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THE RESULTS OF DEEP SEA INVESTIGATION IN THE
TASMAN SEA.

II.—THE EXPEDITION OF THE "WOY WOY."

2.—MOLLUSCA FROM EIGHT HUNDRED FATHOMS, THIRTY-FIVE
MILES EAST OF SYDNEY.

By CHARLES HEDLEY.

(Plates lxvi.-lxvii.).

In continuation of the biological examination of the ocean floor off Sydney conducted by Professor W. A. Haswell with the aid of a grant from the Royal Society of London (as detailed ante p. 271) an excursion was made in the "Woy Woy," on October 26-27, 1906. We proceeded thirty-five miles from the coast, and lowered the bucket dredge in an estimated depth of 800 fathoms. It returned nearly full of green ooze. ¹ When the whole load was washed through a sieve of thirty-four to the inch, hardly more than a cupful was retained of shells, foraminifera, or such solid bodies. The only thing alive was a Tubicolous Annelid. From shallower depths of about a hundred fathoms, ten times as much matter would be left in the sieves. So large a proportion of silt to shells seems to indicate that deposition is here proceeding rapidly. I should also have inferred that the deposit of such finely divided matter implied a perfect calm, but my friend Mr. G. H. Halligan who has given these problems special attention, does not consider such a deduction necessary.

On the other hand the flagella of the antennæ in an undetermined prawn from this horizon extended for more than three and a half times the length of its body. Mr. A. R. McCulloch suggests that this enormous development would be manageable only in absolutely still water.

Both species and individuals were less abundant than in the samples of sea bottom previously examined. About sixty different kinds of shells were separated, about a third of which are new. From these the following are selected for description.

¹ For an account of our glauconite deposits, see Collet and Lee—Proc. Roy. Soc. Edinb., xxvi., 1906, p. 273.

LIOTIA CAPITATA, *sp. nov.*

(Plate lxvii., figs. 13, 14).

Shell minute, subdiscoidal, spire slightly elevate, umbilicus wide. Colour cream. Whorls three. Protoconch of a whorl and a half, tilted and inflated. Last whorl scarcely in contact with its predecessor, at last deeply descending. Sculpture, sharp projecting ring ribs, widely spaced on the last half whorl, but crowded on the penultimate, the interspaces and protoconch smooth. Aperture oval, oblique, entire, downwardly directed, fortified by a prominent ring varix. Height 0.6, major diam. 1.3, minor diam. 0.9 mm.

A single specimen.

The present is closely related to *Bifrontia pernambucensis*,² with which the apex especially associates it, but from which it differs by being about half the size and not involute. Though these are not typical *Liotia*, that genus seems to harmonise better with their appearance than does *Bifrontia*.

TURRITELLA CURIALIS, *sp. nov.*

(Plate lxvii., fig. 19).

Shell very small, turrited. Colour pale cream. Whorls eleven including a protoconch of two rounded whorls. Sculpture, the third, fourth, and fifth whorls have a single smooth spiral rib running between the centre of the whorl and the lower suture. From the sixth whorl onwards, this spiral develops conspicuous grains, about fifteen to a whorl, but finally these become obsolete behind the aperture. From the seventh to the last whorl two narrow, wide spaced smooth spiral lyrae revolve above the bead row. Five low spirals ornament the base. Aperture defective in all examples seen, but the direction of growth lines indicate a deep median sinus. Length, 7, breadth 2.95 mm.

Several specimens from 800 fathoms.

In size and shape this resembles *T. crenulata*, Donald,³ but differs in the spiral sculpture.

² Watson—Chall. Rep., Zool., xv., 1886, p. 137, pl. viii., f. 13.

³ Donald—Proc. Malacol. Soc., iv., 1900. p. 52, pl. v. f. 2.

RISSEO PROFUNDIOR, *sp. nov.*

(Plate lxvii., fig. 15).

Shell small, ovate, turritid rimate. Colour cream. Whorls five. Sculpture, two apical whorls smooth, remainder with elevates, distant, arcuate, radial ribs, thirteen to a whorl, which gradually vanish on the base. Along the summit of each whorl runs a broad spiral band linking together the tops of the ribs. A few (six or seven) raised spiral threads traverse the base and periphery. Aperture broadly ovate, inner lip reflected. Length 2.95, breadth 1.85 mm.

