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ON THE AUSTRALIAN TERTIARY PALLIOBRANCHS.

By PROFESSOR RALPH TATE, F.G.S., &c., President.

Plates VII.—XI.

[Read October 5th, 1880.]

Bibliography.—Among the fossils collected by Captain Sturt during his journey down the River Murray, and figured in his work “Two Expeditions into the Interior of South Australia,” 1834, is one terebratulid. The shell has been described and variously named by subsequent authors, and is referred to in this paper as *Waldheimia Garibaldiana*, Davidson. Mr. G. B. Sowerby, in Count Strzelecki’s “Physical Description of New South Wales and Van Diemen’s Land,” 1845, describes and figures a second palliobranch as *Terebratula compta*, which I have removed to the genus *Magasella*. In 1862 Mr. Davidson described Sturt’s terebratulid in the “Geologist,” vol. v., under the name of *Waldheimia Garibaldiana*, at that time believing it to be from the Tertiary beds of Malta. In the same year appeared the Rev. J. E. Tenison Woods’ “Geological Observations in South Australia,” in which Sturt’s terebratula is confounded with *T. compta*, Sow.; but in the “Trans. Phil. Soc., Adelaide,” for 1865, he figures and describes it as a new species under the name of *Waldheimia imbricata*. In the same paper Mr. Woods describes *Waldheimia gigas*, *W. Crouchii*, and shows that *Terebratula compta* belongs to *Terebratella*, in which genus he describes a second species as *T. Tenisoni*. Additional species are made known by Mr. R. Etheridge, jun., in a paper entitled ‘On some Species of Terebratulina, Waldheimia, and Terebratella from Mount Gambier and the Murray River Cliffs.’ (Annals and Mag. of Nat. Hist., 1876). Of the five species herein described and figured:—*Waldheimia Gambierensis*, which is identical with *W. grandis*, Woods, and *W. Garibaldiana*, were previously known; a *Terebratella* is erroneously referred to *T. compta*, it is a species closely allied to the recent *Magasella Cumingiana*, I have named it *M. Woodsiana*. The remaining two species, *Waldheimia Taylori* and *Terebratulina Davidsoni*, are decidedly new.

The Rev. J. E. Tenison Woods describes and figures (Trans. Roy. Soc., N.S.W., 1878) some palliobranchs from the Miocene

beds at Table Cape, Tasmania, collected by Mr. R. M. Johnston. Unfortunately the species are very inadequately illustrated; and also because of the very brief characters given, it is almost impossible to understand the species. However, I have been favoured by Mr. Johnston with the loan of the very excellent drawings of the original specimens, and of some specimens named from the types. The species represented are, so far as I can judge, *Waldheimia Garibaldiana*, and the previously undescribed *Terebratula vitreoides*, *Waldheimia Tateana*, and a species erroneously referred to *W. Corioensis*, McCoy. The last may be a *Terebratella*; it is unknown to me. An undescribed *Rhynchonella* is also referred to in the text. Professor McCoy, in the "Fifth Decade of the Palæontology of Victoria," 1877, figures and describes a new and remarkable *Waldheimia* as *W. Corioensis*, and adult forms of *W. Garibaldiana* under the name of *W. macropora*.

From these sources nine species have been well established, and the existence of three or four others are indicated. Adding to these the species now described for the first time, the total number of palliobranchs from the Australian Tertiaries is 33, generically distributed as follows:—*Terebratula*, 4; *Waldheimia*, 15; *Terebratulina*, 4; *Terebratella*, 4; *Magasella*, 4; *Thecidium*, 1; and *Rhynchonella*, 1.

Localities and Horizons.—The surpassing richness in palliobranchs of most fossiliferous localities in South Australia is imperfectly indicated by the fact that all the above species, excepting *Terebratella Woodsii* and *Thecidium australe*, have been collected within the province. My experience as a collector beyond the limits of the colony is limited to the Muddy Creek beds, near Hamilton, Victoria. In many of the sections the profusion of palliobranchs and echinoderms recalls a feature of the Jurassic formations. Their generally good state of preservation, and the comparative facility with which the interiors can be dissected out, have enabled me to discriminate species with a much greater degree of confidence than is usually possible. Indeed, no criterion as to generic position can be drawn from the external characters alone. Thus, without a knowledge of the interior of *Terebratula Aldingæ*, that shell might very well have been referred to *Waldheimia*, if not indeed associated with *W. insolita*. Again, the external characters by which *Terebratella furculifera* is separable from *W. insolita* are so trivial in themselves, though nevertheless practical tests, that one might well hesitate to regard them of specific value. In consequence of a mimetic resemblance among some species in different genera, I have hesitated to assign to its genus any species whose interior characters have not been ascertained. In such cases of

uncertainty the generic name employed has a note of interrogation affixed.

The uppermost set of marine fossiliferous beds of the South Australian Tertiaries is almost devoid of palliobranchs; and only in one locality—near Morgan, on the River Murray—have specimens been gathered in a sufficiently good state of preservation for accurate determination. The superior beds of the River Murray cliffs, or Upper Murravian, I have elsewhere endeavoured to prove are contemporaneous with the celebrated fossiliferous strata of Muddy Creek, in Victoria. In both of them the palliobranchs are all of small size, and are for the most part dwarfed examples of species which have passed up from lower horizons. The species in common are *Waldheimia Garibaldiana*, *W. Tateana*, and *Terebratulina Scouleri*, all rare and small. The Muddy Creek beds have yielded in addition—*Terebratulina Davidsoni*, very rare and small; *Magasella Woodsiana*, small form, though not rare; *Rhynchonella squamosa*, very rare; *Thecidium australe* and *Waldheimia Corioensis*, rare. In the basal beds of the Upper Murravian, about Blanchetown, a large *Waldheimia* (*W. MacLeani*) is profusely abundant.

The Middle Murravian beds contain *Terebratulina Scouleri*, *Waldheimia gigas*, and *W. Garibaldiana* in great abundance.

The Lower Murravian beds of the northern section of the Lower Murray cliffs have not yielded any examples of the class, except *Magasella Woodsiana*, at one locality only (Moorundi, near Blanchetown), where it occurs in great plenty and of large size. But in the cliffs about Mannum and on the River Bremer palliobranchs occur in great variety and abundance. The commoner forms are *Terebratulina Davidsoni*, *Magasella compta*, *M. Woodsiana*, and *Waldheimia* (?) *divaricata*.

In correlated beds we have in the white limestone at Mount Gambier *Magasella Woodsiana* and *Terebratulina Davidsoni* in abundance; and in the yellow Polyzoal calcareous sands of Aldinga Bay *Magasella Woodsiana*, var., and *Waldheimia furcata* of infrequent occurrence. The Table Cape beds, Tasmania, are probably not older than the above series; and though the class is represented in them by seven species, yet individuals seem to be rare.

Descending in the scale of our Tertiary deposits we encounter in the glauconitic limestones of the cliffs in Aldinga Bay, and in their probable representatives on the opposite shore of St. Vincent's Gulf, and in the chalk of the Bunda Cliffs in the Great Australian Bight, a palliobranch fauna with a facies very distinct from that of higher horizons. The total number of species collected from them is twenty-one, or seven-elevenths of the known Australian Tertiary species. Of these fifteen do not pass to higher stages of the formation. Many of the

species occur in abundance, such as *Waldheimia pectoralis*, *W. sufflata*, *Terebratulina lenticularis*, and *Terebratula subcarnea*; *Waldheimia Tateana*, which is profusedly abundant, *Terebratula vitreoides*, *Terebratulina Scouleri*, and *T. Davidsoni* occur here of a much larger size than in the higher beds to which they pass up.

In an appended table I have set forth the stratigraphical and geographical distribution of the species.

Alliances.—The facies of our Tertiary palliobranch fauna is, so far as regards genera, most decidedly modern; but the specific points of contact are few. They are notably *Terebratula vitreoides*, *Waldheimia Garibaldiana*, *Terebratulina Scouleri*, *Magasella Woodsiana*, *Thecidium australe*, and *Rhynchonella squamosa*. Nevertheless, not one of the fossil forms is actually known to be represented in living creation. Of the above *T. vitreoides* and *Th. australe* are related to living Mediterranean species, whilst the others have near recent allies in the Australasian region. On the other hand, the great richness in species of *Waldheimia*, more than half of which are of exceedingly large size, gives to the faunula a character peculiarly its own. The presence, moreover, of several biplated species of that genus is another fact which increases the contrast between our Tertiary and living palliobranch faunas.

A general resemblance seems to subsist between our Tertiary species and those of the European Miocene; but if the *Terebratulæ* of the latter are correctly so assigned, then the resemblance is in part at least mimetic rather than actual. Thus *Waldheimia grandis* approaches *Terebratula Pedemontana*; *W. insolita* to *Terebratula Hilarionis*; and other similitudes might be pointed out.

The absence of the genera *Megerlia*, *Platidia*, and *Argiope* from our Tertiary fauna, also the paucity of *Rhynchonella*, and the presence of *Magasella*, offer great difficulties to the establishment of any well-defined relationship between the European and Australian Tertiary palliobranch faunas. If we select *Terebratula subcarnea* and the *Terebratulinas* (excepting *T. Scouleri*), we might, as equally well, claim for the Australian Tertiary palliobranch fauna a Cretaceous facies.

Viewed in its entirety our Tertiary palliobranch fauna has as much a character of its own, as it has affinity with that of the European Cretaceous or to that of recent Australia. But viewed in its duality, then the older is seen to be far removed from recent types, whilst the newer is seen to possess more pronounced affinities with members of the class inhabiting the seas around and adjacent to this continent. In respect to the older fauna, it may be well to recall the fact that two at least of its species (*Waldheimia insolita* and *Rhynchonella squamosa*) are constituents of the fauna of the Upper Eocene

of New Zealand; and I have reason for the opinion that when a careful comparison shall have been instituted between the fossils of the Eocene of New Zealand and those from the Aldinga beds great specific identity will be found to obtain.

DESCRIPTION OF SPECIES.

Terebratula vitreoides, T. Woods. Plate viii., fig. 5a 5b. Plate x., figs. 7a—7b.

Ref.—Trans. Roy. Soc. New South Wales, 1878, p. 78, figs. 4a—d.

