afterwards divided into two nuclei; after division they began to enlarge, and the rest of the contained protoplasm was gradually absorbed, and finally there were formed two large orange-coloured spores. This condition is evidently the well-known encysted state, which obtains in many of the lower plants and animals. When encystment takes place, spores in most cases are provided with a thick cell-wall, and are endowed with a great power of resisting all kinds of injurious influences, so much so that many of these resting spores may be boiled, or kept in a dry state for a lengthened period, without destroying their vitality. If, in spite of such unfavourable conditions as mentioned above, they are capable of attaining to the encysted state, there is no reason to suppose that they would do otherwise when in their natural habitat. No doubt many of them may die, through injury, and make the water foul; but still there is no trace of the dead bodies of the Peridinia on the surface of the mud, or in the water where they are abundant.

If the organism does not die in large numbers, and its composition is not likely to be injurious, how has it acted so injuriously on the littoral fanna? This is a difficult question to answer without direct experiment on the organisms affected. There are, however, several ways in which this may have been brought about, without supposing that the effects are the result of any poisonous qualities, or that they arise from the death and decomposition of the Peridinia themselves. The bivalve mollusca have evidently been the most affected, and their decomposition has had some influence in killing the limpets, periwinkles, and other animal life. The death of the bivalves may be attributed to several causes; the Peridinia may have been present in such numbers as to literally clog the gills and prevent respiration, or the water may have been so deficient in oxygen as to be unfit to support the higher forms of life, or they may have been so overfed as to produce indigestion and sickness. No doubt any one of these causes acting for weeks in succession, or a combination of the whole, would be sufficient to render the entire littoral fauna unhealthy; and every death of the larger animals would tend to make the conditions worse for those that remained. I examined the stomachs of both oysters and mussels, and found them full of Peridinia, and in many cases the water enclosed in the shell contained great quantities in a living condition.

From what I have observed of the habits of the particular species of the Peridinia in question they appear to be extremely social, and seek each other, and swim in lines or clouds, always with a tendancy towards the light; and, as it is probable they do not extend to a great depth, the bottom fauna will not be so much affected as the littoral. The sudden appearance of this organism, which has discoloured the whole of the waters of Port Jackson and destroyed a very considerable portion of its fauna, is another instance of our ignorance of the various conditions which affect our marine food supplies, and shows the importance and necessity of the immediate establishment of a thoroughly efficient biological station. If such an Institution had been in existence during the presence of this extraordinary visitation, the whole of the question as to its effects on our marine fauna could have been satisfactorily determined experimentally.

I have the honour to be, Sir, your obedient servant,

THOMAS WHITELEGGE.

P.S.—(7th May) The Peridinium mentioned in the above report is probably a new species, and will be dealt with in a further report. The organism in question made its appearance in vast numbers about the middle of March, and is now disappearing.—T.W.

NOTE ON THE NIDIFICATION OF *PLOTUS NOVÆ-HOLLANDIÆ*, *Gould.*

The New Holland Snake-bird or Darter.

BY A. J. NORTH, F.L.S.

THE Trustees of the Australian Museum have lately received the eggs of *Plotus novæ-hollandiæ*, taken by Mr. J. L. Ayres at Lake

Buloke, in the Wimmera District of Victoria, on 1st April, 1891. The nest was built at a height of about fifteen feet, on the branch of a Eucalyptus standing in the water, it was outwardly composed of sticks lined inside with twigs, and contained five eggs, one of which was unfortunately broken in descending the tree. The eggs are elongated ovals in form tapering gradually towards the smaller end, where they are somewhat sharply pointed ; the shell has a thick, white, calcareous covering, only a few scratches here and there revealing the true colour underneath, which is of a pale blue. Length (A) 2·41 x 1·45 inches, (B) 2·32 x 1·42 in., (C) 2·34 x 1·45 in., (D) 2·43 x 1·47 in. Although very late in the season, Mr. Ayres found another Darter's nest on the same day, containing five newly hatched young ones.

This species is found all over Australia, but is more sparingly distributed in the extreme southern and western portions of the Continent.

ON A NEW AND PECULIAR FRESHWATER *ISOPOD* FROM MOUNT KOSCIUSKO.

By Chas. Chilton, M.A., B.Sc.

[With Plates XXIII.-XXVI.]

Towards the end of 1889 I received from the Trustees of the Australian Museum, Sydney, a small collection of Australian Crustacea, containing among others, some terrestrial and fresh-water species collected by Mr. R. Helms while on an expedition to Mount Kosciusko on behalf of the Museum.* Among these I at once saw that one was quite different from any of the terrestrial and fresh-water crustacea previously described from Australia, and that it belonged to a genus *Phreatoicus* established by myself in 1882, for a peculiar blind subterranean Isopod found in wells in Canterbury, New Zealand. This genus was of special interest both because of the situation in which the original species was found, and because it combined characters belonging to several different families, and was also, to some extent, intermediate between the Isopoda and the Amphipoda The discovery of a species belonging to the same genus in such a widely remote situation as Mount Kosciusko, and living under such different conditions is therefore of peculiar interest, and will probably have an important bearing on the difficult question of the origin of the blind subterranean forms. In the present paper, however, I do not propose to enter upon this question, as I hope to be able to do that on a future occasion when describing more fully the subterranean forms from New Zealand. For the present I shall content myself with describing the new species as fully as possible and with discussing the position of the genus among the *Isopoda*. It will be well, however, first to give the circumstances under which the species was taken, as they are given by the finder, Mr. R. Helms, a collector of whose zeal and accuracy I had had experience before he left New Zealand.

The specimens were, he says, taken at a place 'locally known 'as "Piper's Creek," at an elevation of 5,700 feet or perhaps 'rather more, on the track from "Pretty Point" towards the '"Ram's Head." The creek (or a least a branch of it) runs here 'through a, in damp weather, boggy flat, and at the time (early 'in March 1889) was slowly trickling along forming puddles here 'and there. In one of these puddles where there was only a little

* A short account of this expedition is given by Mr. Helms in the "Records of the Australian Museum," Vol. I., No. 1, p. 11.

'water covering the black bog mud, perhaps from two to three 'inches, I made the find. In turning the stones (flat pieces such 'as frost will split from rocks—not boulders) I found no difficulty 'in picking the animals off, the most of them keeping quiet. They 'were pretty numerous under the stones, when at all, and looked 'exceedingly like the surrounding earth. Through this and their 'quiet habit I did not notice at first that they were so numerous, 'but seeing that they were interesting things (I had not seen any 'thing like it before) I took pretty well all I could lay hands on; 'and this is the only time and place I have collected them although 'I have many a time turned stones in the neighbourhood and in 'similar localities.'

In speaking further of the locality he explains that it is nearly at the top of a branch of the leading plateau that extends, with various interruptions, towards the Ram's Head, Mount Townsend and Mount Kosciusko, the highest points of the range, and that it is only about one-half or three-quarters of a mile from the rise which forms the watershed between the river basins on the north and south. This rise is only about 30 or 40 feet higher than the place at which the animals were found. Consequently the amount of water in the creek can never be very great and, moreover, it is specially to be noted that for about six months of the year the place is covered with snow and the ground itself is probably frozen. On March 13th at "Pretty Point," Mr. Helms found the remains of his tea completely frozen in his "billy."

The Isopod about to be described is quite different from any of the fresh-water and terrestrial crustacea hitherto recorded from Australia, its nearest allies being marine in their habitat, and its occurrence on the top of a hill nearly 6,000 feet high is very peculiar. In connection with this it will be interesting to mention the following facts of a somewhat similar kind.

Mr. G. M. Thomson has taken in New Zealand a species, *Pherusa cœrulea*, Stebbing, at a height of about 3,000 feet. He gives the following account of its habitat:—"*Hab.* Several specimens of this species were taken in a runnel of water on the Obelisk (or Old-Man) range, in the interior of Otago, at a height of about 3,000 feet. The stream was a little thing that one could have dammed with the hand, and running at such a slope that I can hardly imagine how the crustacea are not washed away by every shower of rain. The Old-Man range is about 80 miles from the sea. The only other fresh-water Amphipod found in New Zealand (excluding the subterranean forms found by Chilton) is *Calliope fluviatilis*, mihi, which is very common."*

Here we have a species belonging to a genus chiefly marine in its habitat, found in a small stream on the top of a hill—a place which must frequently be covered with snow during the winter.

* See Transactions Zoological Society, London, Vol. XII., part vi., (1887) p. 208.

In Lake Titicaca, South America, about 13,000 feet above sea-level, there are found several species belonging to the genus *Allorchestes*, a littoral genus which had previously yielded but one or two authentic fresh-water species.*

I have recently taken *Idotea lacustris*, Thomson, in Mihiwaka Creek (near Port Chalmers, N.Z.), a rocky mountain stream running from Mount Mihiwaka (about 2,000 feet) to the sea; the place where I took the specimens was, however, perhaps not more than 200 or 300 feet above the sea. Before this the species was known only from Tomahawk Lagoon, a fresh-water lagoon quite close to the sea. Almost all the other species of Idotea are marine. It is quite possible that diligent search in our mountain lakes and streams would reveal other species that have been similarly preserved in these situations.

From the discussion given below of the position of this new species among other Isopoda, it will be seen that it does not fit into any of the usually recognised families of the Isopoda, and that it will therefore be necessary to form a special family for its reception. This family, which appears to approach more nearly to the *Asellidæ* than to any other, may be provisionally defined as follows:

Family PHREATOICIDÆ.

Body sub-cylindrical, more or less laterally compressed. Mandibles with a well developed appendage. Legs distinctly divided into an anterior series of four, and a posterior series of three. Pleopoda broad and foliaceous and branchial in function, but not protected by an operculum. Abdomen large, of six distinct segments. Uropoda styliform.

Genus Phreatoicus, *Chilton.*

[Transactions New Zealand Institute, XV., p. 89.]

The following is the original diagnosis that I gave for this genus when I had only the one species *P. typicus* before me. It will include our present species without further modification.

Generic diagnosis.—"Body long, sub-cylindrical, laterally compressed. Upper antennæ short, lower long, with flagellum. Mandible with an appendage. First pair of legs subchelate, others simple; first *four* pairs articulated to body at the anterior ends of their segments and directed forwards, last *three* articulated at posterior ends of their segments and directed backwards. Abdomen long, of six distinct segments, last joined to telson. Sixth pair of pleopoda biramous, styliform. Telson large, subconical."

* Bulletin of the Museum Comparative Zoology, Cambridge, Vol. III. No. 16, p. 361.

Our Mount Kosciusko specimen may be defined thus—

PHREATOICUS AUSTRALIS, *sp. nov.*, Plates xxiii.–xxvi.

Body with surface generally uneven, wrinkled, and with irregular depressions; head and anterior portion of pleon smoother, a few rather short setæ scattered over the surface and forming a short thick fur on the dorsal portion of the last segments of the pleon. Eyes small, round. Upper antennæ reaching to the end of the peduncle of the lower, peduncle apparently of three joints, the second much shorter and narrower than the first, third about as long as the second but narrower, not distinguishable from the flagellum which is composed of four joints with a minute terminal one and is somewhat swollen towards the end. Lower antennæ rather more than one-third the length of the body, peduncle of five joints, first four short, subequal, fifth half as long again as the fourth, flagellum longer than the peduncle. First pair of legs having the propodos large and swollen and forming with the dactylos a powerful subchelate hand. First five segments of pleon with pleura produced inferiorly, rounded below, inferior and posterior margins fringed with long setæ. Uropoda with peduncle reaching about as far as the end of pleon, rami about as long as peduncle, outer ramus shorter than the inner.

Length, about half an inch (12·5 mm.), breadth, about one-tenth inch (2·5 mm.) Colour, (in spirit) legs and part of the body light brown, the greater part of the body almost completely covered with marbled markings of a darker brown.

Hab. Mount Kosciusko Plateau—at Piper's Creek, about 5,700 feet above sea-level.

This species does not differ so much as might naturally have been expected from the original species of the genus, *Phreatoicus typicus*, a blind species found in wells in Canterbury, New Zealand. It is distinguished from that species however by the possession of eyes, by the colour, the much shorter lower antennæ and by a few other points in the surface of the body, the setæ, &c.

I have given this brief diagnosis because I quite agree with the remark that Brooks makes in his "Report on the 'Challenger' Stomatopoda" to the effect that it is desirable that a brief diagnosis of every new species should be given, although this should be supplemented wherever possible by a much fuller description giving the points in which it resembles other species as well as those in which it differs from them. I therefore proceed now to a detailed description of the various parts of the animal.

Body, (Plate xxiii., fig. 1.)—The length of the body is usually about half an inch, (12·5 mm.). It appears from the specimens that I have examined, that the female is slightly smaller than the male. The body is broadest at the third segment of the pereion and thence the breadth gradually decreases posteriorly, the pleon being somewhat laterally compressed. The depth of the body in the pereion is about equal to the breadth, but in the pleon, owing to the pleura being produced downwards, the depth is about twice the breadth. The dorsal surface is regularly rounded and very convex, the ventral surface of the pereion is almost flat so that the pereion is pretty regularly sub-cylindrical; the pleon presents the appearance of a semi-cylinder laterally flattened.

Head, (Plate xxiii., fig. 1.)—The dorsal surface of the head is very convex and curves downwards anteriorly making the outline as seen in a lateral view subtriangular. The anterior margin is deeply emarginate in the centre behind the bases of the superior antennæ. A clearly marked depression runs across the dorsal surface near the posterior margin and extends down the sides, running out into the posterior margin of the head. This mark reminds one of the similar depressed mark found on the head in many species of Idotea. The inferior margin is nearly straight, the notch serving for the articulation of the base of the mandible being small and shallow, and by no means so distinct as in *Asellus aquaticus* as described and figured by Sars.* In front of the eye and a little below it is a deep cleft in the anterior margin of the head, and a slight depression extends backwards from this cleft below the eye.

Eyes.—The eyes are situated laterally on the portion of the head which is slightly produced on each side at the bases of the antennæ. They are of moderate size, round in shape and consist of about 20 lenses arranged fairly regularly in circular rows and separated from one another by distances about equal to the diameter of the lenses.

Pereion, (Plate xxiii., fig. 1.)—The first segment of the pereion is closely attached to the head and appears to be capable of little or no independent motion, though the division mark between the two is very distinct. It is worth while to recall the fact that this is also the case with some species of *Idotea*, in some of which as *Idotea elongata*, Miers, the union of the head with the first segment of the pereion has gone so far that the line of division is almost obliterated. The head and first segment of the pereion are confluent also in *Apseudes* and in *Tanais.* When viewed from above the first segment is seen to be very short (narrow) in the centre, and to have the anterior and posterior margins both concave for the reception of the head and second segment of the pereion respectively. In side view the segment widens inferiorly and is somewhat produced anteriorly so as to impinge closely upon the head.

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* Crustacés d'eau douce de Norvège, p. 94, pl. viii., fig. 9.

The second, third, and fourth segments of the pereion are all about equal in length, being about three times as long as the first in the centre. They are of the same length throughout from side to side. The inferior margins are slightly concave in the centre for the reception of the *basi* of the legs (*epimera*) and have the anterior angle slightly produced and tipped with setæ while the posterior angle is regularly rounded. (See Plate xxiii., fig. 1, and also Plate xxv., fig. 4).

The fifth, sixth and seventh segments are similar to one another, the fifth being somewhat shorter than the fourth, and the sixth and seventh each shorter than the preceding segment. The epimera extend along almost the whole of the inferior margins and fit into rather deep triangular emarginations; both the anterior and posterior angles of the margins are tipped with setæ (see Plate xxv., fig. 5).

Epimera.—The first to fourth epimera inclusive are all similar in form, and consist of two lobes separated by a distinct cleft reaching upwards from the inferior margin more than half way to the upper margin. The epimeron of the first segment is rather deeper than those of the other three, in the first and second the two lobes of the epimera are of about equal size, in the third and fourth the anterior lobe is larger than the posterior. The margins of the epimera are free from setæ. (Plate xxv., fig. 4.)

The epimera of the fifth, sixth, and seventh segments are all similar and are triangular in shape fitting into a triangular emargination in the inferior margins of the segments. The posterior angle is produced a little and is tipped with three or four setæ, while the anterior angle is somewhat rounded and bears no setæ. There are usually two or three short setæ on the surface of the epimera. (Plate xxv., fig. 5.)

Pleon.—The first segment of the pleon is nearly as long as the seventh segment of the pereion in the centre of the dorsal surface, but gradually narrows somewhat inferiorly. It extends downwards slightly beyond the epimeron of the seventh segment of pereion and has the lower margin regularly rounded. The second, third, fourth, and fifth segments are similar, slightly longer dorsally and not narrowing inferiorly and they are produced downwards considerably further than the first segment. The sides of the segments *(pleura)* are thus fully as well developed as in any of the Amphipoda, and form, as in the Amphipoda, a lateral protection for the pleopoda. The body part proper in the fifth segment is separated from the pleuron by a slight depression. The sixth segment and the telson appear completely coalesced, forming a tail piece regularly convex above, curving posteriorly as well as from side to side; posteriorly it ends in a small narrow projection tipped with stiff setæ. From the upper corner of the articulation of the uropoda with the segment a short ridge bordered with setæ extends anteriorly and upwards about half way to the anterior margin of the segment. The inferior and posterior margins of the first to fifth segments of pleon (inclusive) are regularly fringed with long setæ, thickly set on the inferior margin but more sparsely placed on the posterior margin. On the inferior margin of the sixth segment the corresponding setæ (about 15 or 16 in number) are short and stout, almost spiniform, most of them bear 4 or 5 pectinations on the posterior edge toward the end of the setæ. The projections at the end of the tail piece are thickly covered with setæ of various sizes, some of them thick and spiniform.

Surface of body.—In the pereion the surface has a crinkled appearance caused by numerous shallow depressions separated by small narrow ridges; the first segment is smoother than the others and the surface of the head is also smooth. The surface of the pleon with the exception, to some extent, of the dorsal surface is smooth. In the pereion there are a few setæ partially arranged in tufts scattered about on the dorsal surface, and the inferior angles both of the segments and of the epimera usually bear a few short setæ. In the pleon, especially in the posterior segments, the dorsal surface is covered with a thick fur of short setæ with some longer scattered setæ as in the pereion, but more numerous. The long setæ on the margins of the segments of the pleon have been already mentioned.

The ground tint of the colour is a light brown and is seen in the appendages, but in the body this ground tint is almost covered with marbled markings of a much darker brown, the lighter colour showing up in more or less rounded patches on the head and here and there on the segments of the pereion. The lateral portions of the pleon are usually darker than the other parts of the body and of a uniform slaty colour. This colour is probably protective—Mr. Helms notes that the animals looked exceedingly like the surrounding earth.

Upper antenna. (Plate xxiii., fig. 2.)—The upper antenna is short, scarcely reaching to the end of the peduncle of the lower antenna, the peduncle apparently consists of three joints, but is not clearly distinguishable from the flagellum. The first joint is partially hidden by the head, it is longer and broader than the second joint, which is of about the same length as the third, but broader. The flagellum consists of from 5 to 7 joints, the proximal joints usually short, the others longer and swollen, this being most noticeable in the third and fourth joints from the end; the terminal joint is very small and is tipped with a few setæ. The swelling of the terminal joints is chiefly confined to the chitinous integument, the central portion containing the muscles &c. not being similarly swollen. The setæ on the antenna are few and small; there are a few on the second and third joints of the peduncle and on some of the joints of the flagellum. On the last four joints of the flagellum are "auditory cilia," one or two on each joint. These are very small but are of the usual shape being similar to those of *Asellus aquaticus* as figured by Sars.*

Lower antenna. (Plate xxiii., fig. 3.)—The peduncle consists of five joints and is considerably shorter than the flagellum. The first joint is short, the second, third, and fourth, are subequal in length, the fifth about half as long again as the fourth, but narrower; the third is rounded above and bears two small tufts of setæ, small tufts are also present on the fourth and fifth joints. The first joint of the flagellum is longer than the succeeding, the next three or four are usually short, the others subequal in length but gradually becoming narrower; towards the end they also increase a little in length. Each joint bears one or two small setæ above and below at the distal end.

The *upper lip* (Plate xxiii., fig. 4) is large and strong, regularly rounded distally, the centre being slightly produced. It bears a number of short setæ thickly set together and converging towards the centre of the distal margin.

The *mandibles* (Plate xxiii., figs. 5 and 5*a*) are large and powerful. In a side view of the head the basal joint can be easily seen extending along the anterior portion of the lower margin of the head; just below the base of the lower antenna it gives off the three-jointed palp which extends anteriorly beneath the antennæ, from this point the basal portion of the mandibles extends downwards and forwards and curves inwards to form the cutting edge. From the inner surface arises the large and powerful molar tubercle which extends obliquely upwards and inwards almost at right angles to the portion of the mandible from which it springs, until it reaches the median line and meets the molar tubercle of the other side. The two mandibles are of the same size and general appearance but differ in a few details. It will be convenient to describe the left mandible first.

The cutting edge of the left mandible consists of two separate processes one inside the other; the outer one consists of four sharp strong teeth, brown in colour, and the inner one of three similar teeth. Figure 5*a* of plate xxiii., shows the ends of these two processes as seen from the inside. Within these two processes is another, the chitinous integument of which is less strong and thickened; it is rather slender but expands somewhat distally and extends inwards to the median line so that the end of it is in a line with the cutting edge of the mandible and the end of the molar tubercle; the end is crowned with about 15 to 20 sharp strong setæ which project radially from the end. Between the base of this process and that of the molar tubercle are four or five plumose or pectinated setæ nearly as long as the last mentioned

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* Crustacés d'eau douce de Norvège, plate viii., fig. 19.

process. The molar tubercle is nearly circular in section and owing to the curving of the basal portion of the mandible is of considerable length, the extremity is square-truncate and is thickly covered with short setæ arranged in numerous rows running more or less parallel to one another across the end. Owing to the cutting edge of the mandibles projecting in one direction and the molar tubercle in another it is difficult to make a good drawing of them, to show all the parts and give a good idea of the arrangement of them. Figure 5 of plate xxiii., shows the left mandible as seen from above and a little from within so as to bring the teeth of the cutting edge into view. This part of the mandible projects downwards through the plane of the paper, while the molar tubercle extends obliquely upwards and is somewhat foreshortened in the drawing.

The right mandible differs from the description already given in having no second or accessory cutting edge—in this respect resembling *Asellus aquaticus.* The next process crowned with strong setæ is present but appears to have the end narrower so that the setæ are closer together and form two rows, one projecting on each side; the molar tubercle has the extremity oblique instead of square-truncate as in the left mandible.

The mandibular palp is the same in both mandibles. It consists of three joints, the first is short being not much longer than broad, on the outer edge towards the end it bears a number of setæ and on the basal part of the mandible just posterior to the articulation of the palp is a small group of three setæ. The second joint of the palp is about twice as long as broad, towards the distal end it bears several rather long setæ in groups, some being on the outer margin and others on the under surface. The third joint is about two-thirds as long as the second, it is a little narrowed at the base and narrows also distally. The upper margin is rounded and free from setæ, the under surface bears a double row of setæ which gradually increase in length towards the distal end, the last two or three being considerably longer than the others and about as long as the joint itself. The setæ in one row bear projecting teeth on one side, those in the other appear simple.

From the description here given it will be seen that the mandibles are not very different in form from those of *Asellus aquaticus* as described by Sars, the chief difference being that the setæ between the cutting edge of the base of the molar tubercle are placed on a raised base so as to form a distinct process, and are moreover somewhat different in character from those found in *Asellus.*

The *lower lip* (Plate xxiii., fig. 6) consists of two rounded lobes somewhat widely separated distally and connected at the base by a flexible membrane fringed at the margin, and generally seen folded upon itself or puckered when the lip is removed for examination. Each lobe is somewhat oblong in shape with the distal angles rounded off and densely fringed with setæ, all more or less directed inwards towards the median line.

The *first maxilla* (Plate xxiii., fig. 7) consists of two parts, the outer part is longer and broader than the inner, its total length is nearly four times the greatest breadth, the outer edge is curved so that the distal half is directed somewhat inwards to the median line. On the end it bears about 10 to 12 short stout spiniform setæ arranged mainly in two rows, the outer setæ are the largest, the others decreasing in size inwards, some of the smaller are minutely denticulated on the inner side near the middle. Both the inner and outer margins of the outer portion of the maxilla bear a number of very fine hairs, and near the inner distal angle one or two delicately plumose setæ arise a little below the base of the spiniform teeth.

The inner portion of the maxilla is only about half as long as the outer, and it is also narrower. It curves somewhat inwards and bears fine hairs on both margins. The extremity bears four or five large setæ somewhat distant from one another, each being densely but finely plumose in the distal half. In addition to these there are also two simple setæ at the base of the plumose setæ, one at the outer distal angle, and the other at the centre of the surface of the joint.

In describing the first maxilla of *Ianthe speciosa*, Bovallius speaks of the two portions similar to those just described, as the *exopodite* and *endopodite* respectively.* The appendage is undoubtedly difficult of interpretation, but from Boas's comparative researches it appears more probable that these two portions represent the internal and external *laciniæ* arising from the basos and ischios respectively, the remainder of the typical limb being lost.†

The *second maxilla* (Plate xxiv., fig. 1) consists of a basal portion prolonged at its inner distal angle into a long rounded lobe, and two lobes external to this articulating with the basal portion. The inner margin of the base is very slightly concave, and is supplied throughout its whole length with a thick fringe of long setæ, these setæ are arranged in a distinct line which at the end leaves the margin and is continued for a short distance along the surface of the inner fixed lobe. The rounded end of the lobe is also fringed with setæ, the innermost of which are pectinated, while those in the row along the inner margin are simple.

The two articulated lobes are of about the same size, sub-oblong in outline, curving slightly inwards and with the ends obliquely

* "*Ianthe*, a new genus of Isopoda," Bihang. Till. K. Svenska Vet. Akad. Handlingar. Band 6, No. 4, p. 7.

† See Parker—"The skeleton of the New Zealand Crayfishes." (Studies in Biology for New Zealand Students. No. 4) p. 21; also Boas—"Studien über die Verwandtschaftsbeziehungen der Malakostraken."

truncate—sloping inwards. The end of each is supplied with from 12 to 16 long setæ, nearly as long as the lobes themselves. These setæ curve inwards and have the inner margins supplied with short pectinations which project at right angles to the setæ. In the outer setæ on each lobe the pectinations are fine and minute, but in the inner setæ they are much stouter and rounded at the end. There is a tuft of fine setæ on the outer side of the basal portion, at the point where the outer lobe articulates with it. The outer lobe is slightly concave and overlaps and partially encloses the middle lobe, which in its turn overlaps the lobe formed by the prolongation of the basal portion. This appendage, like the first maxilla is difficult of interpretation, but it appears probably, according to the authorities already quoted, that the innermost lobe represents the internal *lacinia* arising from the coxos, and the two articulated lobes the internal *laciniæ* arising from the basos.

The *maxillipedes* (Plate xxiv., figs. 2, 3, and 4) are large and well developed and cover the greater part of the under surface of the mouth parts. The basal joint *(coxos)* is well developed and is distinctly marked off from the succeeding joint the *basos.* It is broader than long, and from its outer distal margin arises a large flat plate representing the *epipodite.* This fits closely on the under surface of the head on each side covering and protecting the other mouth parts ; it extends as far forwards as the mandibles. In outline it is broadly elliptical, about half as long again as broad ; the outer edge bears about eight short setæ sparsely arranged. The basos is more than twice as long as broad, rectangular, inner margin quite straight, outer margin curving slightly outwards towards the distal end. From the inner margin a flat plate projects inwards at right angles to the surface of the maxillipede and this is produced distally a little beyond the end of the inner side of the ischios. Only the distal end of this plate can be seen when the maxillipede is viewed from below (*i.e.* from without) but the whole can be readily seen if it is viewed from above (*i.e.* from within), and the plate is bent back upon the rest of the maxillipede. This view is shown in Plate xxiv., fig. 3. If the plate were left in its natural position when the maxillipede is viewed directly from above, only the inner edge of the plate would be seen. The end of this plate is truncate and thickly fringed with stout setæ, some of them plumose, the inner surface is also thickly covered with setæ, some of them simple, but the others along the margin long and densely plumose. Besides these setæ there are on the outer edge of its distal portion three strong curved setæ hooked at the end. These appear to hook into the corresponding setæ on the other side, and to keep the two maxillipedes closely together.