A few specimens.

The present seems shorter and broader than *R. acuticostata*, Dall.,⁴ to which it has a strong general resemblance.

PYRENE BABYLONICA, *sp. nov.*

(Plate lxvii., fig. 16),

Shell small, solid, glossy, conical, apex pointed, base contracted. Whorls five and a half, the lower narrowly but sharply tabulate. Colour cream. Sculpture, the protoconch consisting of a whorl and a half is smooth and very glossy, the next whorl is duller with incipient ribbing. On the last three whorls there are strong widely spaced perpendicular ribs, which on the penultimate number fourteen. Below the periphery they gradually vanish, above they terminate in a blunt point, the summits are linked together by an indefinite spiral cord. The anterior extremity is scored by six fine spiral grooves. Aperture oval, feebly denticulate within the outer lip, on the columellar wall a thick callus layer. Length, 5.5, breadth 2.5 mm.

Three imperfect specimens.

Pyrene stria, Watson,⁵ appears to resemble this but is larger, without the denticules in the aperture and has a different apex.

It is curious that four widely differently species of the collection before me, viz., *P. babylonica*, *Rissoa profundior*, *Mitra miranda*, Smith and *Drillia challengerii*, Smith, affect the same style of ornament.

⁴ Dall—Bull. Mus. Comp. Zool., xviii., 1889, pl. xix., f. 10.

⁵ Watson—Chall. Rep., Zool., xv., 1886, p. 237, pl. xiii., f. 2.

ARCULARIA DIPSACOIDES, *sp. nov.*

(Plate lxvii., fig. 21).

Shell ovate, rather thin, remarkably tabulate. Whorls eight of which half are comprised in the protoconch. Colour, cream, except the protoconch which is pale purple. Sculpture, protoconch conical, smooth, with a peripheral keel which is just exposed above the suture of the succeeding whorls. In the adult whorls spiral threads reticulate radial riblets, producing sharp tuberculate granules at the point of intersection, on the last whorl there are eleven spirals and twenty-two radials, both cease on the base and vanish on the subsutural shelf, the radials mount the spire obliquely, between the riblets are fine radial threads. Behind the canal a broad furrow encircles the base. The aperture is without the thickening usual in the genus, which gives an unfinished aspect to the shell, outer lip sharp and denticulate by the external sculpture. Three rest stages on the last whorl are indicated by thin lamellæ followed by grooves. A thick callus layer is spread over the inner lip. Canal very short, recurved, the truncate base of the columella bent outwards. Length, 12, breadth 8 mm.

This species appears to be abundant and wide spread in deep water. Besides the present station in 800 fathoms, it was taken in plenty by Mr. W. F. Petterd and myself in 250 and 300 fathoms. It was misquoted in our report (ante p. 214) as *Nassa jacksonensis*, Q. & G.. Dr. J. C. Verco has shown me examples of *A. dipsacoides* which he dredged in deep water off the coast of S. Australia.

Of published species the nearest ally is *Nassa ephamilla*, Watson,⁶ from deep water off New Zealand. The novelty is of smaller size, with smaller and more numerous granules.

The familiar *Nassa* of Lamarck⁷ is not here employed because Dr. W. H. Dall⁸ has pointed out that *Nassa* was earlier used by Bolten⁹ with a different meaning, namely for the group of *Buccinum sertum*, Bruguière, generally known by Adams' name of *Iopas*.

⁶ Watson—Chall. Rep., Zool., xv., 1886 p. 187, pl. xi., f. 9.

⁷ Lamarck—Mem. Soc. Hist. Nat. Paris, 1799, p. 71.

⁸ Dall—Journ. of Conch., xi., 1906, p. 295.

⁹ Bolten—Mus. Bolten., (2), 1798, p. 132.

EPITONIUM BELLICOSUM, *sp. nov.*

(Plate lxvii., fig. 18).

