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THE RESULTS OF DEEP-SEA INVESTIGATION IN THE
TASMAN SEA.

3.—MOLLUSCA FROM EIGHTY FATHOMS OFF NARRABEEN.

By C. HEDLEY, Conchologist.

(Plates liv.-lvi.)

The fourth collection from the continental shelf of this coast I have been privileged to examine was discussed in the last issue of this serial. The fifth forms the subject of the present article. It was obtained under the circumstances above related, on 7th June, 1906, in a single haul of the bucket dredge in eighty fathoms, twenty-two miles east of Narrabeen, New South Wales.

Probably the alluvial of the Hawkesbury River is here spread by the prevailing current, for at this point the continental shelf extends in an unusually broad terrace. A depth of two hundred and fifty fathoms is attained at the same distance east of Botany Heads, while six hundred fathoms are reached south of Ulladulla at no greater distance off the land.

According to the "Challenger" observations, long continued west winds push the great warm current beyond this station, but usually its stream sweeps over the position. A rich fauna inhabits this spot. In all I have separated two hundred and forty species of shells, a total far greater than was realised by the best haul of the voyage of the "Challenger." This result is partly due to the productive nature of the ground, and partly to the efficiency of the bucket dredge as a collecting tool.

Assuming that we have here the entire molluscan fauna of three square feet of the sea floor, it is interesting to speculate what proportion of a fauna extending over thousands of square miles of continental shelf, subsists on three square feet. If we counted the plants of three square feet on a river bank, what proportion would they represent of the total flora of the valley? I am inclined to suppose that the cases are not parallel, that a square foot of the sea floor contains a larger proportion of the fauna of a square mile than happens on land. This is supported by the continuity of fossil zones elaborated by modern palaeontologists, and is deducible from the uniformity of conditions in

deep water. I am struck by the repetition in the "Miner's" haul of most species taken off Wollongong, fifty miles south; and off Cape Byron, three hundred and sixty miles north. But if the series before me represents a tenth or even a quarter of all the mollusca of the continental shelf, then we are grasping a fauna as rich or richer than any known.

Of this collection many apparently new are too imperfect for description. Others are suitable for publication but time has not allowed the preparation of drawings and descriptions. As species observed in previous dredgings are here first introduced, so I shall hope for a future opportunity to publish those now put aside.

Five years ago a collection made anywhere from our continental shelf would have presented quite thirty per cent. of new species. This might fairly be ranked as a new fauna. As collections are described, the proportion of novelties in any particular haul will decrease. When reduced to three or four per cent. we might claim to have a fair knowledge of that fauna. A high proportion, about sixteen per cent., appears in the present collection, consequently much work is to be performed before we gain a tolerable acquaintance with the mollusca from 20-100 fathoms off Sydney.

In the first of these reports¹ I drew attention to the appearance in a recent state, of several species previously known as Tertiary fossils. I now add to these *Trivia avellanooides*, McCoy. Dr. J. C. Verco, who is publishing details, informs me that the difference between my *Astele bilix* (now removed to *Basilissa*) and Tate's *Seguenzia radialis* are hardly more than varietal. When a good knowledge of both recent and fossil Australian shells is combined in one brain, the list of survivors will probably be enlarged. The types of the new species are to be preserved in the Australian Museum.

Dr. J. C. Verco is now describing shells from the continental shelf of South Australia and finds there a number of the species here recorded. I have benefited by comparison and interchange of specimens and it is hoped that duplication of work has been avoided.

My thanks are due to Mr. G. M. Goldfinch, a volunteer assistant, who undertook the sorting and separation of the collection. Without his help I should have been unable to present this report at so early a date.

¹ Hedley—Mem. Austr. Mus., iv., 5, 1902, p. 287.

The following are the shells identified.

- Acteon austrina*, Watson.
 „ *rosea*, Hedley.
Adacnarca squamea, Hedley.
Admete stricta, Hedley.
Amphithalamus pyramidatus, Hedley.
Amusium thetidis, Hedley.
Arca reticulata, Gmelin.
Architectonica atkinsoni, Smith.
 „ *reevei*, Hanley.
Aspella undata, Hedley.
Atlanta fusca, Eydoux and Souleyet.
 „ *inclinata*, E. & S.
 „ *rosea*, E. & S.
Atys pransa, Hedley.

Basilissa radialis, Tate.
Bathyarca perversidens, Hedley.
Bathytoma agnata, Hedley and Petterd.
Bulla incommoda, Smith.

Cadulus spretus, Tate and May.
Cancellaria scobina, Hedley and Petterd.
Capulus devotus, Hedley.
Carditella angasi, Smith.
Cardium pulchellum, Gray.
Cavolina inflexa, Leseur.
 „ *longirostris* v. *angulata*, Souleyet.
 „ „ v. *strangulata*, Hedley.
 „ *quadridentata*, Leseur.
 „ *tridentata*, Forskal.
 „ *trispinosa*, Leseur.
Chione despecta, Hedley.
Chlamys hedleyi, Dautzenberg.
Cirsonella weldii, Ten. Woods.
Cithna angulata, Hedley.
Clio acicula, Rang.
 „ *pyramidata*, Linne.
 „ *subula*, Quoy and Gaim.
 „ *virgula*, Rang.
Cocculina coërcita, Hedley.
Columbarium pagodoides, Watson.
Columbella angasi, Brazier.
 „ *plexa*, Hedley.
Coralliophila lischkeana, Dunker.

- Coriarius semiradiatus*, Tate.
 „ *vitreus*, Hedley.
Crassatellites discus, Hedley.
 „ *securiforme*, Hedley.
Crossea carinata, Hedley.
 „ *concinna*, Angas,
 „ *naticoides*, Hedley.
Cryptopora brazieri, Crane.
Cuna delta, Tate and May.
 „ *concentrica*, Hedley.
 „ *particula*, Hedley.
Cuspidaria brazieri, Angas.
 „ *latesulcata*, Ten. Woods.
Cuvierina columella, Rang.
Cyclostrema inscriptum, Tate.
 „ *johnstoni*, Beddome.
Cylichna arachis, Quoy and Gaimard.
 „ *protumida*, Hedley.
Cymatium kampylum, Watson.
Cyrella dalli, Hedley.
Dacrydium fabale, Hedley.
Daphnella crebriplecata, Reeve.
 „ *vestalis*, Hedley.
 „ *sculptior*, Ten. Woods.
 „ *tasmanica*, Ten. Woods.
Dentalium erectum, Sowerby.
 „ *lubricatum*, Sowerby.
Dimya corrugata, Hedley.
Drillia dilecta, Hedley.
 „ *haswelli*, Hedley.
 „ *multilirata*, Smith.
 „ *nesia*, Hedley.
 „ *pentagonalis*, Verco.
 „ *tricarinata*, Ten. Woods.
Emarginula superba, Hedley and Petterd.
Epigrus ischnus, Tate.
Euchelus scabriusculus, Angas.
Eulima fricata, Hedley.
Euthria tabida, Hedley.
Fascinus typicus, Hedley.
Gafrarium angasi, Smith.
Hemithyris columnus, Hedley.
Hydatina tasmanica, Beddome.