From the outer distal angle of the basos (on its outer surface) arise four very long setæ directed inwards and reaching nearly to the end of the plate already described. The *ischios* is very short, transverse, and bears four or five setæ at the outer distal angle and two others at the inner distal angle. The *meros* is subtriangular, having the outer angle produced nearly to the end of the carpus, while the inner edge is only as long as that of the ischios; the inner distal angle is rounded and bears about 6 or 7 setæ, the outer distal portion of the joint is somewhat concave for the reception of the carpus, and has the margin fringed with long setæ. The *carpus* is somewhat sunk in the meros, it is narrowed at the base but widens distally and has the end truncate; the inner margin is densely fringed with two or three irregular rows of setæ and there is a small tuft at the outer distal angle. The *propodos* is elliptical, widest towards the distal end; the inner margin, like that of the carpus, is fringed with setæ, the outer margin bears six long setæ towards the distal end. The *dactylos* is broad and elliptical and arises from a slight concavity at the end of the propodos; the whole of the inner margin and the distal half of the outer margin are fringed with long setæ, those at the apex being the longest and also the stoutest.

From the description given above it will be seen that the maxillipedes of *Phreatoicus* bear a close general resemblance to those of *Asellus aquaticus*.

The *first thoracic leg* (or *first gnathopod*). (Plate xxiv., figs. 5 and 5*a*.)—This appendage has the dactylos bent back upon the enlarged propodos so as to form a powerful subchelate hand similar to that found in many *Amphipoda*. This form of limb is not so common among the *Isopoda*, but is found in several genera such as *Anthura*, *Asellus* &c. The *basos* is strong, about two and a half times as long as the greatest breadth, somewhat constricted near the base; on the anterior margin is a row of 5 or 6 long simple setæ, and there is a tuft of similar setæ at the postero-distal angle. The *ischios* is rather more than half as long as the basos, and is subrectangular, slightly narrowed proximally; there is a tuft of long simple setæ about the middle of the anterior margin and two smaller tufts on the posterior margin. The *meros* is subtriangular and is produced anteriorly and distally into a rounded lobe partially surrounding the carpus and fringed all round with long simple setæ, it also bears a tuft on the posterior margin. The *carpus* is also subtriangular and has the posterior margin supplied with a fringe of long setæ, sometimes indistinctly separated into two tufts, the junction of the carpus with the propodos is oblique. The *propodos* is very large and ovate, the anterior margin strongly convex with a small tuft of setæ at the base of the dactylos and another placed more proximally; the palm is oblique, somewhat convex and occupies about two-thirds of the posterior margin but is not clearly defined; it is armed with a row of stout and very acute spiniform setæ, and also bears a row of long simple setæ, three or four tufts of setæ are situated on the surface of the propodos near the palm. The *dactylos* is stout and fits closely on to the palm, there is a row of about 7 or 8 fine setæ along the inner margin and a small tuft towards the end of the outer margin; the extremity is indistinctly separated from the rest of the dactylos and bears the terminal unguis and on the inner margin a small secondary tooth.

The description just given and the figures 5 and *5a* of Plate xxiv. apply to the first thoracic leg of a fully grown male. In the female and probably also in young male the limb is of the same general shape, but the subchelate hand is less strongly developed, the propodos being much less swollen.

The *second thoracic leg (second gnathopod)* (See Plate xxv., fig. 1.) has the *basos* and *ischios* similar to those of the first leg but the fringe of setæ on the anterior margin of the basos is much longer and contains about fifteen setæ, and the tuft on the anterior margin of the ischios contains much stouter setæ; the *meros* is subtriangular, narrow at the base but does not overlap the carpus, the posterior edge bears about 6 or 7 stout setæ and a number of others more slender, and there are similar tufts at the middle of the anterior margin and at the antero-distal angle. The *carpus* is not so short and triangular as in the first leg, the anterior margin is rather convex and bears a tuft of fine setæ at the antero-distal angle, the posterior margin is straight and bears six stout setæ increasing in length distally. The *propodos* is subrectangular rather more than twice as long as broad, and is somewhat longer than the carpus; the anterior margin is slightly curved and bears a few setæ chiefly at the base of the dactylos, the posterior margin is straight and bears 5 or 6 stout spiniform setæ and a few slender ones. The dactylos is more than half as long as the propodos and is similar to that of the first pair of legs except that it is smaller and bears fewer setæ upon it. Fig. 1 of Plate xxv. represents the *third* thoracic leg, but will do equally well for the *second*.

The *third thoracic leg (first pereiopod)* (Plate xxv., fig. 1) is similar in all respects to the second, and is of about the same size.

The *fourth thoracic leg (second pereiopod)* (Plate xxv., fig. 2) of the male is rather shorter than the two preceding legs and differs from them in a few small details. The basos and ischios are quite similar to those of the second and third legs, and are nearly as large; the meros and carpus are similar but are shorter and stouter in proportion; the propodos is also stouter and has the anterior margin strongly convex, the posterior margin is very short and bears two very stout spiniform setæ placed side by side and defining a slightly concave palm; the dactylos is strongly curved and bends back upon these two setæ so as to form a powerful claw. It is only in the male that the fourth leg is thus modified, in the female it does not differ appreciably from the two preceding legs.

The four pairs of legs now described form an anterior series, differing considerably in form from the remaining three which are similar to one another and form a posterior series, the members of which increase in size posteriorly.

The *fifth thoracic leg (third pereiopod)* (See Plate xxv., fig. 3) is slightly longer than the fourth. The *basos* is produced posteriorly into a thin flat expansion with convex margin fringed with long setæ—much in the same way as in many Amphipoda. The *ischios* is large, about two thirds as long as the basos and is subrectangular, though expanding somewhat distally; it bears tufts of stout setæ on both margins. The *meros*, *carpus*, and *propodos* are all similar and subrectangular, but each is longer and narrower than the preceding, they all bear numerous tufts of stout spiniform setæ on both margins. The meros has the postero-distal angle slightly produced as in many Amphipoda.

The *sixth* and *seventh thoracic legs (fourth* and *fifth pereiopoda)* are similar to the fifth but are much larger, the various joints are all similar to the corresponding joints of the fifth leg, but they bear a greater number of setæ, and the setæ themselves are stouter, the basos has the posterior margin more produced and more convex and the dactylos is longer and more slender.

Figure 3 of Plate xxv., shows the last (seventh) leg, but will do almost equally well to represent the general appearance of the fifth and sixth.

It is worthy of note that although these thoracic legs are very Amphipodan-like in general appearance, they all have the ischios large and well developed instead of being small and very short as in almost all the Amphipoda, and that although the first pair of legs has a well developed subchelate hand, the second pair is quite simple, while as a general rule both pairs are more or less subchelate in the Amphipoda. The resemblance of these legs to those of the Amphipoda is therefore more superficial than real, and a comparison of my figures with those given by Sars of *Asellus aquaticus* will show that there is a close general resemblance between the two.

I have called all these legs "thoracic legs" instead of speaking of the first two pairs as "gnathopoda" and the remainder as "pereiopoda" as is usually done in the Amphipoda. This would have made an arbitrary and misleading distinction between the second and third pairs which are precisely similar to each other, while it would probably have led to confusion if I had spoken of them all as "pereiopoda," as those of the last pair would then be the *seventh* pereiopoda, while if the plan adopted with the Amphipoda were adhered to they would be the *fifth* pereiopoda. It seems to me a pity however that the term "pereiopoda" has not been applied to all the appendages of the pereion both in the Amphipoda and Isopoda, leaving the term "gnathopoda" a special one to be used where necessary instead of "first" or "second pereiopoda."

The *first pair of pleopoda* (Plate xxvi., fig. 1) like the following pairs appears to be branchial in function and is not specialized to form an operculum as in *Anthura, Janira*, &c. The basal portion, probably representing the coxos and basos, is subrectangular and has the outer edge fringed with long setæ, while the inner edge bears a few long setæ chiefly towards the distal end. The *endopodite* is shorter than the exopodite, irregularly elliptical in form, margins quite free from setæ and with a shallow emargination at the extremity. The *exopodite* has the inner margin nearly straight and the outer one slightly curved and converging distally towards the inner so that the joint is widest towards the base and narrows towards the extremity. The whole margin of the exopodite is bordered with setæ, those near the end longest and plumose, the others simple.

The *second pleopoda* (Plate xxvi., fig. 2). In the male these appendages differ from those of the female in having a part of the endopodite specially modified to form a "penial filament." The whole appendage is considerably larger than the first pleopod. The basal portion is subrectangular and is almost completely filled with the powerful muscles which move the endopodite and exopodite. The *endopodite* is somewhat swollen near the base and gives off on the inner side a long narrow semi-cylindrical process (the "penial filament") which is articulated to the other portion of the endopodite, and is moved by powerful muscles situated in the swollen portion of the base. This process extends beyond the end of the endopodite as far as the extremity of the first joint of the exopodite; it curves slightly outwards and appears to be hollowed out along the outer side so as to form a half tube; at the end it bears a few short stout setæ. Most probably this process acts as an accessory copulatory organ. A somewhat similar organ has been described and figured by Bovallius in *Ianthe speciosa*.* Beddard has described organs named by him "penial filaments" in *Ichnosoma bacilloides* and in *Acanthomunna proteus*, which appear to be similar in function to the one found in *Phreatoicus australis*† In *Asellus aquaticus*, as described by Sars, the whole of the second pleopod seems to be modified in a very different way for reproductive purposes.‡ In some genera, such as *Ianthe*, *Jæra*, and apparently also in *Ichnosoma* and *Acanthomunna* the first pair of pleopoda (as well as the second) is modified to form a male organ, but this is not the case with *Phreatoicus*.

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* Bihang. Till. K. Svenska Vet. Akad. Handlingar Band 6, No. 4, p. 10, plate iii., figs. 30 and 31.

† Report of the "Challenger" Isopoda, Part II., p. 46, plate vi., fig. 10. and p. 49, plate xii., fig. 13.

‡ Crustacés d'eau douce de Norvège, p. 101, pl. x., figs. 6 and 7.

The remaining portion of the second pleopod is branchial in function. The rest of the endopodite is similar to that of the first pleopod, margins free from setæ and with an emargination at the distal end. The *exopodite* consists of two joints, the first one sub-elliptical with a rounded lobe extending back along the outer margin of the base and partially covering it, both margins are fringed with setæ, those near the proximal end simple, but those at the distal end very long and densely plumose ; the second joint is small, elliptical, and has the margin fringed with twelve very long plumose setæ.

The second pleopoda in the female differ from those of the male only in the absence of the "penial filament," as the result of which the base of the endopodite is not swollen and does not contain the powerful muscles found in the male.

The *third pleopoda* (Plate xxvi., fig. 3) are similar to the second pleopoda (of the female) except that the exopodite has the first joint more narrowed distally. Arising from the outer margin of the basal portion (the protopodite) is an ovate appendage which perhaps represents the *epipodite.* The margins are fringed with long simple setæ and the integument appears thin and delicate so that this portion probably is branchial like the rest of the pleopod. I have not found this appendage in the first and second pairs of pleopoda.

The *fourth* and *fifth pleopoda* (Plate xxvi., fig. 4) are similar in all respects to the third, but the endopodite gradually increases in size as compared with the exopodite, till in the fifth pleopod it reaches to the end or somewhat beyond the end of the first joint of the exopodite.*

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* Attached to the pleopoda and apparently partially imbedded in the integument, I have frequently found a number of oval or egg-shaped bodies, the real nature of which I have not been able to ascertain. They may perhaps be algæ of some kind. Beddard found a "number of green bodies of varying form" in the interior of the thoracic appendages of *Astrurus crucicauda,* which he took to be parasitic algæ. He also refers to the fact that parasitic Infusorians (*Anoplophyra circulans,* Balbrani, Recueil Zool. Suisse, ii., 1885, p. 277) are known from the appendages of *Asellus.* [See 'Report of the "Challenger" Isopoda,' Part II., p. 38, footnote] In one of the specimens of *Phreatoicus australis* I found in some of the thoracic legs a number of oval bodies, which I at first thought were the same as those found on the pleopoda, but they differ in some points and are perhaps different—possibly they are infusorians of some kind. They are not quite 1/50 inch in length, elliptical, about half as broad as long, surface smooth, and they have been deeply stained by the borax-carmine with which I stained the appendages before mounting them, the thick outer portion or integument has not been stained so deeply as the inside. The bodies found on the pleopoda appear to be on the surface and partially imbedded in the integument ; they are of about the same size but have scarcely been stained by the borax-carmine and appear yellowish and have the surface much wrinkled ; some of them are shown in position in Plate xxvi., fig. 4 at *a*, and an enlarged view of one

So far as my knowledge goes, the division of the exopodite of all the pleopoda except the first, into two distinct joints is very unusual in the *Isopoda;* the plate attached to the outer margin of the base (epipodite ?) also appears to be peculiar to this genus

The *Uropoda* (Plate xxv., fig. 6) are well developed and extend somewhat beyond the extremity of the pleon. The basal joint is as long as the longer of the two rami and is very stout; on the under side near the base it bears two groups of stout setæ, each group containing about six or seven. The upper surface is broad and slightly concave, each of the edges being supplied with a row of stout spiniform setæ, which are more numerous on the outer than on the inner edge, and are largest towards the distal end. At the end of the base below the articulation of the outer branch are two very thick setæ with a few pectinations at the end on the upper side only. Many of the other stout setæ on the uropoda are pectinated in the same way though not to the same extent.

The two rami are similar, subcylindrical in section, tapering distally and curving slightly upwards. The inner is slightly the longer, both bear stout setæ and a larger number of fine setæ or hairs arranged in groups chiefly on the upper surface; the ends of each are free from setæ.

Sexual differences.—Of the specimens I have examined, nearly two-thirds were undoubtedly males, all having the external male organs present at the base of the seventh pair of thoracic legs. One of these is shown in Plate xxvi., fig. 6. The remainder of the specimens were females. They are similar in general appearance to the males but are slightly smaller, the subchelate hand of the first pair of thoracic legs is less strongly developed, the fourth pair of thoracic legs does not present the special modification found in the male, and the second pair of pleopoda are of normal form. None of the specimens examined bore eggs or young, but some had what appeared to be small brood plates already developed on the bases of the legs of the second, third and fourth segments of the pereion.

Position of Phreatoicus among the Isopoda.

When I originally described the genus Phreatoicus in 1882 I

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in fig. 5. Besides these bodies I have found on other pleopoda great numbers of other bodies which appear like empty spherical cases with a small oblong or elliptical opening—many of them being broken or imperfect. I have not the least idea what they may be, but they are so numerous on the pleopoda of some specimens that I thought it best to mention them. They appear merely to rest on the surface of the pleopoda but whether their presence there is accidental or not I cannot say. A small stalked Infusorian *(Vorticella ?)* is also found in great abundance attached to the hairs of the pleopoda, three or four individuals usually branching from the one stalk.

placed it under the Isopoda, and pointed out various separate resemblances to the *Idoteidæ*, the *Anthuridæ*, and the *Tanaidæ*, and also drew attention to the several superficial resemblances to the Amphipoda, but after doing this I left the exact position of the genus among the other Isopoda an open question for the time.* When preparing the "Critical List of the Crustacea Malacostraca of New Zealand," Mr. Thompson, judging from the general appearance (he had not had an opportunity of examining specimens), was inclined to place the genus under the Amphipoda, an opinion with which I did not agree, and accordingly it was arranged that it should be placed between the Amphipoda and the Isopoda under a separate heading with the following note:—"The systematic "position of this singular Crustacean is doubtful. In general "appearance I was inclined to place it among the *Amphipoda*, but "from the fact of the first five pairs of *pleopoda* acting as branchial "organs, and from the absence of any such organs attached to "the *pereion*, Mr. Chilton places it among the *Isopoda*.—G. M. T."†

Unfortunately however the separate heading was omitted by some error, probably on the part of the printer, and the genus therefore appears under the last family of the Amphipoda, viz.—the *Platyscelidæ*, as though it belonged to that family. It is no wonder therefore that the Rev. T. R. R. Stebbing in his notice of the "Critical List" says, in speaking of *Phreatoicus*—"I do not know what are the special reasons for classing it among the Platyscelidæ." He also says—"The list [*i.e.* our 'Critical List'] continues with—'*Suborder II.* Isopoda. *Tribe I.* Anisopoda. *Fam. I.* Tanaidæ,' and probably the affinities of *Phreatoicus* will eventually prove to be rather with the Tanaidæ than with the Hyperina."‡ In another reference to the species *Phreatoicus typicus* Mr. Stebbing calls it "a singular well-shrimp, of a new genus and species, which appears to be an Isopod with some remarkable Amphipodan affinities."§

The fuller examination that I have now made in describing the new species *Phreatoicus australis* has convinced me that the genus has few *affinities* to the Amphipoda, though it presents several *resemblances* to them, and that these resemblances are more or less superficial. They are briefly (1) The body, especially in the pleon, is somewhat laterally compressed. (2) The pleura of the segments of the pleon are produced downwards so as to protect the pleopoda on either side. (3) The legs of the pereion consist of an anterior series of *four*, and a posterior series of *three*. (4) The general appearance of the legs and also of the uropoda is not

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* See Trans. New Zealand Institute, XV., p. 91.

† Transactions New Zealand Institute, XVIII., p. 151.

‡ Report on the "Challenger" Amphipoda, p. 587.

§ Loc. cit., p. 543.

unlike that common among the Amphipoda. (5) The pleon is formed of six separate segments and is better developed than most Isopods.

I think these are all the points in which *Phreatoicus* specially resembles the Amphipoda and an examination of them shews that none is of any particular importance in its bearing on the systematic position of the genus. Most of the Isopoda are, it is true, more or less dorso-ventrally compressed, and I do not now recollect any one in which there is any lateral compression as in *Phreatoicus*, but here the lateral compression is not great and is chiefly confined to the pleon where the downward prolongation of the pleura is no doubt a special adaptation for the protection of the pleopoda and may very well have arisen quite independently of the similar adaptation in the Amphipoda. The pereion of *Phreatoicus* is almost sub-cylindrical and thus resembles *Anthura*, *Paranthura*, and some of the species of *Idotea*, where there is no dorso-ventral compression. On the other hand there are genera among the Amphipoda in which the body is more or less cylindrical and shows no lateral compression *(e.g. Corophium*, *Haplocheira* &c.,) and in some such as *Icilius* and *Iphigenia* the body is very much flattened as in the Isopoda.

The division of the appendages of the pereion into an anterior and a posterior series has been used by Dana in separating the *Anisopoda* from the typical *Isopoda* and the possession of an anterior series of *four*, and a posterior series of *three* is by no means a special Amphipodan character. It is, moreover, probably of little importance from a systematic point of view, seeing that it is found in such widely different genera as *Phreatoicus*, *Stenetrium*, *Munnopsis*, *Tanais*, and *Arcturus*, and its adoption as the chief bond of connection between a number of forms results, as Mr. Haswell has pointed out, in "an extremely artificial arrangement."* In connection with the fourth point, the general Amphipodan appearance of the legs and the uropoda, I have already shown that this is more apparent than real, as the legs all have the *ischios* well developed and fairly long instead of very short as in most Amphipoda. The uropoda again present no greater resemblance to the Amphipoda than to several of the Isopoda such as *Asellus*.

In the possession of an abdomen formed of six distinct and well developed segments *Phreatoicus* certainly differs from the greater number of the Isopoda, but this character is also possessed by the *Apseudidæ* and the *Tanaidæ*, which are usually classed among the Isopoda, and by *Limnoria*, and also to a greater or less extent by many of the *Cymothoidæ* and *Oniscidæ* &c. On the other hand

* Revision of the Australian Isopoda, Proc. Linn. Soc., N.S.W., IX., part iv., p. 10.

although the segments of the pleon are generally separate and well developed in the Amphipoda, the latter never have all the first six pairs of pleopoda similar to one another and all branchial in character as in *Phreatoicus*, and this fact is of itself, in the absence of characters to the contrary, sufficient to show that *Phreatoicus* must be placed among the Isopoda and not under the Amphipoda.

Having now discussed the supposed Amphipodan affinities of *Phreatoicus*, and having come to the conclusion that they are by no means sufficient to remove it from the Isopoda, we have next to consider its affinities to other Isopoda. When originally describing the genus I briefly compared it with the *Tanaidæ*, the *Anthuridæ*, and the *Idoteidæ*, but did not at that time notice its affinities to the *Asellidæ*, although these are, as I hope to be able to show, greater than those with any of the other three groups.

The resemblance to the *Tanaidæ* is not great, and is confined to the more or less cylindrical form of the body, the direction of the legs and the possession of an abdomen of six distinct and well developed segments. All of these characters are however separately shared by other groups, and the differences between the *Tanaidæ* and *Phreatoicus* in other respects (which it is unnecessary to point out) are very great, so that we may safely conclude that there is no very close affinity between the two.

The resemblance to the *Anthuridæ* is somewhat closer. In addition to the general resemblance in the form of the body there is a fairly close resemblance in the legs, and the abdomen of the *Anthuridæ* though by no means so well developed as in *Phreatoicus* is sometimes composed of more or less distinct segments bearing pleopoda not very dissimilar. The mouth parts of the *Anthuridæ* are however very different, though in some cases they are no doubt specially modified to form an apparatus probably suctorial in function, and there are other differences quite sufficient to form a pretty wide gap between the *Anthuridæ* and *Phreatoicus*.

With the *Idoteidæ*, *Phreatoicus* agrees fairly well in the general shape of the body, in the antennæ and to a less extent in the mouth parts, except that the mandible has a well developed palp in *Phreatoicus*, but none in the species of the *Idoteidæ*. It is probable however that this should not be considered a very important point, as in the Amphipoda we have the mandibular palp present in widely separated genera while it is sometimes absent in others which are otherwise closely similar to genera in which the palp is present. Thus the old genus *Montagua*, Spence Bate, is considered by Stebbing to be divisible into *Stenothoë*, the species of which have no mandibular palp, and *Metopa* in which the palp is present.*

* Report on the "Challenger" Amphipoda, p. 293.

A much more important difference between *Phreatoicus* and the *Idoteidæ* is however to be found in the abdomen and particularly in the last pair of appendages—the uropoda. In *Phreatoicus* these are fairly normal in character and not very dissimilar from those found in *Asellus* and other genera, while in the *Idoteidæ* they are specially modified into flat subrectangular plates to cover the lower surface of the abdomen and to protect the pleopoda. In some species of the *Idoteidæ*, however, there is a rudimentary second ramus, showing that this plate is formed from the typical uropod consisting of a basal joint and two rami, the inner ramus being rudimentary or absent, and the formation of the protecting plate is probably a special modification of comparatively recent date. On the whole the affinities of *Phreatoicus* to the *Idoteidæ* may be considered to be somewhat greater than its affinities to the *Anthuridæ*. In the same way we might compare *Phreatoicus* with the *Arcturidæ*, a group that must be placed near the *Idoteidæ*.

When we come to compare *Phreatoicus* with the *Asellidæ* we see at once that the form of the body is very different from that usually found in the *Asellidæ*, but on examining in detail we find that there is a fairly close resemblance in many other respects. The head, antennæ and mouth parts are all in close agreement, except that the head is flattened in the *Asellidæ*; the resemblance in the mouth parts is on the whole very close and is somewhat striking, considering the great difference in the general appearance of the animal. I have been able to take Sars' description of the mouth parts in *Asellus aquaticus* as my guide in describing those of *Phreatoicus*, and to follow that guide very closely. All the legs and the uropoda are also closely similar, the resemblance in some of the legs being quite as close as that in the mouth parts. It is in the abdomen and the pleopoda that we find the greatest difference between the two. In the *Asellidæ* the abdomen is usually depressed and formed of a single piece, though traces of other segments are sometimes present, the pleopoda lie closely under the abdomen and are usually protected by a more or less perfect operculum formed of the first pair of pleopoda. In *Phreatoicus* the abdomen is not depressed but somewhat compressed laterally, the six segments are all separate and well developed, the pleopoda hang vertically downwards from the segments of the abdomen and there is no operculum, the pleopoda being exposed below though protected laterally by the pleura of the abdominal segments.

These differences in the abdomen are pretty considerable, but from the traces of separate segments found in some of the species of the *Asellidæ* it is quite clear that the ancestors of the *Asellidæ* possessed an abdomen of six separate segments, and that these have gradually coalesced to form a single plate just as we see the same process going on at the present time in the *Idoteidæ*, where some species have the abdomen composed of four or five separate segments, other species with only two or three segments, and others again, like *Idotea elongata*, with the abdomen formed of a single piece.* The development of an operculum from the first pair of pleopoda would naturally follow from the flattening of the abdomen which would leave the pleopoda much exposed below. Thus *Phreatoicus* appears to have preserved the fully developed abdomen which must have been possessed by the ancestors of the *Asellidæ*, while in the latter this has been specially modified in accordance with the general flattening of the body, which would render a long jointed abdomen unsuitable and a source of danger to the animal, especially by the exposure to which it would subject the pleopoda.

There is one genus—*Limnoria*—sometimes classed under the *Asellidæ*, which differs from them and resembles *Phreatoicus* in possessing an abdomen of six separate segments, the pleopoda also are unprotected. *Limnoria* however resembles the other *Asellidæ* in the flat depressed body, and the segments of the abdomen though separate are short, so that *Limnoria* may very well be looked upon as an intermediate link between *Phreatoicus* and the *Asellidæ*. The great difference between the two latter is caused by the fact that the body in the *Asellidæ* is flat and depressed, while it is somewhat compressed in *Phreatoicus*, and that consequently the *Asellidæ* are always represented as seen from above, while *Phreatoicus* is usually seen from the side. This difference in the form of the body though it gives quite a different appearance to the animal is probably not of very much importance from a systematic point of view, thus some of the species of *Idotea* differ very much in the shape of the body, and I think we must place *Phreatoicus* near to the *Asellidæ*, but forming a new family, the *Phreatoicidæ*, which bears to the *Asellidæ* much the same relation that the *Caprellidæ* do to the *Cyamidæ* among the Amphipoda. *Limnoria* will perhaps best be placed as a special subdivision of the *Asellidæ*, connecting them to some extent with the *Phreatoicidæ*.

I have not compared *Phreatoicus* with some other families of the Isopoda that it might well be compared with, such as, for intance, the *Ægidæ* and the *Sphaeromidæ*, but from what has been already said it will readily be seen that it possesses various characters in common with these as well as with those already considered inasmuch as it preserves to a large extent the typical characters of the Isopoda, and thus occupies a more or less central position, around which the other families may be grouped.

The relation of *Phreatoicus* to its nearest allies may be graphically represented by the following hypothetical genealogical tree:

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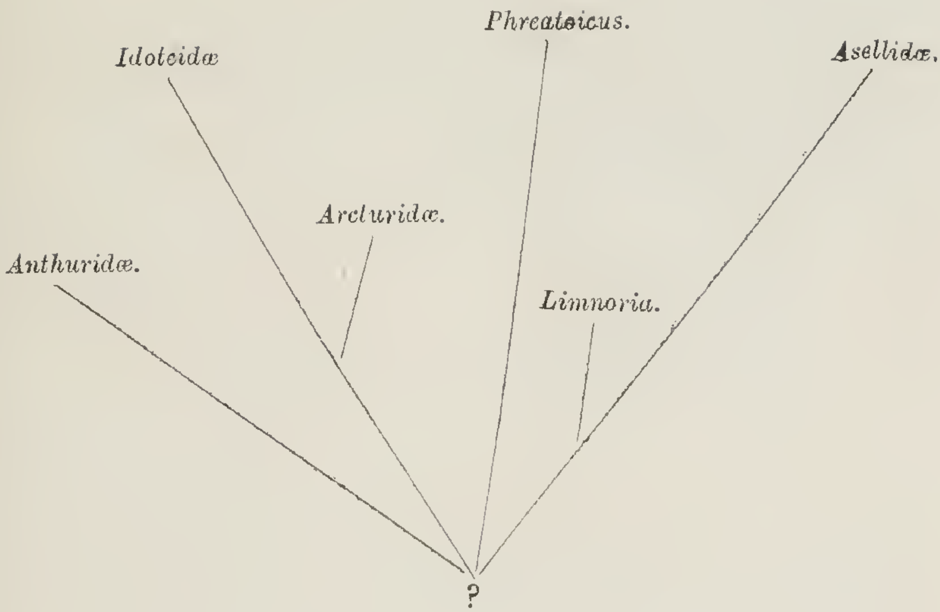
* See "Revision of the New Zealand Idoteidæ," Transactions N. Z. Inst., XXII., p. 199.