Shell slender, turritid, imperforate. Whorls eight, first three smooth and tightly rolled, remainder so untwisted that the volutions are only connected by the tips of the lamellæ. Colour, milk white. Sculpture, thin, outstanding, rather curled lamellæ, which on the final whorl amount to seventeen, on the shoulder angled and produced in a sharp point, thence crossing the whorl obliquely, end applied to that of one of the preceding whorl and thus mounting the spire obliquely and continuously. Between the lamellæ the shell is quite smooth and glossy. Aperture sub-circular, lip reflected, the outer one developing the usual shoulder angle, the inner spread over curled ends of the basal lamellæ. Length, 7·5, breadth, 3·25 mm.

A few specimens from 800 fathoms and others from 250 fathoms twenty-three miles east of Sydney.

The novelty is related to *E. jukesianum*, Forbes,¹⁰ but is distinguished by the expanded spiny lamellæ and consequent angle at the shoulder.

The name *Scalaria* for this genus has been generally abandoned. In substitution, *Scala* has been advanced,¹¹ but the anonymity of the Catalogue in which it appeared is fatal to its acceptance. Granting this it is necessary to fall back on Bolten's *Epitonium*,¹² recognised by De Boury¹³ and others as applicable to the genus.

CANCELLARIA SCOBINA, *Hedley and Petterd.*

Cancellaria scobina, Hedley and Petterd, *ante*, p. 222.

This species did not occur in the 800 fathom haul, but is now introduced to remark on synonymy. Since last writing on deep sea shells, I have had an opportunity of comparing an example of *C. scobina*, from 80 fathoms, off Narrabeen, with the type of

¹⁰ Forbes—Voy. "Rattlesnake," ii., 1852, p. 383, pl. iii., f. 7.

¹¹ Melvill—Journ. of Conch., x., 1904, p. 340.

¹² Bolten—Mus. Bolt., (2), 1798, p. 91.

¹³ De Boury—Mon. des Scaldæ, 1886, p. x.

Cancellaria micra, Tate,¹⁴ in the Tate Collection, University Museum, Adelaide. The fossil has more and finer spirals, but weaker radials. In size, shape, and other respects they are identical. My conclusion is that the recent *C. scobina* may be regarded as a slight variation of the fossil *C. micra*.

PHILINE OSCITANS, *sp. nov.*

(Plate lxvii., fig. 17).

Shell small, opaque, moderately solid, oblong-ovate. Spire not concealed, plane, of two and a half rapidly increasing whorls, separated by a deep sutural furrow. Sculptured by spiral rows of small close punctures, radially undulate with rather coarse incremental lines. Colour, pale yellow. Aperture very large, rounded anteriorly. Columella with a heavy callus. Outer lip free at the vertex, ending in an acute angle. Length, 2, breadth, 1.6 mm.

A single specimen from 800 fathoms. On reconsidering the species noticed (ante p. 288) as *P. trapezia* from 80 fathoms off Narrabeen, I find that these specimens belong to the present form. *Philine trapezia*, Hedley,¹⁵ is related but is narrower, thin, and possessess a distinct and characteristic angle.

LEDA PALA, *sp. nov.*

(Plate lxvi., fig. 1).

Shell small, smooth, inequilateral, moderately inflated, the rostrum not differentiated from the remainder of the valve, with a slight pearly sheen. Colour, olive-buff. Umbo prominent, anterior and ventral margins rounded, posterior dorsal margin concave. Hinge with 10 posterior and 8 anterior teeth. Specimen drawn is—height, 2.85, length, 4.25; depth of single valve 1.15 mm. Another fractured valve is 4.1 mm. high.

Numerous separate valves from 800 fathoms.

The novelty approaches *Leda oblonga*, Pelseneer,¹⁶ from the Antarctic, but is less pointed posteriorly.

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

¹⁵ Hedley—Proc. Linn. Soc. N. S. Wales, xxvi., 1901, p. 704.

¹⁶ Pelseneer—Result Voy. "Belgica," Moll., 1903, p. 23, pl. vi., f. 79-80 (as *L. antarctica*, p. 69).

LEDA FORTIS, *sp. nov.*

(Plate lxvi., fig. 2, 3).