- Leda miliacea*, Hedley.
Lima bassi, Ten. Woods.
 „ *bullata*, Born.
Limacina inflata, D'Orbigny.
Limea murrayi, Smith.
Limopsis brazieri, Angas.
 „ *tenisoni*, Ten. Woods.
Lippistes torcularis, Ten. Woods.
Liotia compacta, Petterd.
 „ *minima*, Ten. Woods.
 „ *tasmanica*, Ten. Woods var. *scalaris*, Hedley.
Lyonsiella quadrata, Hedley,

Mangelia emina, Hedley
 „ *granulosissima*, Ten. Woods.
 „ *lutaria*, Hedley.
 „ *spica*, Hedley.
Marginella allporti, Ten. Woods.
 „ *brazieri*, Smith.
 „ *laevigata*, Brazier.
 „ *multiplicata*, Tate and May.
 „ *ochracea*, Angas.
 „ *simsoni*, Tate and May.
 „ *stanislaus*, Ten. Woods.
 „ *stilla*, Hedley.
 „ *strangei*, Angas.
 „ *whani*, Pritchard and Gatliff.
Mathilda decorata, Hedley.
Mitra scalariformis, Ten. Woods.
 „ *strangei*, Angas.
 „ *tasmanica*, Ten. Woods.
Mitromorpha alba, Petterd.
Modiola australis, Gray.
 „ *linea*, Hedley.
Modiolaria splendida, Dunker.
Monilea arata, Hedley.
 „ *philippensis*, Watson.
Murex acanthopterus, Lamarck.
Myadora albida, Ten. Woods.

Nassa jacksoniana, Quoy and Gaimard.
Nucula obliqua, Lamarck.

Odostomia simplex, Angas.
Omalaxis meridionalis, Hedley.
Oxygyrus keraudrenii, Lesson.

- Philobrya inornata*, Hedley.
 „ *pectinata*, Hedley.
 „ *tatei*, Hedley.
Philine teres, Hedley.
 „ *trapezina*, Hedley.
Pleurotomella fastosa, Hedley.
 „ *vepratrica*, Hedley.
Polinices beddomei, Johnston.
 „ *subcostata*, Ten. Woods.
 „ *umbilicata*, Quoy and Gaim. var.
Poroleda ensicula, Angas.
Poromya laevis, Smith.
Promicula decorosa, Hedley.
 „ *minuta*, Ten. Woods.
Puncturella demissa, Hedley.
Rissoa bicolor, Petterd.
 „ *filocincta*, Hedley and Petterd.
 „ *integella*, Hedley.
 „ *novariensis*, Frauenfeld.
 „ *olivacea*, Dunker.
Rissoina elegantula, Angas.
Rochfortia acuminata, Smith.
 „ *angasi*, Smith.
 „ *lactea*, Hedley.
Sarepta obolella, Tate.
Scala distincta, Smith.
 „ *jukesiana*, Forbes.
 „ *levifoliata*, Murdoch and Suter.
 „ *translucida*, Gatliff.
Schismope atkinsoni, Ten. Woods.
Scissurella australis, Hedley.
Sirius badius, Ten. Woods.
Stiva ferruginea, Hedley.
Tellina tenuilirata, Sowerby.
Terebratulina radula, Hedley.
Thraciopsis arenosa, Hedley.
Trigonia margaritacea, Lamarck.
Trivia avellanoides, McCoy.
Trophon goldsteini, Ten. Woods.
 „ *laminatus*, Petterd.
 „ *simplex*, Hedley.
 „ *stimuleus*, Hedley.
Turritella opulenta, Hedley.
 „ *smithiana*, Donald.

- Turritella sophie*, Brazier.
 „ *subsquamosa*, Dunker.
Typhis syringianus, Hedley.
 „ *philippensis*, Watson.
Venericardia cavatica, Hedley.
 „ *dilecta*, Smith.
Vermicularia nodosa, Hedley.
 „ *waitei*, Hedley.
Verticordia vadosa, Hedley.
 „ *australiensis*, Smith.
Voluta undulata, Lamarck, var.
Xenophora tatei, Harris.

COCCULINA COERCITA, *sp. nov.*

(Plate liv., figs. 1, 2).

Shell small, thin, almost symmetrical, slightly elevated, very narrow. Colour white. Apex prominent, smooth, inrolled, two-whorled, situated a little behind the centre of the shell. Anterior and posterior slope about equal. Sculpture, slight concentric growth lines. Edge of aperture sharp, smooth; sides straight; ends rounded. Length, 4·6; breadth, 1·3; height, 1·15mm.

The present collection contained a single specimen, another was dredged by Mr. W. F. Petterd and myself in 300 fathoms twenty-seven-and-a-half miles east of Sydney.

PUNCTURELLA DEMISSA, *Hedley*.

(Plate liv., figs. 3, 4, 5).

Puncturella demissa, Hedley, Rec. Austr. Mus., v., 2, 1904, p. 93, f. 19.

This species was originally described from Foveaux Strait, New Zealand. Its range is now extended to Australia. The example dredged by the "Miner" is larger than the type, being 1·5 in height, 2·5 in length, and 0·9 mm. in breadth. The surface is clothed with a rather caducous ochraceous epidermis disposed in oblong grains. When stripped of the epidermis the white surface of the shell shows no trace of these grains, and would readily pass for a different species. Towards the margin some specimens have broad shallow radial undulations. A specimen from off Port Stephens is in this Museum; the "Thetis" took it in 63-75 fathoms off Port Kembla, and I have dredged it in 20 fathoms in Wreck Bay, N. S. Wales.

SCALA LEVIFOLIATA, Murdoch & Suter.

Scala levifoliata, Murdoch and Suter, Trans. N. Zeal. Inst., xxxviii., 1906, p. 296, pl. xxv., f. 35, 36.

A single shell from the "Miner's" haul, compared with a cotype of the New Zealand species, has the peripheral carina less pronounced, and carries above it an additional carina, which gives the Australian shell a more rounded whorl. It is however, identical in other respects. This entry is an addition to the Australian fauna.

SCALA TRANSLUCIDA, Gatliff.

Scala translucida, Gatliff, Proc. Roy. Soc. Vict., (n.s.), xix., 1906, p. 2, pl. i., f. 3, 4.