NOTES ON "ROCK-SHELTERS," OR "GIBBA-GUNYAHS," AT DEEWHY LAGOON.

By R. Etheridge, Junr.

Several fine "Rock-shelters" may be seen along the escarpment of Hawkesbury Sandstone forming the southern boundary of the hollow wherein lies the Deewhy Lagoon, between Manly and Narrabeen. Some of these were examined by Messrs. G. H. Barrow, R. Jenkins, and the Writer, and the following notes obtained :—

The Shelters are of the usual type seen throughout the Port Jackson District, recesses in the escarpment, overhung by thick, more or less tabular masses of rock, in some cases dry and habitable, in others wet and apparently never used by the Aborigines. The first examined lay at the south-east end of the escarpment, where the latter almost abuts on the swampy ground of the lagoon. The length was twenty-nine feet, depth sixteen feet, height from floor to ceiling four feet, the total height inclusive of the rock covering nine feet six inches. Interments did not appear to have been made in this Shelter, or if they had, we failed to discover any remains. From the regular and undisturbed condition of the hearth-earth, I think it more than probable that such had not been the case in this instance. The following section was laid bare on excavation :—

		ft.	in.
1.	Thin surface layer of black soil... ...	0	3
2.	Yellowish-white fire layer	0	9
3.	Black carbonized soil	1	0
4.	Second fire layer...	0	3
5.	Black soil, as before	1	0
6.	Third fire layer	0	6
7.	Black soil, as before	1	3
8.	Fourth fire layer	0	6
9.	Black soil, as before		
	Feet—	5	6

The black carbonaceous layers were of the usual kind found in these shelters, a mixture of earth, sand, humus, shells and shell-fragments, with an occasional fish or mammalian bone, and a few stones. The shells are the commoner species now living on the coast, more particularly those of an edible nature. The fire layers, of which we dug through four, without reaching the bottom of the shelter, consisted of a friable white, or yellowish-white, limey deposit, which, if at all dry, is most trying to the eyes when digging. The largest fire layer in lateral extent, and at the same time the thickest, was almost in the centre of the Shelter. This recess had clearly been long used by the Aborigines of the locality as a cooking place, and, it may be legitimately inferred, as one of residence also, for temporary periods perhaps considering their nomadic habits, but periods extending over many years.

A second Shelter some little distance along the escarpment to the west was next examined. This was seventy-four feet in length, twelve feet in depth, eight feet in height, with a total height from the floor to the top of the shelter rock of twelve feet. It was an unusually long and narrow retreat, and contained similar fire layers, although not to so great a depth as the first described. About nine inches below the surface soil we disinterred the partially complete skeleton of a young child, now set up in the Ethnological Hall of the Museum. As usual, the body had been protected by stone slabs placed more or less all round and above, but apparently not below it. The bones missing were those of the right hand, the left forearm and hand, the right foreleg bones, and both feet. The remainder were in a good state of preservation, and such of the teeth as are present are sound and very strong.

Beyond the position of the second Shelter the escarpment trends in a slightly north-west direction, and cuts the Manly-Pittwater Road. Between these points are a string of large Rock-shelters, and as the floors had been dug and explored by others we did not pay particular attention to them, but the nature of the soil thrown out clearly showed that they had also been put to the same use.

The constant traces of native occupation thus afforded by these Rock-shelters, seems to indicate that the population, from an aboriginal standpoint, was a fairly numerous one, due, doubtless, to the facilities afforded by the proximity of the lagoon for procuring fish, which we know formed a very large portion of the food of these blacks.

I think we may accept a general statement to the effect that the Aborigines of the Port Jackson coastal districts were Shelter dwellers to a greater or less extent, and for the matter of that, those of other districts where suitable conditions prevailed. Wherever escarpments of the Hawkesbury Sandstone are traced along the various inlets and arms of Port Jackson and the Hawkesbury River, these rocky recesses are met with, and the majority reveal traces of habitation in some form or another.

Caves have from the remotest historical periods of the world's history been the retreat of man, and this we see repeated in Australia, in a modified form it is true, within the historical period. Such habitations here, however, do not strictly conform to the term cave, but fall within the designation generally applied to them, that of "Rock-shelters." "Caverns," says Mr. John Evans,* "are either long and sinuous, in places contracting into narrow passages, and then again expanding into halls more or less vast; while others are merely vaulted recesses in the face of a rock, or even long grooves running along the face of some almost perpendicular though inland cliff," the two forms owing their existence to causes of a different nature. The stone dwellings here described rather fall within the second category. They usually occur in cliffs and scarps, with horizontal bedding, but, the beds possessing varying degrees of hardness and permeability to water, the softer and lower strata wear away faster than the harder, leaving recesses of greater or less depth.

The contents of these aboriginal Rock-shelters are in the main simply refuse heaps, thus resembling those of France and Belgium, "containing the bones, fractured and unfractured, of animals which have served for human food, mixed with which are the lost and waste tools, utensils and weapons, and even the cooking-hearths of the early cave-dwellers."†

Eliminating the utensils, a more truthful picture of the contents of our aboriginal Rock-shelters could not be drawn. There is, however, no evidence whatever of cave or cave-shelter tenancy by man alternating with that of either a living or extinct lower mammalian fauna, similar to that found in other quarters of the globe.

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* Ancient Stone Implements, &c., Gt. Brit., 1872, p. 428.
† *Ibid*, p. 430.

Sir William Dawson has divided caverns into those of driftage, interment, and residence.* The Rock-shelters of Eastern Australia are clearly a combination of the two latter, similar to some of the European caves mentioned by him, such as the Dordogne and Mentone Caves. "The accumulation of ashes, bones, and other remains," says Dawson, "is in exact accordance with the want of cleanliness of the ruder American tribes, and also with the habits of a people who in summer live in the open air, or in temporary cabins or wigwams, and only in the colder months or in bad weather resort to more secure and permanent abodes."† No doubt this equally describes the occupancy of our Rock-shelters.

The absence of bones of mammalia in the refuse heaps at the mouths of the latter, other than those of recent species, is strong confirmatory evidence of the non-existence of man together with the extinct mammalian fauna of Australia.

DESCRIPTION OF A NEW PELAGIC HEMIPTERON FROM PORT JACKSON.

By Frederick A. A. Skuse.
(Entomologist to the Australian Museum.)

Halobates whiteleggei, *sp. n.*

(Plate xxvii., figs. 1–10.)

Ovate, widest behind the middle. Glaucous above, with a silvery bloom; yellowish-ochreous beneath. Antennæ (including jointlets) and legs black, with a very minute greyish pubescence. Head with two triangular reddish-yellow spots, which do not meet on the hind margin.

Male and female. Antennæ at the base, antennal tubercles, prosternum, coxæ and trochanters, and a spot (more prominent in female) beneath the base of femora, in the fore-legs, coxæ and trochanters (with the exception of a black spot beneath), in intermediate legs, a spot beneath the apex of coxæ, and the outer margin of trochanters, in the hind-legs, fore and intermediate acetabula beneath, and margin of first and whole of second genital segment above, and all beneath, ochreous. Apical half of the

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* Fossil Men, 1883, p. 222.

† *Ibid*, p. 226.

horns of the second (male) genital segment microscopically tubercular, black (pl. xxvii., fig, 9). Antennæ: first joint three times the length of the second, third joint about two-thirds the length of the second, fourth joint scarcely the length of the second, stouter; second intermediate jointlet extremely minute (pl. xxvii., fig. 8). Front tarsi: second joint twice and a half the length of the first (pl. xxvii., fig. 6). Middle tarsi: first joint more than three times the length of the second.

Male. Length 3·81, breadth 1·77; intermediate femora 4·56, hind femora 4·06 mm.

Female. Length 4·31, breadth 2·54; intermediate femora 5·58, hind femora 4·81 mm.

Larva. About the same size as adult male but broader; the legs and antennæ stouter, and the hind femora shorter, similarly colored to those of the adult. In spirit specimens the dorsal integuments are sordid ochreous or yellowish-brown, with the chitenous plates glaucous (pl. xxvii., fig. 2); in dried specimens the integuments are deep brown or black, with the plates of a leaden and lighter hue (pl. xxvii., fig. 1). Abdominal segments nine, the two last entirely chitenous. Above, the first genital segment is narrow, and is the last segment bearing the chitenous dorsal plates, beneath, it is half the length of the whole of the preceding abdominal segments taken together, and like them of a pallid hue; beneath, the second segment is nearly twice the length of the first, somewhat wider than long, with the posterior half blackish; third segment small, blackish; the last two segments black above; these segments do not appear to exhibit any sexual characteristics.

Length 3·81, breadth 2; intermediate femora, 4·56, hind femora 3·55 mm.

Hab. Tarban Creek, Parramatta River, Balls' Head Bay, and Middle Harbour, Port Jackson, N.S.W. (Whitelegge and Skuse). April and May.

Male. Head moderately convex in middle of vertex, somewhat depressed in front. Antennæ three-fourths the length of the body, slender; first joint longer than the remaining three taken together; second, one-third the length of the first; third, two-thirds the length of the second, thicker; fourth, about the length of the second, incrassate, attenuate at the tip; several small spines at the apex above of first joint, and one or two at the apices of the remaining joints.

Pronotum rather more than twice and a half broader than long, flattened, with an anterior transverse forea laterally. Mesonotum widest at the middle, with a very indistinct longitudinal impressed median line.

Front legs: femora stout, narrower at the apex; tibiæ four-fifths the length of the femora; tarsi (pl. xxvii., fig. 6) five-eighths the length of the tibiæ, second joint twice and a half the length of the first, cleft before the middle.

Intermediate legs: femora rather more than three-fourths the length of the tibiæ and tarsi taken together; tibiæ about five-sixths the length of the femora; tarsi (pl. xxvii., fig. 7) more than three-fifths the length of the tibiæ, first joint more than three times the length of the second.

Hind legs: femora about one-third longer than the tibiæ and tarsi taken together; tibiæ scarcely more than three times the length of the tarsi; tarsi cleft at two-thirds of their length.

Abdomen: second to fifth ventral segments narrow, parallel, of equal length, the first and sixth equally long, together equal to the remaining four.

Genital segments (pl. xxvii., figs. 9–10): first beneath about equal in length to preceding ventral segments taken together; second with horns reaching to two-thirds the length of the third, their apical half microscopically tubercular; third (pl. xxvii., fig. 10) above scarcely wider than long, with prominent lateral angles.

Female. Considerably larger than the male, agreeing with it in color and markings. Legs proportionately longer than in male.

Abdomen: ventral segments narrow, parallel, gradually increasing in length successively.

Genital segments: first beneath shorter than the preceding ventral segments taken together, the posterior margin concave; lamellæ of the second overlapping.

Obs. Closely resembling *Halobates Hayanus*, White (Voy. H.M.S. Chall., xix., p. 52, pl. i., fig. 8, 1883), described from the Red Sea. Differs principally in its larger size, the relative lengths of the joints of the antennæ and legs, and the shape of the terminal genital segment, and less prominently in some minor points of coloration.

I have much pleasure in dedicating this species to my esteemed colleague, Mr. Thos. Whitelegge, F.R.M.S., who first drew my attention to its occurrence at Tarban Creek, Parramatta River, during the course of his investigations in regard to the late organic discoloration of the waters of Port Jackson. But I must not omit to mention that I have subsequently ascertained, through the instrumentality of Mr. Geo. Masters, the Curator of the Macleay Museum, that several specimens of the larva of this insect, labelled N.S.W., have for many years existed under a MS. name in the Collection of the late W. S. Macleay. Mr. Masters also collected a few specimens many years since upon our coast. As far as I am aware the species is confined to Port Jackson, and like its congener, *H. Hayanus*, White, occurs in large "schools" close to the shore, usually in sheltered spots. At first sight I concluded that this species was no other than *H. Hayanus*, which supposition was strengthened by the possibility that it had in some way been imported to our waters through the medium of the mail steamers passing through the Red Sea *en route* for Australia. However, this does not appear to have originated its occurrence from the fact that specimens exist in the Macleay Collection which must have been obtained prior to the advent of steamers *via* Suez Canal. Even were this not the case, our insect, to my mind, proves itself sufficiently distinct structurally to separate it from *H. Hayanus*.

When our specimens were first obtained, during April of the present year, a large percentage were discovered *in copulâ* ; but observations in regard to the time the eggs were deposited or where laid have up to the present been unavoidably postponed. As the insect occurs in immense numbers ample opportunity is thus afforded for further investigation, meanwhile I am content to present a preliminary description of the larval and adult forms. In the act of copulation the female carries the male on her back, the latter grasping her round the body with the front legs above the region of the intermediate acetabula.

NOTE ON THE NIDIFICATION OF *EDOLIISOMA TENUIROSTRE*.

By A. J. North, F.L.S.

Edoliisoma tenuirostre, *Jardine*.

Ceblepyris jardinii, Rüppell.

Campephaga jardinii, Gould.

During the latter end of September, 1882, Mr. C. C. L. Talbot observed a pair of these birds building their nest in the angle of a thin forked horizontal branch of an Ironbark *(Eucalyptus sp.)*, about forty feet from the ground, on Collaroy Station, Broad Sound, 556 miles N.W. of Brisbane. A week after, seeing the female sitting on the nest for some length of time, he climbed up to it and found it contained a perfectly fresh egg, which he took (not waiting for the full complement, which is probably two), as the tree was a difficult one to climb, at the same time securing the nest. It was a small and shallow structure composed of wiry grasses securely fastened together with cobwebs, and closely resembled the branch on which it was placed. The egg is ovoid in form, of a very pale bluish-grey ground colour, uniformly spotted and dotted with irregular shaped markings of different shades of umber and slaty-brown, underlying blotches of slaty-grey appearing as if beneath the surface of the shell. Length 1·2 x 0·82 inch. In the colour and disposition of its markings, it resembles some varieties of the eggs of *Sittella chrysoptera*, and in shape and size that of the egg of *Graucalus hyperleucus*, but is entirely free from the asparagus-green ground colour which predominates in the eggs of the latter genus. This is the only occasion I have known of the nest and egg of this species having been taken.

The northern and eastern portions of the Australian Continent constitutes the habitat of this species.

ON THE RECENT DISCOLOURATION OF THE WATERS OF PORT JACKSON.

By Thomas Whitelegge.

(Plate xxviii.)

Towards the latter end of last March, the citizens of Sydney were astonished and alarmed by the sudden discolouration of the water in Port Jackson. The water in the harbour in many places presented the appearance of blood, and the Board of Health immediately requested Mr. W. M. Hamlet, the Government Analyst, to report on the matter. He found that the red colour was due to the presence of a minute organism, which he thought might be the *Englena sanguinea*, Ehrenberg. Immediately after the publication of this report, quite a number of people gave their views of this somewhat mysterious discolouration. It was suggested that it was due to *zoospores* of some marine *Algæ ;* to the *Trichodesmium* which discolours the Red Sea ; and to the young of *Medusæ ;* whilst others maintained that it was caused by blood and other refuse turned into the harbour from the abattoirs.

On the 31st March I proceeded to Dawe's Point and procured a bottle full of water, in which there was a good supply of the organism in question. After a careful examination I satisfied myself that it belonged to the family *Peridiniidæ*, and I published a letter in the *Daily Telegraph* to that effect. At the time I thought it was a species of the genus *Peridinium*, but further research led me to the conclusion that it was a new species of the closely allied genus *Glenodinium ;* in the former genus the cuirass is marked by the presence of facets, whilst in the latter the cuirass is smooth. After the publication of my first letter on the subject, I was requested by Dr. E. P. Ramsay, Curator of the Museum, to make a detailed examination of the shores of the harbour, and to ascertain what effect the organism had had on the fauna generally.

The result of my investigation was embodied in a preliminary report furnished to the Department of Fisheries ; this report was published in the Sydney daily papers, and also in the "Records of the Australian Museum," No. 7. During my investigation I visited the head of Tarban Creek, Hunter's Hill on the Parramatta River, Mossman's Bay, Little Sirius Cove, Farm Cove, Darling Harbour, Woolloomooloo Bay, Watson's Bay, Manly, Coogee, Maroubra, and Middle Harbour. I found the organism at all the above-mentioned places in larger or smaller quantities. At Coogee, Maroubra, and the outer beach at Manly, I failed to obtain specimens in water taken direct from the sea, but I found them frequently in rock-pools. My visit to Middle Harbour was made in a waterman's boat which started from Long Bay. During the trip I examined many of the smaller bays and also the water round about the mangrove flats. At the time of my visit the organism was not abundant, but there was ample evidence to show that it had been there in quantity from the fact that many of the oysters had been killed; in the lower parts of Middle Harbour a large percentage of the oysters were seen with the valves gaping widely and the animals gone, or in a high state of decay, whilst those towards the head of the harbour seemed to be unaffected. So far as the harbour proper is concerned, I found that the oysters and mussels with few exceptions were destroyed, and it was a difficult matter to obtain living specimens for examination. Abundant evidence of the destructive influence of the organism on the oysters, mussels, and other bivalves living within tidal limits was plainly visible on the piles of the jetties and along the shores from Manly to the head of Tarban Creek. The rest of the shore fauna, consisting of limpets, the various species of univalves, starfish, worms, ascidians, and other lower forms of life, was all more or less seriously affected, and the dead and the dying were strewn about in great profusion. As a consequence nearly the whole of the higher forms capable of rapid movements had retired to deep water.

Some of the places where I have been in the habit of visiting, and which under normal conditions were literally swarming with life, seemed to be almost deserted. After turning over the stones the only living forms met with were a few worms, one of which, *Phymosoma japonica*, appeared to be unaffected. The crustacea and small fish usually so plentiful were entirely absent. As far as I am able to judge, fully one half of the shore fauna must have been destroyed, and the bivalves almost exterminated, at least such was the case in those localities where the organism was abundant during the whole of the visitation. The great destruction of life brought about by such an apparently insignificant organism, is of the highest interest from a biological point of view, as shewing our limited knowledge concerning the causes which influence our marine food supplies. This is particularly the case in regard to the cultivation of the oyster, for there are many cases on record of its almost total disappearance from localities which formerly yielded abundant supplies,* without any satisfactory reason being given. The facts ascertained in connection with this somewhat mysterious visitation may possibly throw light on the matter, for no doubt the presence of similar

* See Prof. Huxley's paper in the English Illustrated Magazine, 1883 (November), pp. 115-121.

organisms in other parts of the world have had the same effect, indeed there are numerous cases recorded, and probably many such instances have escaped notice. For example, had the organism which appeared in Port Jackson been colourless its presence might have been overlooked, and the destructive effects produced by it would have remained enshrouded in mystery. As a proof of this I may mention the fact, that another and allied species (*Gymnodinium spirale*, Bergh,) made its appearance during the period in which the *Glenodinium* reached its climax, and in a short time it appeared to equal the latter in number in many parts of the harbour. Yet it remained unnoticed by the public generally, owing no doubt to its being colourless, and had it not been accidentally met with during my examination of the water its advent would probably have been unrecorded.

From my observations of the habits of the *Gymnodinium*, I am of the opinion that it had a very important bearing on the final disappearance of the organism causing the discolouration, inasmuch as nearly every individual had in the gastric cavity one or two specimens of the *Glenodinium*, while many of them were so gorged with food as to be almost unrecognizable, being forced wholly out of shape by the contents of the stomach. The *Gymnodinium spirale*, Bergh, was first observed about the middle of April in water from Tarban Creek, only a few specimens being seen ; during the latter part of the month they seemed to increase rapidly, and by the second week in May they were found in great abundance in many parts of the harbour, the water appearing to be quite thick with them, and it was only necessary to dip a tube into the water to secure some thousands of specimens. Concurrently with the increase of the *Gymnodinium*, the *Glenodinium* gradually disappeared. The above mentioned facts point to the conclusion that the former organism was mainly instrumental in considerably reducing the number of the latter, and no doubt contributed largely towards its final disappearance.

The sudden discolouration of the harbour by the appearance of a minute organism in such vast numbers is rather a difficult matter to explain, except on the supposition that the whole of the conditions favourable to its full development were nearly perfect, and the causes which would tend to retard it were reduced to a minimum. There is no reason to suppose that this was the first time that the organism had appeared in Port Jackson. Mr. J. Brazier informs me that he has noticed similar discolourations at various times, and in the year 1866 the oysters, mussels, &c., were killed in large numbers. No doubt the causes which contributed towards the development of the organism were exceptionally favourable, the very large rainfall and the remarkable period of calm weather that prevailed during the whole of the visitation, may have had some bearing on its appearing in greater numbers than in other seasons. If the weather had been stormy the organism would have been more diffused, and consequently might have been less injurious, and it might possibly have remained unnoticed.

The destructive effects brought about by the *Glenodinium* are difficult to account for. As far as the family *Peridiniidæ* is concerned there does not appear to be any valid reason why they should be regarded as injurious when taken as food,* their chemical constituents are similar to what is found in diatoms, desmids, and many other minute forms of life which are known to provide a highly nutritious food for oysters, mussels, and other lower forms of animal life. Several samples of highly discoloured water were obtained from different localities and at some distance from the shore, with a view to ascertain if the *Glenodinium* gave off any fœtid odour, such as is often the case with water in which there exists living organisms in large numbers—particularly fresh water containing *Peridinia*, unicellular *Algæ*, and other forms rich in protoplasm—but I could not detect any unpleasant smell in the water examined. At several places where the organism existed in great abundance, I collected some of the mud by carefully skimming the surface with a spoon in order to determine if its death and subsequent decay had anything to do with the fouling of the water, but I failed to find any evidence that such was the case either in the mud or in the water. If the organism is not in itself injurious when used as food, and it does not affect the water by its death and decay, how has it acted so injuriously on the shore fauna? This is a question that could only be satisfactorily answered by a long series of experiments. After giving the matter serious attention, and making a careful examination of a number of the oysters and mussels, I am of the opinion that they died from suffocation brought about by the presence of vast numbers of the organism in question. It is very evident that water so thickly charged with millions of minute forms for a period of six weeks in succession would be unfit to support life in a healthy condition, and even if only a small percentage of the oysters, mussels, and other forms were killed

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* Since the above remarks were written, I have seen a paper by MM. G. Pouchet and J. de Guerne, "On the Food of the Sardine" (Comptes Rendus, 1887, p. 712), an abstract of which is given in the Ann. & Mag. N. H. Vol. xix. 5 ser. 1887, p. 323. The authors, after enumerating some of the organisms constituting the food of the sardine, go on to state that "The chief interest of the viscera from La Corogne is the extraordinary abundance of Peridinians which fill them. These belong to two types, *Peridinia divergens* and *P. polyedricum*. The latter literally fills the digestive tube of the sardines, being recognizable even in the rectum." After estimating the cubical capacity of the intestine and the size of the Peridinium, the authors conclude that the number of individuals found in the viscera of one specimen is no less than 20 millions. The facts recorded by Pouchet & Guerne show that the Peridinia are not injurious to fish as a food.

by being suffocated, their death and decay would help to make the conditions still more unfavourable, and bring about the destruction of others in the immediate neighbourhood. All along the shores, after the red colour had disappeared, abundant evidence was visible to shew that most of the organisms had been killed by secondary causes chiefly due to the presence of the putrid bodies of the oysters and mussels. At Watson's Bay and at Vaucluse Point, although the red colour was not noted to the same extent as at other places, the effects produced were equally destructive, and the stench from the mussel beds at the former place was almost unbearable. I received a bottle of water from Vaucluse, and with it a note to the effect that the discoloured water had not been observed there, and yet the oysters were dying just as in other parts of the harbour. On examining the water, which appeared to the eye quite clear and free from impurities, I found the *Glenodinium* present in considerable quantity.

The *Glenodinium* appeared to be almost confined to the surface of the water and to swim in lines or clouds, not only in the harbour but also when seen in a bottle; and if placed near a light it invariably collected at the point at which the light was most intense. It is therefore probable that the fauna in the deeper parts of the harbour would escape or be only slightly affected. The area of surface water more or less discoloured by the presence of the *Glenodinium* is rather difficult to estimate, it was observed in nearly all the bays and inlets throughout Port Jackson, and I was told that Mr. H. Prince saw a large patch of red water about two miles off Manly, and which was about a mile in length. I also obtained specimens at Coogee and Maroubra, which shew that it existed in greater or less number for some distance along the coast.

The species enumerated in the following list have been obtained during the author's visits to various localities in Port Jackson and the neighbourhood; they were mostly taken in the tow-net. Amongst them is the one which I regard as a new species (*Glenodinium rubrum*), and two previously known to occur only in fresh water, namely, *Ceratium hirundinella* and *Anurea cochlearis*. The latter is found in ponds near Sydney, while the former as well as the twenty-nine additional species have not hitherto been recorded from Australian waters :—

PROTOZOA.

Grade CORTICATA, *Lankester*.

Class DINOFLAGELLATA, *Bütschli*.

Order ADINIDA, *Bergh*.

Family Prorocentrina.

1. *Exuviaella lima*, Ehr.; Saville-Kent, Manual of Infusoria, 1882, Vol. i. p. 462. Bütschli in Bronn's Klass, und Ord. d. Thier-Reichs, Abt. ii. p. 1002, pl. 51, f. 2, a-b-c.

Rock-pools, Coogee Bay.

2. *Prorocentrum micans*, Ehr.; Kent, l. c. Vol. i. p. 461, pl. 25, f. 37-39. Bütschli, l. c. p. 1002, pl. 51, a-b.

The typical form of this species was obtained from rock-pools at Coogee Bay; I also found what may be a variety in gatherings from the tow-net. The body is elongate, narrowed towards each end, and the spine is longer and finer; the cuirass is distinctly and coarsely cribate.

Surface, off Green Point; rock-pools, Coogee Bay.

Order DINIFERA, *Bergh.*

Family DINOPHYIDA.

3. *Phalacroma rapa*, Stein.; Bütschli, l. c. p. 1009, pl. 55, f. 2.

Surface, off Green Point, P. J.

4. *Dinophysis lævis*, Bergh. Morp. Jahrbuch, Vol. vii. p. 224, pl. 15, f. 55.

Surface, off Green Point, P. J.

5. *D. homunculus*, Stein.; Bütschli, l.c., pl. 55, f. 3, b. (Plate xxviii., figs. 9-16.)

A large series of specimens of this fine species in various stages of development were obtained from the surface off Green Point. The youngest specimens met with had the form of a round disc, without any trace of the transverse groove. During my examination of the material obtained by the tow-net, I saw some hundreds of examples exhibiting almost every gradation between the disc-like form and that of the adult. The various changes during the development appear to be as follow:—The round disc assumes an oblong shape, and the transverse groove appears at the anterior end of the body, which is slightly narrower than the posterior; afterwards the longitudinal furrow is formed by the gradual extension of the membranous crests downwards, from the margin of the transverse groove. The next change is marked by the growth of the medium spine-like prolongation of the body, and afterwards by the formation of a similar, but much shorter, process at the base of the dorsal surface. Although the above mentioned stages have not been followed out in the life history of the individual, I am of the opinion that the presence of a large series of intermediate forms—gradually passing from the discoidal stage up to what I consider to be the adult—in one gathering, render it highly probable that they are simply the various stages in the development of one and the same species. The cell contents are green, and the cuirass is ornamented by the same cribriform markings in all the different forms. Several specimens were seen in process of division, the line of cleavage being longitudinal, and extending along the dorsal and ventral surfaces. When viewed from above, the cup-like membrane above the transverse groove, was seen to be divided so as to appear like two half circles, having a space nearly as wide as the body between them. I regret that owing to a want of books I am unable to go fully into the synonymy of this species. However, judging from the published descriptions and figures available, I think it highly probable that the form described by Stein as *D. homunculus* is identical with *D. inæqualis*, Gourret, and *D. allieri*, Gourret, and that all three are simply immature forms of *D. tripos*, Gourret.