“A small, smooth, orbicular species, with very conspicuous concentric lines of growth. Foramen small. Of this fossil Mr. Davidson says—‘This is another of those undecided forms that resemble many things described as distinct species. It has some resemblance to *T. vitrea* or to *T. orbicularis*, Sequenza, I would not like to assign it positively to any species, although I would not assign to it any very distinguishable features.’”—*T. Woods.*

The specimen which I have figured Plate viii., fig. 5, under the above name is one of a small series from the lower beds at Aldinga, agreeing very well with Woods’ description and figures, except that the foramen is usually larger. Of the Aldinga examples I have not been able to dissect out the interior; but somewhat similar shells from the River Murray cliffs prove to have the loop of a *Terebratula*, see plate x., fig. 7. Of the latter I have only been successful in collecting three examples, all of which are smaller than the Aldinga specimens, and differ in being more gibbous with depressed sides, and in having a smaller foramen, characters which approximate it more to *T. vitrea*, Born., whilst the Aldinga specimens make an approach to *T. elliptica*, Sequenza. The differences, which may be due to age, are too slight to justify the specific separation of the two forms.

The loop of *T. vitreoides* differs from that of *T. vitrea* in being relatively shorter and stouter, the breadth of the curved front portion is much greater, and the crural processes are inconspicuously developed.

Dimensions.—A large specimen from Aldinga has the following measures:—Length, 1·45; breadth, 1·05; thickness, ·7 inch. One from the Murray cliffs:—Length, 1·0; breadth, ·8; thickness, ·5 inch.

Locality and Horizon.—Lower Aldinga—glauconitic limestones, Blanche Point, Aldinga Bay; and Middle Murravian, calcareous sands at Blanchetown. (Tate).

Table Cape, Tasmania. (R. M. Johnston).

Terebratula Aldingæ, *spec. nov.* Plate x., figs. 2a—2b.

Shell obtusely five-sided; a little longer than wide; broadest

about the anterior third; straight or slightly indented in front. Valves moderately convex, the brachial valve more depressed. Surface marked with inequidistant concentric imbricate lamellæ of growth. Punctations of test not visible under a pocket lens, except in thin sections when viewed by transmitted light; punctations minute, widely separated. Beak small incurved and obliquely truncated by a small oval foramen, separated from the umbo of the brachial valve by a small triangular deeply impressed deltidial plate (elements not distinguishable). Interior without a medial septum; of the loop the part posterior to the crura only known. These portions are longer, more slender, and less divergent than in *T. vitreoides*.

Dimensions.—Length, .9; breadth, .75; thickness, .45 inch.

Obs.—Young examples of this terebratulid and *Terebratella furculifera* closely resemble each other, but the latter is at once known by its densely punctated shell structure and foramen. From *Terebratula vitreoides* it differs especially in its nearly flat brachial valve and pentagonal shape.

Locality and Horizon.—In the glauconitic limestones, north side of Blanche Point, Aldinga Bay. (Twelve examples).

***Terebratula* (?) *subcarnea*, spec. nov.** Plate ix., figs. 1a—1b.

The interior of this species is not known, and the external characters which belong to *Waldheimia* are not presented by it. It so closely resembles *T. carnea* of the European Cretaceous rocks, that it is only after very careful comparison with many specimens of that species that differences are found to exist. *T. subcarnea* has a larger, though small, foramen; the brachial valve is not so gibbous; and its greatest breadth is nearly medial. These characters partly serve to separate it from *T. carneoides*,* Guppy, of the Antillian Miocene, to which must be added that the front margin of our shell is either straight or slightly depressed.

Dimensions of a large specimen:—Length, $1\frac{3}{4}$ inches nearly; breadth, $1\frac{1}{2}$ inches; thickness, 1 inch nearly.

Locality and Horizon.—In the top-bed of chalk, Bunda Cliffs, Great Australian Bight. (For the geology of, see vol. ii. p. 104, of this Society's Transactions).

***Terebratula* (?) *bulbosa*, spec. nov.** Plate vii., figs. 5a—b.

Shell ovate, longer than wide, rounded laterally and attenuated towards the narrow, nearly straight, slightly crenulated front.

Brachial valve very convex, slightly depressed near the

* Quart. Journ. Geol. Soc., London, vol. xxi., t. 19, fig. 3, p. 296, 1866; and Davidson, Geol. Mag., 1874, t. 8, fig. 11, p. 158.

front; interior unknown. Peduncular valve as deep as the opposite valve; beak large, incurved, and obliquely truncated by a large obovate foramen.

Surface smooth, marked by moderate lines and striæ of growth.

Dimensions.—Length, 1·8; breadth, 1·35; thickness, 1·3 inch.

Locality and Horizon.—In the coarse limestones forming the low sea-cliff on the south side of the jetty at Edithburgh, Yorke's Peninsula. (One example).

Waldheimia Garibaldiana, Davidson. Plate xi., figs. 1a—1c.

Ref.—Geologist, vol. v., p. 446, t. 24, f. 9, 1862.

Id. R. Etheridge, jun., Ann. and Mag. Nat. Hist., vol. 17, p. 17, t. 1, f. 2, 1876.

Syn.—Terebratula sp., Sturt. Two Expeds. in S. Aust., vol. ii., t. 3, f. 15, 1834.

Terebratula compta, Woods. Geol. Obs. in S. Aust., p. 74, wdct., 1862 (non Sow).

Waldheimia imbricata, Woods. Proc. Phil. Soc., Adelaide, fig. 3, 1865; and Trans. Roy. Soc. of N.S.W., p. 79, f. 1, 1878.

Waldheimia macropora, McCoy. Prod. Pal. of Victoria, decade v., pl. 43, figs. 4 and 6, 1877.

W. imbricata, W. Garibaldiana, and W. macropora, Etheridge. Cat. Aust. Fossils, 1878.

W. Garibaldiana is the commonest palliobranch in the middle beds of the River Murray cliffs, and exhibits some slight variation of form and ornament, more particularly in respect to age. The example figured by Etheridge is exceptionally large, and is more angular in outline and more deeply sulcated than the majority of adult specimens which I have seen. In its adolescent stage of growth, which is represented by Sturt's figure, the outline of shell is more or less circular, with slightly convex valves, which are fimbriated; but the front is not depressed, nor is there an appearance of biplication.

The form varies from nearly circular to ovate; and the pentagonal outline, though never obscure in the adult, varies in its angularity, and in the depth of the sulci exhibits much variation, as also the height and number of ribs. The medial depression is occupied with from three to six longitudinal ribs, and the lateral portions of the valves have usually about ten curved ribs on each side.

The loop is that of a *Waldheimia* reaching nearly to the front in a gentle curve, the reflected portion approximating to the long slender erect cruræ, which are rather distant from the hinge plate.

The shell structure is conspicuously punctate as viewed with a pocket lens. The pores are large circular, but not so

numerous as in *W. flavescens* in the proportion of about five to eight.

Dimensions.—A senile example: length, 1.75 inch; breadth, 1.5 inch; depth, 1 inch.

The specimen figured by Mr. Etheridge, another aged form:—Length, 1.5; breadth, 1.25; depth, .8 inch.

A rather large example, in which the diverging ribs of the peduncular valve and the arched front have not acquired prominence, has length, 1.2, breadth 1.0, depth 0.75 inch.

Alliance.—*W. Garibaldiana* bears some resemblance to *W. flavescens*, now living off the eastern and southern coasts of Australia; but as pointed out by Mr. Davidson, is less ovate, the beak is less elongated, and it has a smaller foramen; and to which differences has been added by Prof. McCoy that of the very much larger pores of the test of the fossil species. In its adult state *W. flavescens* never acquires that remarkable development of the frontal sinus and longitudinal ridges observable in all aged examples of *W. Garibaldiana*.

Observations.—Mr. R. Etheridge, jun., is evidently wrong in referring Sturt's terebratulid to *Terebratella compta*, as Sturt's figure represents a fimbriated shell, and in other respects is totally unlike *T. compta*. The error is traceable perhaps to Mr. Woods, who reproduced Sturt's figure, and applied to it the name of *T. compta*; a rectification was, however, made by him a few years later, when he described it as a new species under the name of *Waldheimia imbricata*. Though he does not refer to the figure in his "Geological Observations," nor to Sturt's, yet as the drawing which accompanied his paper in the Transactions of the Philosophical Society of Adelaide seems to be a reproduction of one or the other, there cannot be a doubt that Sturt's terebratula and Woods' *Waldheimia imbricata* belong to the one species.

That *W. imbricata*, Woods, is a young example of *W. Garibaldiana*, Etheridge, is an opinion formed after the examination of many score of specimens of the species, ranging from less than one-third inch in diameter to more than one and a half inches in diameter. *W. macropora*, McCoy, is a somewhat intermediate form.

I have selected from a large series collected from the same stratum at Blanchetown three specimens (pl. xi., figs. 1a—1c), which illustrate as many stages of growth, and to which the names of *W. imbricata*, *W. macropora*, and *W. Garibaldiana* have been respectively applied.

The shell, which Mr. Woods has figured (Trans. Roy. Soc., N.S.W., p. 79, fig. 2) as the young of this species, differs not only in its well-developed longitudinal ribs from juvenile examples of *W. Garibaldiana*, but seems rather to have the

characters belonging to a *Terabratulina*. It bears some resemblance to my *T. triangularis*.

Mr. Etheridge, l. cit., January, 1876, writes:—"When originally described, *W. Garibaldiana* was supposed to have come from the Tertiary beds of Malta; but Mr. Davidson afterwards satisfied himself that it in reality came from Mount Gambier. The nature of the matrix filling the valves bears out this view, for it agrees exactly in lithological character with that adhering to authenticated specimens from the same locality." One would think from this that all doubt as to the *habitat* of the species was set at rest. But not so Mr. Davidson supplies a note to Mr. Woods (Trans. Roy. Soc., N.S.W., p. 78, 1878), to the effect that the Tasmanian shell referred to under the name of *W. imbricata*, nobis, *W. macropora*, McCoy, M.S., "is a new but allied species, and has also a little resemblance to my *W. Garibaldiana*, although I think not the same species." Prof. McCoy says of it, however:—"I do not know how it can be separated from Davidson's *W. Garibaldiana*." Nevertheless, Prof. McCoy remarks in an appendix to his description of *W. macropora*:—"I should have thought Mr. Davidson's *W. Garibaldiana* identical with this species, but in a letter I have seen from him to the Rev. Mr. Tenison Woods—[referred to above]—he thinks differently." I think it not improbable that Prof. McCoy has misinterpreted Mr. Davidson's remarks, which bear solely upon the possible separation of the Tasmanian shell from *W. Garibaldiana*, and do not necessarily imply that the type of the species is not Australian. As Mr. Davidson observes, "the subpentahedral elongated shape—[of the Tasmanian shell]—is remarkable;" but it can be matched with examples from the River Murray cliffs, and is nothing more than one of the forms of this variable species.