An imperfect shell from off Narrabeen agrees with Victorian examples kindly sent me for the purpose of comparison by Mr. J. H. Gatliff.

EULIMA FRICATA, sp. nov.

(Plate lv., fig. 14).

Shell sub-cylindrical, scarcely tapering, blunt at either end. Whorls six, first dome-shaped. Colour: apical whorls white opaque, lower semitransparent, permitting the axis to be clearly seen through the wall. Suture, above scarcely distinguishable, below linear. Aperture regularly pyriform, a slight callus on the columella. Length, 4.25; breadth, 1.15 mm.

Two specimens occurred. This is closely allied to *E. paxillus*, Hedley², from which it differs by being nearly twice as large and by having a longer narrower aperture.

CROSSEA NATICOIDES, sp. nov.

(Plate liv., figs. 6, 7).

Shell small, turbinate, solid. Whorls, four rounded. Colour cream. Sculpture none, surface smooth and polished. Umbilicus deep and narrow, its margin a faint basal funicle. Aperture entire circular, double-edged, on its right lower margin the low arched butt-end of the basal funicle, then a broad thick callus tongue, probably marking the termination of a second inner funicle, and reaching half-way across the umbilicus; lastly a similar but smaller callus pad laid upon the preceding whorl. Height, 2.35; major diam., 3.0; minor diam., 2.15 mm.

² Hedley—Rec. Austr. Mus., v., 2, 1904, p. 96, f. 24.

A few specimens.

Most of the genus are cancellate; the present with *C. carinata*, Hedley³ and *C. glabella*, Murdoch⁴, are smooth. The latter is remarkable for a double basal funicle. In *C. naticoides* a second funicle appears to exist also, but the inner is swallowed by the umbilicus and its presence is only indicated by the callus on the aperture. The outer funicle is unusually faint, the basal aspect of a young shell (Pl. liv., fig. 7) exhibits the best developed funicle before me.

CITHNA ANGULATA, *sp. nov.*

(Plate lv., fig. 16).

Shell small conical, thin polished perforate. Colour: some individuals milk white, others hyaline with a yellow apex. Whorls five, compactly coiled, with rather flat sides, parted by deeply impressed sutures. Protoconch not particularly distinguished. Sculpture: a sharp elevated cord accentuates the peripheral keel, above it and on the spire occur a few faint irregular radial ribs. Aperture pyriform, anteriorly sub-channelled, outer lip produced medially, thin at the edge, but fortified remotely by a slight external rib varix. Columella long and nearly straight, its reflection reaching partly over the umbilicus. Base rounded. Umbilicus variable, best shown in adults, a narrow furrow circumscribed by a ridge which runs to the anterior extremity of the shell. Length, 2.9; breadth, 1.85 mm.

The genus *Cithna*, being Adamsian, was confusedly framed as Dr. Watson⁵ has indicated. I have not had the advantage of examining authentic specimens, but have based my reference of our species to *Cithna* on a beautiful figure by Dautzenberg.⁶

The above described is one of the commonest shells on the continental shelf. Besides the present station it is represented in the Museum from off Port Stephens (Prof. Haswell, 1880); 41-50 fath. off Cape Three Points (Thetis); 54-59 fath. off Wata Mooli (Thetis); 63-75 fath. off Port Kembla (Thetis), and 100 fath. off Wollongong (Halligan and Hedley). No *Cithna* have previously been noticed in Australia.

³ Hedley—Mem. Austr. Mus., iv., 6, 1903, p. 345, f. 71.

⁴ Murdoch—Trans. N.Z. Inst., xxxvii., 1905., p. 225, pl. viii., f. 16, 17.

⁵ Watson—Chall. Rep., Zool., xv., 1886, p. 519.

⁶ Dautzenberg—Result. Camp. Monaco, Fas. i., 1889, pl. ii, f. 8.

TURRITELLA OPULENTA, sp. nov.

(Plate liv., fig. 9).

Shell small, glossy, tall and slender. Whorls ten, two of which form the protoconch. Colour, irregular pale brown marbling on a milk white ground. Sculpture: the upper whorls are strongly bicarinate by two projecting spirals which evenly divide the height of the whorl into quarters. On the lower whorls these keels are less conspicuous. About the eighth whorl a spiral thread is intercalated above, between and below the keels; these increase with the whorls, but fail to attain the size of the major spirals. Fine close-set radial riblets traverse every adult whorl, above they form a coarse lattice with the carinæ; on the older whorls they merely raise small beads on the keels and intermediate threads; on reaching the base they cease abruptly. Base bounded by a strong smooth spiral, within which are concentrically arranged four faintly raised spirals. Along the suture a crack or fissure is interposed between the basal rib of the upper whorl and the beaded thread which forms the summit of the succeeding whorl. Protoconch smooth, globose. Aperture ovate, angled above, effuse below, lip sharp, columella straight, slightly thickened. Length, 6; breadth, 2 mm.

This species appears to be common and generally distributed upon our continental shelf. Besides the present station it has occurred in 41-50 fathoms off Cape Three Points (type); in 250 and 300 fathoms off Sydney; in 50-52 fathoms off Botany Heads; in 55-56 fathoms off Wollongong, and in 63-75 fathoms off Port Kembla.

The sculpture is subject to considerable variation; in some examples the spiral sculpture is less, and the radial more prominent than in the individual figured.

Its nearest ally would seem to be *Turritella parva*, Angas,⁷ to which in size and shape it nearly approximates, but from which its radial sculpture and sub-channeled anterior aperture effectually divides it.

VERMICULARIA NODOSA, sp. nov.

(Plate liv., fig. 8).

Shell small, very solid. Colour gray (? faded). Whorls three, rapidly increasing, coiled adherent to a foreign body, except a third of the last whorl, which is free and semi-erect. Sculpture: thick out-standing radial ribs, about twenty on the last whorl,

⁷ Angas—Proc. Zool. Soc., 1877, p. 174., pl. xxvi., f. 17.

which broaden to the periphery, narrow to the suture, and are parted by deeply excavate interstices of corresponding breadth. Aperture circular, its lip constituted by the final rib. Major diam., 2.25; minor diam., 1.65 mm.

Among described species the Californian *V. anellum*, Morch, alone resembles this. Judging from the figure⁸ the American species has finer closer ribs.

TRIVIA AVELLANOIDES, *M'Coy, sp.*

(Plate lv., figs. 17, 18).

Cypræa avellanoides, M'Coy, Ann. Mag. Nat. Hist. (3), xx., 1867, p. 436. *Id.*, Prod. Pal. Vict., dec. iii., 1876, p. 36, pls. xxviii., xxix., f. 3. a-c.

Trivia avellanoides, Harris, Cat. Tert. Moll. Brit. Mus., i., 1897, p. 213.