6. *Ornithocercus magnificus*, ? Stein ; Bütschli, l. c. p. 1011, pl. 55, f. 7.

Two examples were observed, and although the main characters of the species were present in the specimens, there appeared to be a slight difference in the width and ornamentation of the membranous crests ; this may be due to immaturity, and from the facts noted in the growth of the previous species—*D. homunculus*—it may be safely inferred that the crests vary in size and structure in keeping with the age of the individual.

Surface, off Green Point, P. J.

Family Peridinida, *Bergh.*

7. *Diplopsalis lenticula*, Bergh, l. c. p. 244, pl. 16, f. 60-62 ; Kent, l. c. Vol. ii. Appendix, p. 859. Bütschli, l. c. p. 1003, pl. 53, f. 2.

Surface, off Green Point, P. J.

8. *Peridinium divergens*, Ehr. ; Kent, l. c. Vol. i. p. 453, pl. 25, f. 8-13. (*Ceratium*) Bütschli, l. c. pl. 53, f. 1, a-b.

A very variable species, scarcely any two individuals being found alike.

Common on the surface, off Green Point.

9. *P. michaelis*, Ehr. ; Kent, l. c. p. 453. (*Ceratium*) pl. 25, f. 23. Bütschli, pl. 52, f. 8.

Surface, off Green Point, P. J.

10. *P. globulus*, Stein. ; Bütschli, l. c. pl. 52, f. 7.
Surface, off Green Point.

11. *Goniodoma acuminata*, Ehr. ; Bütschli, l. c. pl. 52, f. 5, a-b-c.
Surface, off Green Point, P. J.

12. *Gonyaulax polyedra*, Stein. ; Bütschli, l. c. pl. 52, f. 3, a-b.
Surface, off Green Point, P. J.

13. *Ceratium fusus*, Ehr. ; Kent, l. c. p. 456, pl. 25, f. 40. Bergh. l. c. p. 208, pl. 12, f. 7-8, pl. 13, f. 28-32.

Common on the surface, off Green Point.

14. *C. furca*, Ehr.; Kent, l. c. p. 455, pl. 25, f. 31-32. Bergh. l. c. p. 195, pl. 12, f. 1-3; pl. 13, f. 13-20. Gourret. Ann. d. Mus. d'Hist. Nat. Marseille Mem. No. 8, 1883, p. 45-47, pl. iv., f. 58-59, 67-68.

There seem to be two well marked forms, which may be regarded as varieties of this species. Besides the typical form (Bergh. figs. 13-20) there is the *C. pentagonum*, Gourret, and its variety *rectum* (pl. 4, f. 58-59), which are fairly constant in size, shape, length of horns, and the strongly areolate cuirass. One of the specimens which came under my observation had nearly the whole of the areolate plates broken away, and there remained a rigid homogeneous shell, having the same shape as those in which the plates were intact. This fact suggested to my mind two questions, to which as yet I am unable to find answers: Is the cuirass double? or does the individual cast it off naturally when it is too small, and secrete a larger one?

The forms described by Gourrett, under the following names, *C. dilatatum* and its variety *parvum*, and *C. globatum* were well represented in my gatherings, and seemed to be constant as to length of horns, sculpture, &c.; the only noticeable variations appeared to be in the form of the body and the distance between the posterior horns. In some specimens the body was well rounded and the horns but a little distance apart; others had the body compressed and the horns widely separated, whilst many examples had a deeply concave ventral surface, and the aspect of the body when viewed from behind exhibited a cresentic outline, with the horns closely approximate, and the dorsal surface strongly convex.

Obtained in tow-net off Green Point (very common).

15. *C. gravidum*, Gourret, l. c. p. 58, pl. 1, f. 15.

In the description of this species the (inferieure) anterior portion of the body is described as globose. The specimen met with by me had the body strongly compressed, otherwise it agrees with the description and figure.

Surface, off Green Point, P.J.

16. *C. tripos*, Müll.; Kent, l. c. p. 454, pl. 25, f. 24-33. Bergh. l. c. p. 204, pl. 12, f. 4-6, pl. 13, fig. 21-27. Gourret, l. c. pl. 1, f. 1,2,3-7, pl. 2, f. 33-35.

This is a very variable species, scarcely any two individuals being found alike. The references given above indicate the varieties observed.

Very common in surface gatherings off Green Point, P.J.

17. *C. hirundinella*, Müll.; Kent, l. c. p. 457 (*C. longicorne*), and p. 859, pl. 25, f. 26. Bergh. l. c. p. 215, pl. 13, f. 12. Bütschli, l. c. pl. 53, f. 9, a-b.

As far as I have been able to ascertain, this species has not hitherto been found in salt water. After a very careful examination of many specimens, I cannot find any essential differences upon which it could be separated from the European fresh water form. As yet it is not recorded from fresh water in this part of the world.

Surface gatherings of Green Point, P.J.

18. *Glenodinium rubrum*, sp. n. (Plate xxviii., figs. 1-7.)

Cuirass ovate; anterior half of the body unevenly conical, the posterior rounded, ventral surface slightly depressed, the dorsal evenly convex; equatorial groove well marked, symmetrically developed; longitudinal furrow straight, ill defined; cuirass smooth without facets or pores; cell contents conspicuous, consisting of yellowish granular protoplasm, and large starch grains; nucleus round, large, and almost colourless in young individuals, ultimately assuming a bright red colour in adults. $\frac{1}{1000}$ of an inch in length.

When viewed in active motion, this species would easily be mistaken for a member of the genus *Peridinium:* the very dense protoplasmic contents and the somewhat polygonal aspect when swimming rapidly, led me to assign it to that genus in the preliminary report on the subject. Subsequently I saw that although the cuirass by its contour appears as if facetted, still it is homogeneous and quite smooth. For a time I experienced some difficulty in keeping the specimens alive on a glass slip for more than a few seconds. Every time they were placed on the slip they all fell down to the bottom of the water, first casting off the longitudinal flagellum, then the transverse flagellum, and finally the cuirass, which is so transparent that it is only seen with difficulty. This casting off of the cuirass I thought might be due to the pressure of the cover-glass, but the same results happened when the objects were placed in a cell. I ultimately found that it was caused by the change of temperature, and by thoroughly warming the microscope and glass slips, I could keep them alive for several hours, and that the pressure of the cover-glass did not affect them in the least. After taking the above precaution, I was enabled to watch the process of the throwing off of the flagelli, and also of the cuirass. The first indication of these changes is the gradual reduction of the speed of the swimming motion, which becomes more like a series of irregular waddling jerks, first in one direction and then in another; some time before these movements cease, the longitudinal flagellum is thrown off, and it falls down with a wriggle like that of a nematoid worm; the body continues to move by the aid of the transverse flagellum, but only for a short space of time, when this also leaves the body, and the undulatory movements of the flagellum are noticeable for a short period.

In a few seconds after the organism comes to rest, the cuirass is cast off by the rupture of its wall at the posterior end. After the shedding of the cuirass the body presents the appearance of a thick walled cell, and it immediately begins to increase in size and assume a more rounded outline. The subsequent changes lead up to the formation of what I regard as resting spores. The yellowish-brown colouring matter which is at first diffused throughout the body becomes concentrated in the nucleus, the latter then assumes a brilliant red colour; afterwards the nucleus undergoes division, and either one or two orange-coloured spores are formed, at the expense of the granular protoplasmic contents, which gradually disappear as the spores increase in size. Unfortunately I have not been able to ascertain what takes place after the spores are fully formed, the specimens which I had under observation having all remained in the same condition for the last two months. The cell wall appears to resist the attacks of the bacteria and infusoria, which exist in vast numbers in the vessel containing them.

This species made its appearance during the month of March last in such vast numbers as to render the water in Port Jackson quite red, and for a period of six weeks the whole of the surface water was more or less discoloured by the presence of this minute organism. When viewed from a distance, the surface of the water presented a variegated appearance, consisting of long streaks and patches of glaucus-green, yellowish-brown, and blood-red colour. The various streaks of red changed about from time to time owing no doubt to the direction of the wind and tidal currents. In nearly all the bays and small inlets the water on the surface was quite thick with the organism, and if a bottle full of water was taken up and allowed to stand for a few minutes, there was a thick brown deposit formed at the bottom, consisting of the bodies of the *Glenodinium.*

Port Jackson, March, April, and May, 1891.

Family Gymnodinida, *Bergh.*

19. *Gymnodinium spirale*, Bergh, l.c., p. 223, pl. 16, f. 70-71. Kent, l.c. p. 858, Appendix. Bütschli, l.c. pl. 51, f. 5. (Plate xxviii., fig. 8.)

During the months of April and May, this species was obtained in abundance by dipping a tube into the water. To my mind it appeared to be just as plentiful as the *Glenodinium*, but owing to its being transparent it did not perceptibly influence the colour of the water.

Hunter's Hill, Mossman's Bay, Woolloomooloo Bay, and Middle Harbour.

Class RHYNCHOFLAGELLATA, *Lankester.*

Family Noctilucidæ.

20. *Noctiluca miliaris*, Suriray; Kent, l.c., p. 397, pl. 1, f. 33-34.

It is with some hesitation that I venture to record this species. So far, I have not seen the flagellate form. The stationary form figured in the "Challenger" Narrative, under the name of *Pyrocystis pseudonoctiluca* (Vol. I., pt. ii., p. 936, f. 335-37.) was obtained in abundance in surface gatherings off Green Point. June, 1891.

21. The form figured in the "Challenger" Narrative as *Pyrocystis fusiformis*, Vol. I., pt. ii., p. 937, f. 338, was also met with, but only a few individuals were seen.

Surface, off Green Point, June, 1891.

Class CILIATA.

Family TINTINNODÆ.

22. *Amphorella ganymedes*, Entz., Mitt. Zool. Sta. Neapel, Bd. 5, 1884, p. 409, pl. 24, f. 17, 18.

Surface, Woolloomooloo Bay, April, 1891.

23. *Tintinnopsis curvicauda*, Daday, Mitt. Zool. Stat. Neapel, Bd. 7, p. 554, pl. 19, f. 33.

Very common on the surface, off Green Point, May and June, 1891.

24. *T. cyathus*, Daday, l.c., p. 556, pl. 20, f. 2.

Surface, off Green Point, June, 1891.

25. *T. ventricosa*, Cl. & L., Etudes sur les Infusoires, 1858-59, p. 208, pl. 9, f. 4. Kent, l.c., p. 609, pl. 31, f. 31. Daday, l.c., p. 559, pl. 2, f. 19, 20.

This species was found in plenty in the surface gatherings, and I saw several cases in which conjugation was taking place. At this time their appearance presented a strong resemblance to what I have seen in the genus *Difflugia*, and I was not aware of the true nature of the occupant of the test, until I saw the animal protrude the wreath of cilia and swim rapidly away. June, 1891.

26. *Codonella annulata*, Cl. & L., l.c., p. 207, pl. 9, f. 2. Kent, l.c., p. 609, pl. 31, f. 25. Daday, l.c., p. 571, pl. 20, f. 21.

Surface, off Green Point, June, 1891.

27. *C. lagenula*, Entz., Mitt. Zool. Sta. Neapel, Bd. 5, 1884, p. 409, pl. 24, f. 17-18. Kent, l.c., p. 616, *(C. galea)* pl. 31, f. 32, 33, pl. 31, f. 21-22.

Very common in surface gatherings, off Green Point, June, 1891.

28. *Cyttarocylis claparedei*, Daday, l.c., p. 582, pl. 21, f. 5, 16.

Surface, off Green Point, June 1891.

29. *C. cassis*, Haeckel., Jena. Zeits. Med. Naturu. 1873, Bd. vii. p. 563, pl. 27, f. 1-3. Daday, l.c., p. 580, pl. 21, f. 3. Kent, l.c., p. 624 (*Dictyocysta*) pl. 32, f. 29-31.

Surface, off Green Point.

30. *Dictyocysta templum*, Haeckel., Jena. Zeit. p. 564, pl. 27, f. 6. Kent, l.c., p. 625, pl. 32, f. 27. Daday, l.c., p. 585, pl. 21, f. 8, 9.

Surface, off Green Point, June, 1891.

Class ROTIFERA.

31. *Anurea cochlearis*, Gosse, Ann. & Mag. Nat. Hist., 2 ser. Vol. VIII., 1851, p. 202. Hud. & Gosse, Rotifera, p. 124, pl. 29, f. 7, 7a.

About twenty specimens of this species were obtained in the tow-net off Green Point. The species is common in fresh-water all round Sydney, but it has not hitherto been found in the sea. See Dr. C. T. Hudson's list in Journ. Roy. Micro. Soc., 1889, pt. 2, April, p. 176.

ALGAE.

32. *Halosphaera* sp.

This species is closely allied to, if not identical with *H. viridis*, Schmitz, Mitt. Zool. Sta. Neapel, Bd. 1, p. 67-92, pl. 3. figs. 1-15. Jour. Roy. Micro. Soc. 1879, p. 458, pl. xvi.

Frequent on the surface, off Green Point, P.J.

The following is a list of the more important books and papers bearing on the organisms dealt with in this paper. I have also attempted to compile a bibliography of the Dino-flagellata published since the issue of Bütschli's Protozoa, in Bronn's Klass. u. Ord. d. Thier-reichs 1885. In the latter work will be found (p. 915) a very complete guide to the literature of the class from 1786 down to the date of publication.

Note on the Red Colouring Matter of the sea around the shores of the Island of Bombay, by H. J. Carter, Ann. & Mag. N. H., 3rd ser., Vol. I., 1858, p. 258.

Mémoire sur les Animacules et autres corps organises qui donnent a la mer une couleur rouge. Par M. Camille Dareste. Ann. des Sci. Nat. 4 ser. Tome 3, 1855, p. 179-242.

Ehrenberg, C. G., Die Infusionsthierchen als vollkommene Organismen, Leipzig, 1838.

Dujardin, F., Hist. Natur des Zoophytes, Infusoires. Paris 1841.

Claparède, E., et Lachmann, J., Etudes S. les Infus. et les Rhizopodes. Mém. Instit. Geneve, 2 vols., 1858-61.

Stein, Fr. von, Der Organismus der Infusionsthiere, III. Abth, I. Hälfte, Leipzig 1878, II. Hälfte, 1883.

Kent, W. Saville-, Manual of the Infusoria, 3 vols. London 1881-2.

Bergh, R. S., Der Organismus der Cilioflagellaten. Morphologisches Jahrbuch VII., 1882, p. 177-288, pls. xii.-xvi. ; Abstract in Jour. Roy. Micro. Soc. Vol. II., ser. 2, p. 351-355, 1882 ; Prof. T. Jeffrey Parker in New Zealand Jour. Sci., Vol. I., No. 2, May 1882, p. 111.

Klebs, G., Ueber die organisation einiger Flagellaten-gruppen. Unters aus dem botan. Institut. zu Tubingen Bd. 1, p. 233-262, pl. 2-3, 1883.

—— Ein Kleiner Beitrag zur Kenntniss der Peridineen. Botanische Zeitüng. Jahrg. 42, 1884, p. 721-33, et p. 737-45, pl. x. Abstract Jour. Roy. Micro. Soc., Vol. V., ser. 2, p. 468-469.

Pouchet, G., Contribution a l' histoire des cilioflagelles Jour. de l' Anatomie et de la Physiologie, 1883, p. 399-455, pls. 19-22.

Gourret, P , Sur les Peridiniens du golfe de Marseille Ann. du Musèe d'Hist. Nat. de Marseille, Vol. I., 1883, Mem. No. 8, 101 pp., 4 pls.

Bütschli, O., Einige Bemerkungen über gewisse organisationsverhaltnisse d. Cilioflagellaten und der Noctiluca. Morph. Jahrb. Vol. X., 1885, p. 529-77, 3 pls. Abstract Jour. Roy. Micro. Soc., Vol. VI., ser. 2, p. 461.

Daday, E. von, Monographie der Familie der Tintinnodeen Mitt. Zool. Station Neapel, Bd. vii., p. 473-591, pls. 18-21. Abstract Jour. Roy. Micro. Soc., 1888, p. 436.

Bibliography of the Dino-flagellata from 1885.

Bergh, R. S., Ueber den Theilungsvorgang bei den Dino-flagellata Zool. Jahrb., Vol. II., p. 73-86.

Blanc, H., Note on Ceratium hirundinella, Bull. Soc. Vaudoise Sci. Nat. Vol. XX., 1885, p. 305 ; Abstract Jour. Roy. Micro. Soc., Vol. V., p. 470, and in Ann. & Mag. N.H. ser. 5, Vol. XVI., p. 444-453.

Bovier, Lapierre —., Nouvelles observations sur le Peridiniens appartenants au genre Polykrikos. Comptes Rendus, Soc. Biol. Vol. V., p. 579.

Daday, E. von, Systematiches Uebersicht der Dino-flagellata des Golfes von Neapel. Budapesth 1888, 8vo, 24 pp., 1 pl.

—— On Cenkridium, Zool. Anz. No. 213, p. 15-19. Abstract Journ. Roy. Micro. Soc., ser. 2, Vol. VI., p. 462.

Danysz, J., Un Nouveau Peridinien et son evolution Gymnodium musaei, Arch. Slav. Biol. Vol. III., 1887, p. 1-5. Abstract Jour. Roy. Micro. Soc., 1887, p. 602.

—— Contribution a l' étude de l' evolution des Peridiniens d' eau douce. Comptes Rendus, Paris CV., p. 238-240. Abstract Jour. Roy. Micro. Soc., 1887, p. 976.

Grenfell, J. G., On a new species of Scyphidia and Dinophysis, Jour. Roy. Micro. Soc., 1887, p. 87-112, 2 pls.

Penard, E., Contribution a l' études des Dino-flagelles, Geneva. Abstract Jour. Roy. Micro. Soc., 1889, p. 399.

Pouchet, G., Contributions a l' histoire des Peridiniens, Jour. Anat. et Physiol. Tom XXI., 1885, p. 28-88, pls. ii-iv.; Abstract Jour. Roy. Micro. Soc., ser. 2, Vol. V., p. 469-470.

—— Contributions a l' histoire des Peridiniens, Jour. Anat. et Physiol., Vol. XXI., 1885, p. 525-34, 1 pl. Abstract Jour. Roy. Micro. Soc., ser. 2, Vol. VI., 1886, p. 261.

—— Qautrieme contribution a l' histoire des Peridiniens, Jour. Anat. et Physiol., Vol. XXIII., 1887, p. 87-112, 2 pls. Abstract Jour. Roy. Micro. Soc., 1887, p. 602.

—— Sur Gymnodinium polyphemus. Comptes Rendus, CIII., 1886, p. 801-3; Abstract Jour. Roy. Micro. Soc., 1887, p. 101.

Pouchet, G., Sur un Peridinien Parasite, Jour. de Micrograph, Tom 8, 1885, p. 347-348 ; Abstract Jour. Roy. Micro. Soc., Vol. IV., ser. 2, p. 759.

Pouchet, G., and Guerne, J. de, Sur la nourriture de la Sardine, Comptes Rendus, Paris, Tom 104, p. 712-715. Abstract Ann. & Mag. N.H., Vol. XIX., ser. 5, 1887, p. 323.

Schütt, Dr. F., Ueber die sporenbildung mariner Peridineen, Ber. Deutsch. Bot. Gesellsch. 1887, Band 5, Hft. 8, p. 364-374, 1 pl. Abstract Jour. Roy. Micro. Soc., 1887, p. 437.

—— Colouring-matter of the Peridinieæ. Ber. Deutsch. Bot. Gesellsch.. Vol. VIII., 1890, p. 9-32, 2 pls.; Abstract Jour. Roy. Micro. Soc., 1890, p. 472.

Stokes, A. C. Dr., On Peridinia and other Infusoria, Jour. Trenton Nat. Soc., I., 1886, p. 18-22. Abstract Jour. Roy. Micro. Soc., Vol. VI., ser. 2, p. 261-262.

DESCRIPTIONS OF THREE NEW PAPUAN SNAKES.

By J. Douglas Ogilby.

Hypaspistes, *gen. nov.*

Body very much elongated and compressed; tail of moderate length, rounded, or but slightly compressed anteriorly, prehensile. Head quadrangular, completely shielded, distinct, but not markedly so, from the neck. Snout rather short. Eye of moderate size, the pupil eliptical. Nostril lateral, pierced in a single nasal which is grooved behind. Shields regular, the occipitals increased in number to three pairs; loreal present. Scales smooth, quadrilateral, the vertebral series not dilated.

Hypaspistes dipsadides, *sp. nov.*

Scales on the body anteriorly in thirty, posteriorly in twenty-three series; the series bordering the abdominal plates much the largest; abdominal plates three hundred and twenty-seven; anal plate single; sub-caudal plates in two rows of one hundred and seventeen each, preceded by a semicircular band of eleven small scales. Head very distinct from neck. Muzzle of moderate length, broad, very obtuse, and rather depressed; the occiput rounded. Eye lateral, the outer skin rather opaque, the pupil elliptical and erect. Body slender in front, becoming much higher behind. Skin of the throat loose, forming a distinct longitudinal gular sac. Rostral triangular, deeply pitted, its median height five-sevenths of its breadth, extending backwards for some distance between the anterior frontals, which are small, quadrilateral, and concave behind; two pairs of posterior frontals, the inner pair the larger and forming a narrow suture with the vertical; the latter shield hexagonal, as long as broad, with the lateral edges converging posteriorly; supraciliary large and pentagonal; three pairs of occipital shields, the two anterior pairs transversely oblong and of equal size; the posterior pair of irregular shape and smaller; a number of various sized shields on the temporal region; loreals replaced by from nine to eleven scale-like plates; three pre- and four post-oculars of equal size, with the exception of the upper preocular which is greatly enlarged; twelve upper labials, the four anterior ones pitted, the sixth and seventh entering the eye; sixteen lower labials, the six preceeding the last four pitted. Scales on the anterior part of the body elongate and quadrangular, on the posterior larger and rhombic; no enlarged vertebral series. A minute conical rudimentary hind limb. *Colors*—Upper surface of head light brown, the edges of the shields purplish-brown, broadest posteriorly; an oblique dusky band behind the eye; general color of body and tail yellowish with dark brown transverse bands, which are ill-defined and irregular anteriorly, better defined and gradually forming a junction on the under surface of the body posteriorly, and best defined on the tail.

Total length thirty-one and a half inches; tail five and a half inches. Register number R. 1087.

Dendrophis papuæ, *sp. nov.*

Scales on the body anteriorly in fifteen, mesially in thirteen, and posteriorly in eleven series; the series bordering the abdominals more distinctly larger in comparison anteriorly than posteriorly; the vertebral series more so posteriorly than anteriorly; abdominal plates one hundred and eighty-three; anal plate single; sub-caudal plates in two rows of one hundred and forty-three each. Head but little defined from trunk. Muzzle very short, broad, truncated, and depressed; occiput depressed. Eye lateral large, the pupil rounded. Body compressed and keeled, the tail much less so. Rostral twice as broad as high, not encroaching on the upper surface of the head; anterior frontals quadrilateral, the lateral margins rounded in front; posterior frontals* pentagonal, bent down on the sides to form a suture with the loreal, which is large, and pointed posteriorly; vertical shield pentagonal, much broader in front than behind; supraciliary shields forming a sharp ridge overhanging the eye; occipitals large, a little longer than broad, rounded behind; one

* In the unique specimen this shield is undivided except for about the anterior third of its length, where there is a slight, but distinct, groove.

large preocular forming an angular projection between the posterior frontal and the supraciliary; two postoculars, the upper the larger; two pairs of temporals, the lower of the anterior pair much the larger, and completely separating the upper from the posterior pair; fourth and fifth upper labials entering the eye; fifth lower labial the largest. *Colors*—Head and body above pale brown, below yellowish-white anteriorly, becoming dirty brown posteriorly; tail above dark brown, below lighter with a central lead-colored zigzag stripe.

Total length fifty-six inches; tail eighteen inches. Register number R. 1088.

DENDROPHIS ELEGANS, *sp. nov.*

Scales on the body anteriorly in thirteen, posteriorly in eleven series; abdominal plates one hundred and eighty-five; anal plate divided; subcaudal plates in two rows of one hundred and forty-four each. Head moderately distinct from the neck. Rostral two-thirds broader than high; loreal oblong, twice as long as high; supraciliaries swollen, forming a blunt ridge over the eye; occipitals quadrilateral, squarely cut off behind; five temporal shields; fifth and sixth upper labials entering the eye. In all other respects similar to *D. papuæ*. *Colors*—Upper surface of head black, the supraciliaries with an orange tinge; lower surface and greater part of the upper labials cream color; general color of the upper surface of the body yellowish-brown lighter in front and duller, variously ornamented with black, which predominates on the neck and neighboring part of the body; mesially the black takes the form of oblique bands from one to two scales in breadth and about five times that distance apart, and encroaching on the belly but not reaching across the abdominal scales; posteriorly the markings become almost merged in the duller and darker ground color; belly anteriorly cream color, becoming a greenish lead color posteriorly; tail very dark brown above, lead color below.

Total length about sixty inches; tail nineteen inches. Register number R. 1089.

The three Snakes described above were obtained by the collectors of the Royal Geographical Society's Expedition to the Fly River, New Guinea, in 1885.

NOTE UPON THE NIDIFICATION OF *TURNIX MELANOTUS*, *Gould.*

Small Black-spotted Turnix.

By A. J. North, F.L.S.

Of the three small species of *Turnix* found in Australia, two of them, *T. velox* and *T. pyrrhothorax*, give decided preference to the open grassy plains of the inland districts, while *Turnix melanotus* is essentially an inhabitant of the low marshy ground and damp scrubs contiguous to the eastern coast of Australia. Near Sydney the latter species is not uncommon in the neighbourhood of Randwick, Botany, and La Perouse, localities also frequented by the Least Swamp Quail, *Excalfatoria australis*, and both species, shot at Botany on the same day, have been recently presented to the Museum.

The nidification of *Turnix melanotus*, similar to that of other members of the genus, is a scantily grass-lined hollow in the ground, sheltered by a convenient tuft of grass or low bush. The eggs are four in number for a sitting; specimens obtained on Mr. Boyd's plantation on the Herbert River, Queensland, on the 13th of December, 1890, are oval in form, tapering somewhat sharply to the smaller end, the ground colour is of a greyish-white, and is almost obscured with minute freckles of pale umber-brown, while sparingly distributed over the surface of the shell are conspicuous spots and blotches of dark slaty-grey, which in some places approach an inky-black hue. Length (A) 0·97 x 0·73 inch, (B) 0·98 x 0·73 inch. These eggs can easily be distinguished from those of *T. velox*, by being much darker and the surface of the shell bright and glossy. During the same month, eggs of *Excalfatoria australis* were procured in the same locality. The latter species, Mr. J. A. Boyd informs me, is very common on the Herbert River.

ON *HADRA GULOSA*, GOULD.

By C. Hedley, F.L.S.

(Plate xxix.)

Hadra gulosa, Gould, having been instituted by that author, the type of his genus *Badistes*, and by Pilsbry the type of the subsection of that name, it is desirable that an account of its soft parts should be placed on record. On acquiring two living specimens from Dr. Cox and Mr. Brazier, the opportunity is accordingly embraced of publishing the following observations.

Gould states, Otia, p. 18, that *H. pedestris*, imitates in its gait the geometer caterpillars and progresses by looping its foot into undulations instead of by the usual sliding motion practised by other helices. On p. 243, he transfers this extraordinary action to the credit of *H. gulosa*, for which, apparently on account of this supposed peculiarity, he creates the genus *Badistes*. I have carefully observed the animal of *gulosa*, and have never seen any such gymnastic evolutions performed by it. However Messrs. C. T. Musson and C. J. Wild, both keen observers, have separately remarked this habit in *Chloritis brevipila*, and it seems probable that it is to this animal and not to *gulosa* that the observations of Drayton (Gould's collector) refer.