The publication of Davidson's name has priority over that of *W. imbricata*, whilst the latter antedates that of *W. micropora* by several years.

Locality and Horizon.—Upper Murravian, near Morgan, and Muddy Creek, Hamilton; rare and of stunted growth. (Tate.)

Middle Murravian, River Murray cliffs, North-west Bend, Blanchetown, &c. (Sturt, Tate, &c.)

Lower Murravian, River Murray cliffs at Mannum; on the River Bremer, three miles south from Callington; rare. (Tate.)

Mount Gambier (Woods); between Mount Eliza and Mount Martha (McCoy); Table Cape, Tasmania (R. M. Johnston.)

***Waldheimia furcata*, spec. nov.** Plate vii., figs. 2a—2b.

Shell obscurely pentagonal, inflated; valves about equally convex, ornamented with sub-acute ribs, which commence from

the umbonal region and increase in number by bifurcation towards the front, and numerous and close-set transverse lamellæ. The line of contact of the two valves is in one plane, and is only slightly indented by ridges and sulci.

Beak produced, sub-erect to slightly incurved, truncated by a small foramen, and separated from the hinge line by a deltidium. Pores of the test circular few and large, as in *W. Garibaldiana*, but not so numerous in the proportion of four to five. Reflected portion of loop unknown; septum very prominent, extending for about half the length of the valve. Cruræ very short; loop towards its origin, rather broadly compressed, and falcately excavated on the upper side.

Dimensions.—Length, .8 inch; breadth, .6 inch; depth, .5 inch.

Observations.—In its sub-pentagonal form and small foramen it closely resembles *W. Garibaldiana*, from which it is separable by its inflated form, straight front margin, and by the bifurcation of its strongly fimbriated ribs, and in certain details of the loop. It comes nearer to *W. flavescens* than *W. Garibaldiana* does, but, as with that shell, it has a much smaller foramen and fewer and larger pores.

Locality and Horizon.—Rather rare in the Polyzoal calciferous sands forming the lower part of the sea-cliffs immediately to the south of Port Willunga jetty, Aldinga Bay, and at Seaford, near mouth of the River Onkaparinga, St. Vincent's Gulf; at Surveyor's Point, Yorke's Peninsula.

***Waldheimia* (?) *divaricata*, spec. nov..** Plate viii., figs. 8a—8b.

This species has some resemblance to *W. Garibaldiana*, but is a narrower shell. The brachial valve is less inflated and much depressed in front, and the convexity of this valve is more or less interrupted by a median longitudinal depression, corresponding to which in the other valve is a strong truncated keel. The beak is more depressed, the deltidial area broader, and the beak ridges more conspicuous.

The ribs are *en chevroa*, rarely inconspicuous. It also presents in form some agreement with *Magasella Woodsiana*, but in that shell the valves are regularly convex, and the front margin is not angulated.

The loop is unknown, but there is a well-developed septum, which extends for about half the length of the valve. There are no signs of transverse attachments.

Dimensions.—Length, 1 inch; breadth, .75 inch; depth, .5 inch.

Locality and Horizon.—In the red raggy limestones of the River Murray cliffs at Mannum (many examples).

Waldheimia Tateana, Woods. Plate vii., figs. 6a—6b; plate viii., figs. 6a—6c; plate ix., fig. 2.

Ref.—Terebratula Tateana, Tenison Woods.

Trans. Roy. Soc., N.S.W., p. 79, f. 5, 1878.

Shell longitudinally oval, narrow, widest about the middle; sides slightly rounded, nearly straight in front. Valves moderately convex; surface smooth, marked with a few concentric striæ of growth. Beak long, narrow, sub-erect, truncated by a small circular foramen.

Shell structure conspicuously punctate under a lens; pores oval, large, crowded, rather larger than in *W. Garibaldiana*, but about equal in number.

The loop offers no particular character; in a specimen of a total length of .8 inch the loop reaches within $1\frac{1}{2}$ lines of the front.

Dimensions of a median-sized example.—Length, .8; breadth, .55; thickness, .35 inch.

Observation.—The species exhibits considerable variation; typical specimens are insensibly connected with an ovate form, with rounded sides and front. Another phase of its variability is exhibited by the development of a biplicated front, which gives to the shell a subpentagonal outline. In this latter variety the peduncular valve has a broad shallow depression in the middle line bounded by obtuse folds, corresponding with which, in the brachial valve, is a broad median ridge, bounded by two short almost marginal sulci. There are imperceptible gradations connecting the oval, ovate, and subpentagonal shapes; the sulcations are always shallow and limited.

The specimens upon which the species was founded prove on actual examination to be immature examples, though they present the leading characteristics of the adults which I have selected as typical of the species.

Locality and Horizon.—Upper Murravian, near Morgan, R. Murray; Muddy Creek, Hamilton (Tate); Table Cape, Tasmania (Woods). Abundant in the glauconitic limestone to the north of Blanche Point, Aldinga (Tate); Muloowortie clays, Yorke's Peninsula (Tepper).

Waldheimia (?) fimbriata, *spec. nov.* Plate viii., figs. 2a—2b.

Shell longitudinally ovate, sides and front rounded. Valves moderately convex, the peduncular much the deeper. Surface marked by rounded radial ribs, which extend to about one-third; about five ribs occupy the front, and a like number on each side; the rest of the surface is smooth, with a few concentric striæ of growth. Shell structure conspicuously punctate under a lens.

Beak largish, suberect, and truncated by a large foramen.

Loop unknown.

This species has much affinity with *W. Tateana*, particularly with the biplicated variety of it, but the more pronounced costations and the larger foramen separate it.

Dimensions.—Length, .9 inch; breadth, .7 inch; depth, .55 inch.

Locality and Horizon.—Glaucopitic limestones, Blanche Point, Aldinga Bay (a few examples).

Waldheimia (?) Johnstoniana, *spec. nov.* Plate viii., figs. 9a—9b.

Shell elongate, oval, subpentagonal; much longer than wide, with nearly parallel sides, attenuating somewhat rapidly to the beak, but truncated in front. Front margin bispinuate, the sulci shallow and very short, flanked on each side by faint plicæ.

Valves about equally and regularly convex, not inflated. Surface smooth, with a few inequidistant concentric lines of growth. Test minutely and densely punctate, visible under a pocket lens.

Beak short and stout, erect, transversely truncated by a rather large circular foramen; deltidial pieces small, fused together; beak ridges inconspicuous.

Loop unknown, but the brachial valve shows a strongly impressed medial line.

Dimensions.—Length, 1.2; breadth, .7; thickness, .6 inch.

Observations.—It is allied to *W. Tateana*, through the biplicated variety of that species, but is relatively longer and narrower, and its foramen is much larger, and the beak shorter and stouter.

Locality and Horizon.—Glaucopitic limestone, north side of Blanche Point, Aldinga Bay (nine examples).

The species is named after Mr. R. M. Johnston, F.L.S., to whom Australian geologists are indebted for much of their knowledge on the Miocene fauna and geology of Table Cape, Tasmania.

Waldheimia (?) insolita, *spec. nov.* Plate ix., figs. 6a—6b.

Shell oval, nearly as long as wide; sides and front margins curved; valves moderately convex; surface smooth, with a few concentric lines of growth.

Beak small, erect, depressed, with strong beak ridges, obliquely truncated by a rather small circular foramen. Deltidial pieces well-developed.

Loop that of *Waldheimia*, septum about one-third the length of the brachial valve. Punctations of test visible under a pocket lens.

Specimens collected from a marly band in Blanche Point Cliff, Aldinga, exhibit radial flashes of colour.

Dimensions.—Length, 1·1; breadth, ·9; thickness, ·45 inch.

Observations.—This species has some external resemblance to *Terebratula Aldingæ*, but differs in its rounded outline, in the shape of its beak, and in its smaller foramen. It varies in the degree of convexity of the valves, the more depressed forms recalling the inflated variety of the Liassic *W. numismalis*, but without its circular shape and minute foramen. It also bears a striking likeness to *Terebratula Hilarionis*, Meneghini, from the Eocene of Italy (*vide* Geol. Mag., 1870, p. 401, t. 17, f. 4, 5).

Locality and Horizon.—Glauconitic limestones, Aldinga Bay; upper part of chalk rock, Bunda Cliffs, Great Australian Bight (R. T.); Upper Eocene, New Zealand, the identification based on specimens kindly forwarded by Dr. Hector.

Waldheimia grandis, T. Woods. Pl. xi., figs. 3 and 4.

Ref.—Trans. Adelaide Phil. Soc., 1865, t. 2, fig. 1.

Syn.—*W. Gambierensis*, Etheridge, jun., Annals and Mag. Nat. Hist., vol. 17, p. 19, t. 2, fig. 4 (1876).

“Shell smooth, very thick, elongated, convex; ventral valve subcarinated, margin with two obscure plaits in the older specimens; beak short, obtuse, obliquely truncated, with a large circular cup-shaped thickened foramen. Loop two-thirds as long as the dorsal valve; lamellæ slender, straight, reflection unknown; septum, as long as loop, gradually tapering; cruræ thick, semicircular. Length 2·2 inches, breadth 1·4 inches. It is a very variable shell.”—T. Woods.

Etheridge's figure represents the adult form of the species, though its dimensions are below the average of fully developed examples. The Rev. J. E. Tenison Woods' illustrations of this species are of a large but somewhat immature specimen, in which the biplicated front, characteristically shown in Mr. Etheridge's drawings, is only commencing to be formed. There cannot be a doubt of the relationship existing between the two shells; they, moreover, came from the same locality.

Etheridge referred his species to *Waldheimia*, solely because a mesial septum was indicated by an impressed line on the brachial valve. Tenison Woods, however, proceeds with more caution, and states that he is not certain if it be probably referred to that genus, though the unreflected portion of the loop was alone unknown to him. Having been fortunate in obtaining a full display of the interior, uncertainty as to the generic position of the species is entirely removed. The loop presents no character worthy of note.

Mr. T. Davidson says:—“It approaches to the Italian

Tertiary *T. Pedemontana*, but still distinct, being more regularly oval."

My notes referring to *W. Tateana* and reproduced by Mr. Woods, Trans. Roy. Soc., N.S.W., have been by mistake transferred by him to *W. Gambierensis*.

Dimensions of a large example:—Length, 2·4; breadth, 1·5; thickness, 1·3 inches.

Locality and Horizon.—Very abundant in the calciferous sands occupying the middle portion of the River Murray cliffs about Blanchetown and Morgan; rare in the red yellow calciferous sandstone forming the upper part of the Mannum cliffs on the River Murray; River Bremer, four miles south from Callington (Tate). Rather rare in the coralline limestone of Mount Gambier (Woods). Table Cape, Tasmania (R. M. Johnston).