Shell small, solid, smooth, nearly equilateral, subtriangular, rather inflated. Colour cream. Sculpture delicate growth lines. Rostrum short and broad, with an angular ridge. Dorsal margins meeting at an acute angle. Anterior and ventral margins rounded. Hinge with twelve teeth on each side. Height, 3·7; length 4·2; depth of single valve, 1·45 mm.

Several separate valves.

This species appears to belong to the sub-genus *Jupiteria*.¹⁷

NUCULA DILECTA, *Smith.*

Nucula dilecta, Smith, Proc. Zool. Soc., 1891, p. 442, pl. xxxv., f. 23.

Of common occurrence in the vicinity of the type locality is a *Nucula* which coincides with the account of *Nucula dilecta* and which is accordingly identified as such. But this involves adding *N. dilecta* to the synonymy of *Nucula obliqua*, Lamarck, the nomenclature of which was discussed in dealing with the "Thetis" mollusca.¹⁸

CUSPIDARIA ALVEATA, *sp. nov.*

(Plate lxvi., fig. 6).

Shell much inflated, nearly equilateral, umbo prominent, dorsal margin rather straight, anterior perpendicularly truncate, ventral rounded, posterior scarcely sinuate, rostrum hardly apparent. Colour cream. Sculpture, medially there are faint radiating impressed lines which vanish on the anterior quarter, but posteriorly gradually pass into deep and wide furrows. These furrows notch the margin and are parted by sharp elevated ribs of which about ten are stronger than the rest, the broadest furrows contain each a small interstitial riblet. Except the smooth umbo the whole surface is over-run by fine close concentric threads which bead the crests of the ribs. Length, 9·5; height, 8; depth of single valve 3 mm.

A single valve and a few fragments were procured.

¹⁷ Sacco—Moll Terr. Tert. Piedmont, pt. xxvi., 1898, p. 56.

¹⁸ Hedley—Mem. Austr. Mus., iv., 5, 1902, p. 292.

The posterior radial ribbing recalls *C. alcocki*, Smith¹⁹ from the Bay of Bengal, from which the abbreviated rostrum readily distinguished the Australian species.

THYASIRA ALBIGENA, *sp. nov.*

(Plate lxvi., fig. 4, 5).

Shell minute, rather higher than long, translucent with faint growth lines. Anterior margin slightly sinuate, ventral rather straight, posterior rounded. Fold almost obsolete. Umbo prominent, median, incurved. Muscle scars opaque, solid, projecting above the interior surface and visible from the outside. Height, 2; length, 1.9; depth of single valve, 0.75 mm.

A few separate valves.

This species is very distinct from any yet recorded from Australia. It appears to belong to the sub-genus *Axinulus*,²⁰ characterised by the absence of the fold, but is narrower with more prominent umbo than any referred to that group. The white cheeks of the opaque adductor scars contrasted with the translucent shell are a convenient recognition mark for the species.

LUCINA INDUTA, *sp. nov.*

(Plate lxvi., fig. 11, 12).

Shell minute, very thin, brittle, glossy, white, concealed beneath a thick hard brown mass which cakes, cracks and splits off when dry. In shape subcordate, rounded anteriorly, subangled posteriorly, beaks prominent incurved. Lunule absent. Sculpture, irregular concentric undulations and striations. No muscle scars visible. Hinge, the valve margin is produced under the umbo to simulate a cardinal tooth, the ligament occupies a narrow groove. Length, 3; height, 2.65 mm.

Several complete specimens, from 800 fathoms.

As usual with thin shells the muscle scars are invisible, indeed so few salient characters are presented that the systematic position of the species is uncertain. Possibly it may enter *Vaticinaria*.²¹

¹⁹ Smith—Ann. Mag. Nat. Hist., (6), xiv., 1894, p. 170, pl. v., f. 8.

²⁰ Verrill and Bush—Proc. U. S. Nat. Mus., xx., 1898, p. 790.

²¹ Dall—Proc. U. S. Nat. Mus., xxiii., 1901, p. 830.

*TURQUETIA INTEGR*A, *sp. nov.*

(Plate lxvi., fig. 7, 8, 9, 10).