The color of this animal appears to vary greatly. A specimen from Bulli presented by Dr. Cox, possessed a bright orange-red mantle margin, body and tentacles pale ochreous brown, darkening behind the tentacles and passing into orange-red on the tip of the tail, sole of foot light ochreous brown. Another specimen contributed by Mr. Brazier from Lawson, which is situated at a height of 2400 feet on the Blue Mountains, differed wholly from the foregoing, having the mantle-margin a creamy yellow, the body and tentacles coal black with ashy tubercles, sole of foot dark ashy blue. When extended the animal measured about 55 mm. in length, the tail projecting about 10 mm. behind the shell; tentacles 12 mm. in length. The facial area is defined by two not very distinct grooves which run upwards and backwards from the lips to the mantle. Along the median dorsal line two rugae or sets of rugae bound a furrow which proceeds from the mantle and terminates between the tentacles. On either side of these about six ranks of long narrow tubercles extend from the mantle outwards and downwards. The genital orifice appears in the right facial groove behind the right tentacle. The tentacles taper and spring from swollen bases 2 mm. apart, their ocular bulbs are rounded and symmetrical. The rest of the body is covered with irregular polygonal tubercles which usually are partially subdivided into minor tubercles, those on the tail are round, small and entire. At the origin of the left facial groove, two small lobes spring from the mantle, they measure together 2 x 4 mm., these are undoubtedly the homologues of the lobes which attain so great a development in the *Naninidæ*. I have observed them in other *Hadræ*, but am not aware whether these rudimentary lobes are common to other divisions of the helices.

Jaw arched, crossed asymetrically by nine stout flat-topped ribs of various widths, the central the narrowest, denticulating both margins, ends smooth, angled.

Radula strap shaped, three times as long as broad, rows flattened bracket (—^—) shaped, formula 180 rows of 39 : 18 : 1 : 18 : 39 ; rachidian reflection unicuspidate, linguiform extending along two-thirds of a base which is longer than wide and slightly expanded posteriorly ; the immediate laterals are also unicuspidate and linguiform, twice as large as the rachidian, the reflection cusp falling short of the margin of the base whose alate angle is curved and acuminate, the distant laterals are more slender and inclined projecting past the basal margin ; the marginals acquire proximal and distal accessory cusps which increase in size proportionaly as the ranks retreat.

In the genitalia the penis sac is expanded into a wide reniform dilatation and bears at its apex a slender flagellum 15 mm. in length, the ovoid spermatheca is seated at the termination of a long duct.

ON THE OCCURRENCE OF THE GENUS *PALÆASTER* IN THE UPPER SILURIAN ROCKS OF VICTORIA.

By R. Etheridge, Junr.

(Plate xxx.)

The Upper Silurian rocks of Victoria have so far yielded two species of Asteroidea, and one well defined species of Ophiuroidea, whilst a second doubtful species of the latter class is believed to exist. The former are *Petraster Smythii*, McCoy,* from the Moonee Ponds beds, and *Urasterella Selwynii*, McCoy,† from near Kilmore. The single described species of the second class is *Protaster brisingoides*, Gregory,‡ from Moonee Ponds, the doubtful one being a MS. name *Tæniaster australis*, McCoy. It has been suggested that this is merely a synonym of Gregory's *P. brisingoides*.

In the genus *Palæaster*, Hall, the structure of the arms on the actinial side consists of two rows of ambulacral plates, and two rows of adambulacral plates, bordered on each side by a row of marginal plates. In *Urasterella*, McCoy, adambulacral plates are present as in *Palæaster*, but marginal plates do not exist. In *Petraster*, Billings, on the other hand both adambulacral and marginal plates are developed, but separated by a row of disc plates; while in *Palasterina*, the disc itself is much extended, and the adambulacral plates in the interradial angles are large and triangular.

I now purpose describing a star-fish in the Museum Collection, from Moonee Ponds, which certainly appears to have the structure of *Palæaster*, Hall, rather than that of either of the genera named.

Palæaster meridionalis, *sp. nov.*

(Pl. xxx., fig. 16 & 17.)

Sp. Char.—Body small; rays moderately long and rather acutely pointed, fifteen millimeters from the actinial centre to the apices; interbrachial angles broad and obtuse; abactinial surface unknown. Ambulacral avenues wide in comparison to the size of the body, deep, very gradually tapering, the sides more or less straight walled; ambulacral plates about twenty in number on each side, transversely oblong, bearing more or less pyriform pores; adambulacral plates quadrangular, smaller than the marginal plates, placed along the prominent edges of the ambulacral avenues;

* Prod. Pal. Vict., Dec. I., 1874, p. 41, t. 10, f. 1.
† *Ibid*, p. 42, t. 10, f. 2 and 3.
‡ Geol. Mag., 1889, vi. (3), p. 24.

marginal plates transversely elongated, slightly supra-marginal in position, and thus partially visible dorsally, diminishing very gradually in size towards the apices of the rays; interbrachial marginals apparently two in number, much larger than the others, and generally triangular in shape; oral plates not distinctly visible. but apparently lanceolate.

Obs.—This elegant little Star-fish, the first of its genus described from Australian rocks, in form and proportions generally resembles *Palæaster matutina*, Hall,* from the Trenton Limestone, but Hall gives very few particulars of its actinial surface. From *P. Shæfferi*, Hall,† from the Hudson River Group, and *P. eucharis*, Hall,‡ characteristic of the Hamilton Group, our species is separated on the one hand by the much more transverse form of its ambulacral plates, and proportionately wider ambulacral avenues; and on the other by its much smaller size. The latter feature will likewise serve as a point of separation from *P. granulosus*, Hall,§ also a fossil of the Hudson.

Amongst other American species, to which *P. meridionalis* is far more nearly allied than to the British, *P. niagarensis*, Hall,‖ is easily distinguished by its large boss-like marginal plates. *P. antiquatus*, Locke,**and *P. exculptus*, Miller,††are much too large to need comparison. In *P. Dyeri*, Meek,‡‡are similar transverse ambulacral plates to those of our species, but the adambulacral and marginal plates are quite different to those of the latter. It is hardly necessary to institute a comparison with such a well-marked form as *Palæaster Jamesi*, Dana,§§ for in this species there are enormously developed adambulacral plates, or at least, what appear to be so.

It is unnecessary to compare *P. meridionalis* with any of the so-called British Palæasters, for the Star-fish so far referred to the genus by English authors, do not, in the opinion of the Writer, belong to that genus, with one exception. The latter is *P. caractaci*, Salter, and this unfortunately is a MS. name. It has already been shown by Prof. H. A. Nicholson and the Writer, that *Palæaster* as understood by Salter, and those who followed him is not *Palæaster*, Hall, and we therefore instituted a new genus for the reception of the British species.‖‖

Loc. and Horizon.—Moonee Ponds, near Melbourne, Victoria.

Coll.—Australian Museum.

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* Twentieth Ann. Report State Cab. Nat. Hist. Univ. N. York, 1867, p. 283, t. 9, f. 2.

† *Ibid*, p. 284, t. 9. f. 1. ‡ *Ibid*, p. 287, t. 9, f. 3 and 4. § *Ibid*, p. 285.

‖ Pal. N. York, 1852, ii., p. 247, t. 51, f. 21.

** Proc. Acad. Nat. Sci. Philadel., 1846, iii., p. 33.

†† Journ. Cincinnati Nat. Hist. Soc., 1881, iv., p. 69, t. 1, f. 1.

‡‡ Ohio Geol. Report, Pal. I., Pt. ii., p. 58, t. 4, f. 2—2*f*.

§§ *Palasterina*, Man. Geology, 1875, 2nd Edit. p. 205, f. 375; Meek gives a good figure of this, *Loc. cit.*, t. 4, f. 4.

‖‖ Mon. Sil. Foss. Girvan in Ayrshire, 1880, Pt. 3, p. 318.

THE OPERCULATE MADREPORARIA RUGOSA OF NEW SOUTH WALES.

By R. Etheridge, Junr.

(Plate xxx.)

The first mention of an Australian Operculate Rugose Coral, was, I believe, made by the late Rev. W. B. Clarke, F.R.S., in the third edition of his "Sedimentary Formations of New South Wales,"* wherein the discovery of *Calceola* is mentioned in the supposed Devonian rocks of Mount Froome, Co. Phillip. In the fourth edition of the same publication† this locality is again referred to, and *Calceola* is also said to have been found "along the Yass and Murrumbidgee Rivers." The Clarke specimens are not unfortunately, now extant for reference but previous to the destruction of the collection, the late Prof. de Koninck described from Rock-Flat Creek (probably near Cooma) a *Calceola*-like Coral, termed by him *Rhizophyllum interpunctatum*,‡ and it is more than probable that the fossil, formerly referred to by Clarke as *Calceola*, to which it bears a very strong resemblance on a macroscopic examination only, is a species of *Rhizophyllum*. The specimen described very briefly by De Koninck is said to be a semi-cone shaped cast, bearing on the curved surface fine granulated radiating ridges. The flat side is only provided with ridges towards the lower part, and they are smooth, whilst in the middle line is the impression of the well developed large median septum.

In 1880 I described another Operculate Rugose Coral from near Yass, sent to me by Prof. A. Liversidge, F.R.S., and possessing a similar general resemblance to *Calceola*. This I also referred to Lindström's genus *Rhizophyllum* as *R. australe*,§ pointing out, however, that "one of the three specimens is more *Calceola*-like than the other two, which again resemble *Rhizophyllum* to a greater extent."

I am now indebted to Messrs. J. A. Wall and J. Mitchell for an opportunity of examining a much larger series of these corals from Yass and Silverdale, and they have been good enough to

* Mines and Min. Statistics of N. S. Wales (N. S. Wales Intercol. and Philadelphia Internat. Exhib., 8vo., Sydney, 1875—by Authority), 1875, p. 159.

† Remarks on the Sedimentary Formations of New South Wales. Fourth Edition (8vo., Sydney, 1878—by Authority), p. 16.

‡ Foss. Pal. Nouv. Galles du Sud, Pt. 1, 1876, p. 61.

§ Journ. R. Soc. N. S. Wales for 1880 (1881), xiv., p. 248.

present specimens to the Museum Collection. A careful study of these induces me to believe that under the name of *R. australe*, I included two species as foreshadowed in the above quotation. In other words, this name must be restricted to Fig. 7 of the plate cited from the "Journal of the Royal Society of N. S. Wales," whilst Fig. 8 of the same reference will require separation under a distinct name, and will be now described as *Rhizophyllum interpunctatum*, De Koninck.

Operculate Rugose Corals are also known to me from Queensland. Mr. George Sweet, F.G.S., collected one at Reid's Gap, apparently differing from either of the preceding, and I saw rather indifferently preserved examples of a small form in the Geological Survey Museum at Townsville. These will be ultimately described elsewhere.

The following are the descriptions of the two N.S.Wales species:

Genus Rhizophyllum, *Lindström*, 1865.

(K. Vet. Akad. Forhandl., 1865, No. 5, p. 287.)

Rhizophyllum australe, *Etheridge, fil.*

(Pl. xxx., figs. 1 – 6.)

Rhizophyllum australe, Etheridge, fil., Journ. R. Soc. N.S.Wales for 1880 [1881], xiv., p. 248, pl., f. 7 (2 figs.), *non* fig. 8.

Rhizophyllum australe (pars), Lindström, Bihang K. Vet. Akad. Handl. Stockholm, 1882, vii. No. 4, p. 29.

Sp. Char.—Corallum elongately-pyramidal, more or less curved, not greatly expanded above, acutely pointed or truncated below, the curvature always towards the convex side; lateral angles rounded and obtuse, when pointed the apex flattened from before backwards, not laterally; section roughly semicircular. Dorsal surface moderately convex in the middle, rather flattened at the sides; ventral surface quite flat transversely, but well curved longitudinally. Calice, in depth equal to about one-third the height of the corallum; edge or margin horizontal or slightly oblique; infilling vesicles very numerous, but small; ventral margin or hinge line sharp and bevelled inwards, a few indistinct crenulations representing septa; cardinal septum not visible, counter septum prominent, distinct, in a very shallow fossula. Operculum semicircular, thick. Epitheca bearing sub-imbricating laminæ and fine transverse ridges, which slightly crenulate the lateral angles; exothecal outgrowths apparently absent.

Obs.—In my first description of *R. australe*, the septal characters were derived from the structure of the conical form, now described as *R. interpunctatum*. On clearing out the calice of the present species, I find that with the exception of the counter septum the septa along the ventral margin are confined to a few obscure crenulations, and that so far as can be seen there is no outward manifestation in the calice of the cardinal septum. The vesicles filling the former extend quite up to its margin.

The position of the counter septum is indicated on the flat ventral side by the slightest appearance of a ridge, causing an almost imperceptible angularity to the surface. The same is even the case on the dorsal, or convex side, indicating the position of the cardinal septum, although it is not visible in the calice. But when the epitheca is removed by weathering the counter septum stands out as a thickened ridge extending from the hinge line to the basal apex. This is remarkably well shown in a fractured base, where also the vesicular tissue is apparent, but of a much larger mesh than in the higher portion of the corallum; and again the indistinct septa, but the cardinal septum is not to be seen.

One specimen has a partially preserved operculum *in situ*, sufficient remaining to show that it had a similar method of articulation to that described by Dr. Lindström on the bottom valve of *Goniophyllum*, and the single valve of *Calceola*.* Neither the nucleus nor the sculpture are preserved.

Rhizophyllum australe appears to have for its nearest ally *R. elongatum*, Lindström, from the Upper Silurian of Gotland and China.

Locality and Horizon.—Hatton's Corner, near Yass; Upper Silurian, probably Wenlock (J. A. Wall).

Collections.—Australian Museum, and J. A. Wall.

Rhizophyllum interpunctatum, *De Koninck.*

(Pl. xxx., figs. 7 – 15.)

Rhizophyllum interpunctatum, De Koninck, Foss. Pal. Nouv. Galles du Sud, Pt. 1, 1876, p. 61, t. 1, f. 10.

Rhizophyllum australe, Etheridge, fil., Journ. R. Soc. N.S. Wales for 1880 [1881], xiv., pl., f. 8 (2 figs.), *non* fig. 7.

Rhizophyllum australe (pars), Lindström, Bihang K. Vet. Akad. Handl. Stockholm, 1882, vii. No. 4, p. 29.

Sp. Char.—Corallum semi-conate, curved, short, moderately expanded above, acutely pointed below, generally *Calceola*-like; section semi-circular; lateral angles generally sharp, but occasionally rounded and obtuse; dorsal and ventral surfaces as in the last species. Calice shallow, highly vesicular, the vesicles large; margin more or less oblique; ventral margin sharp, bevelled inwards, and bearing about twenty vertical, granulated septa, and at the lateral angles, and on the dorsal side are about twelve fine and highly granulated curved septa, which all descend into the calice beneath the vesicles; cardinal septum not apparent; counter septum large, projecting forwards as a triangular knob, placed in a shallow fossula. Operculum unknown. Epitheca

* Geol. Mag., 1871, viii., p. 124.

coarsly wrinkled and striate, slightly imbricately laminate, crenulating the lateral angles. Exothecal outgrowths not observed.

Obs.—The principal characters of *R. interpunctatum* are its remarkable *Calceola*-like outline, prominent counter septum, and highly and coarsely vesicular structure. The relation in which *R. interpunctatum* stands with regard to *R. australe* has already been commented on, but the form, and more highly developed septa will tend to separate the species.

In outline *R. interpunctatum* approaches nearest to *Rhizophyllum gotlandicum*, F. Roemer,* and *R. tennesseense*, F. Roemer,† but it is a smaller species, and the longitudinal curve of the corallum is proportionately greater in relation to its size.

The septa in *R. interpunctatum*, unlike those of *Goniophyllum pyramidale*, are completely hidden by the highly developed vesicular tissue, instead of passing over the latter and disappearing at the bottom of the calice. Mr. Mitchell's specimens are in the form of internal casts of the calice, with the vesicular tissue removed, precisely in the same condition as De Koninck's were. The septa on the ventral side are vertical and increase in length from the lateral angles towards the counter septum. They are very finely granulated, and when in the least degree worn, with their angular inner sides rubbed off, appear double. No doubt Lindström's suggestion that each is composed of two laminæ satisfactorily accounts for this. In counting the septa this feature must be taken careful note of, otherwise the total number will be accepted as exactly double. At the lateral angles and on the dorsal side of the calice the septa are represented by minutely granulated, very fine ridges, the granules in a single row, conforming in the curvature to the outline of the corallum.

Locality and Horizon.—Hatton's Corner, near Yass (J. A. Wall), Silverdale (J. Mitchell); Upper Silurian, probably Wenlock.

Collections.—Australian Museum, J. A. Wall, and J. Mitchell.

General Remarks.—Both *Rhizophyllum australe* and *R. interpunctatum* agree with the genus *Rhizophyllum*, rather than *Calceola*, in the highly and openly vesicular nature of the corallum. On the other hand, the total apparent absence of exothecal structures in the form of anchoring stolons from the flattened under surface show a departure towards the last named genus, in which there is no trace of them. The arrangement of the vesicular tissue of the corallum is precisely similar in both our species to that seen in *Goniophyllum*—infundibuliform layers, with the convexities of the vesicles directed upwards and inwards. This structure is particularly well shown in one of Mr. Wall's specimens of *R. interpunctatum* (Pl. xxx., Fig. 7), from which the epitheca has been removed by weathering. It is also apparent

* Lindström, Bihang K. Vet. Akad. Handl. Stockholm, 1882, vii. No. 4, t. 3, f. 4.

† Sil. Fauna Westl. Tennessee, 1860, p. 77, t. 5, f. 1.

that along a line answering to the position of the cardinal septum, the corallum is split, and the ends of these layers are turned or tucked inwards, towards the interior of the visceral chamber. In another example there is a similar incision on the ventral face, answering to the counter septum, thus separating the corallum as it were into two triangular halves. A similar division is sometimes visible in *Goniophyllum pyramidale*,* and it is also shown in Bayle's figure of *Rhizophyllum gervillei*,† on the ventral face, although in this instance the epitheca seems to be preserved. On the other hand I have failed to detect any division along the lateral angles as described by Lindström in the calice of *Goniophyllum*,‡ separating the corallum in that genus into four portions. Both in *R. australe* and *R. interpunctatum*, when epithecate, the above incisions, as previously mentioned, are replaced by a faint angulation or ridging of the surface, but this does not approach anything like the definite rib seen on Lindström's beautiful figure of *Rhizophyllum gothlandicum*.§

NOTES ON THE STRUCTURE OF *PEDIONOMUS TORQUATUS*, WITH REGARD TO ITS SYSTEMATIC POSITION.

By Hans Gadow, Ph.D., M.A.,

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The Trustees of the Australian Museum have, besides many other valuable birds forwarded through the Curator, Dr. Ramsay, to the Cambridge Museum of Zoology, sent two well preserved spirit specimens of *Pedionomus torquatus*, and Dr. Ramsay has more than once expressed the wish that I should determine the affinities of this peculiar bird. Although I have much pleasure in making the following communication, I do so with some reluctance, because of the incomplete state of my investigations. Two intact specimens of *Pedionomus* would be of course sufficient for an extensive and amply illustrated monograph, if such were desirable,

* Lindström, Bihang K. Vet. Akad. Handl. Stockholm, 1882, vii. No. 4, t. 5, f. 1.
† Expl. Carte Géol. France, 1878, iv. Atlas, t. 17, f. 13.
‡ Geol. Mag., 1866, iii. p. 358.
* Bihang K. Vet. Akad. Handl. Stockholm, 1882, vii. No. 4, t. 3, f. 4.

but in order to sift the somewhat intricate relationship of this bird, it would be necessary not only to compare it with the Rasores s. Gallinæ and with the Turnices s. Hemipodii, but also with interesting and outlying forms such as Thinocorus, Attagis, Mesites, and various other Limicoline and Ralline genera. Thinocorus, Attagis, and Mesites I have not yet been able to procure; of Turnix I have only *T. sykesi*, in spirits, although several skeletons of other species, I cannot therefore make such comparisons as I would wish,—hence the scantiness of my communication.

However it reveals something, namely that *Pedionomus* is closely allied to the Turnices, although not closely enough to include it in that group, unless the limits and the definition of the group be considerably widened. Moreover, it connects the Turnices with the Rasores, not directly, but through a number of characters which indicate the common descent of both from some less differentiated and less specialised Ralline-Limicoline stock. How the various branches of our much searched for hypothetical tree converge and diverge is another question. Suffice it to hint at the possible advisability of a Rallo-Galline combination. Fuerbringer, in his monumental work, Taf. xxix.*a* indicates such a combination as optional, but not so on pp. 1566 and 1567.

I do not know that anyone else has published a single line on the anatomy of *Pedionomus*. Garrod does not mention it at all. Fuerbringer, p. 1250 says only "the change of the Turnicidæ into proper cursorial birds has secondarily (via *Pedionomus*) caused the loss of the hallux." Forbes refers to it in his list of Tridactyle birds (Ibis 1882, p. 389) thus: "Turnicidæ,(exc. *Pedionomus*)" meaning that *Pedionomus* has four toes; in another paper (Ibis, 1882, p. 428) he enumerates it as the last of the eleven known species of Turnicidæ. That Gray (Handlist of Birds, Vol. ii., p. 271, gen. No. 2429, and Genera of Birds, Vol. iii., p. 511, pl. 131, fig. 3) referred *Pedionomus* to his Turnicinæ, speaks well either for his sagacity or for the occasional value of some of the so-called external characters, but he was wrong in letting the Turnicinæ form a subfamily of the Tetraonidæ, the latter being the fourth family of his order Gallinæ.

Tegumentary System.

The primary remiges are ten in number, of which the seventh to tenth or most distal quills form the tip of the wing; the eighth and ninth are slightly longer than the rest, but there is no trace of an eleventh quill. Each of the ten primaries possesses an upper large covert, but there is no distinct trace of an eleventh upper covert. The secondary remiges or cubitals consist of eleven longer quills and two or three much weaker and shorter quills on the elbow, a character which occurs also in the Rasores, but not in the Turnices. The fifth cubital is absent, although it is present both in the Turnices and Rasores. The alula or wing of the pollex is composed of three quills of which the distal one is the longest, and the proximal one the shortest. The pollex shows no indication of a horny nail. The rectrices are twelve in number ; they are all soft and very short ; the central pair is the longest, the others shorten gradually towards the outside. The Turnices have likewise twelve rectrices, while in most of the Rasores the number is increased.

The dorsal feather tract is interrupted by a long spinal apterium which begins on a level with the shoulder-joint and is continued a little beyond the level of the hipjoint. Each half of the tract is composed of three to seven rows of feathers of which those nearest the middle line are the strongest. Behind the spinal apterium the tract is continued on to the oil-gland. The humero-scapular tract is very broad, its feathers are longer than the cubitals and form a conspicuous parapteron. This humeral tract is connected through sparingly developed feathers on to the ventral middle cervical tract, but not at all with the dorsal cervical tract, which latter occupies the whole dorsal surface of the neck. The femoral tract is isolated and very distinct ; its feathers are so long that they form the chief covering of the outer surface of the fleshy part of the leg. The feather tracts on the under surface :—the under surface of the neck is covered uniformly, then the tract divides, leaving a bare interclavicular space. Each tract divides again on a level with the anterior end of the keel, into a lateral thick patch which extends over the lateral part of the sternum, over the sternal ribs, and into a narrower branch which runs nearer the middle line, where it swells out on the abdomen and then narrows again, being continued by scattered feathers towards the hinder end of the os pubis. The whole distribution and shape of the feather tracts closely resemble that of the Turnices.

The aftershaft is present, very thin and delicate, but much longer than in the Rasores. The oil-gland is large and tufted, it is otherwise naked except on the dorsal middle line on which the spinal tract is continued. The nostrils are formed by very long and wide slits ; they are protected by a large, soft upper valve, which internally is composed of a cartilaginous thin plate. The whole operculum is quite bare of feathers. The sheath of the bill is composed of one piece only. The tarso-metatarsus is covered in front with one row of about twelve or more transverse scutes, which reach over to the median and outer side. The posterior or plantar surface is protected by a similar row of transverse scutes. The narrow space between the dorsal and ventral row of scutes is filled by one row of small granular scales on the outer side, by two rows on the median side. The same covering of small granular scales exists on the distal half of the bare portion of the leg. The plantar side of the whole heel is covered with numerous narrow transverse scutes ; the outer and median spaces are filled up by small granular scales. The number of toes is four, the hallux being weak but functional; all the toes are furnished with very short nails. But for the bare distal portion of the leg, and the presence of the hallux, the whole foot of *Pedionomus* closely resembles that of the Turnices and differs from that of the Rasores although its intermediate position between a *pes cursorius* and a *pes radens* is obvious.

Muscular System.

The muscles of the hindlimb afford some interesting points. Garrod's formula for the Rasores is A B × y +, meaning that these birds retain the primitive condition in which besides others the following muscles are present :—

+ = M. ambiens.
A = Femoro-caudal muscle, *i.e.* pars caudalis m. caud-ilio-femoralis.
B = Accessory femoro-caudal, *i.e.* pars iliaca m. caud-ilio-femoralis.
× = Semitendinosus *i.e.* the tibial insertion of the m. caud-ilio-flexorius.
y = Accessory semitendinosus, *i.e.* the femoral insertion of the m. caud-ilio-flexorius.

In a few of the Rasores, viz. in *Pavo* and *Meleagris*, and in a few other birds *e.g.* in *Podiceps*, *Otis*, *Dicholophus*, *Serpentarius*, *Phœnicopterus*, &c., the caudal portion of the m. caud-ilia-femoralis is absent, the formula being B × y. In the Turnices on the other hand the iliac portion of this muscle is absent; consequently A × y. In *Pedionomus* both portions are present, but while the iliac portion is very broad and is inserted nearly along the whole length of the femur, the caudal portion is an extremely thin and feeble slip which comes as a mere thin tendon from one of the caudal vertebræ, and can scarcely be traced as an independent slip beyond the pubis, where it practically disappears and merges into the iliac portion of the muscle. The formula for *Pedionomus* is therefore A B × y as in most Rasores, and if the reduction of A were continued, *Pedionomus* would have the same symbolic formula as *Pavo*, *Meleagris*, viz. B × y. Certainly there is no resemblance between *Pedionomus* and *Turnix* in this respect, but it would be very rash to conclude that *Pedionomus* is allied to the Rasores because of this formula. On the contrary we have to conclude that *Pedionomus* still retains partly the primitive condition, and that the reduction of the muscle A is due to the same unknown causes which have eliminated it in *Pavo* and in *Meleagris*, in *Podiceps*, *Otis*, *Dicholophus*, *Serpentarius*, and in *Phœnicopterus*, *i.e.* in birds which prove that the absence or presence of this muscle can be only of very little taxonomic value.

Fuerbringer's Table XL*n*. B. contains several other myological characters, Nos. 30 – 42 of occasional taxonomic value, but they are not suitable for the solution of the question if *Pedionomus* is more nearly allied to the "Galli" or to the "Hemipodii," because these two groups either agree with each other or the characters differ too much within the "Galli" themselves.

Vascular and Respiratory System.