Waldheimia (?) Crouchii, T. Woods. Plate xi., fig. 8.

Ref.—Trans. Phil. Soc., Adelaide, 1865, t. 2, fig. 2.

This species is founded on a brachial valve of nearly circular outline, and with seven large angular plaits on the anterior margin.

Dimensions.—Length, 2·3 inches; breadth, 2·2 inches.

Locality.—Mount Gambier (Woods).

Observations.—This appears to be very distinct from its congeners, but I suspect it to be closely related to *W. grandis*.

Waldheimia MacLeani, *spec. nov.* Plate vii., figs. 1a—1c.

Shell large, a little longer than wide, with a sub-pentagonal outline, convex; greatest width about the anterior third of the whole length, rapidly attenuating posteriorly and gradually narrowing anteriorly to the truncated front margin. Lateral margins narrowly plicate, front margin sinuous, *Brachial* valve regularly convex and deep, ornamented by a few curved costæ, which are limited to near the margin, with an ill-defined medial longitudinal fold bounded by two short depressions. *Peduncular* valve convex deep, the marginal plications more pronounced and longer than in the brachial valve; a shallow depression extends from about the middle of the front, where it is bounded by two rounded plaits each equal in width to the depression. *Beak* moderately produced, sub-erect, truncated by a large circular foramen. *Surface* of both valves with concentric lines of growth.

Young shell ovate, without plicæ, the line of junction of the valves is in one plane.

Dimensions in inches:—

	Length.	Width.	Depth.
(1.)	1·175	1·3	·45
(2.)	1·9	1·4	·5

Observations.—The general shape of *W. MacLeani* is that of *W. Garibaldiana*, but its outline is not so angular, it is more convex, the plications shorter and stouter, and it wants the angular folds of the peduncular valve and the depressed angular front; the foramen is, moreover, very much larger, and the beak more voluminous. Young shells of these two species are very distinct from one another.

The alliance of *W. MacLeani* is rather with *W. grandis*, though strikingly different in shape. Young shells of these species at the same stage of growth show the following distinctive characters:—

W. MACLEANI.	W. GRANDIS.
Rounded front	Narrowed front
no fold	mesial folds
margin in one plane	margin flexuous
larger foramen.	smaller foramen.

The species is named after my friend D. MacLean, Esq., J.P., who has rendered great service in the cause of South Australian palæontology, particularly by the bringing to light under great difficulties the cranium of a balænoïd whale imbedded in the River Murray Cliffs at Murbko, fifteen miles north of Blanchetown.

Locality and Horizon.—*W. MacLeani* is profusely abundant in a chalky limestone, which commences the limestone and shell beds forming the Upper Murravian series at Blanchetown and northward for about 18 miles. Many of the fossils in this stratum, at a point about three-quarters of a mile south from Mr. MacLean's residence, Glenforslan, are pseudomorphs after selenite, but in the case of the *Waldheimias* their tests are of the original substance, though their interiors are for the most filled with gypsum. By breaking the shell away there may be obtained most beautiful casts enclosing the loop, the opacity of which makes it a well-defined object as seen through the transparent gypsum.

***Waldheimia Vincentiana*, spec. nov.** Plate x., figs. 1 and 8.

Shell elongated, oval, much longer than wide, greatest breadth in the middle, whence the shell tapers gradually towards the front and beak; marked with inequidistant concentric lines of growth. Test thick, densely punctated.

Valves nearly equally convex; the brachial valve most convex in the umbonal region. Lateral margin of the valves nearly straight, front margin slightly bisinuated.

Beak short, prolonged, and transversely truncated by a circular foramen of large dimensions. Deltidial pieces distinct, rather small and narrow, beaks moderately well defined.

An impressed line on the surface of the brachial valve, extending for about one-third its length, indicates the existence of a mesial septum. Interior unknown.

A small shell, bearing an external resemblance rather to *W. Vincentiana* than to any other known species, possesses internal characters totally different from those of any *Waldheimia*. The septum is remarkably long, extending through a distance of .65 inch of a total curvilinear length of the brachial valve of .85. The loop is broadly compressed, the forward limb is con-duplicate, and is excessively expanded anteriorly and confluent with the returning portion of the loop; at this point the depth is $\frac{1}{5}$ th of an inch.

Dimensions.—Length, $2\frac{3}{4}$ inches; breath, $1\frac{7}{10}$ inch; depth, $1\frac{3}{10}$ inch.

Observation.—The only species from the Australian Tertiaries that bears any resemblance to *W. Vincentiana* is *W. gigas* (T. Woods), which has, however, a more elongated shape, and is more attenuated and conspicuously buplicated at the front.

Locality and Horizon.—In the raggy limestones about one mile south from Port Vincent (or Surveyor's Point), west coast of St. Vincent's Gulf (two examples).

***Waldheimia Taylora*, Etheridge. Plate xi., fig. 2.**

Ref.—Annals and Mag. of Nat. Hist., vol. xvii., p. 18, t. 1, f. 3. 1876.

“Shell elongato-ovate, longer than wide; greatest width near the middle. Peduncular valve exceedingly convex, with two slightly diverging obtusely-rounded ridges proceeding from the beak towards the front, where they become lost, and enclosing between them a narrow space which in its upper part is rounded, and becomes flattened or a little concave towards the front of the shell; the lateral portions of the valve are also flattened, but not concave; beak produced, incurved, and truncated by an oblique circular foramen contiguous to the umbo of the brachial valve, but separated from it by a small deltidium. Brachial valve, slightly convex in the umbonal region, becoming almost flat towards the front, but presenting in its longitudinal outline a gentle continuous convexity. Lateral margins a little flexuous; surface marked by a few concentric lines of growth; shell distinctly punctate.

Length, 2 inches $3\frac{1}{2}$ lines; width, 1 inch 10 lines; depth, 1 inch 5 lines.

Locality and Horizon.—Coralline limestone of the Murray River cliffs, near the Great Bend, S. Aust. *Mus. Prac. Geology*, London.” Etheridge.

This shell is unknown to me, unless I have mistaken for it a narrow form of *W. Corioensis*, which occurs at Mannum. It

is, however, distinguishable from the Mannum fossil by its broad front and the tripartite division of the peduncular valve. *W. Taylori*, *W. Corioensis*, and *W. sufflata*, which are of about equal size, are among the largest species of the genus.

Waldheimia Corioensis, McCoy. Plate ix., figs 4 and 7; plate x., fig. 4.

Ref.—Palæontology of Victoria, Decade v., tab. 43, figs. 1—3, 1877.

Shell sub-ovate, greatest width about the middle, margin of sides convex in the middle. Pedunculated valve very convex or very obtusely carinated along the middle, sides flattened, very slightly convex, becoming slightly concave near the lateral margins; in profile it is much arched near the large incurved beak, becoming tangentially straight towards the front, which is elevated at the margin into a deep sinus (bisinuate when old). Brachial valve flattened in the umbonal half, with lateral margins abruptly deflected at right angles towards the other valve, becoming gradually depressed in the middle towards the narrowed front; in old specimens the mesial depression is divided by a wide slight convexity.

Foramen moderate, deltidium tripartite, the narrow middle portion convex; beak ridges moderate, angulated.

Surface smooth, with moderate lines of growth. Mesial septum about one-half the length of the shell. Length, $2\frac{2}{3}$ inches. (Abridged from the original diagnosis.)

A few large terebratulids obtained at Mannum seem to agree generally with the example of *W. Corioensis*, represented by the woodcut on p. 11. The least imperfect of them is shown by fig. 4, pl. x.

A fragment of the umbonal half of a large brachial valve shows some peculiarities of the rostral boss. The hinge plate is broad and deeply concave, the cardinal process is deeply tripartite, the central lobe erect, thick, and compressed, the laterals are divaricate, lamellar, and confluent with the cruræ. (Pl. ix., fig. 7.)

A single specimen of another large terebratulid (fig. 4, pl. ix.), though differing greatly in its wide and deep mesial depression, is provisionally referred to this species.

Locality and Horizon.—Lower Murravian, rare in raggy limestones at Mannum (Tate).

Miocene Tertiary, Corio Bay, Geelong; Jan Juc (abundant), more rare at Muddy Creek (McCoy).

Dimensions of the specimen, fig. 4, pl. x:—Length, 2.65 inches; breadth, 1.8 inch; thickness, 1.6 inch. Of the variety, fig. 4, p. ix):—Length, 2.2; breadth, 2; thickness, 1.2 inches.

Waldheimia pectoralis, *spec. nov.* Pl. vii., figs. 1a—d.

Shell elongate to elongate-ovate, longer than wide; greatest width near the middle; valves very unequal, lateral margins strongly curved, deflected. Brachial valve strongly convex longitudinally; at the anterior third flattened; with a shallow sulcus proceeding from the beak and widening out to the front margin, which is sinuated or slightly plicate. Peduncular valve very convex and deep, with a flattish triangular area corresponding with the sulcus of the other valve.

Loop reaching to near the front margin; lamellæ slender, with a slight curve towards the central line; reflected portion opening out to three times the width of the other; septum high, extending for three-sevenths of the length of the brachial valve.

Beak produced sub-erect, truncated by a very small foramen, and separated by a large crescentic deltidium of one piece, which is corrugated transversely to its length. Surface of the shell with concentric lamellæ of growth; densely and minutely punctated. Immature shell with a shallow sulcus extending to the front margin, which is depressed and sinuous.

Dimensions—Length, 2.25 inches; breadth, 1.8; thickness, 1.1 inch.

Locality and Horizon.—Not uncommon in the glauconitic limestone, which forms the base of Blanche Point Cliff, Aldinga.

Waldheimia (?) sufflata, *spec. nov.* Plate vii., fig. 3; plate viii., fig. 4.

Shell subovate, greatest width about the middle; lateral margins convex in the middle, becoming straight or slightly bisinuated (rarely biplicate) towards the narrow rounded front. Test thick, surface smooth, with numerous moderately strong lines of growth. Shell structure minutely and closely punctate, as viewed under a lens. Peduncular valve very convex in a longitudinal direction, and regularly convex transversely. Beak strongly incurved, slender, foramen minute. Deltidium of one piece, broadly triangular and deeply concave. Brachial valve very convex, faintly impressed or flattened medially, becoming gradually depressed in the middle towards the somewhat narrowed front.

Septum a little less than half the length of the valve. Loop unknown.

Dimensions.—Length of a large specimen, 2.65 inches; width, 1.8; depth, 1.6.