Two specimens, one perfect, the other broken, are the first of this species reported as recent. The perfect specimen, of which I offer a figure, is 4.5 mm. in length, has thirty-seven thread-like riblets which are interrupted by a smooth, not excavate, dorsal space. Its colour is white, the smooth dorsal area more opaque than the rest.

All authors who have dealt with the species comment on its extreme variability. The recent example, though not typical, certainly intergrades with a small delicately sculptured form of the fossil. Mr. R. Etheridge, who kindly checked my comparison of the "Miner" shell with a series of Victorian fossils concurred in this determination.

The species is embraced in a group distinguished by a thin shell, wide aperture, and a narrow outer lip, for which Jousseaume has proposed⁹ the name *Triviella*. Its members are distributed in South Africa, Southern Australia and New Zealand.

TROPHON STIMULEUS, *sp. nov.*

(Plate lv., fig. 19).

Shell minute, thin, prickly, ovately-fusiform, angled at the shoulder. Whorls five, two of which compose the glossy conical protoconch. Colour white. Sculpture: thin close laminate varices, about twelve to a whorl, ascend the spire obliquely, produced on the shoulder in a claw projecting to the suture, crumpled

⁸ Tryon—Man. Conch., viii., 1886, pl. 49, f. 34.

⁹ Jousseaume—Bull. Soc. Zool. Fr., ix., 1884, p. 99.

into folds by a ridge on the shoulder and two lesser ones below the periphery, the shoulder folds rise in hollow thorns. On the base the varices cease. Aperture round, the outer lip projecting in a broad squamose varix, the inner expanding over the axis. Canal short, broad and open. Length, 3·5; breadth, 2·1 mm.

As our investigations are pushed into colder water it may be expected that so characteristic an Antarctic group as *Trophon* will appear in force. Among Australian species, the present diminutive form is most like *T. laminatus*, Petterd,¹⁰ than which it is shorter, comparatively broader, with more prominent and wider spaced varices. In all stages a plain distinction is furnished by the protoconch, which in *laminatus* is abruptly truncate, in *stimuleus* conical.

ASPELLA UNDATA, *sp. nov.*

(Plate lv., fig. 15).

Shell small, solid, ovate. Whorls six, of which two form the protoconch. Colour: cream, with a pale purple-brown, narrow peripheral zone, which re-appears within the aperture. Sculpture: each whorl has eight or nine discontinuous rib-varices, which begin with a minute, forwardly-directed hook under the suture, swell more steeply before than behind, their interstices, broad wave-troughs, describe a sigmoid flexure across the whorls, fade across the base and terminate as scales upon the snout; the general surface is smooth. Protoconch turbinated, glassy. Aperture sub-rhomboidal, pinched above, exteriorly with a well developed varix, lined with a narrow, projecting lip. Columella bent; inner lip well-developed, rising over a short axial groove. Anterior canal very short and broad. Length, 6·5 mm.; breadth, 3 mm.

A few specimens, mostly broken.

The genus *Aspella* was introduced by Morch¹¹ for *Ranella anceps*, Lamk., a species which in Eastern Australia ranges from Torres Strait to Sydney. Dr. W. H. Dall¹² revised the genus, and transferred it to the Muricidae, near *Trophon*. The absence of the bilateral varices gives the novelty an aspect strange to the genus, but the difference is one of degree rather than of kind. In this respect *Aspella senex*, Dall¹³ appears to connect these species.

¹⁰ Petterd—Journ of Conch., iv., 1884, p. 136.

¹¹ Morch—Malak. Blatt., xxiv., 1877, p. 24.

¹² Dall—Bull. Mus. Comp. Zool., xviii., 1889., pp. 206-10.

¹³ Dall—Trans. Wagner Free Inst. Sci., iii., 1903, pl. lx., f. 14.

MARGINELLA ALLPORTI, *Ten. Woods.*

Marginella allporti, Ten. Woods, Proc. Roy. Soc. Tasm., 1875 (1876), p. 28.

Further study of the form I distinguished as *Marginella kemblensis*¹⁴ has convinced me that it is not separable from the Tasmanian species, whose name must therefore supersede it.

ADMETE STRICTA, *sp. nov.*

(Plate liv., fig. 10).

Shell minute, thin, ovately fusiform, deeply constricted at the sutures. Whorls five, rather tumid medially, flattened above contracted at the base; first whorl dome shaped. Sculpture: above radials predominate, below spirals prevail. The radials are prominent undulating ribs, numbering nine on the antepenultimate whorl; they gradually diminish in size as growth proceeds, and vanish on the base. The spirals amount to thirteen on the last whorl, and seven on the penultimate; they consist of sharp elevated cords, over-riding the radial ribs and parted by flat interstices of twice their width; the interstices are finely, transversely grooved. Aperture narrowly reniform, rounded above and below outer lip sharp, columella ending in a single broad fold, whence a callus layer proceeds which overlies a narrow shallow, umbilical groove. Length, 4.5; breadth, 1.76 mm.

A single specimen (the type) from the present station, another imperfect example from 100 fathoms, sixteen miles east of Wolongong.

The genus *Admete* is now first announced from Australian waters. The species is unlike any recent shell, but judging from Prof. Tate's figures¹⁵ it resembles the Tertiary *Cancellaria micra* and *C. turriculata*.

PLEUROTOMELLA FASTOSA, *sp. nov.*

(Plate lv., fig. 21).

Shell small, rather solid, slender, fusiform. Whorls eight-and-a-half, of which six form the protoconch. Colour: adult whorls straw yellow, protoconch cinnamon brown. Sculpture: running below the suture the adult whorls have a spiral thread which ascends into the protoconch for two whorls; this is followed by a broad concave fasciole, margined in turn by a sharp projecting

¹⁴ Hedley—Mem. Austr. Mus., iv., 6, 1903, p. 365, f. 88.

¹⁵ Tate—Trans. Roy. Soc. S. Austr., xi., 1889, p. 158, pl. x., f. 8, 14.

keel which determines an angle in the contour of the shell. Half way between the major keel and the suture runs a smaller keel. On the last whorl there are about fourteen spirals, gradually diminishing anteriorly, below the major keel. The fasciole is ornamented by spaced, delicate, concave riblets. Fine arcuate growth lines appear in the interstices of the spiral keels. In the protoconch, the first whorl and a half are small, rounded, and spirally striate; the rest protrude medially, and are crossed by fine sharp radial riblets, which on the last whorl number twenty-two. Their interstices are latticed by spiral threads.

One example of which the aperture is defective. Length, 5 mm.; breadth, 1.9 mm.

The figures of *Manqilia comatotropis*, Dall,¹⁶ present considerable analogy to our species, but appear to be narrower, with fewer bolder spirals.