Pedionomus possesses two carotides profundæ s. carotides subvertebrales; the left carotis is slightly weaker than the right and covers the latter ventrally. *Pedionomus* agrees in this respect with most (but not with all) Rasores, not necessarily however because of any close affinity with them, but because the presence of these two subvertebral carotids is an old, unchanged feature, which persists in most birds. In *Turnix* and in the Megapodidæ there is one carotis-conjuncta, but the right root, *i.e.* the basal portion of the original right carotis, has been obliterated. It is not likely that this condition has been developed directly from that of *Pedionomus*, because in this bird the basal portion of the left carotis is slightly the weaker one, on the contrary it shows that *Pedionomus* has made an independent departure. The trachea is peculiarly flattened dorso-ventrally, as in the Ratitæ. Its numerous cartilaginous rings are soft and very narrow. The Syrinx exhibits no specially remarkable features, it agrees in its composition closely with that of *Turnix* and differs from that of the Rasores. The pessulus is very weak and there is no distinctly separated branchidesmus. The semi-rings of the bronchi surround the whole ventral surface of the latter. The voice is produced (1) by a pair of membranæ tympaniformes internæ, which from the pessulus onwards occupy the whole dorsal and median half of each bronchus, (2) by several pairs of membranæ tympaniformes externæ, the first of which is the largest and lies between the first and second semi-ring of each bronchus, while smaller membranes exist between two and two of the following semi-rings. The voice is moderated by two pairs of muscles. Each m. sterno-trachealis runs down from the larynx along the side of the trachea and is inserted on to the lateral anterior process of the sternum. Each m. tracheo-bronchialis begins at the point where the m. sterno-trachealis leaves the trachea, runs along its side and is inserted upon the middle of the first bronchial semi-ring. The whole syrinx is distinctly tracheo-bronchial.

Alimentary System.

Neither *Turnix* nor *Pedionomus* possesses a crop, but the upper half of the œsophagus is very dilatable. The gizzard is very strong and of a rounded-off rhombic shape,* without the marked constriction on its upper anterior margin which exists in the gizzard of Turnices and Rasores. *Turnix* and *Pedionomus* agree however in having a slight indication of a pyloric stomach. The rest of the alimentary canal of *Pedionomus* forms three great loops. The

* Contents: quartz pebbles, and several hard Colœoptera.

first, the duodenum, descends straight down and thus turns slightly towards the right with its apex. The second loop lies on the right side, near the back, its distal third is bent upwards ; the whole loop is a closed one, and is retrograde with reference to the course of the duodenum. The third principal loop takes up the space between the first and the second loops, it is likewise retrograde, but open ; the middle portion of both its branches is irregularly kinked ; its ascending branch is accompanied by the two well developed cœca. The intestinal convolutions of *Pedionomus* are certainly different from those of either Turnices or Rasores. There is no indication of a horseshoe-shaped doubling of the second loop, nor do the convolutions of *Pedionomus* agree in numbers and other characters with those of the groups mentioned above. The convolutions of *Pedionomus* exhibit characters which are intermediate between those of Ralli, Turnices and Rasores, and which are at the same time peculiarly modified.

Measurements : Absolute length of the intestine from the pylorus to the anus 47 cm.
Relative length of the intestine 6·5 cm.
Absolute length of the rectum 4·2 cm.
Absolute length of one cœcum 5·5 and 7·0 cm.

The liver of *Pedionomus* consists apparently of three almost equally sized lobes, owing to the left original lobe being split in half. In this respect *Pedionomus* agrees only with the Turnices and with the Rasores, it differs however from the latter and agrees with the former by the small size of the right lobe, which is scarcely half the size of the double left lobe.

Skeleton.

The number of cervical vertebræ is fifteen in *Pedionomus* and in the Turnices, sixteen in the Rasores. The last two of these vertebræ carry long dorsal ribs but without sternal portions. Although *Pedionomus* agrees with the Turnices in the number of cervical vertebræ, it differs from the Turnices (at least from *Hemipodius pugnax*, of Fuerbringer, *op. cit.* p. 240) in the composition of the brachial nerve plexus. The latter is formed in *Hemipodius* by the eleventh to foureeenth spinal nerves, in *Pedionomus* by the twelfth to fifteenth, in the Rasores by the thirteenth to sixteenth or thirteenth to seventeenth spinal nerves. In *Pedionomus* five, almost six ribs, belonging to the sixteenth to twentieth or twenty-first vertebræ are attached to the sternum ; in the Turnices only three or seven, rarely five ; in the Rasores almost always four, very rarely only three. The greater number of these sternal ribs is a more primitive, Ralline character. The sternum of *Pedionomus* is decidedly like that of the Turnices and differs in every essential point from that of the Rasores. The posterior margin of the sternum possesses only one notch of moderate depth on each side, only the Processus lateralis posterior but no Proc.

obliquus being developed. The spina anterior sterni, is a spina communis, being composed of a very feebly developed spina externa and a short and bifurcated spina interna, without a foramen interspinale for the reception of the feet of the coracoids. The median apophysis of the furcula is short and rounded off, resembling that of *Turnix.* The configuration of the pelvis closely resembles that of the Turnices. With regard to the nasal and premaxillary bones, *Pedionomus* and the Turnices are schizorhinal, in opposition to the holorhinal Rasores.

Resumé.

Some of the more noteworthy characters of the various organic systems of *Pedionomus* are arranged in the following tabular form in which the symbol * indicates agreement with the corresponding characters in the Turnices and in the Rasores, the symbol O shows that the characters are either peculiar to *Pedionomus* or that they agree with Ralline birds.

To settle the affinities of *Pedionomus* simply by the numerical majority of coincidences of these characters would be a not unprecedented but utterly fallacious mode of investigation. *The quality not the quantity of these "taxonomic characters" refers Pedionomus to the Turnices as their lowest most Rallo-Galline members.*

Characters of Pedionomus.	Turnices.	Rasores.	Neither.
Number of Primary remiges...	*	*	...
Number of Secondary remiges	...	*	...
Absence of fifth secondary ...	...	...	O
Aftershaft structure	*	...	...
Number of rectrices	*	...	...
Pterylosis	*	...	...
Oilgland	*	*	...
Nasal operculum	*	*	...
Scutillation of Feet	*	...	...
Hallux	...	*	...
Second, third, fourth toes ...	*	...	...
Must. caud-ilio-femoralis ...	...	*	...
Carotids...	...	*	O
Syrinx	*	...	...
Absence of Crop	*	...	...
Liver, three lobes	*	*	...
Liver, situation of right lobe	*	...	...
Intestinal convolutions ...	...	...	O
Number of cervical vertebræ	*	...	...
Brachial plexus	...	...	O
Number of sternal ribs ...	...	...	O
Spina communis sterni ...	*	...	...
Absence of Proc-obliquus sterni	*	...	...
Furcula	*	...	...
Pelvis	*	...	...
Nasal bones	*	...	...
	18	8	5

Explanation of Plate I.

Fig. 1. sternula sinensis, Gmelin
2. Orthonyx spaldingi, Ramsay
3. Ocydromus sylvestris, Sclater
4. Heteromyias cinereifrons, Ramsay
5. Merula vinitincta, Gould

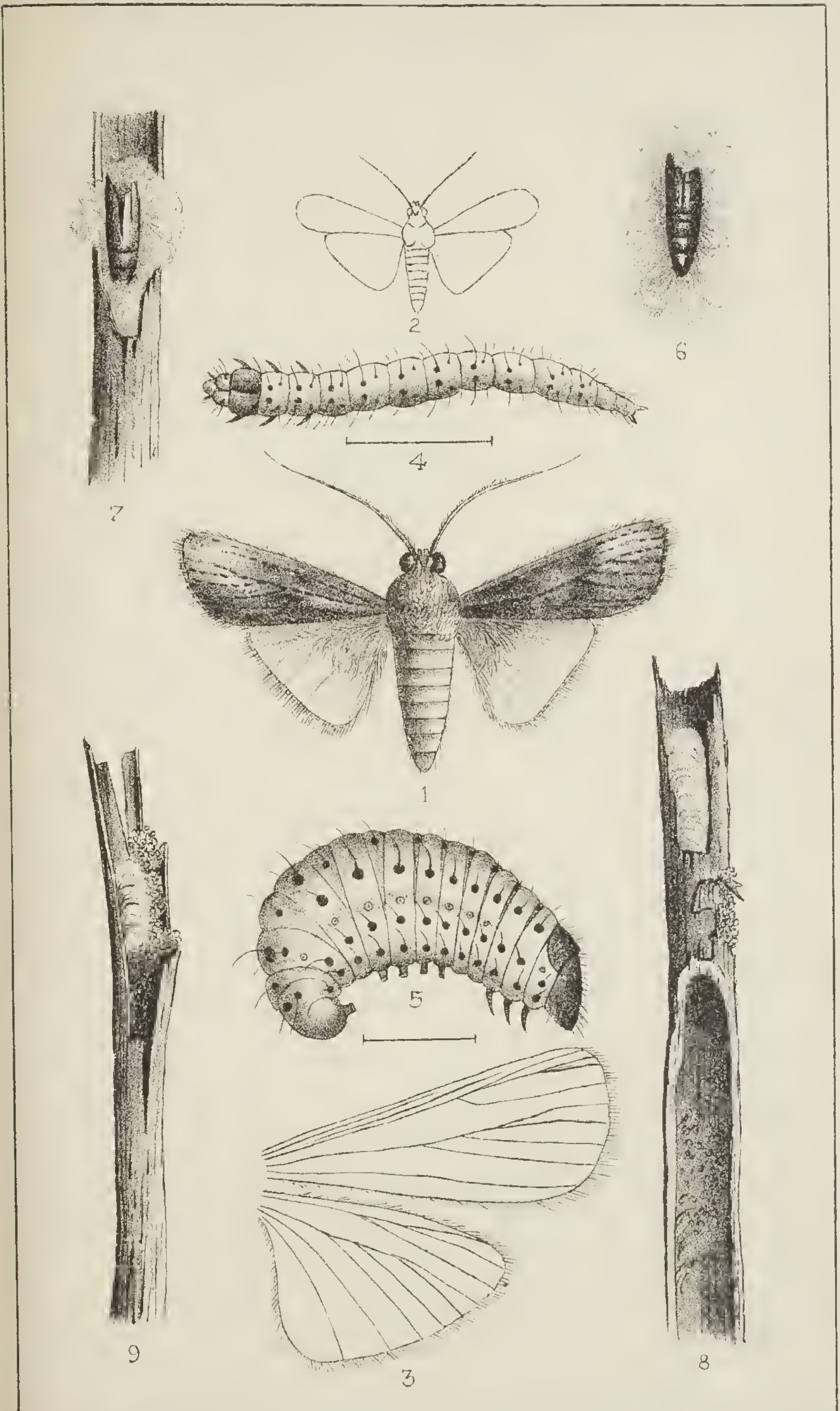
The figures are all of the natural size

EXPLANATION OF PLATE II.

Fig. 1. *Epicrocis terebrans*, Olliff ♂.
,, 2. Outline of same showing natural size.
,, 3. Venation of same. Forewing 11 veins; hindwing 9 veins.
,, 4. Larva of same about two-thirds grown.
,, 5. Larva of same about to pupate.
,, 6. Pupa of same, and portion of cocoon.
,, 7, 8, and 9. Stems or "leaders" of Red Cedar showing borings of larvæ, cocoons, and pupa *in situ*.

The natural sizes are shown by indicators.

G. H. BARROW, DEL. ET LITH.



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Epicrocis terebrans, Olliff.

EXPLANATION OF PLATE III.

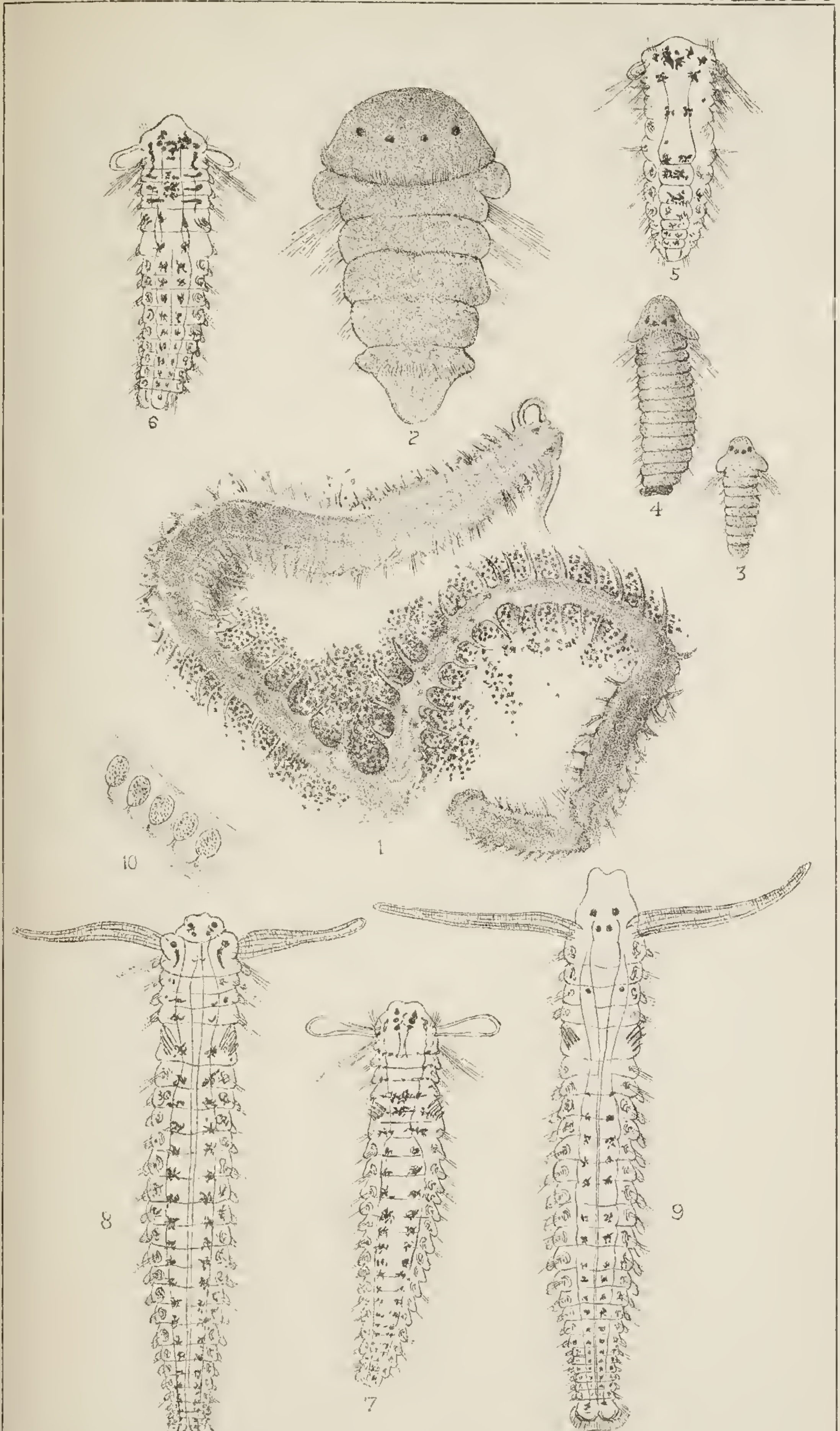
Fig. 1. *Polydora* (*Leucodore*) *ciliata*, with ova, from a photomicrograph, highly magnified. Original.

,, 2. Young larvæ of *Polydora* from a photomicrograph, taken shortly after its escape from the ova-sac, highly magnified. Original.

,, 3 & 4. Older stages, from a photomicrograph, highly magnified. Original.

,, 5 to 9. Somewhat more advanced, after Prof. A. Agassiz.

,, 10. Egg-cases of *Polydora*, attached to the side of the membranous tube, x 7 diameters.



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EXPLANATION OF PLATE IV.

Fig. 1. Adult worm (*Polydora*) enlarged under a lens.

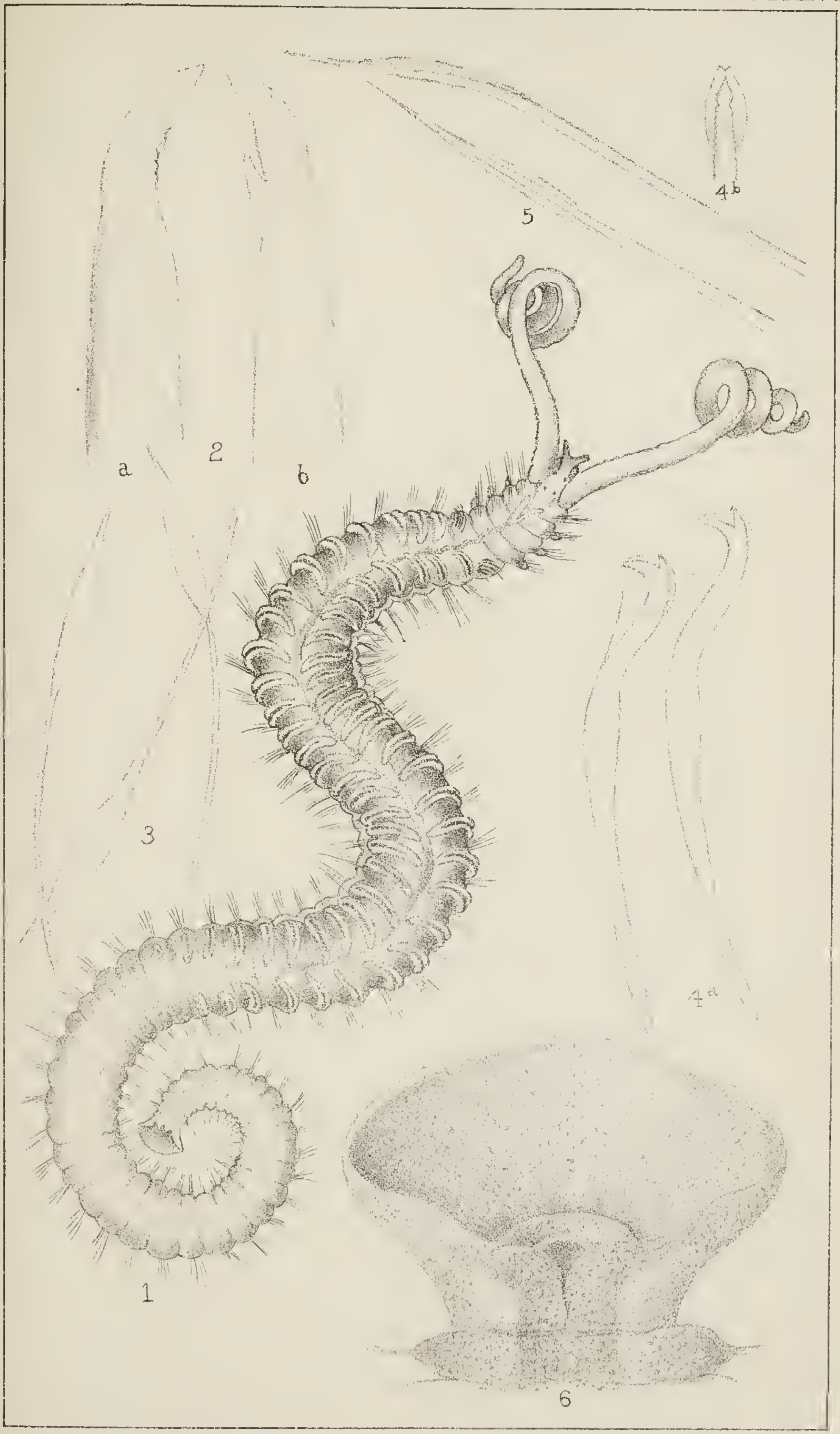
,, 2. Great hooks of the fifth segment of the body; *a*, as usually seen in the separated and perfect organ under pressure; *b*, more complete as obtained in the living animal or in a favourable spirit preparation x 700 diameters.

,, 3. Spear-tipped bristles accompanying the former x 700 diameters.

,, 4. Hooks of the posterior region of the body; *a*, pressed between two glasses; *b*, seen in front, so as to exhibit both wings, x 700 diameters.

,, 5. Front and side view of two of the bristles of the same species, x 700 diameters.

,, 6. Caudal segment and its cup, x 210 diameters. The whole of the figures and explanations after Prof. W. C. McIntosh.



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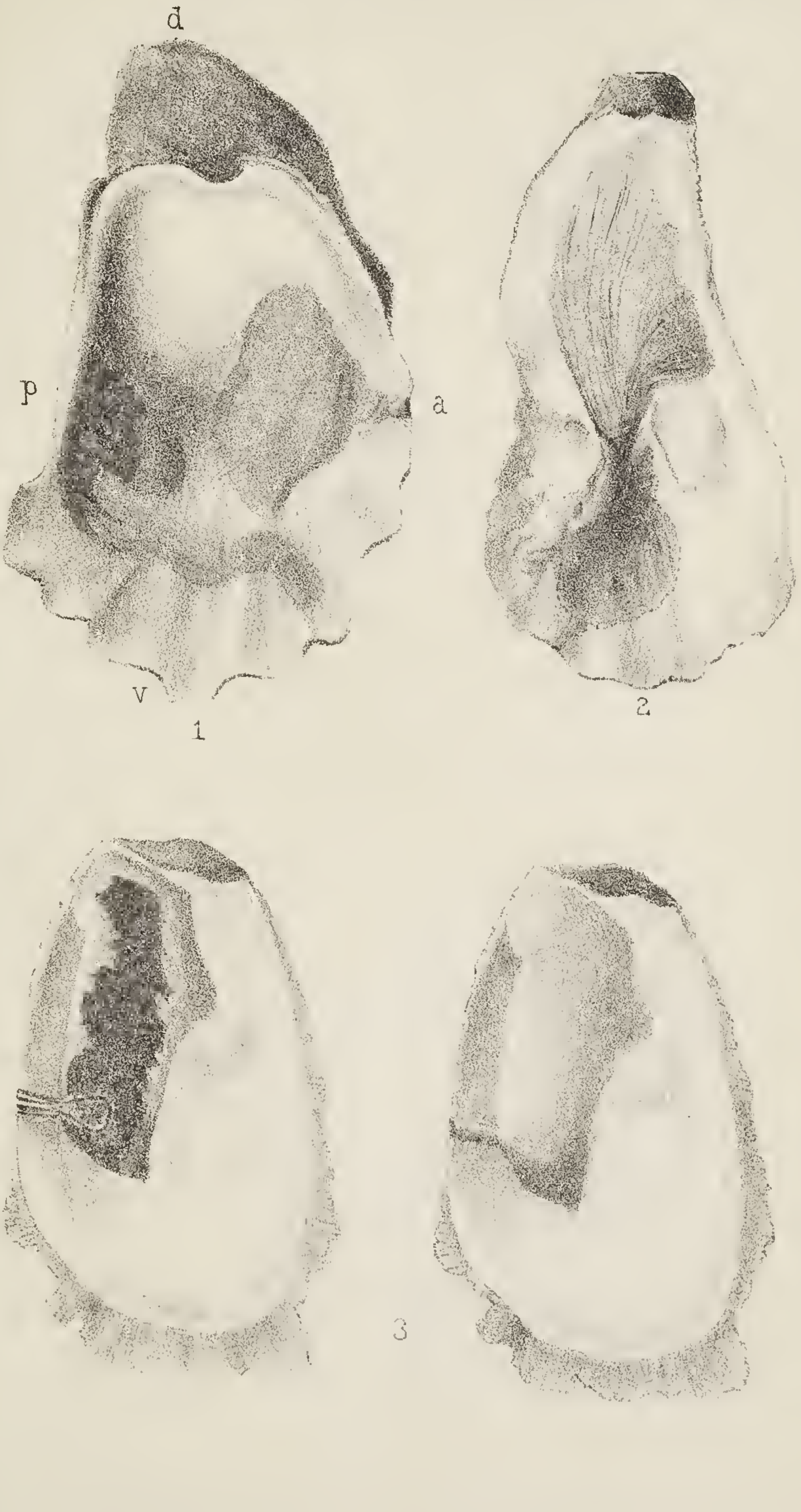
EXPLANATION OF PLATE V.

Fig. 1. Lower (left) valve of *Ostrea cuculata*; (Born) *d*, dorsal edge, *v*, ventral ditto, *a*, anterior margin, *p*, posterior ditto, showing a large blister with the opening of the worm tube on the anterior margin.

,, 2. Upper (right) valve exhibiting two blisters; the one with a dotted outline near the ventral edge, is covered by a calcified layer; the other is in the membranous stage.

,, 3. Upper valve showing a larger blister, the work of a single worm (right hand figure). The same with the surface of the blister removed showing the position occupied by the worm (left hand figure).



G. H. Barrow, del. et lith.

EXPLANATION OF PLATE VI.

Fig. 1. Transverse section of lower valve, exhibiting a series of cavities formed by the oyster in its attempts to cover over the various patches of mud collected by the worms. The entrances to some of the cavities may be seen on the right hand side of the figure (the anterior margin).

,, 2. Section of upper valve showing two cavities, with the openings also on the anterior margin.

,, 3. Upper valve showing the extent of the mud patch collected by a single worm, and the surface of the mud covered by a thin uncalcified membrane.

,, 4. Tubes erected by *Polydora* at the aperture of its tunnel. The attenuated tentacles are seen protruding from the mouth of one. Enlarged under a lens, after Prof. McIntosh.

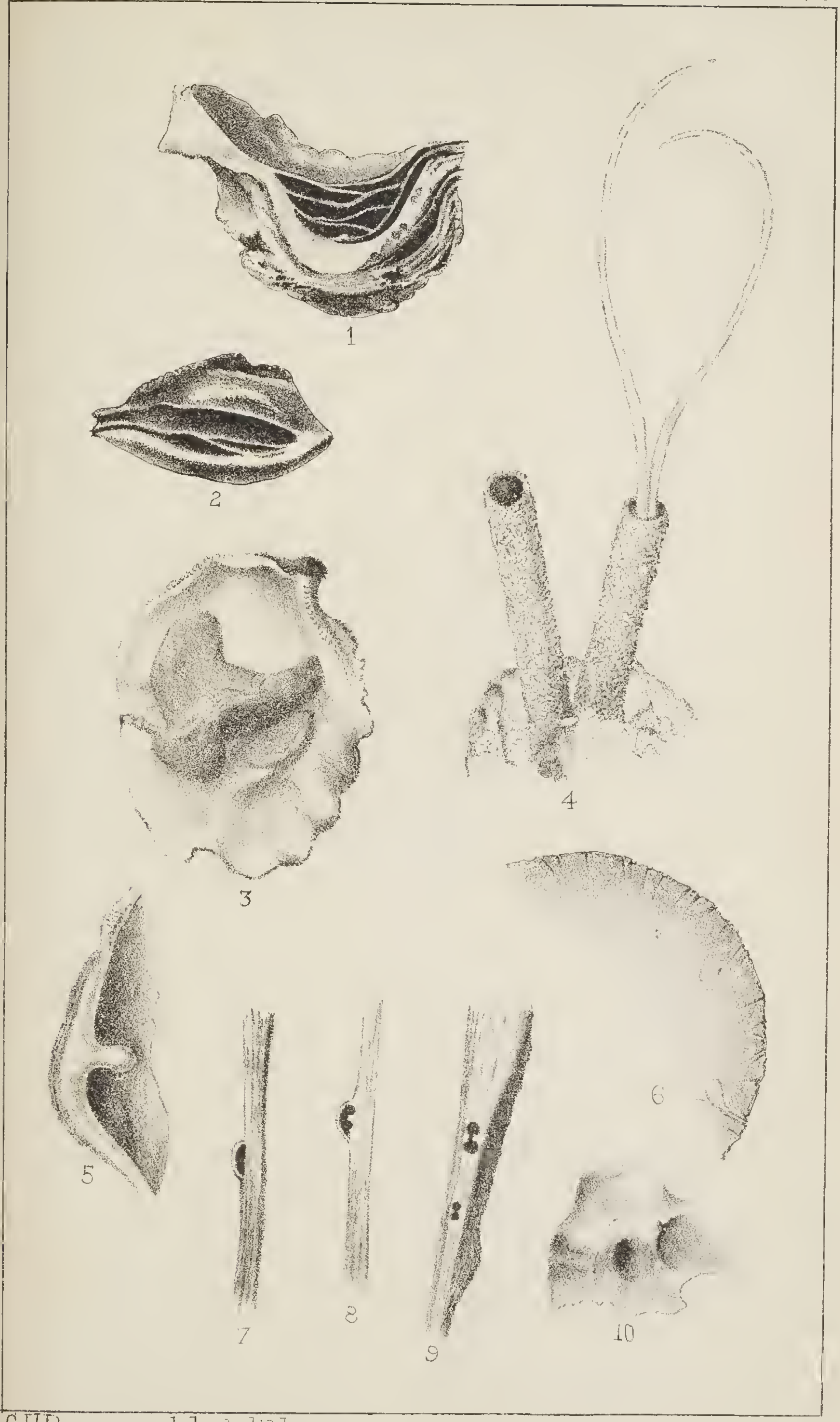
,, 5. Upper valve showing an elevated nodule; near its summit is the tube of the worm projecting at right angles to that of the nodule; the latter is so situated that when the oyster closed its valves there was no communication from without.