Observations.—This species has the minute foramen and slender beak of *W. pectoralis*, but in other respects the differences are very great. Some examples partake of the shape of certain varieties of *W. Corioensis*, but despite this

general resemblance, *W. sufflata* is at once known by its incurved, minutely perforated beak.

Locality and Horizon.—Rare in the yellow Polyzoal calciferous sands, forming the base of the sea cliffs, south side of Willunga Jetty, Aldinga Bay; and rough shelly limestones at Surveyor's Point and Stansbury, Yorke's Peninsula. Many examples.

***Terebratulina Scoulari*, spec. nov.** Plate viii., figs. 3a—3d.

Shell pentagonal, about half as long again as wide, broadest about the middle, tapering gradually towards the truncated front; sides and front slightly curved. Peduncular valve uniformly convex, with a slight median depression in the anterior half of the valve. Brachial valve moderately convex. Surface ornamented with very numerous radiating rounded ribs, which are repeatedly bifurcated; the interspaces rather narrower than the breadth of the ribs; the entire surface crossed by close-set concentric lines of growth; the ribs about the margins of the umbonal regions with imbricating scales.

Hinge line narrow, arched; beak moderate; foramen, in the adult, complete, circular, moderate, laterally margined by small deltidial plates.

Loop that of *Terebratulina*.

Dimensions.—Length, 1.2 inch; breadth, .75; thickness, .5.

Observations.—*T. Scoulari* belongs to the group typified by *T. caput-serpentis*, from which it differs in being more depressed and attenuated towards the front, and in having the ribs and concentric lines more numerous and finer; the form of the loop is also different. In shape it closely agrees with *T. Japonica*, as also to the recent Australian species *T. cancellata*. From the latter it differs in its more pentagonal outline, less inflated valves, and coarser ribbing; characters which are very pronounced in the young. The annulus of the loop of *T. Scoulari* is rather subcircular; it is smaller and more contracted than that of either of the above.

The specific name is in compliment to Mr. Gavin Scoular, who has so ably worked out the geology of Munno Para.

Locality and Habitat.—Rare in the Upper Murravian, near Morgan, and at Muddy Creek, Victoria (*Tate*). Common in the Middle Murravian white calciferous sand rock. Not uncommon in the glauconitic limestones of Aldinga Bay (*Tate*). Rare in the Muloowurtie clays, Yorke's Peninsula (*Tepper*).

***Terebratulina Davidsoni*, Etheridge.** Pl. xi., figs. 6a—6d.

Ref.—*T. (?) Davidsoni*, Annals and Mag. of Nat. Hist., 1876, t. 1, f. 1, p. 16.

“Shell small, oval, flattened, tapering towards the beak, rounded towards the front; lateral margins in one plane, not

sinuous. Peduncular valve slightly convex, with the beak but little produced, truncated by a slightly oblique foramen more or less below the apex of the beak, excavated out of its substance, and completed by the two small deltidial plates and the umbo of the brachial valve. Brachial valve almost flat, with the slightest indication of a mesial sinus in the front; hinge-line a little arched. Surface of both valves ornamented with a large number of fine radiating ribs, occasionally bifurcating, and a few concentric lines of growth; margins crenulate."—*Etheridge*.

The founder of this species, being unacquainted with its internal portions, placed it with a doubt in the genus *Terebratulina*, but having seen the loop, which offers no special character, I can confidently refer it to that genus.

The shell is conspicuous from its almost hemispherical shape; the peduncular valve being strongly convex and the brachial valve flat, or with a slight medial depression. The ribs, which are usually somewhat thick and crowded, are crenulated and nodulated towards the front by strong lines of growth. The edge of the valves is conspicuously crenulate.

Dimensions of a large and narrow specimen—Length, .46 width, .35. One of the ordinary size gives—Length, .35; width .3; depth, .28 inch.

Locality and Horizon.—This is one of the most widely diffused of our palliobranchs, though not generally abundant. More commonly the valves are widely gaping.

In the Upper Murravian beds near Morgan on the River Murray and contemporaneous beds of Muddy Creek, near Hamilton, Victoria (Tate).

In the Lower Murravian at Mannum (Tate), and in the coralline limestone at Mount Gambier (Woods and Tate).

In the glauconitic limestones, Aldinga Bay, and corresponding beds at Surveyor's Point and Stansbury, Yorke's Peninsula (Tate).

***Terebratulina lenticularis*, spec. nov.** Plate vii., figs. 4a—c.

Shell small, broadly oval, a very little longer than wide. Brachial valve regularly convex deeper than the peduncular valve, which is moderately convex and slightly impressed in the middle line towards the front. Surface ornamented with numerous rounded, bifurcating radial ribs, crowded towards the front, and with imbricating concentric lines of growth towards the same region. Beak stout, obtuse; hinge line narrow, slightly arched; fissure large, deltidial pieces inconspicuous.

Dimensions.—Length, .35; breadth, .3; depth, .15 of an inch.

Observations.—This species is with some difficulty to be distinguished from *T. Seebachi*, Schloenbach, from the Upper Chalk of Hanover and Oligocene of Saxony, as it resembles it in shape and ornamentation. *T. lenticularis* differs, however, in its arched hinge line, smaller and obtuse beak, and in the limited development of the deltidium.

Locality and Horizon.—Abundant in the glauconitic limestones, north of Blanche Point, Aldinga Cliffs (Tate), and in the yellow clays at Muloowurtie, Yorke's Peninsula (Tepper).

***Terebratulina triangularis*, spec. nov.** Plate viii., figs. 7a—7d.

Shell triangularly ovate, a little longer than wide; widest at about the anterior—third; front and sides rounded. Surface ornamented with acute ribs, bifurcating; interspaces linear, fimbriated by imbricating lines of growth. Brachial valve flattish, slightly convex in the posterior part, with a faint median depression towards the anterior, which produces a faintly sinuous front margin. Peduncular valve regularly convex. Beak prominent, acute; hinge line narrow and straight; foramen longitudinal, large, and triangular.

Dimensions.—Length, .35 inch; breadth, .3 inch; depth, .15 inch.

Locality and Horizon.—In the marls at Blanche Point, Aldinga Cliffs, and in the chalky limestone, Bunda Cliffs, Great Australian Bight.

***Terebratella Tepperi*, spec. nov.** Plate ix., figs. 8a—8c.

Rounded, moderately inflated, smooth, with concentric lines of growth. Front margin plane.

Brachial valve regularly and moderately convex to nearly flat. Peduncular valve inflated and medially subangulated. Beak broad, blunt, foramen large, deltidia small, separate.

Loop imperfectly known; but so much as remains in the sole specimen which has been found to afford internal characters is clearly that of *Terebratella*. The medial septum is remarkably short, being less than one-third the length of the valve.

This species belongs to the group typified by the recent New Zealand *T. rubicunda*, Solander, for which it cannot be mistaken.

Dimensions.—Length, .85; breadth, .8; thickness, .45 of an inch.

Locality and Horizon.—“Muloowurtie Clays,” near Ardrossan, Yorke's Peninsula (five examples). Collected by Mr. Tepper, to whom the species is dedicated. For an account of the geology of the Muloowurtie Cliffs see his paper Trans. of this Society, vol. ii., p. 74.

Terebratella (?) pentagonalis, *spec. nov.* Plate ix., figs. 5a—5b.

Shell small, obtusely pentagonal, longer than wide, broadest about the middle. Valves moderately convex, flattened along the middle; surface marked with imbricating lamellæ concentric with the lines of growth.

Beak large, rather produced, obtuse; foramen large, oblong, incomplete; deltidial pieces small. Interior unknown, but the shell is placed in the genus *Terebratella*, because of its incomplete foramen, and general resemblance to *T. rubicunda* and its allies.

Dimensions.—Length, .65; breadth, .5; thickness, .35 of an inch.

Locality and Horizon.—Glaucconitic limestone, north side of Blanche Point, Aldinga Bay. Two examples.

Terebratella furculifera, *spec. nov.* Plate xi., figs. 7a—7c.

Shell orbicular-oval, a little longer than wide; side and front margins in one plane. Valves moderately convex, the peduncular valve a little the deeper, obtusely carinated in the rostral half. Surface smooth, with a few concentric lines of growth; conspicuously punctate under a lens.

Beak small, erect, depressed with strong ridges; truncated by a small triangular foramen; deltidial pieces rather large, disunited.

Septum less than half the length of the valve. Loop doubly attached, first to the diverging portions by transverse processes from the end of the septum, and secondly by a forked process which unites the abruptly truncated terminal bend of the loop to the summit of the extremity of the septum. I have no less than five specimens showing this peculiar conformation of the cop.

Dimensions.—Length, .65; breadth, .55; depth, .3 of an inch.

Observations.—Externally the species resembles *Terebratula Aldingæ* and *Waldheimia insolita*, but may be recognised by the form of its incomplete foramen.

Locality and Horizon.—In the glaucconitic limestones, Blanche Point, Aldinga Bay. Six examples.

Terebratella (?) Woodsii, *spec. nov.* Pl. ix., figs. 10a—10c.

Ref.—*Waldheimia Corioensis*, Trans. Royal Society, N.S.W.; p. 79, fig. 3a—3c, 1878.

The Rev. Mr. Woods referred a small shell with a deep depression on the smaller valve from Table Cape to *W. Corioensis*, McCoy. But until young shells of that species are known, it would be well to regard the identification as bad. The only palliobranch from our Tertiaries, which possess a mesial depression and somewhat similar shape to it is the young

shell of *Magasella compta*, but the beak and foramen of the latter are very small. The excellent figures of the species, drawn by Mr. R. M. Johnston, which I have had reproduced, show a large incomplete foramen, and may therefore indicate a young *Terebratula* or allied form. If the shell be an adult, then it probably belongs to *Terebratella*, where I have ventured to place it.

Locality and Horizon.—Miocene strata, Table Cape, Tasmania (Johnston).

GENUS MAGASELLA, DALL.

The four following species are referred to *Magasella*, because of the strong resemblance they bear to *Terebratella* (?) *Cumingiana*, now transferred by Mr. Davidson to Dall's genus, whose description has not yet reached me. They agree externally in having a prominent beak with a small foramen and the deltidium blended with the shell; the loop presents the characters of *Terebratella*, whilst in others it seems to be related to that of *Magas*.

Magasella compta, Sowerby. Pl. x., figs. 6a—6e.

Ref.—*Terebratella compta*, Sow., in Strezlecki's Phy. Desc. of N.S.W., &c., 1845, p. 297, t. 19, f. 4 (*Non* Woods' Geol. Obs. S. Aust., p. 74, 1862).