If the characters be analysed for generic disposal in the perplexing maze of the Pleurotomidæ, the most prominent features resolve in the elaborately sculptured protoconch, and the broad sub-sutural fasciole, indicative of a deep sinus. These features are repeated, though associated with different form and sculpture, by my *Pleurotoma vepratica*.¹⁷

Verrill's *Pleurotomella*,¹⁸ while not exactly conforming to the requirement appears to come nearest, and is therefore here employed.

MANGELIA LUTARIA, *sp. nov.*

(Plate liv., figs. 11, 12).

Shell small, solid, cylindrical, abruptly truncate above. Whorls five, three forming the protoconch, sloping on the shoulder, perpendicular at the side, and concave at the base. Colour grey (? bleached). Sculpture: deep narrow pits are formed by the intersection of radial and spiral sculpture; radials strong, prominent, perpendicular, continuous ribs, about a dozen to a whorl, knotted at the crossing of the spirals, which number four on the upper and twelve on the lower whorl, the spiral defining the basal angle larger and more prominent. Protoconch: first whorl wound oblique to the axis of the main shell, the second overhanging the third, appearing as if the apex was wrapped in a turban. Aper-

¹⁶ Fischer and Dautzenberg—Mem. Soc. Zool. Fr., ix., 1896, p. 419, pl. xvii., f. 15.

¹⁷ Hedley—Mem. Austr. Mus., iv., 6, 1903, p. 384, f. 97.

¹⁸ Verrill—Am. Journ. Sci. (3), v. 1872, p. 15; Cossmann—Essais de Paléconchologie comparée, ii., 1896, p. 133.

ture long, narrow, fortified by a heavy varix, in the anterior angle of which is excavated a deep sinus. Columella nearly straight, overlaid by a slight callus. Anterior canal very short and wide. Length, 3·0; breadth, 1·15 mm.

One specimen.

This species appears nearest related to *M. cancellata*, Beddome,¹⁹ from which, judging by the figure,²⁰ it differs by having a whorl less and by the cancellate sculpture continuing below the more acute basal angle. In *Drillia telescopialis*, Verco, weaker and more numerous radials enclose nearly square pits, but in *M. lutraria* they are much longer than broad.

MANGILIA SPICA, *sp. nov.*

(Plate lv., fig. 20)

Shell small, slender, conical, base excavate. Whorls six-and-a-half, including a protoconch of two whorls and a half. Colour: protoconch cinnamon, adult whorls white ribbing on a buff background. Sculpture: eight prominent undulating radial ribs descend the spire obliquely, and terminate abruptly at the periphery of the last whorl. They are over-ridden by five strong spiral cords, the peripheral the largest, and marking an obscure angle on each whorl. Between the cords, and broader than them, are deep, radially-striated interstices. On the base are about six widely-spaced spiral cords. Aperture narrow, posterior sinus indistinct, canal short, broad, open. Length, 4·1; breadth, 1·25 mm.

Two specimens from off Narrabeen; another from 100 fathoms, sixteen miles east of Wollongong.

DRILLIA HASWELLI, *sp. nov.*

(Plate lv., fig. 22).

Shell small, fusiform, blunt at each end, rather thin, scarcely opaque. Whorls five and a half, the first two constituting a glassy dome-shaped protoconch, the rest rather inflated, constricted at the sutures, excavate at the base. Colour chalk white, rather glossy when fresh. Sculpture: fine spiral threads, one more prominent than the rest defines a slight angle on the shoulder. On the last whorl there are about four above and twenty below the angle. The spirals are crossed by arcuate growth lines. Aper-

¹⁹ Beddome—Proc. Roy. Soc. Tas., 1882 (1883), p. 167.

²⁰ Tate and May—Proc. Linn. Soc. N. S. Wales., xxvi., 1901, pl. xxiv., f. 27.

ture slightly ascending, narrow above, rounded within a deep notch, fortified without by a heavy varix; a thin callus is spread on the inner lip. Canal short and broad. Length, 5.5; breadth, 1 mm.

This species is related to *D. tricarinata*, Ten. Woods, from which it is readily separable by smaller size, broader form, and more delicate sculpture. *D. haswelli* is represented by numerous specimens in the "Miner" haul, and seems to be generally distributed on our continental shelf. The "Thetis" took it in 41-50 fathoms off Cape Three Points, and I have dredged it in 100 fathoms off Wollongong and 300 fathoms off Sydney.

DRILLIA PENTAGONALIS, Verco, var.

Drillia pentagonalis, Verco. Trans. Roy. Soc. S. Austr., xx., 1896, p. 222, pl. vii., f. 2, 2 a.

This is a new record for Eastern Australia. Observing that the "Miner" shells differ from the original description by having seven ribs instead of five, and by being of larger size, I submitted them to the author of the species. Dr. Verco kindly replied:—22 Sept, 1906. "Your *Drillia* is I think my *D. pentagonalis*. Yours is somewhat larger, and its angles do not run continuously from end to end of the shell as in my type, but I feel sure it is only a variant."

MITROMORPHA ALBA, Petterd, sp.

Columbella alba, Petterd, Journ. of Conch. ii., 1879, p. 104.

Mitromorpha alba, Tate and May, Proc. Linn. Soc. N. S. Wales, xxvi., 1901, p. 455. *M. flindersi*, Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1899, p. 104, pl. vii., f. 6; *Id. op. cit.*, xviii., 1905, p. 51.

A single specimen which agrees exactly with Victorian examples.

DAPHNELLA SCULPTIOR, Ten. Woods, sp.

Clathurella sculptior, Ten. Woods, Proc. Roy. Soc. Tas., 1878 (1879), p. 38. *Id.*, Tryon, Man. Conch., vi., 1884, pl. xxxii., f. 27. *Id.*, Tate and May, Proc. Linn. Soc. N. S. Wales, xxvi., 1901, pp. 371, 446. *Drillia legrandi*, Beddome, Proc. Roy. Soc. Tas. 1882 (1883), p. 167. *Id.*, Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 178. *Id.*, Hedley, Proc. Linn. Soc. N. S. Wales, xxxv., 1900, p. 509, pl. xxv., f. 1, 2, 3. *Daphnella bitorquata*, Sowerby, Proc. Mal. Soc., ii., 1896, p. 27, pl. iii, f. 9.

This species is already known from Tasmania, South Australia and Victoria. Two individuals in the present haul extend the known range to this State.

CAVOLINIA LONGIROSTRIS, *Lesueur*, var. STRANGULATA, var. nov.

(Plate liv., fig. 13).