,, 6. Edge of an old shell, exhibiting the grooves made by the action of the worms in moving in and out of tubes. The grooves only exist at the margin, and disappear entirely inwards. Slightly enlarged.

,, 7, 8, & 9. Sections of shells showing the openings of the tubes occupied by worms.

Fig. 7, first stage; Fig. 8, second stage; Fig. 9, third stage. Enlarged three times. See page 48

,, 10. Portion of a blister showing the inequalities on the inner surface. See page 46.



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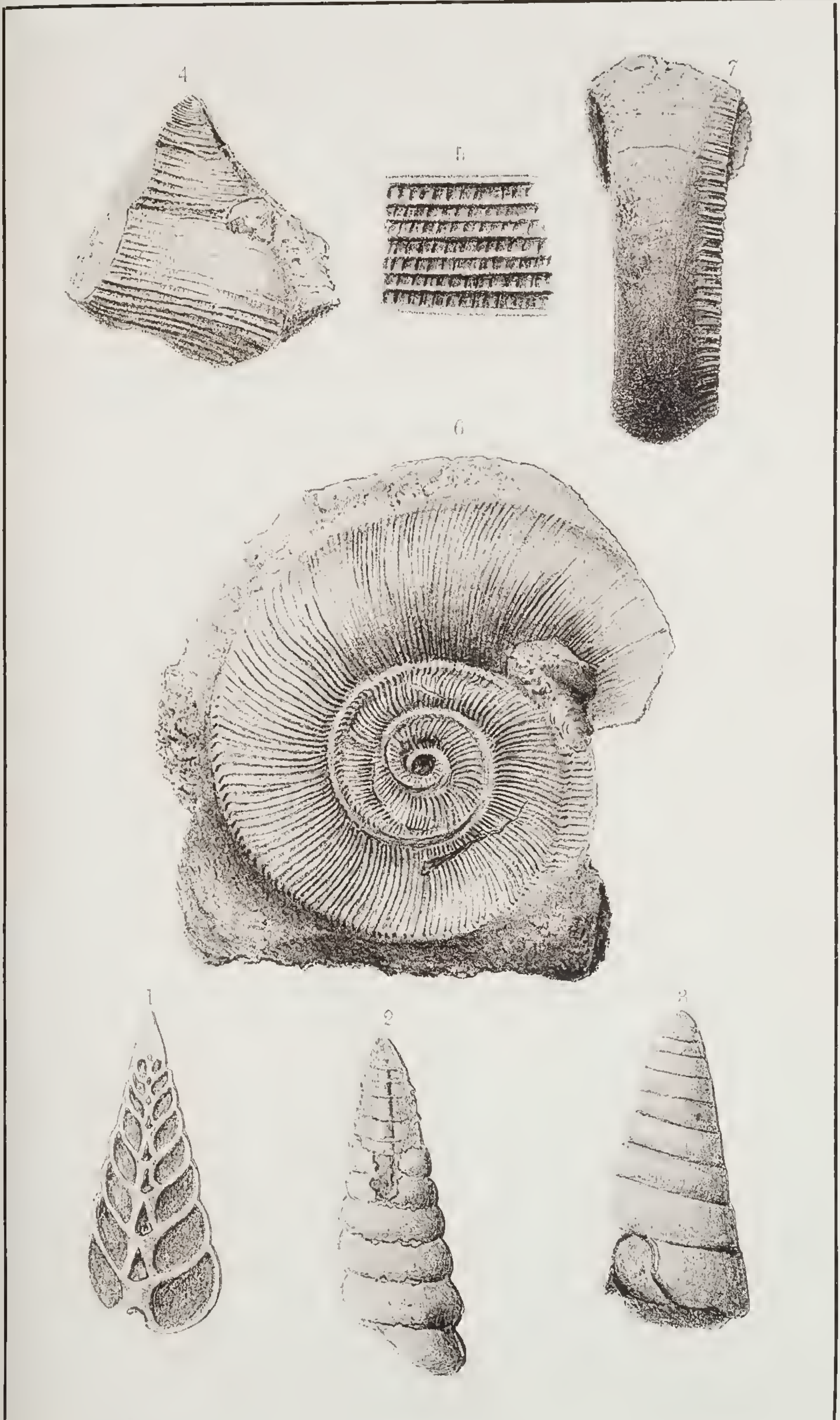

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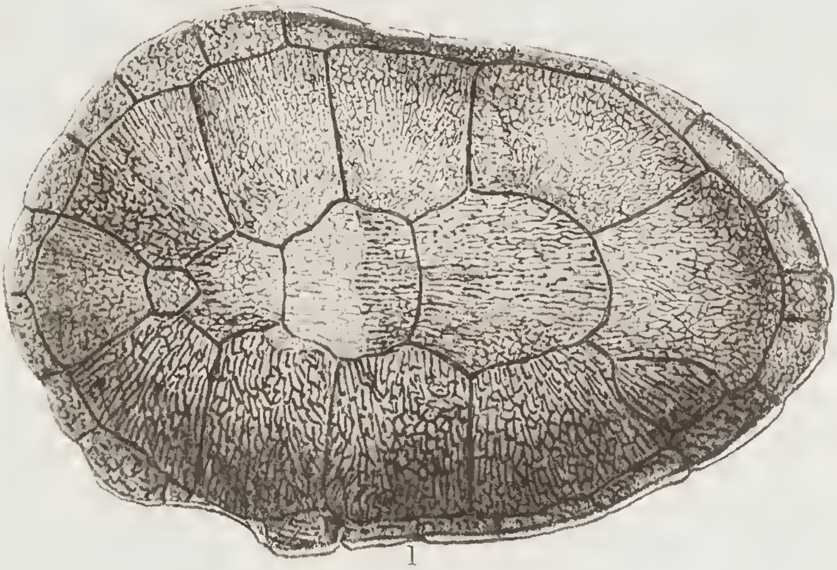
EXPLANATION OF PLATE VII.

Chelodina rugosa, Ogilby.

Fig. 1. Carapace.

„ 2. Plastron.

One-third natural size.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EXPLANATION OF PLATE VIII.

Fig. 1. *Trochus (Scalætrochus) lindströmi,* Eth. fil. Side view of a somewhat damaged specimen.

„ 2. The same. Ventral view.

„ 3. *Niso,* sp. Cross section of an example from the Tertiary beds of Muddy Creek, Victoria—x 7.

„ 4. *Niso (Vetotuba) brazieri,* Eth. fil. Cross section.

„ 5. The same apex downwards, and partly in section.

„ 6. *Favosites grandipora,* Eth. fil. Four corallites in section, showing the single row of large pores in one of the walls of each—x 5.

„ 7. The same. Horizontal section, showing forms of the calices, remains of the proper wall, and secondary thickening—x 5.

„ 8. The same. Portion of the natural surface of a corallum—x 6.

„ 9. The same. Horizontal section of unthickened tubes—x 6.

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EXPLANATION OF PLATE IX.

Fig. 1. *Niso*, sp. Vertical section of a species from the Tertiary beds of Muddy Creek, Victoria—x 3.

,, 2. *Niso (Vetotuba) brazieri*, Eth. fil. Portion of a specimen, partly in relief and partly in broken section, showing the umbilical tube.

,, 3. The same. Specimen with ten whorls.

,, 4. *Cyclonema australis*, Eth. fil. Portion of an individual showing the general features of the species.

,, 5. The same. Portion of the surface ornament—x 6.

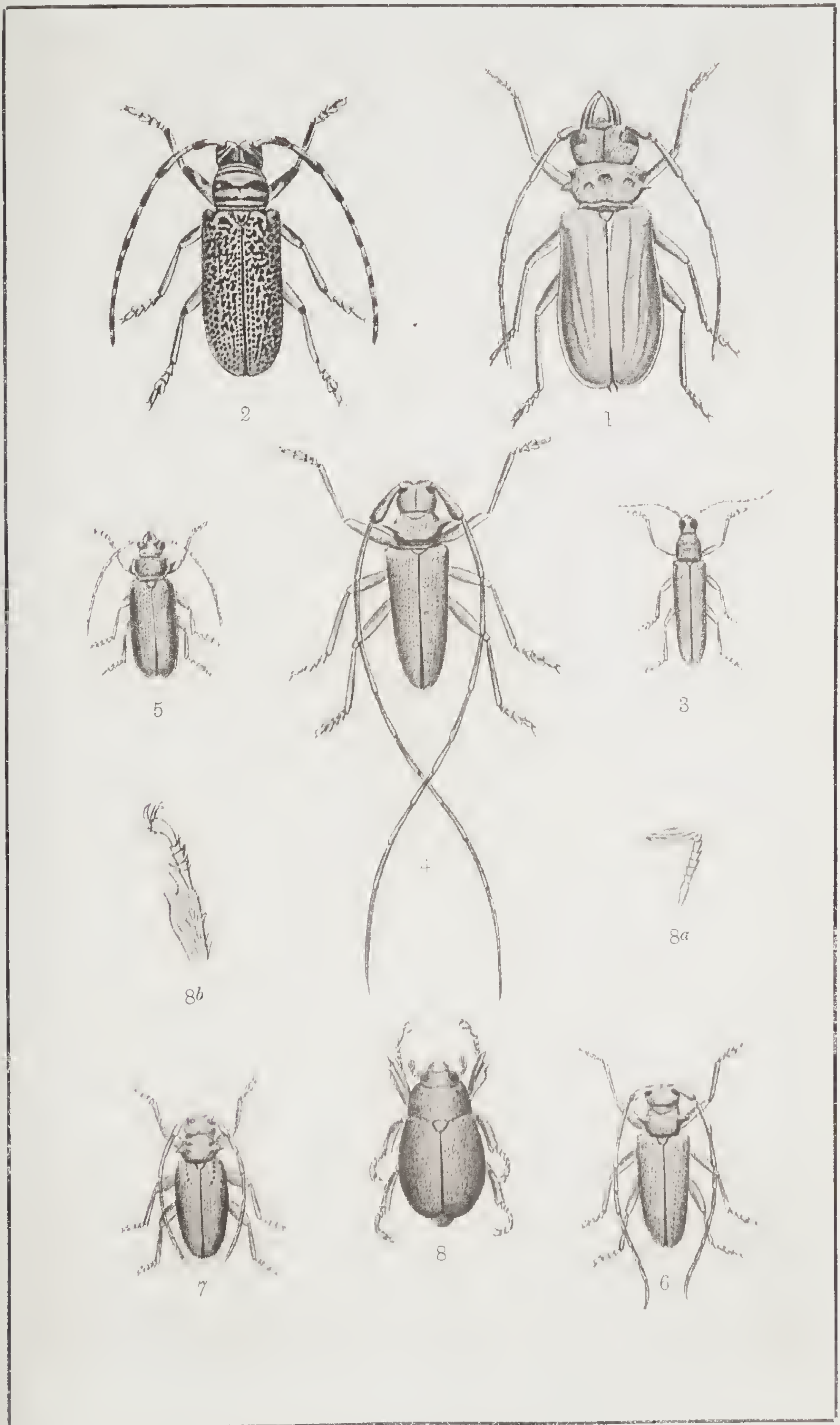
,, 6. *Oriostoma northi*, Eth. fil. Upper view of a nearly complete specimen.

,, 7. The same. View of the back.

EXPLANATION OF PLATE X.

Fig. 1. *Toxeutes rasilis,* Olliff. ♀
„ 2. *Rhytiphora rosei,* Olliff.
„ 3. *Ceresium procerum,* sp. n.
„ 4. *Monohammus æstheticus,* Olliff.
„ 5. *Nothophysis barnardi,* Olliff.
„ 6. *Monohammus artius,* Olliff.
„ 7. *Elasmostoma insulana,* sp. n.
„ 8. *Anoplognathus punctulatus,* sp. n.
„ 8*a* Antenna.
„ 8*b* Anterior tibia and tarsus.

The figures are all slightly reduced in size.



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NEW COLEOPTERA.

EXPLANATION OF PLATE XI.

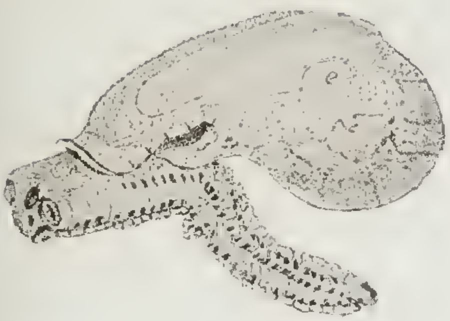
Fig. 1. *Parmella etheridgei*, Brazier, x $3\frac{1}{2}$ diam.
„ 2. Shell of ditto, x 5.
„ 3*a*. Radula of ditto, x 8.
„ 3*b*. Rachidian and lateral teeth of radula, x 1000.
„ 3*c*. Marginal teeth of radula, x 1000.
„ 4. Genital system of ditto, x 6.

c.o., common orifice; *p.s.*, penis-sac; *s*, spermatophore; *f*, flagellum; *v.d.*, vas deferens; *g.b.*, genital bladder; *pr.*, prostrate; *ov.*, oviduct.

PLATE XI.

(Figs. reversed)

I



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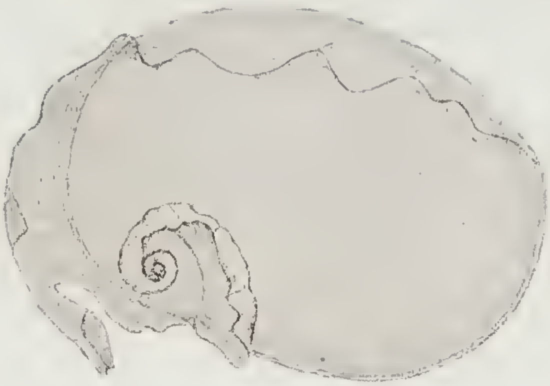
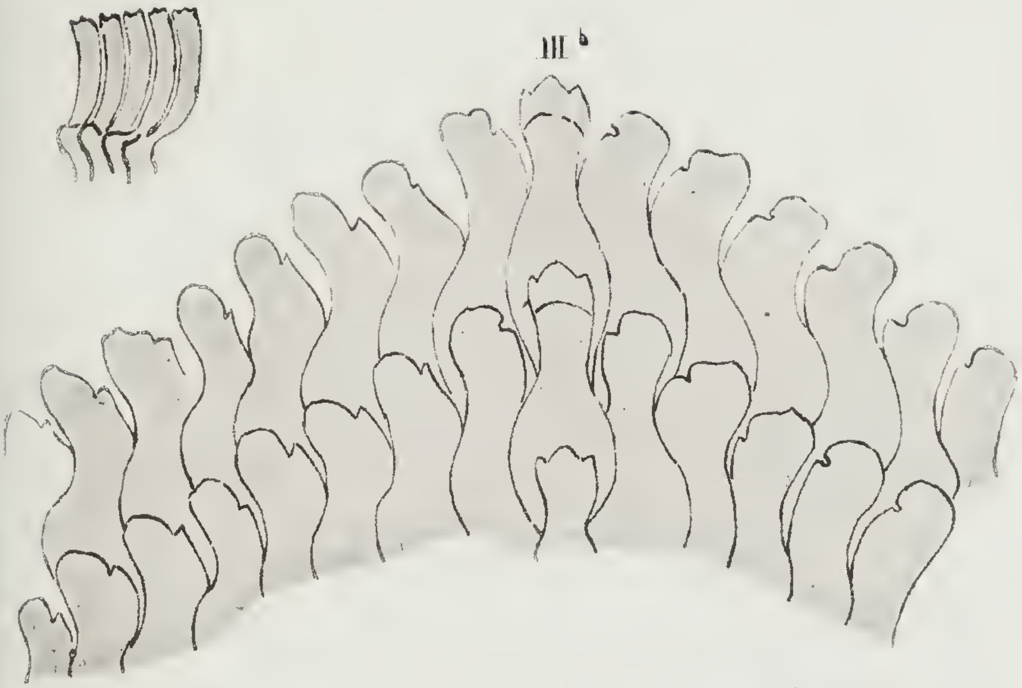


III c

III b



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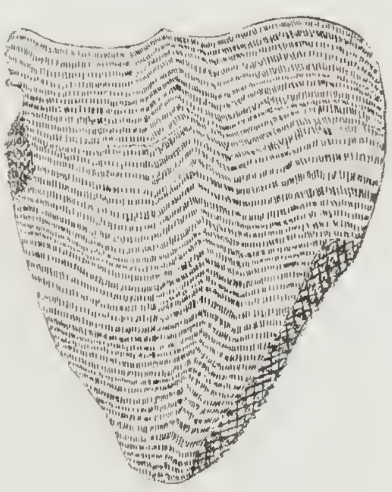
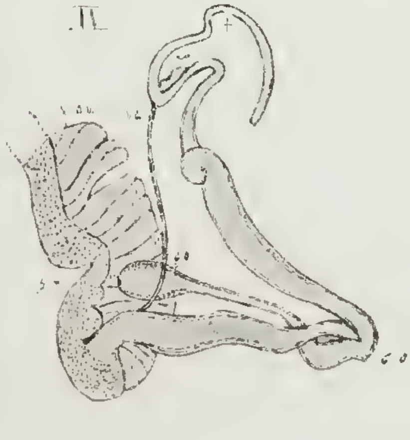


IV



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EXPLANATION OF PLATE XII.

Nest of *Ailurœdus viridis*, Latham, (exterior view) half natural size. Reproduced by heliotype from the originals.

Reproduced by Heliotype

EXPLANATION OF PLATE XIII.

Nest and egg of *Ailurœdus viridis*, Latham, half natural size. Reproduced by heliotype from the originals.

EXPLANATION OF PLATE XIV.

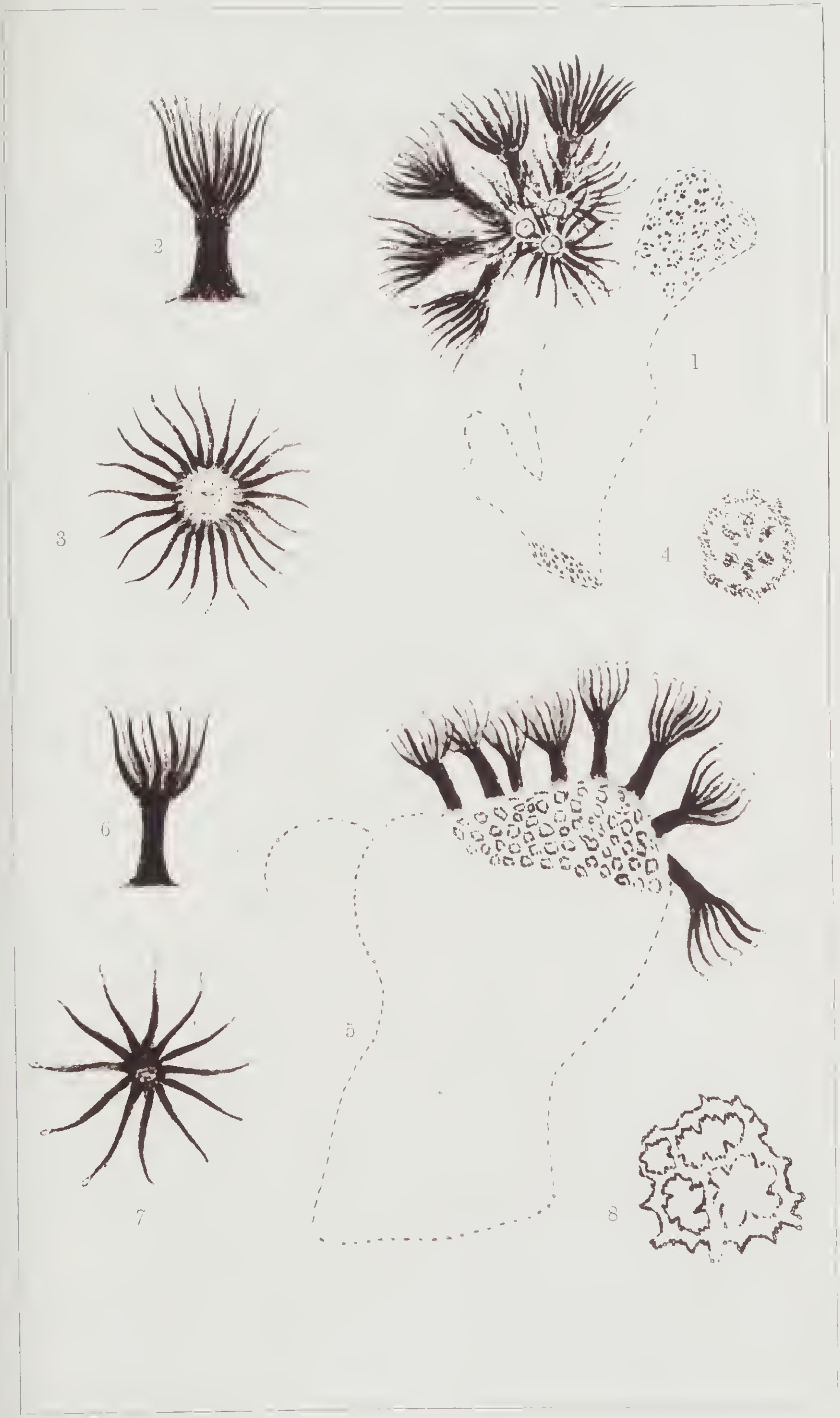
Nest and eggs of *Sphecotheres maxillaris*, Latham, two-thirds natural size. Reproduced by heliotype from the originals.

Reproduced by Heliotype

EXPLANATION OF PLATE XV.

Figs. 1 - 4. *Goniopora fruticosa,* S.-Kent. 1—Corallum with a portion of the polyps extended, natural size. 2 and 3—Horizontal and profile aspects of a single polype, enlarged 2 diameters. 4—Single calicle of corallum enlarged.

Figs 5 - 8. *Alveopora spongiosa,* Dana. 5—Corallum with polypes extended, natural size. 6 and 7—Horizontal and profile aspects of a single polype, enlarged 2 diameters. 8—Superficial aspect of a few adjacent calicles, showing spinous septal elements, enlarged.



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EXPLANATION OF PLATE XVI.

Fig. 1. *Goniopora fruticosa,* S.-Kent. Fig. 2. *Alveopora spongiosa,* Dana.
Heliotypes from original photographs, natural size.

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Reproduced by Heliotype.

EXPLANATION OF PLATE XVII.

Trilacophyllia rectifolia, S.-Kent. Heliotype from original photograph, slightly less than one-third of the natural size.

Reproduced by Heliotype

EXPLANATION OF PLATE XVIII.

Fig. 1. *Ambonychia? poststriata*, Eth. fil. Right valve exhibiting the elevated umbone, posterior radiations, and concentric laminæ.

„ 2. Anterior end of the same specimen showing the large byssal sinus

[The figures, from drawings by Mr. G. H. Barrow, of the Australian Museum, are of the natural size.]

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Reproduced by Heliotype.

EXPLANATION OF PLATE XIX.

Fig. 1. *Cyclonema australis,* Eth. fil. A nearly perfect specimen seen from the back.

„ 2. The same, front view.

„ 3. *Cyclonema lilydalensis,* Eth. fil. Slightly crushed example seen from the back.

„ 4. *Phanerotrema australis,* Eth. fil. A small individual, showing the band, seen from the back.

„ 5. A full grown, although badly preserved example, seen from the back.

„ 6. *Bellerophon cresswelli,* Eth. fil. A broken specimen seen from the front.

„ 7. The same from the side, with the filled up umbilicus.

„ 8. The same from the posterior, exhibiting the band and sinus.

[The figures, from drawings by Mr. G. H. Barrow, of the Australian Museum, are of the natural size.]

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EXPLANATION OF PLATE XX.

Placostylus bivaricosus, Gaskoin, sp., var. *solidus*, Eth. fil.

anterior/ Fig. 1. Front view of a much thickened individual, with the emargination on the inner edge of the outer lip acute, the ~~posterior~~ channel well marked, and the tubercle of the callosity obtusely rounded.

,, 2. Back view of the same specimen, showing the coarse sculpture and irregularly crenulated sutures.

,, 3. Peristome and portion of the last whorl of a thicker-shelled individual, the emargination of the outer lip is shallow, but the tubercle very prominent, the false denticulation on the ~~pos~~- an/ terior margin very apparent, and the thickened margins with concentric laminæ equally so.

,, 4. Side view of the entire specimen Fig. 3, with the umbilicus partially disclosed.

,, 5. Side view of a somewhat less thickened example with the umbilicus practically closed.

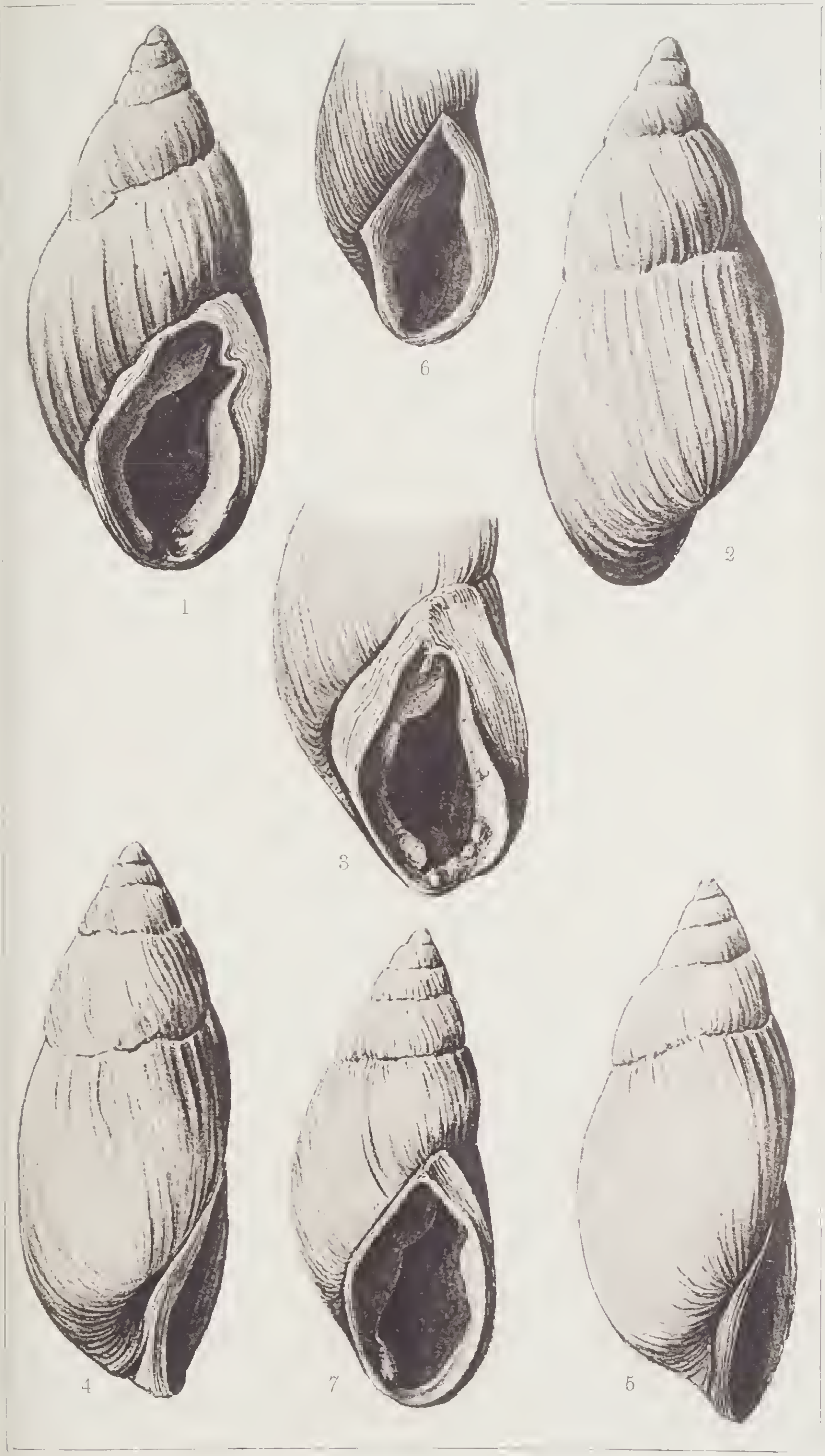
,, 6. Peristome and portion of last whorl of a much smaller specimen from the Sand-dunes, with the general varietal characters marked in less degree, but showing a tendency towards a twisted columella.