Terebratella compta, Woods, Trans. Phil. Soc., Adelaide, f. 4a—b (? *non* 4c—e), 1865. (*Non* Etheridge, jun., Ann. and Mag. Nat. Hist. t. 2, f. 5, p. 19, 1876.)

"Shell smooth, thin trapeziform; lateral margins sub-incurved, anterior margin small obtuse. Hinge area large, with a longitudinal depressed line at either side. Brachial valve triangular, rounded slightly, truncated in front with a small median sinus; peduncular valve faintly keeled. Foramen terminal, small, and round."—Sowerby. To which description Mr. Woods has added brachial valve sub-cordiform, flat, and both valves marked with concentric lines of growth.

The young is nearly circular in outline, with a marginal median sinus in the brachial valve; beak and foramen small, with little or no deltidial area.

The loop is only known by one example (fig. 6e); compared with that of *M. Cumingiana*, the following differences are observable:—In *M. Cumingiana* the erect and thick projection of the septum has, in reality, two distinct slender loops attached to it. But in the example before us the loop at its reflection is broadly expanded, and embraces the elevated part of the septum; it then extends into an almost complete circle. It thus has considerable analogy with that of *Magas* (*sensu strictu*). The different dispositions of the loop in *M.*

Cumingiana and *M. compta* arise from the relative massiveness of the septum and loop; in the former the slender loop is lost in the excessively stout septum along which it may be considered to be decurrent, till it becomes again free, and forms the second annulus; whereas in *M. compta* the septum is lost as it were in the much greater mass of the broad lamellæ of the loop, and the loop seems to be only once attached to the septum.

Dimensions of a larger specimen:—Length, .9; breadth, .7; depth, .5 of an inch.

Observations.—*M. compta* being the oldest described among the related forms need not here be compared with them; its salient characters may, however, be pointed out. Trapeziform, contracted, depressed and biangulated in front; hinge line straight, very broad; beak suberect; deltidial area very large. The species has hitherto been almost unknown except by Sowerby's figures and descriptions, as the common shell which is commonly referred to it, is a distinct though allied species. Figs. 4*a* and 4*b* of Mr. Woods' paper, *op. cit.*, doubtlessly represent Sowerby's shell; but his fig. 4*c* agrees well with *M. Woodsiana*, mihi, and I strongly suspect that the interiors shown by figs. 4*d* and 4*e* belong to the same. A comparison of the original figures of *T. compta*, and those of *T. compta*, Etheridge, *op. cit.*, cannot fail to convince one that two species are represented by them.

Locality and Horizon.—Not rare in the Lower Murravian beds at Mannum on the R. Murray, and near Callington, on the R. Bremer. Rare at Stansbury, Surveyor's Point (*Tate*), at Muloowurtie, Yorke's Peninsula (*Tepper*); Mount Gambier, South Australia, and Portland, Victoria (*Woods*).

The types were obtained "from a raised beach at Point Fairy," on the Cape Otway coast, Victoria; but as in other instances, Strezlecki mistook our Older Tertiary deposits for Post Tertiary beaches.

***Magasella Woodsiana*, spec. nov.** Plate x., figs. 3*a*—3*d*.

Syn.—*Terebratella compta* (pars), Woods, loc. cit., fig. 4*c*—4*e* (1865).

id., Etheridge, loc. cit., 1876.

Shell pyriformly ovate, longer than wide, margins flexuous. Valves unequally convex, peduncular valve much the deeper, which is longitudinally and obtusely carinate. Brachial valve regularly convex in the umbonal half, medial depressed towards the front.

Beak broad and stout, slightly incurved and truncated by a nearly transverse circular foramen of moderate dimensions. Hinge line much arched, beak ridges sharply defined, enclosing

a large triangular area, somewhat concave except where interrupted by a broad medial longitudinal ridge.

Surface with concentric striae and a few ridges of growth; test thin, conspicuously punctate.

A portion of the loop has been illustrated by Mr Etheridge, and very little more of the interior of the adult shell than is there shown is known to me, though a great number of specimens have been sacrificed.

In the adult the medial septum is continued to near the front of the valve, and at about half its length it gives off on each side a flatly expanded process by which it is connected with the diverging portions of the loop. The septum does not appear to have been elevated, as in *M. Cumingiana*. If the specimen to which the following description refers belongs to *M. Woodsiana*, then little remains to complete our knowledge of the interior of the species. Mr. Woods writes:—"Septum round and solid, lamellæ of loop widening to the point of attachment, becoming again contracted at the reflection, and then extending into an almost complete circle with a slight projection towards the hinge."

In young specimens the septum assumes different forms, as I have proved by the examination of more than a dozen specimens from the River Murray cliffs and Muddy Creek. In one from near Morgan the septum is actually adherent to the opposite valve, and the loop shows the same disposition as in *M. compta* (pl. x., fig. 6e). Between this form of septum and that of the adult every possible gradation is exhibited.

Dimensions.—Length, .75; breadth, .55; depth, .4 of an inch.

Observations.—*Magasella Woodsiana* bears a considerable external resemblance to the recent *M. Cumingiana*, but differs in its less trapezoidal shape, and in the greater breadth and height of the deltidial area. Internally the characters are widely different in detail, and the thick mesial ridge in the interior of the peduncular valve of *M. Cumingiana* is peculiar to that shell. The Port Jackson specimens of *Magasella* presented by the Rev. Mr. Woods, who directed my attention to the similarity between it and the Mount Gambier fossil, seems to me to agree better with Reeve's *Bouchardia fibula* than with *Terebratella Cumingiana*, but which Mr. T. Davidson believes to be only a varietal form of the latter.

Locality and Horizon.—Upper Murravian, near Morgan, and at Muddy Creek (Tate); Lower Murravian, at Morrundi, on the River Murray, near Blanchetown; Mannum; and near Callington (Tate). Mount Gambier (Woods & Tate). Yellow calciferous sands, Aldinga Bay; and at Stansbury (Tate).

Magasella Tenisoni, Woods. Plate xi., fig. 5a—5c.

Reference.—Terebratella Tenisoni, Trans. Phil. Soc., Adelaide, 1865, t. ii., figs. 5a, 5b, and 6.

“Shell elongated, usually convex. Peduncular valve, trapeziform, keeled deeply, and terminating in a notch at the anterior margin. Brachial valve orbicular and tapering to a point which fits into the notch on the other valve. Beak obtuse, deltidium striated, foramen oblong.

“Septum thickened, curved, and produced so as to touch the opposite valve; attachments of the loops at the centre, and nearer to the shell than to the edge of the septum. Muscular impressions deep. Hinge and crura sloping away from the septum, with a deep sinus in the centre.

“*Size*, variable, but adult specimens 0·7, breadth 0·4 of an inch.

“This curious species has strong points of resemblance to *T. Evansii*, but whose individual characters are very distinct. In both the septum is produced so as to touch the opposite valve.”—Woods.

Locality.—Mount Gambier and Portland (Woods).

Magasella deformis, *spec. nov.* Plate x., figs. 5a—5c.

Shell oblong-ovate, margins of sides convex in the middle. Peduncular valve very convex, obtusely carinated along the middle, sides convex becoming flat or slightly concave near the lateral margins. Brachial valve regularly convex in the umbonal half, with lateral margins abruptly reflected, becoming abruptly and considerably depressed towards the narrowed front.

Beak depressed, truncated by a minute foramen; deltidial area broad and concave; beak ridges well defined.

Surface with a few lines of growth; malleated punctate under a lens.

Mesial septum thick, about half the length of the valve, abruptly produced so as to touch the opposite valve; diverging lamellæ of loop nearly parallel, connected by short transverse processes to the point of origin of the septal projection; thence continued beyond for about half as far again, widening at the inflection, and apparently becoming attached near the apex of the septal projection.

Dimensions.—Length, ·45; breadth, ·3; depth, ·27 of an inch.

Observations.—The reflection of the lateral margins of the valves is a character belonging to the adult shell. In its young state it resembles *M. compta*, and somewhat *M. Woodsiana* at the same stage of growth, but is at once distinguished by its beak and its malleated test.

Locality and Horizon.—In the glauconitic limestones Blanche Point, Aldinga Bay. Nine examples.

Thecidium australe, *spec. nov.* Plate ix., figs. 3a—3c.

Shell minute, one-eighth of an inch in diameter, triangular-ovate, inequilateral, attached by the umbonal surface of the peduncular valve. Surface smooth, conspicuously punctate, and ornamented by a few thick folds of growth.

Brachial valve flattish; hinge line straight, but interrupted in the middle by a small subquadrate cardinal process; interior unknown.

Peduncular valve, inflated and produced at the umbo, which is obliquely truncated by the surface of attachment; interior with coarse radial striæ, which crenulate the thin margin. Hinge teeth prominent. Within the umbonal cavity is a cup-shaped cavity for the attachment of the adductor muscles, divided longitudinally by a septum, which is continued half as far again beyond it.

This notice is, I believe, the first record of the occurrence of the genus, either recent or fossil in the southern hemisphere.

Locality and Horizon.—In the Miocene strata at Muddy Creek, from which I obtained one perfect shell and four peduncular valves.

Rhynchonella squamosa, Hutton. Pl. ix., figs. 9a—9b.

Ref.—Cat. Tertiary Mollusca of New Zealand, p. 37, 1873.

Syn.—*Rhynchonella cœlata* (McCoy, MS.), Woods, Trans. Roy. Soc., N.S.W., p. 77, 1878.

Rhynchonella lucida, McCoy, M.S. (*non* Gould, 1860).

“Shell irregular, more or less orbicular; valves unequal, the ventral flatter with a deep groove; dorsal valve very convex; both with fine radiating scaly striæ. Length, .7; breadth, .75; height, .5. Easily distinguished from *R. nigricans* by its more numerous striæ.”—Hutton.

Remarks.—The task of establishing a correct synonym of manuscript names is one that is very properly unattempted by monographers; but in this instance the manuscript names of McCoy have a fictitious value from the fact that they have been published with such remarks as may lead up to their identification. The *Rhynchonella* found at Table Cape, Tasmania, was pronounced by Tenison Woods (Trans. Roy. Soc. Tasm., p. 15, 1874) to be identical with *R. lucida* of McCoy, common in the Geelong Miocene beds; subsequently we find the same author (Trans. Roy. Soc., N.S.W., 1878) referring to it as *R. cœlata*, McCoy. Doubtless the two names have been given to the same shell; and it is probable that the change of denomination was

necessitated by the knowledge of the prior occupation of the cognomen *lucida* by a recent shell described by Gould in 1860.*

The identity of *R. cœlata* with *R. squamosa*, Hutton, rests upon the characters given to it by Mr. Woods, and upon the observations of Mr. Davidson published therewith (op. cit. p. 77).