This differs from the typical form by sudden lateral contraction of the rostrum, which distally expands in a spout. In the typical form the rostrum is produced more gradually from the anterior dorsal margin than in the variety. In var. *strangulata* the posterior lateral angles are less developed. Nearest stands the var. *angulata*, Souleyet,²¹ which has the rostrum not spread distally, and contracted from back to front instead of from side to side, it also agrees in the diminutive posterior angles. Boas states²² that he has traced *angulata* through a series of transitions into *longirostris*. But this should not reduce a well-marked variety to an absolute synonym. Souleyet's form also occurs on the coast of N. S. Wales.

I have not met this variety alive, and only know it from dead specimens dredged from the bottom. Besides the present station it has occurred at sixteen miles east of Wollongong, and twenty-three miles east of Sydney. Examples from the neighbourhood of the Great Barrier Island, New Zealand, are referred to²³ as a variation of *C. longirostris*. Var. *strangulata* seems a southern form. Though typical *C. longirostris* has occurred to me plentifully along the Queensland Coast, as at the Palm Islands, Green Island and Thursday Island, I have not seen the variety from the north nor the typical form from the south of Sydney.

OXYGYRUS KERAUDRENII, *Lesueur*, sp.

Atlanta keraudrenii, Lesueur, Journ. de Phys., lxxxv., 1817, p. 391, pl. ii. *Oxygyrus keraudrenii*, Smith, Chall. Rep., Zool., xxiii., 1888, p. 46.

Two imperfect specimens were taken on this trip. Previously the "Thetis" had obtained fragments of it off Port Kembla in 63-75 fathoms, and, in company with Mr. W. F. Petterd, I dredged another broken shell, twenty-three miles east of Sydney. The genus seems to be unknown hitherto from Australian waters.

²¹ Souleyet—Zool. Bonite., ii, 1852, p. 152, pl. v., f. 1-6.

²² Boas—Spolia Atlantica, 1886, p. 211.

²³ Hedley—Trans. N. Z. Inst., xxxviii., 1906, p. 76.

MODIOLA LINEA, sp. nov.

(Plate lvi., figs. 23, 24, 25).

Shell small, thin sub-cylindrical, smooth and glossy, anteriorly slightly produced and angled, posteriorly rounded, dorsal and ventral margins parallel. Umbo low, a little incurved, at a fifth of the total length. Colour white, with a few small, scattered, brown dashes. Sculpture regular, concentric growth striae, which posteriorly are traversed by a few faint impressed rays. Periostracum thin, polished. Hinge edentulous. Length, 5.75; height, 2.5; depth of single valve, 0.9 mm.

In our fauna the novelty is nearest related to *Modiola arborescens*, Chemnitz,²⁴ which is far larger, and even in its young stages, of quite different contour.

CRASSATELLITES DISCUS, sp. nov.

(Plate lvi., figs. 26, 27).

Shell small, thin, sub-quadrate, lenticular, inequilateral, the posterior side being twice the length of the anterior; dorsal and posterior margins straight, ventral slightly rounded, anterior produced. Colour: buff or vinous, with a few broken radial streaks. Sculpture: umbo and neighbouring area smooth, followed by about a dozen sharp, even, elevated, concentric folds, parted by equal interspaces. Over these run a microscopic sculpture of extremely fine concentric scratches. Lunule and dorsal area elongate and narrow. Inner margin of valve smooth and bevelled. Height, 6; length, 7; depth of single valve, 1.7 mm.

A group of small, short *Crassatellites* from East Australia much resemble one another. Single specimens seen separately are difficult to distinguish, but a series of each demonstrates that slight though the differences be, they are constant. *C. fulvida*, Angas,²⁵ is larger; *C. janus*, Hedley,²⁶ is smaller than *C. discus*; besides colour differences, both are more inflated, stronger ribbed, and the anterior and posterior margins meet at a more acute angle. The former has, the latter has not, small denticules on the inner margin. *C. securiforme*, Hedley,²⁷ is longer in proportion to height, the nearly straight dorsal margin, almost at right angles with the anterior margin, distinguish it from *C. discus*.

²⁴ Chemnitz—Conch. Cab., xi., 1795, p. 251, pl. 198, f. 2016-17.

²⁵ Angas—Proc. Zool. Soc., 1871, p. 20, pl. i., f. 32.

²⁶ Hedley—Proc. Linn. Soc. N. S. Wales, xxxi., 1903, pl. xxxviii, f. 29-30.

²⁷ Hedley—Mem. Austr. Mus., iv., 5, 1902, p. 312, f. 53.

This species appears to be the commonest *Crassatellites* on our continental shelf. Besides the present station, where it occurred plentifully, Mr. Halligan and I dredged numerous specimens in 100 fathoms, sixteen miles east of Wollongong. In both these localities it was associated with *C. securiforme*. But the record of *C. securiforme* from 111 fathoms off Cape Byron,²⁸ is, I regret to say, based on a single valve of *C. discus*.

MYODORA ALBIDA, *Ten. Woods.*

Myodora albida, Ten. Woods, Proc. Roy. Soc. Tas., 1875 (1876), p. 160. *M. corrugata*, Verco, Trans. Roy. Soc. S. Austr. xx., 1896, p. 229, pl. viii., f. 1.

This species has not been noted from the coast of New South Wales. A single broken valve was secured by the expedition. A perfect specimen occurs in the Hargreaves collection labelled "outside Sydney Heads." It was probably dredged when a party of Sydney Naturalists were entertained on board H.M.S. "Challenger."²⁹

CORIAREUS, *gen. nov.*

A genus allied to *Lasaea*, with a weaker, less complex hinge, a larger, thinner, radiately sculptured valve clothed with a thick dense epidermis. Type, *C. vitreus*, Hedley; second species, *Montacuta semiradiata*, Tate.³⁰

CORIAREUS VITREUS, *sp. nov.*

(Plate lvi., figs. 28, 29, 30).

Valve ovate-oblong, slightly inflated, equivalve, closed all round, inequilateral, posterior twice the length of the anterior, highly polished, thin and brittle. Colour, milk white. The epidermis is peculiar: a thick, dense, felted, entire rusty-brown coat, which appears as if some foreign substance had caked on the valves, and which flakes away when dry in irregular masses. Sculpture: a few distant, concentric, raised threads mark rest stages in growth; there are numerous sharply elevated, thin, radial riblets, irregularly disposed and spaced, but chiefly grouped in the centre of the valve; towards the margin additional riblets are intercalated. Hinge:

²⁸ Hedley—Rec. Austr. Mus., vi., 2, 1906, p. 42.

²⁹ Spry—Cruise of Challenger, 1876, p. 169.