Placostylus bivaricosus, Gaskoin, sp.

Fig. 7. A recent example showing a transition towards the var. *solidus*, and the twist in the pillar or columellar lip more marked than in Fig. 6.

Figs. 1 - 5 from the Coral-sand Rock ; Fig. 6 from the Sand-dunes Fig. 7 Recent.

[From drawings by Mr. G. H. Barrow, Australian Museum.]



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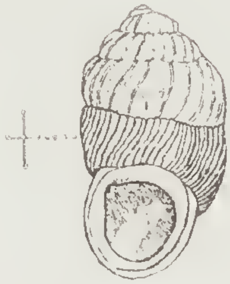
EXPLANATION OF PLATE XXI.

Fig. 1. *Diplommatina macgillivrayi*, Pfr., magnified.
,, 2. *Diplommatina capillacea*, Pfr., magnified.
,, 3. Jaw of *Nanina sophiæ*, Gask., var. *conica*, Braz., magnified.
,, 4. Jaw of *Placostylus bivaricosus*. Gask., magnified.
S/ ,, 5. *Microcysti~~na~~ catletti*, Braz., magnified.
,, 6. Jaw of *Patula whiteleggei*, Braz., magnified.
,, 7. Jaw of *Nanina howinsulæ*, Cox, magnified.
,, 8. *Realia exquisita*, Pfr., magnified.
,, 9. *Simpulopsis (?) mastersi*, Brazier, magnified.

[Reproduced from drawings by C. Hedley.]



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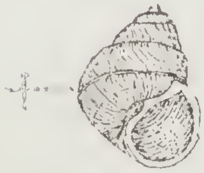

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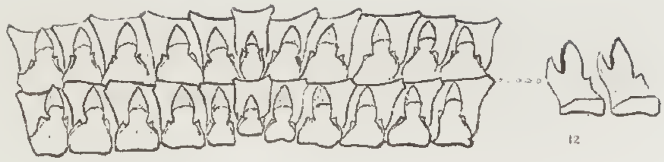
EXPLANATION OF PLATE XXII.

Fig. 1. Radula of *Patula whiteleggei*, Brazier, magnified.
,, 2. Radula of *Nanina hilli*, Cox, magnified.
,, 3. Radula of *Placostylus bivaricosus*, Gaskoin, magnified.
,, 4. Jaw of *Parmella etheridgei*, Brazier, magnified.
,, 5. Genitalia of *Nanina howinsulæ*, Cox.
,, 6 Jaw of *Nanina hilli*, Cox, magnified.
,, 7. Radula of *N. sophiæ* var. *conica*, Brazier, magnified.
,, 8. Radula of *N. howinsulæ*, Cox, magnified.

[Reproduced from drawings by C. Hedley.]



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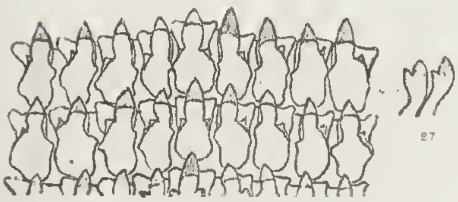

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DESCRIPTION OF PLATE XXIII.

All the figures refer to *Phreatoicus australis*.

Fig. 1. Side view of the animal (♂), × 6.
,, 2. Upper antenna, × 19.
,, 3. Lower antenna, × 19.
,, 4. Upper lip, × 19.
,, 5. Left mandible (seen from in front, *i.e.*, from above, and partly from within) × 45.
,, 5*a*. Extremity of left mandible, showing the cutting teeth, × 45.
,, 6. Lower lip, × 19.
,, 7. First maxilla, × 45.

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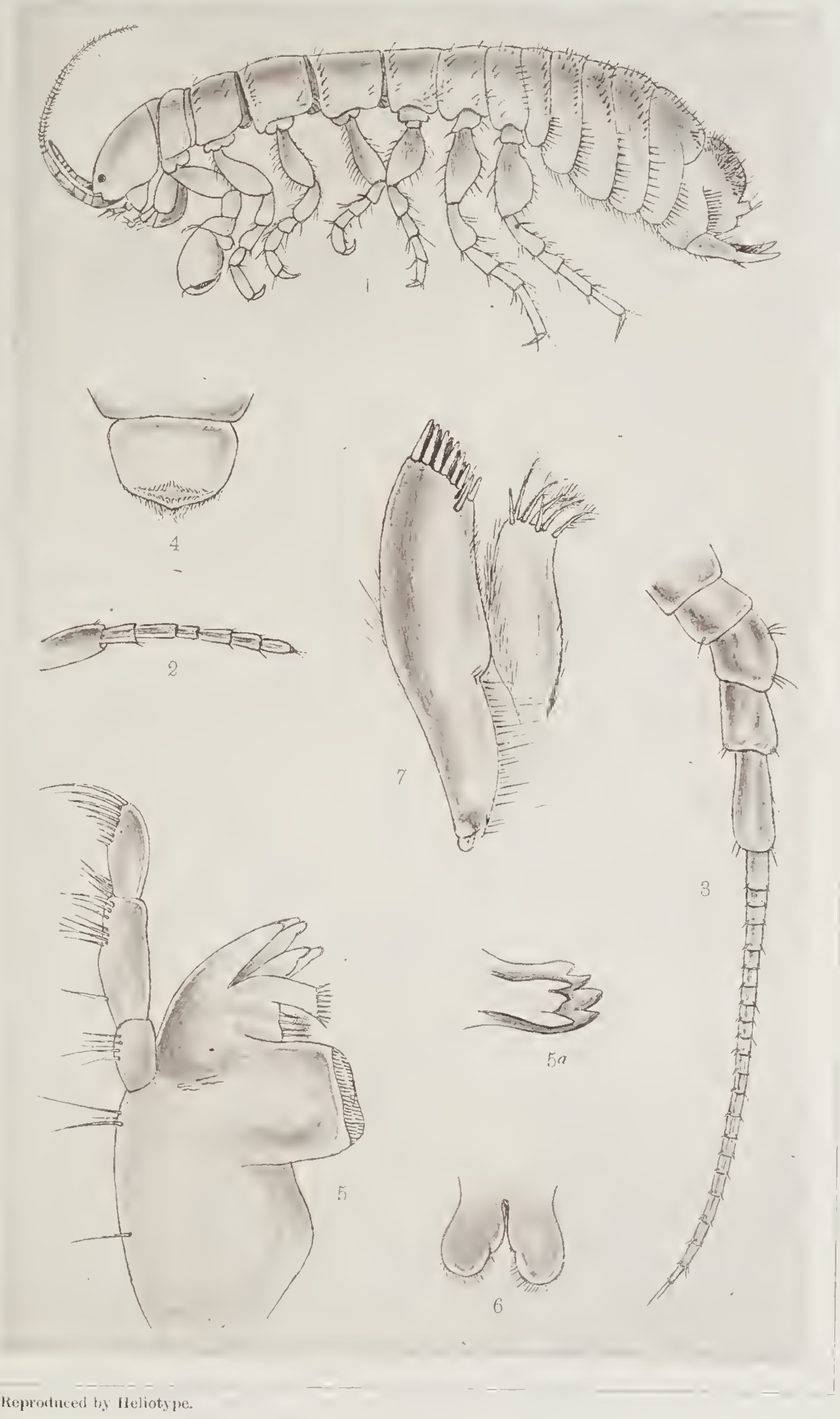

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DESCRIPTION OF PLATE XXIV.

All the figures refer to *Phreatoicus australis*

Fig. 1. Second maxilla, × 45.

,, 2. The maxillipedes, seen from without, × 19.

,, 3. The same, seen from within (*i.e.* in front) × 19.

,, 4. Extremity of the same, × 45.

,, 5. First thoracic leg, × 19.

,, 5*a*. Palm and dactylos of first thoracic leg, × 45.

[Reproduced by G. H. Barrow of the Australian Museum, from original drawings by the author, Chas. Chilton, and printed by Heliotype.]


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DESCRIPTION OF PLATE XXV.

All the figures refer to *Phreatoicus australis.*

Fig. 1. Third thoracic leg, × 19.
,, 2. Fourth thoracic leg of male, × 19.
,, 3. Seventh thoracic leg, × 19.
,, 4. Epimeron of second thoracic segment, × 19.
,, 5. Epimeron of sixth thoracic segment, × 19.
,, 6. Uropoda with portion of last segment of pleon, × 19.

[Reproduced by G. H. Barrow of the Australian Museum, from original drawings by the author, Chas. Chilton, and printed by Heliotype.]


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DESCRIPTION OF PLATE XXVI.

All the figures refer to *Phreatoicus australis*.

Fig. 1. First pleopod, × 19.
,, 2. Second pleopod of male showing the "penial filament," × 19.
,, 3. Third pleopod, × 19.
,, 4. Fourth pleopod showing the parasitic (?) growths at *a*, × 19.
,, 5. One of the latter, × 180.
,, 6. External organ of male, × 45.

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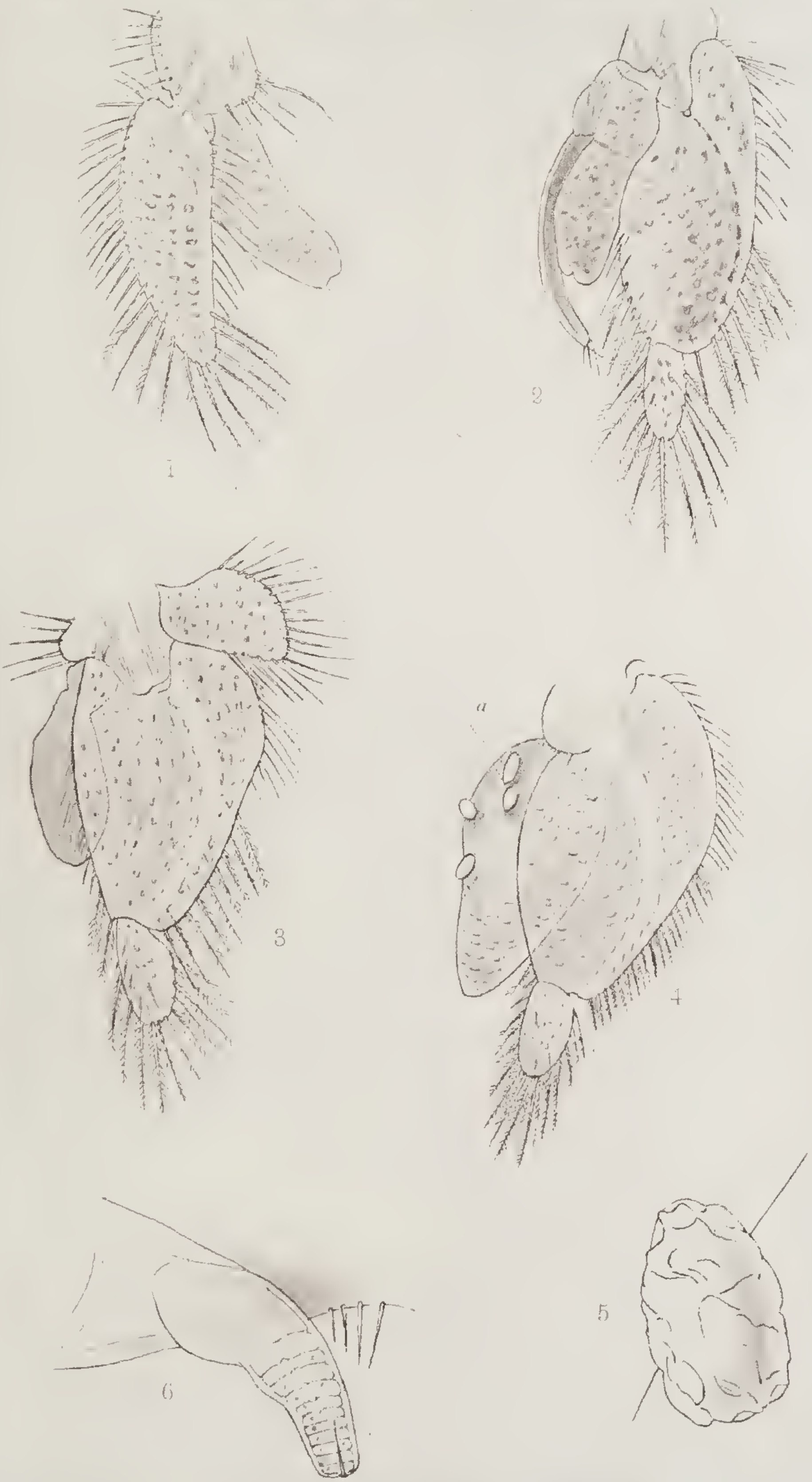

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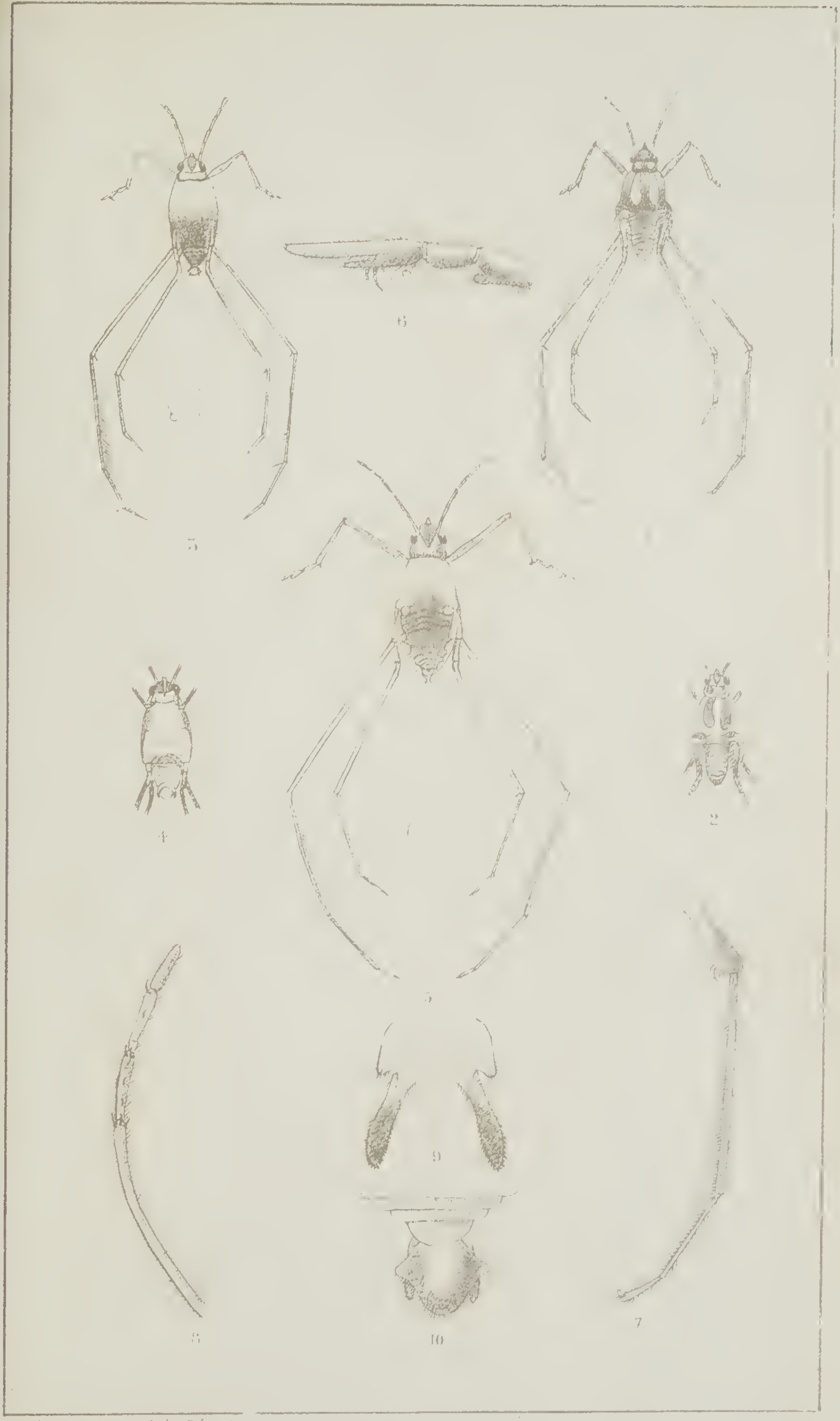
EXPLANATION OF PLATE XXVII.

HALOBATES WHITELEGGEI, Skuse.

Fig. 1. Larva (from dried specimen).
„ 2. Larva (from spirit specimen).
„ 3. Adult male.
„ 4. Underside of body of adult male.
„ 5. Adult female.
„ 6. Anterior tarsus of male.
„ 7. Intermediate tibia and tarsus of male.
„ 8. Antenna of male.
„ 9. Horn-like processes of second genital segment of male.
„ 10. Genital segments of male (from above).

All greatly magnified and drawn from nature by Mr. G. H. Barrow, Australian Museum. Natural sizes denoted by indicators.

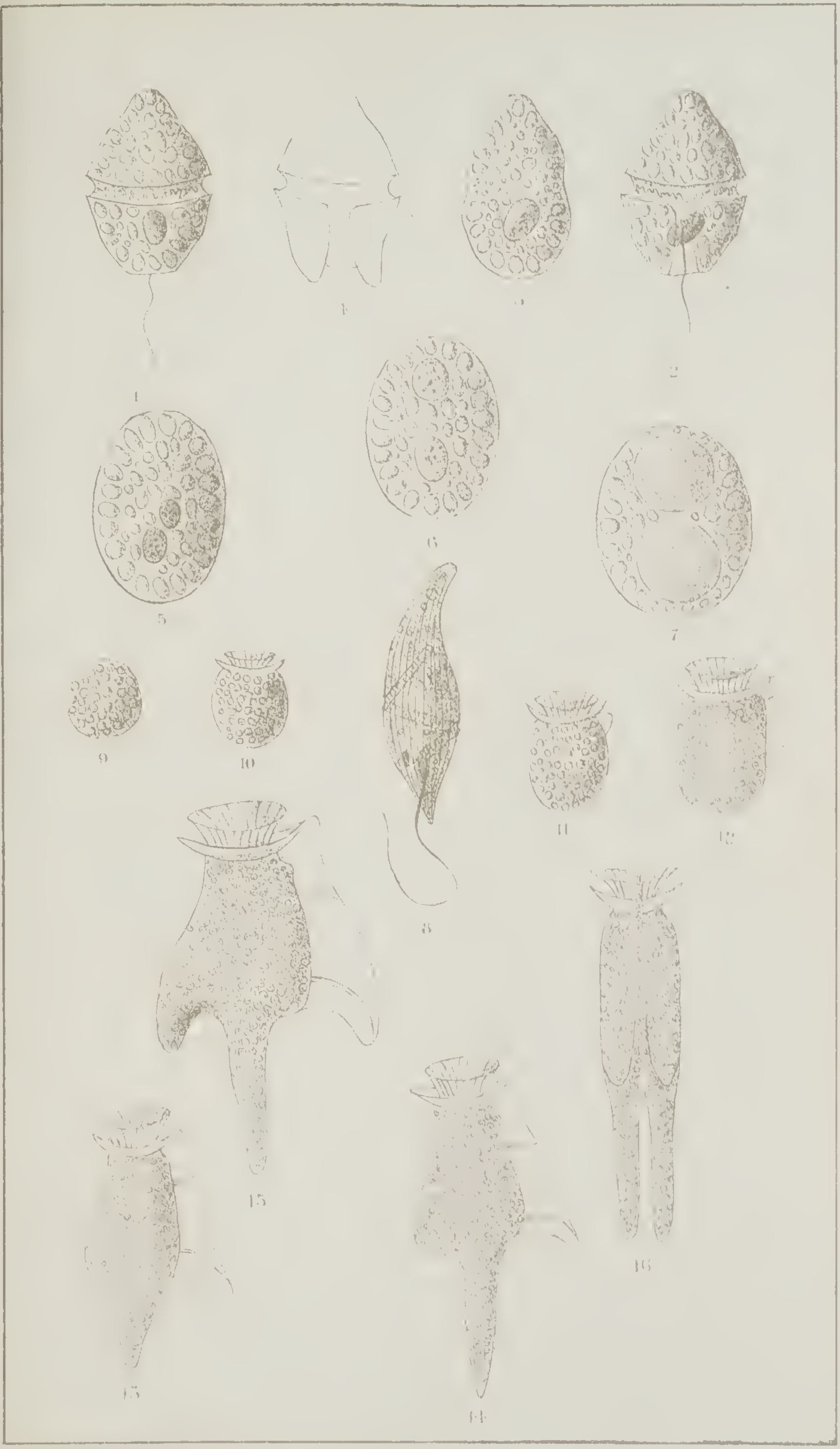


G H BARROW del et Lith

PELAGIC HEMIPTERA.

EXPLANATION OF PLATE XXVIII.

Fig. 1.	*Glenodinium rubrum,*	sp. n., dorsal aspect × 1000.	
,, 2.		Ditto	ventral aspect.
,, 3.		Ditto	example without the cuirass.
,, 4.		Ditto	empty cuirass.
,, 5, 6, 7.		Ditto	examples showing the formation of the resting spores.
,, 8.	*Gymnodinium spirale,* Bergh., after Bergh.		
,, 9 - 15.	*Dinophysis homunculus,* Stein., showing progressive phases of development; highly magnified.		
,, 16.		Ditto	example dividing by longitudinal fission.



GLENODINIUM RUBRUM Fig 1-7
GYMNODINIUM SPIRALE Fig 8
DINOPHYSIS HOMUNCULUS Figs 9-16.

EXPLANATION OF PLATE XXIX.

Fig. 1. Two ranks of eleven teeth from the centre, and of the thirtieth to the thirty-fourth from the margin, of the radula of *H. gulosa*, Gould : much magnified.

„ 2. Jaw of same : magnified.

„ 3. Sculpture of the shell of the same, drawn from below the suture of the last whorl behind the aperture : magnified.

„ 4. Genital system of the same.

„ 5. Animal of the same, left side, mantle-collar reflected and exposing rudimentary lobes : enlarged one and a-half diameters.

„ 6. Animal of the same, right side, showing mode of progression and the mantle lobes surrounding the pulmonary orifice : enlarged one and a-half diameters.

(Reproduced from drawings by C. Hedley.)

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DESCRIPTION OF PLATE XXX.

RHIZOPHYLLUM AUSTRALE, *Etheridge, fil.*

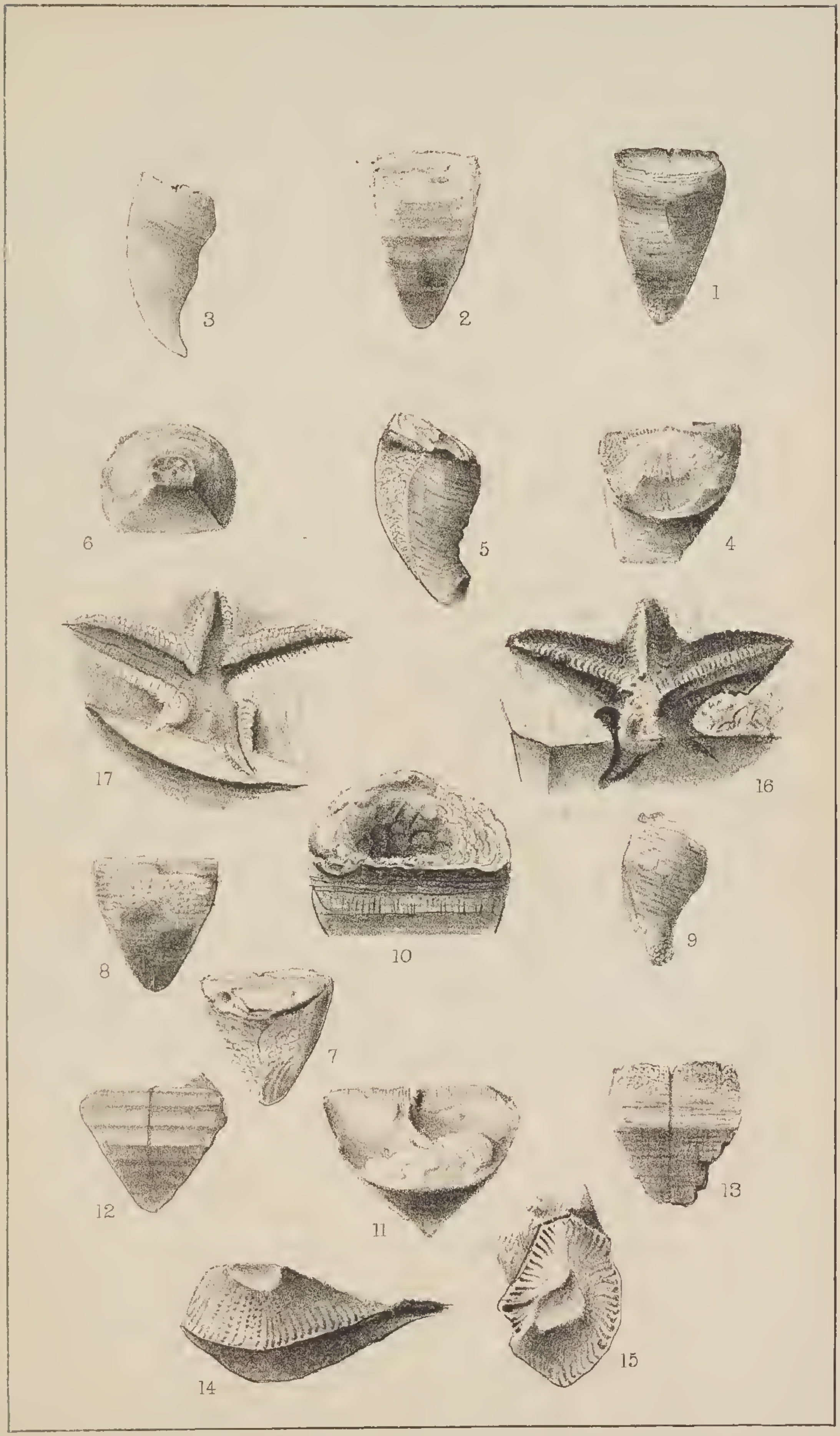
Fig. 1. The corallum, dorsal view, × 2.
,, 2. ,, ventral view, × 2.
,, 3. ,, lateral view, × 2.
,, 4. Remains of an operculum, seen from above, × 2.
,, 5. The corallum lateral view, displaying the vesicular tissue, × 2.
,, 6. Section of the apex, showing the septa, cardinal septum and vesicular tissue, × 3.

RHIZOPHYLLUM INTERPUNCTATUM, *De Koninck.*

Fig. 7. The corallum, dorsal view, with the epitheca removed, displaying the infundibuliform layers of vesicular tissue, × 2.
,, 8. ,, ventral view, × 2.
,, 9. ,, lateral view, × 2.
,, 10. The calice, filled with vesicular tissue, × 2.
,, 11. Another calice, with the counter septum and worn septa exposed on the ventral wall, × 2.
,, 12. The corallum, ventral view, showing the position of the counter septum, and transverse bands of growth, × 2.
,, 13. A similar view, × 2.
,, 14. Internal cast of the calice, ventral side, with the granulated entire septa, × 2.
,, 15. The same seen from below, showing both the dorsal and ventra septa.

PALÆASTER MERIDIONALIS, *Eth. fil.*

,, 16. Impression of the actinial surface, × 2.
,, 17. Mould taken from specimen, × 2.



G. H. BARROW, del.

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