“Rounded trigonal, with a strong mesial fold, with many fine imbricating ribs.”—T. Woods.

“A most beautiful species, very closely related to *R. nigricans*, from New Zealand. Some examples in external shape cannot be distinguished, but I have not observed on any recent *R. nigricans* such prominent and strongly marked imbricated striæ. The fold and sinus seem more strongly marked on the fossil form. The ribs also seem smaller or more delicate than on real *nigricans*.”—T. Davidson.

It will be observed that Mr. Davidson uses the same characters to distinguish the fossil from the recent *R. nigricans* as Prof. Hutton had previously employed in founding the species *R. squamosa*.

Locality and Horizon.—In the glauconitic limestone, north of Blanche Point, Aldinga Cliffs (*Tate*); yellow clays of Muloo-wurtie (*Tepper*), and at Stansbury (*Tate*), Yorke’s Peninsula; on the R. Bremer, at Salem, near Callington (*Tate*).

Muddy Creek, Hamilton (*Tate*), and from several Miocene beds in Victoria (*McCoy*); Table Cape, Tasmania (*T. Woods*); Oamaru Formation (Eocene) Broken River, New Zealand (*Hutton*).

EXPLANATION OF PLATES.

PLATE VII.

- Fig. 1. *Waldheimia pectoralis*, natural sizes. Aldinga. *a* and *b*, two views of an adult shell; *c* and *d*, id of a young shell.
- Fig. 2a-b. *Waldheimia furcata*, natural size. Aldinga.
- Fig. 3. *Waldhemia sufflata*, natural size. Surveyor’s Point.
- Fig. 4. *Terebratulina lenticularis*, much enlarged. Aldinga. *a*, brachial valve; *b*, lateral view of both valves; *c*, front view.
- Fig. 5. *Terebratula bulbosa*, *a-b*, two views, natural size. Edithburgh.
- Fig. 6. *Waldheimia Tateana*, *a-b*, two views of the same specimen, natural size. Aldinga.

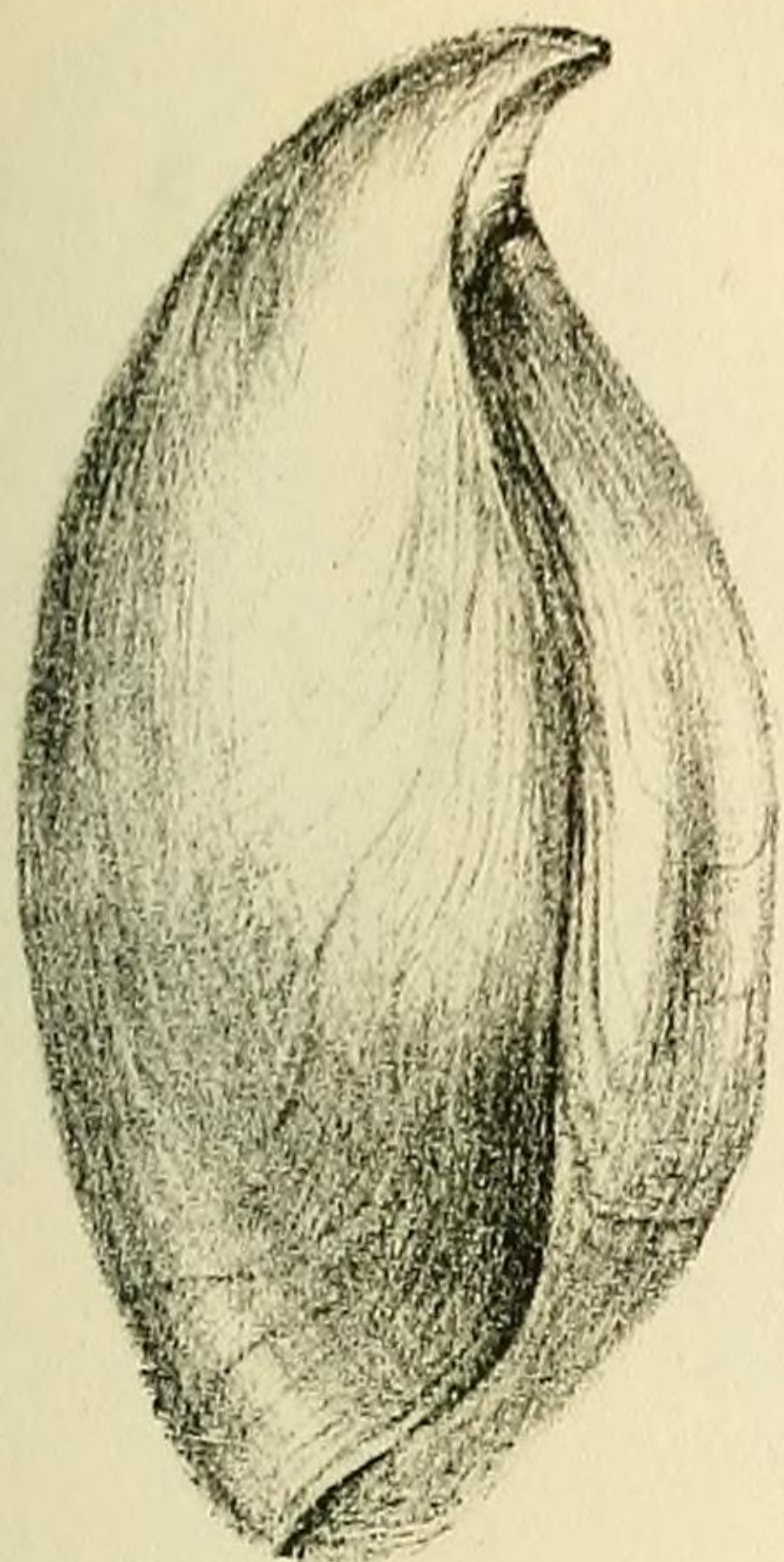
* This species is described as “sub-circular—under the lens radiately striated,” and has no analogy with our fossil.

PLATE VIII.

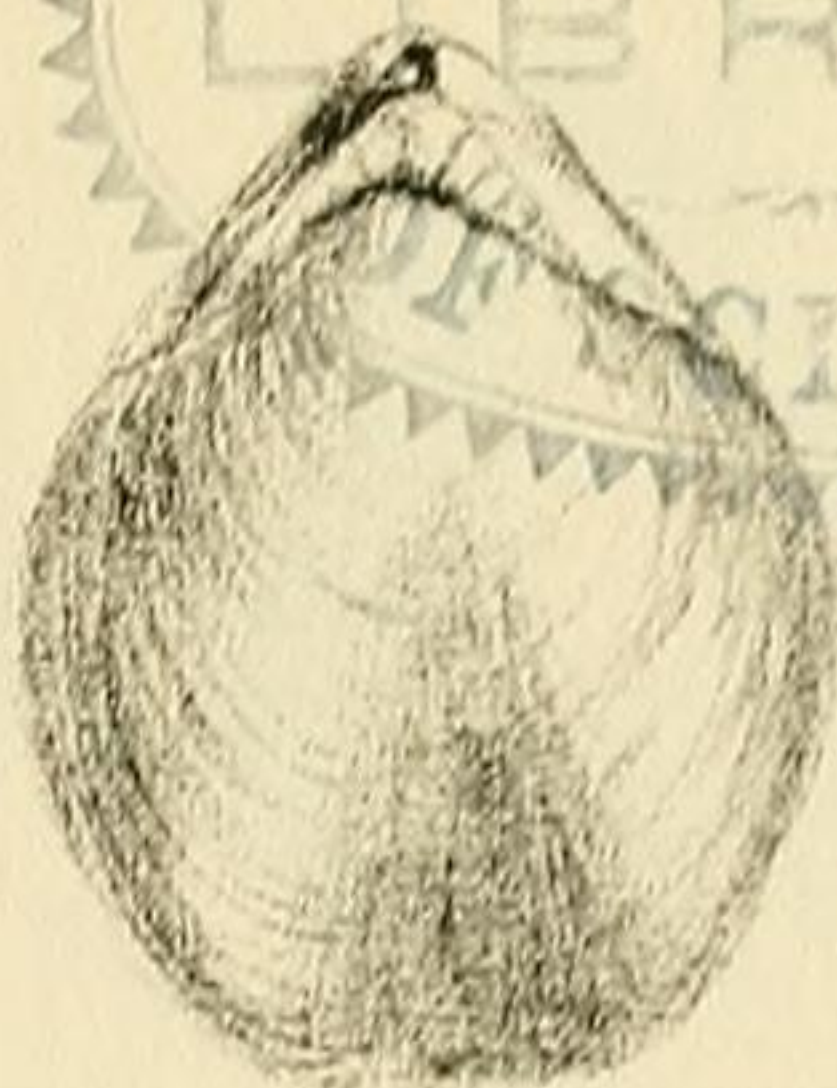
- Fig. 1. *Waldheimia Macleani*. Blanchetown. *a-b*, two views of the same specimen, natural size; *c*, brachial valve of a young shell, natural size.
- Fig. 2. *Waldheimia fimbriata*. Aldinga. *a-b*, two views of the same specimen, natural size.
- Fig. 3. *Terebratulina Scoulari*. Blanchetown; *a*, brachial valve natural size; *b*, enlarged view of portion of the same; *c*, slightly enlarged view of the loop of another specimen; *d*, a young shell, slightly enlarged.
- Fig. 4. *Waldheimia sufflata*; lateral view of specimen, natural size, plate vii., fig. 3.
- Fig. 5. *Terebratula vitreoides*; *a-b*, two views of the same specimen, natural size. Aldinga.
- Fig. 6. *Waldheimia Tateana*; *a-c*, three views of a biplicated example, natural size. Aldinga.
- Fig. 7. *Terebratulina triangularis*, slightly enlarged; *a-c*, three views of a specimen from Aldinga; *d*, brachial valve from Bunda Cliffs.
- Fig. 8. *Waldheimia divaricata*; *a-b*, two views of the same specimen, natural size. Mannum.
- Fig. 9. *Waldheimia Johnstoniana*; *a-b*, two views, natural size. Aldinga.

PLATE IX.