³⁰ Tate—Trans. Roy. Soc. S. Austr., 1888, p. 63, pl. xl., f. 2; Hedley—Proc. Linn. Soc. N. S. Wales, 1906, p. 542, pl. xxxi., f. 1-2.

in the left valve immediately beneath the prodissoconch there descends obliquely into the valve a prominent thickened ridge, above which is a deep narrow groove, followed by the margin of the valve, which is broadly reflected on the umbo; anteriorly the chondrophore is followed by a slight ridge; in the right valve a thickened posterior tubercle and a slight anterior groove; no lateral teeth occur; the muscular impressions, as is usual in so thin a shell, are invisible; inner margin of valve smooth and bevelled. Length, 6.5; height, 5; depth of single valve, 1.5 mm.

Besides the present station the species occurs in 250 and 300 fathoms off Sydney. The individual figured was obtained in the former station by Mr. W. F. Petterd and myself.

C. semiradiata, Tate, was associated with *C. vitreus*, both off Narrabeen and Sydney.

ECTORISMA GRANULATA. Tate.

Ectorisma granulata, Tate, Trans. Roy. Soc. S. Austr., xv., 1892, p. 127, pl. i, f. 3, 3a.

This species was represented by a valve and some fragments, which latter indicate that the shell attains a length of 20 mm. Examples were recently submitted to Dr. W. H. Dall, who informs me—21 Sept. '06—that it is a *Poromya*, and Tate's genus therefore unnecessary. The specific name is already occupied by Nyst in this genus, and if otherwise unnamed the species requires another designation. The species, however answers fairly to the description of *Poromya levis*, Smith,³¹ obtained in 155 fathoms off Raine Island, N. Queensland. So that until actual comparison can be made it seems better to use Smith's name for our shell than to coin a new one.

LYONSIELLA QUADRATA, *sp. nov.*

(Plate lvi., figs. 31, 32, 33).

Shell small, thin, inflated, oblong, the posterior side much longer than the anterior. Umbo much incurved. Sculpture: irregular faint growth lines are crossed by a few inconspicuous radial furrows, one of which, running from the umbo to the posterior ventral angle, is cut deeper than its fellows; except round the umbo, where they have perhaps been worn away, small close-

³¹ Smith—Chal. Rep., Zool., xiii., 1885, p. 55, pl. xi., f. 3.

set, sharply pointed grains bestrew the surface of the shell. Hinge edentulous. Length, 3·75; height, 2·5; depth of single valve, 1·4 mm.

A few separate valves represent a genus new to the Australian fauna. Judging from illustrations *L. abyssicola*, Sars,³² is nearest, and differs by being larger and higher in proportion to its length. Another single valve was dredged by Mr. G. H. Halligan and myself in 100 fathoms off Wollongong.

VERTICORDIA VADOSA, *sp. nov.*

(Plate lvi., figs. 34, 35, 36, 37).

Shell small, rather solid, compressed, equilateral, sub-circular, sub-spiral. Umbo projecting. Lunule deeply excavate. Sculpture: about ten low, broad, undulating radial ribs; except the umbo, which is smooth, the entire surface is densely covered with minute radially-disposed elevata grains, which increase in size towards the margin; interior nacreous, margin smooth. Height, 2·65; length, 2·8; depth of single valve 0·8 mm.

The species is represented by four separate valves in this collection. Another odd valve was taken by Mr. G. H. Halligan and self in 100 fathoms off Wollongong.

This opportunity is taken of withdrawing the name *Verticordia rhomboidea* proposed³³ for a recent shell. I unfortunately failed to observe that Prof. Tate had already chosen this name for a Tertiary fossil.³⁴

Though related, the fossil appears from the description to differ. To avoid confusion I now beg to substitute *Verticordia setosa* as the name of the New Zealand shell. It has already (ante p. 215) been recorded from this coast.

VERTICORDIA AUSTRALIENSIS, *Smith.*

Verticordia australiensis, Smith, Chall. Rep., Zool., xiii., 1885, p. 167, pl. xxv., f 6, 6b.

(Plate lvi., figs. 38, 39).

Half-a-dozen mutilated valves correspond to the figure and description of the species taken by H.M.S. "Challenger" in 155

³² Sars—Moll. Reg. Arct. Norvegiae, 1878, pl. 20. f. 5.

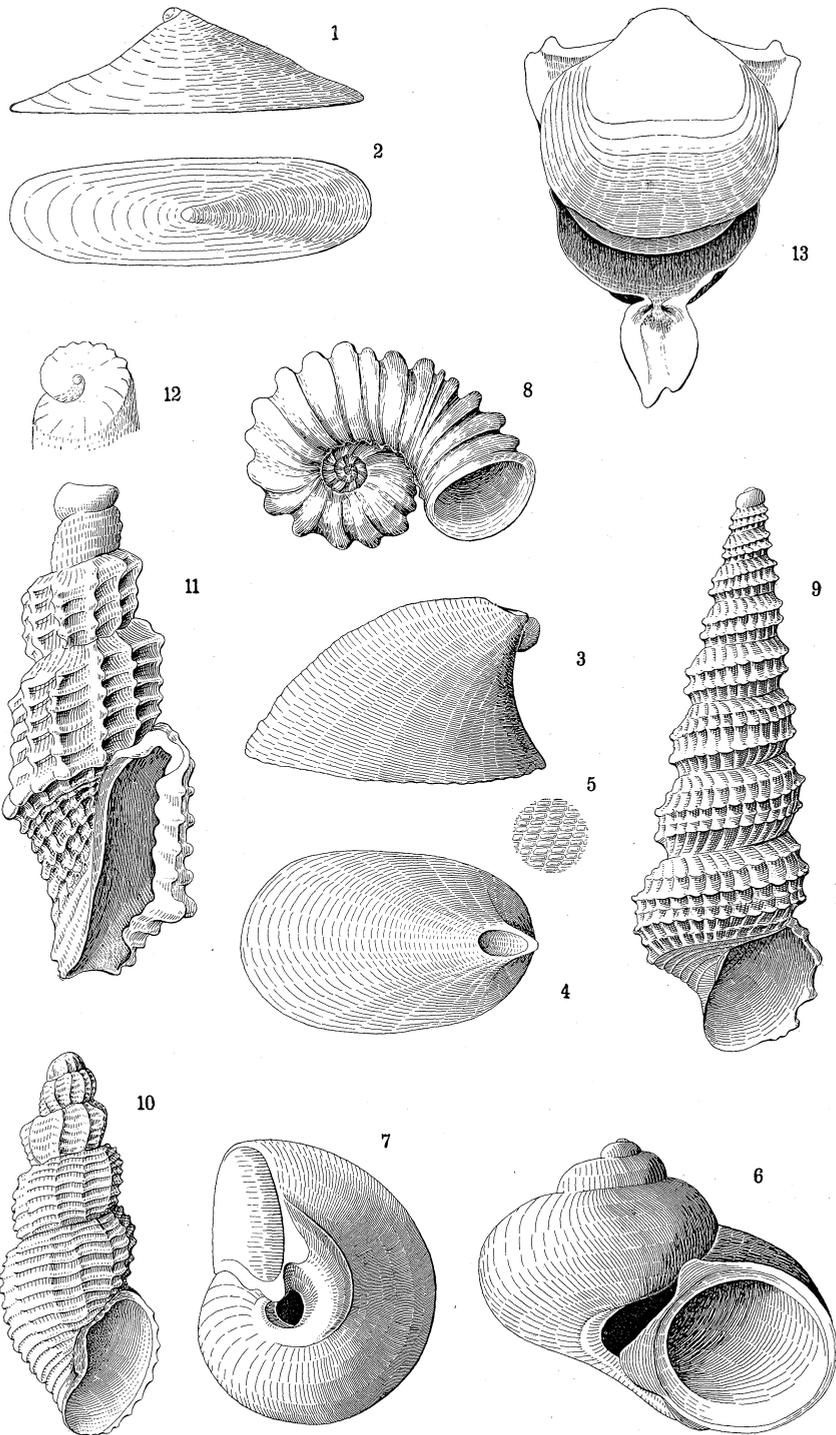
³³ Hedley—Trans. N. Z. Inst., xxxviii., 1905 (1906), p. 71, pl. ii., f. 12, 13, 14.