Shell small, moderately solid, rather inflated, nearly equilateral, oblong, higher behind than before, dorsal margin straight, anterior and posterior rounded, ventral slightly sinuated. Colour cream. Umbo inflated, prominent. A slight shallow median sulcus externally. Sculpture: fine irregular incremental lines. Hinge, a narrow external ligament, no laterals, a tubercular subumbonal cardinal and socket in each valve Pallial line entire. Height, 3·5, length, 6; depth of single valve 1·5 mm.

A few separate valves were taken in 800 fathoms. My figure and description is based on a better example dredged in 250 fathoms, twenty-three miles east of Sydney by Mr. Petterd and myself.

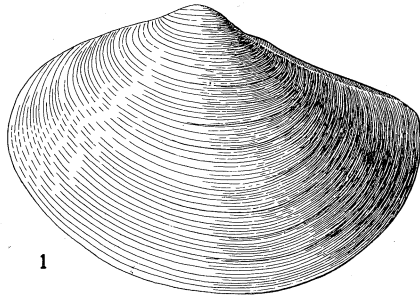
The generic allocation of this species has been a matter of difficulty to me, and I have taken refuge, though not with feelings of security, in *Turquetia*. This at least corresponds to the extent of having a simple pallial line, no laterals and one cardinal in each valve. Our species is larger and has not the short truncate posterior side of the type. *Turquetia* was proposed by Velain²² for a small bivalve from St. Paul Island in the Indian Ocean. Its hinge was more fully explained by Bernard²³.

²² Velain—Archiv. Zool. Exper., vi., 1877, p. 134, pl. v., f. 15-17.

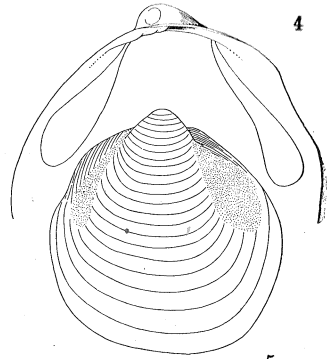
²³ Bernard—Bull. Mus. Hist. Nat., iv., 1898, p. 84, f. 5.

EXPLANATION OF PLATE LXVI.

- Fig. 1. *Leda pala*, Hedley.
,, 2, 3. *Leda fortis*, Hedley—hinge and exterior.
,, 4, 5. *Thyasira albigena*, Hedley—hinge and exterior.
,, 6. *Cuspidaria alveata*, Hedley.
,, 7, 8, 9, 10. *Turquetia integra*, Hedley—hinge, profile, exterior and interior.
,, 11, 12. *Lucina induta*, Hedley—hinge and exterior.

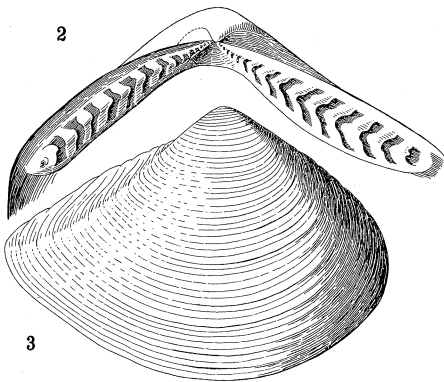


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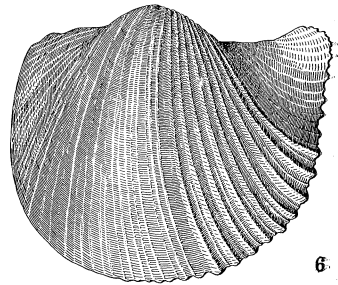
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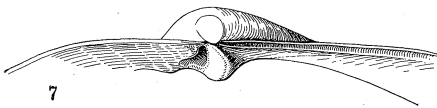