³⁴ Tate—Trans. Roy. Soc. S. Austr., ix., 1886 (1887), p. 149, pl. xiv., f. 14.

fathoms off Raine Island near Cape York, Queensland. It has not been seen since then, and the identification of the "Miner" shells will, if correct, widely extend the geographical range of *V. australiensis*. Whereas the type is $3\frac{2}{3}$ mm. long, a broken valve figured here is 12 mm. in length. Ours has more lyrae, and I do not discern "a very faint depression at the posterior end from the beaks to the ventral margin." The difference between young and old individuals may reconcile these discrepancies.

EXPLANANATION OF PLATE LIV.

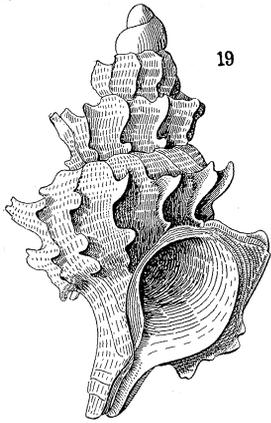
- Fig. 1. *Cocculina coercita*, Hedley. From the side.
" 2. " " " " From above
" 3. *Puncturella demissa*, Hedley. From the side.
" 4. " " " " From above.
" 5. " " " " Sculpture, magnified.
" 6. *Crossea naticoides*, Hedley. From the side.
" 7. " " " " From beneath.
" 8. *Vermicularia nodosa*, Hedley.
" 9. *Turritella opulenta*, Hedley.
" 10. *Admete stricta*, Hedley.
" 11. *Mangelia lutaria*, Hedley.
" 12. " " " " Apex, from above.
" 13. *Cavolina longirostris* var *strangulata*, Hedley.



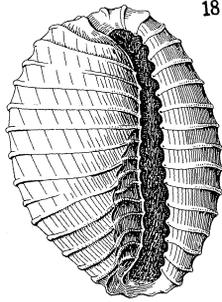
C. HEDLEY, del.
Austr. Mus.

EXPLANATION OF PLATE LV.

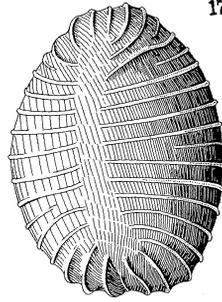
- Fig. 14. *Eulima fricata*, Hedley.
" 15. *Aspella undata*, Hedley.
" 16. *Cithna angulata*, Hedley.
" 17. *Trivia avellanoides*, M'Coy. From above.
" 18. " " " " From beneath.
" 19. *Trophon stimuleus*, Hedley.
" 20. *Mangelia spica*, Hedley.
" 21. *Pleurotomella fastosa*, Hedley.
" 22. *Drillia haswelli*, Hedley.



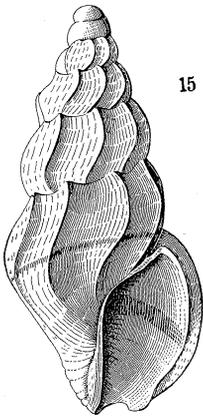
19



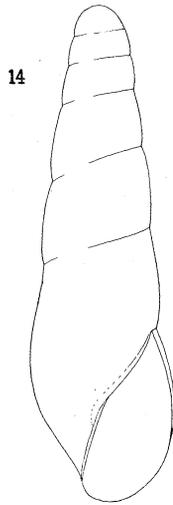
18



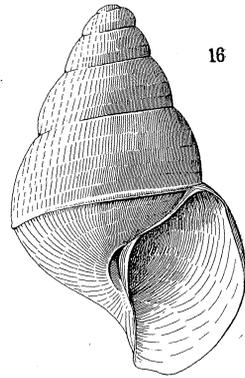
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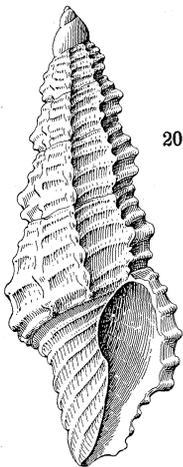
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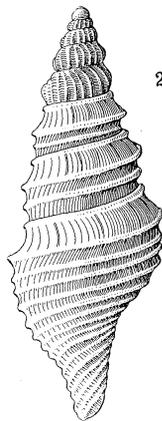
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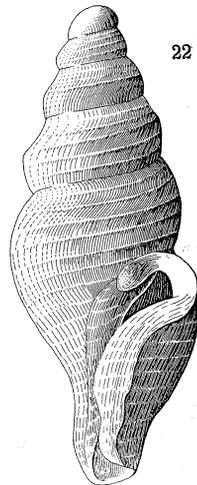
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22

EXPLANATION OF PLATE LVI.

-
- Fig. 23. *Modiola linea*, Hedley. From without.
 " 24. " " " " From above.
 " 25. " " " " From within.
 " 26. *Crassatellites discus*, Hedley. From above.
 " 27. " " " " From the side.
 " 28. *Coriaraus vitreus*, Hedley. From the side.
 " 29, 30. " " " " Hinge.
 " 31. *Lyonsiella quadrata*, Hedley. From the side.
 " 32. " " " " From above.
 " 33. " " " " From within.
 " 34. *Verticordia vadosa*, Hedley. From the side.
 " 35. " " " " From above.
 " 36, 37. " " " " Hinge.
 " 38. " *australiensis*, Smith. From above.
 " 39. " " " " From within.