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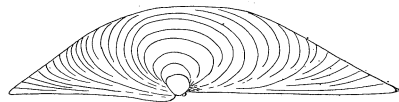
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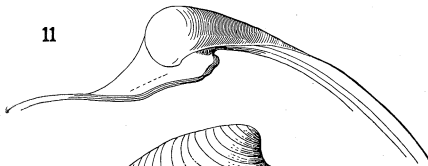
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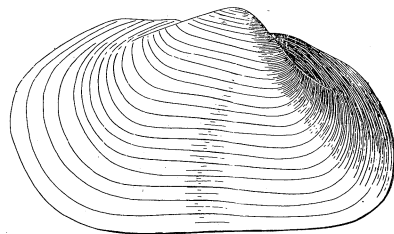
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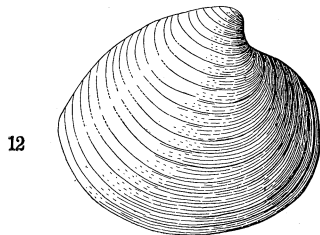
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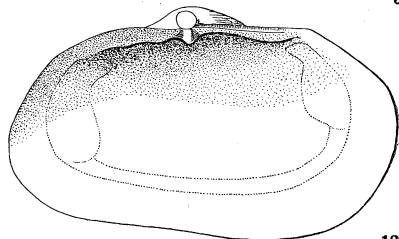
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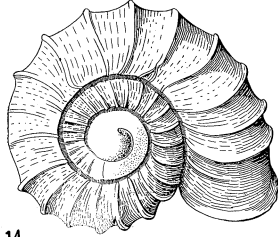


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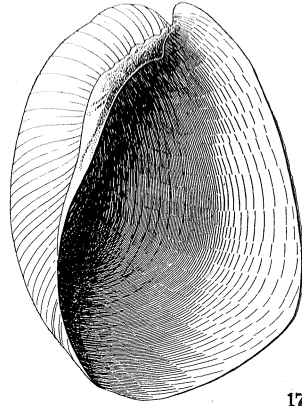
EXPLANATION OF PLATE LXVII.

- Fig. 13, 14. *Liotia capitata*, Hedley.
,, 15. *Rissoa profundior*, Hedley.
,, 16. *Pyrene babylonica*, Hedley.
,, 17. *Philine oscitans*, Hedley.
,, 18. *Epitonium bellicosum*, Hedley.
,, 19. *Turritella curialis*, Hedley.
,, 20. Immature example of *Tiberia nitidula*, A. Adams, inadvertently
included in this plate.
,, 21. *Arcularia dipsacoides*, Hedley.

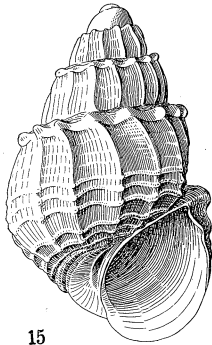
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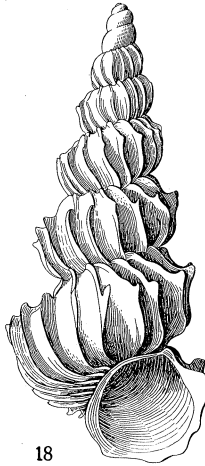
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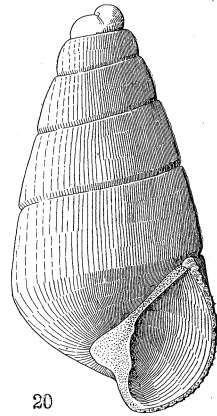
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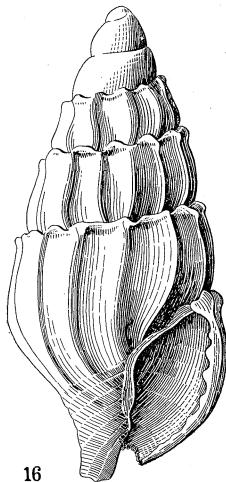
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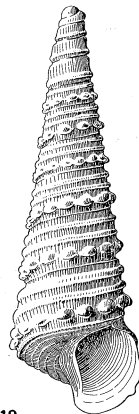
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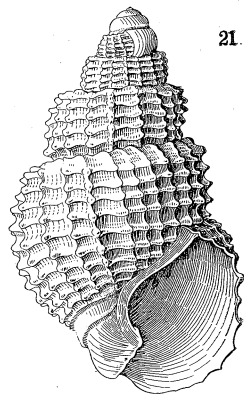
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