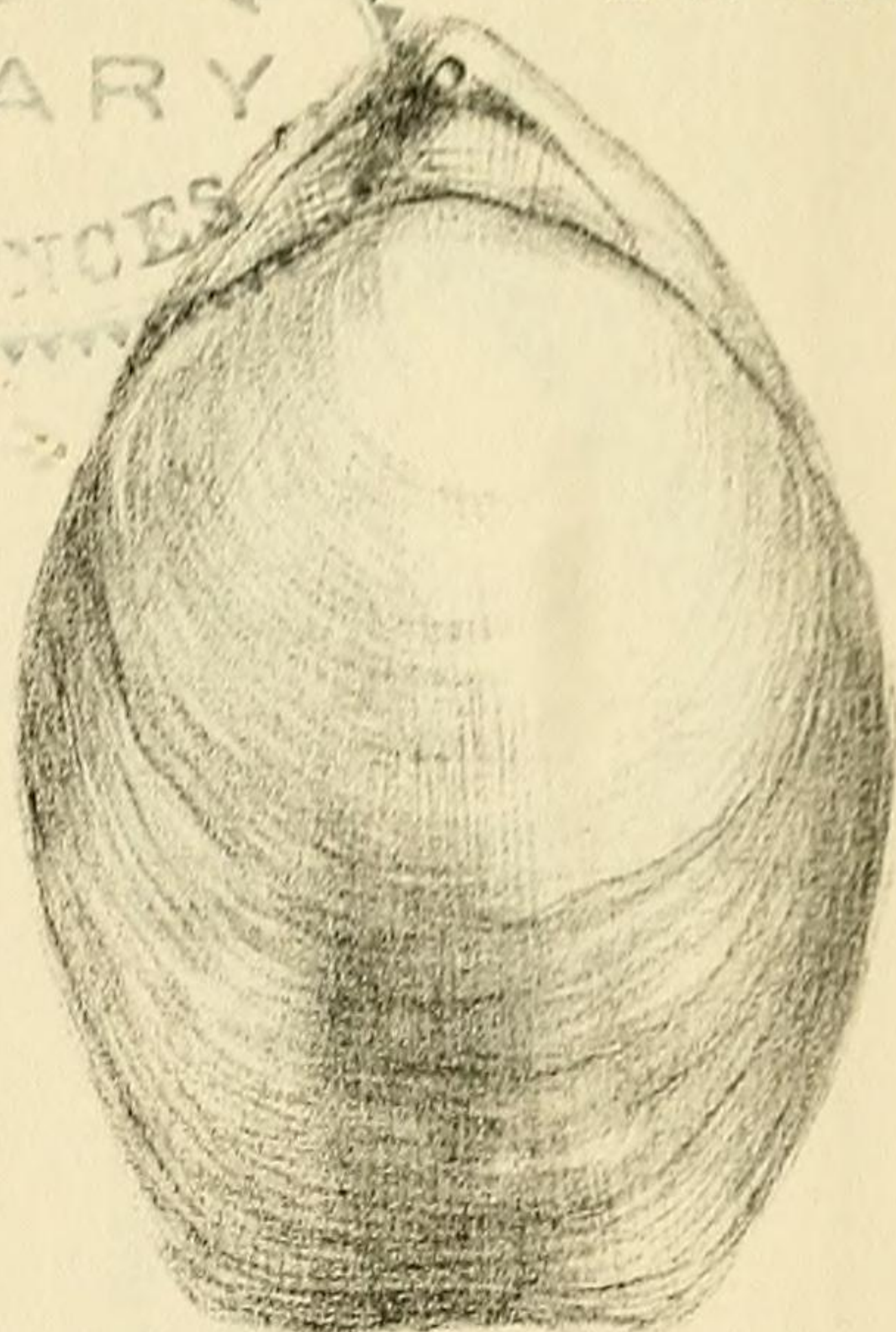
- Fig. 1. *Terebratula subcarnea*; *a-b*, two views of the same specimen, natural size. Bunda Cliffs.
- Fig. 2. *Waldheimia Tateana*, natural size. Stansbury.
- Fig. 3. *Thecidium australe*. enlarged views. Muddy Creek. *a*, brachial valve; *b*, interior of peduncular valve, a portion of the hinge area has been removed to show the adductor impressions; *c*, lateral view of the specimen, fig. 3*a*.
- Fig. 4. *Waldheimia Corioensis*, McCoy (?); natural size. Mannum (?).
- Fig. 5. *Terebratella pentagonalis*; *a-b*, two views, natural size. Aldinga.
- Fig. 6. *Waldheimia insolita*, natural sizes; *a*, from Bunda Cliffs; *b*, from Aldinga.
- Fig. 7. *Waldheimia Corioensis*; interior view of the umbonal part of a brachial valve, natural size. Mannum.
- Fig. 8. *Terebratella Tepperi*. Muloowurtie; *a-b*, two views of the same shell, natural size; *c*, interior of brachial valve of another specimen, natural size.
- Fig. 9. *Rhynchonella squamosa*, natural sizes; *a*, fragment of a peduncular valve, R. Bremer; *b*, perfect shell from Aldinga.



1b



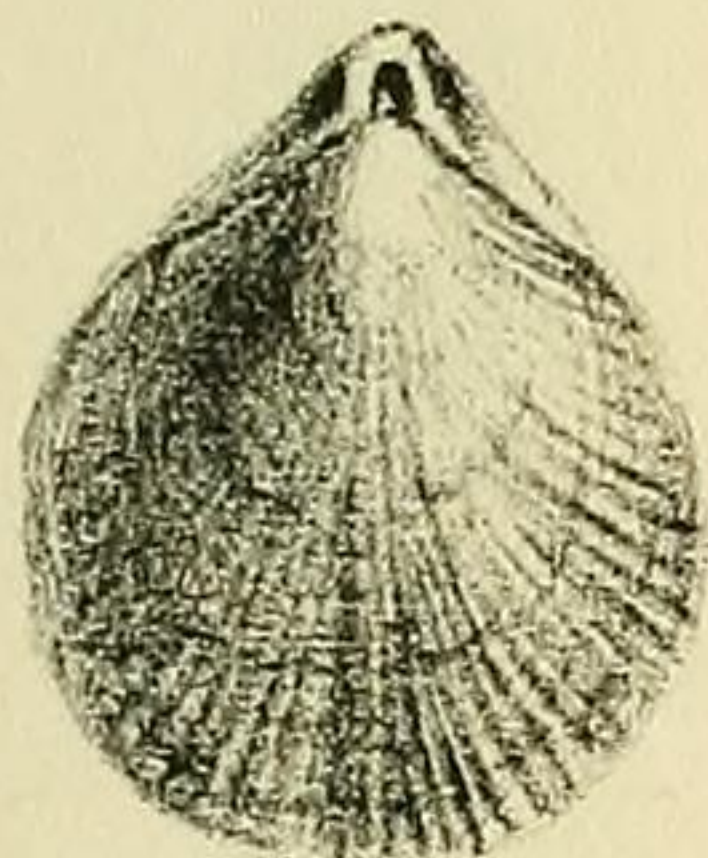
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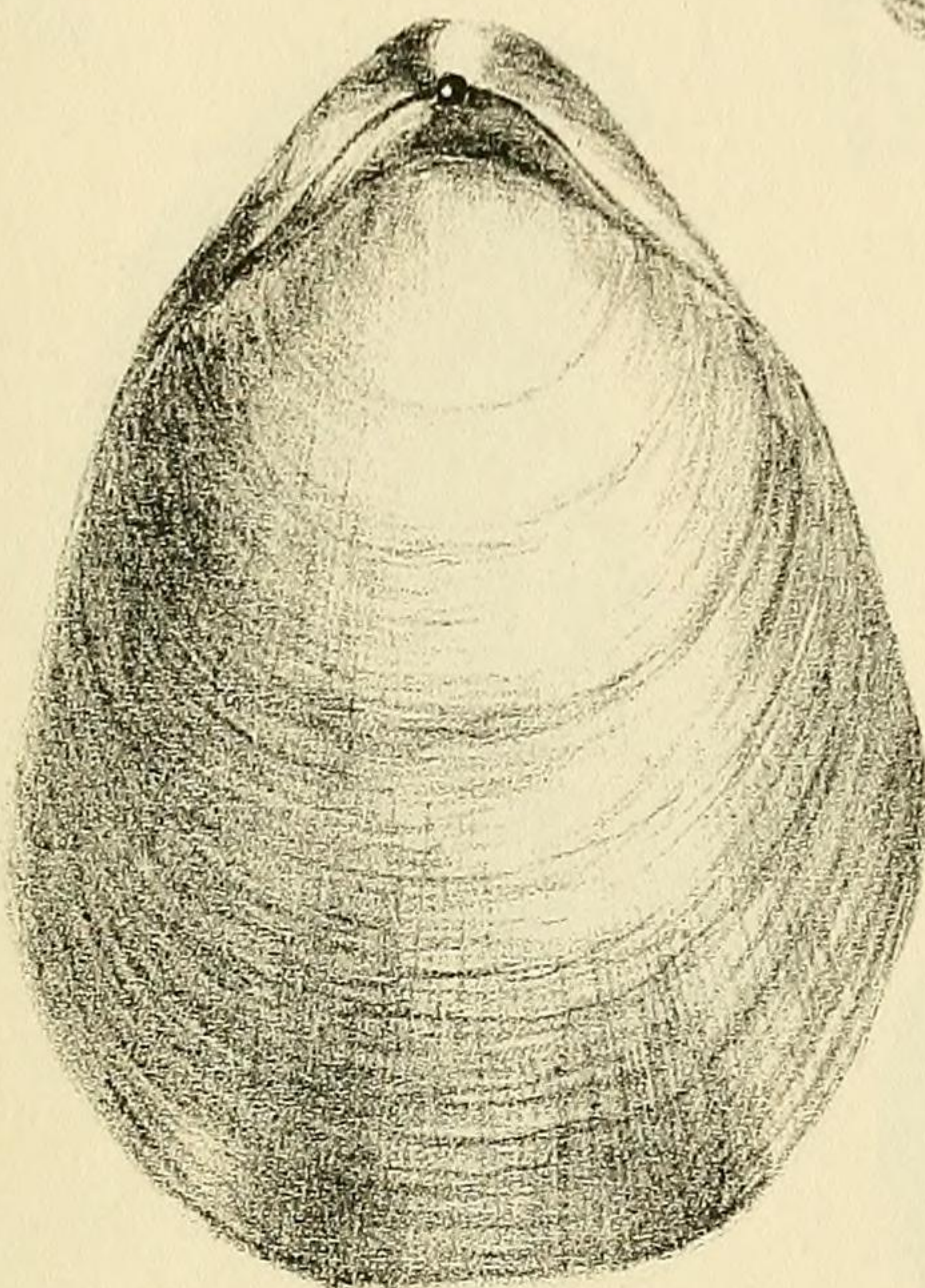
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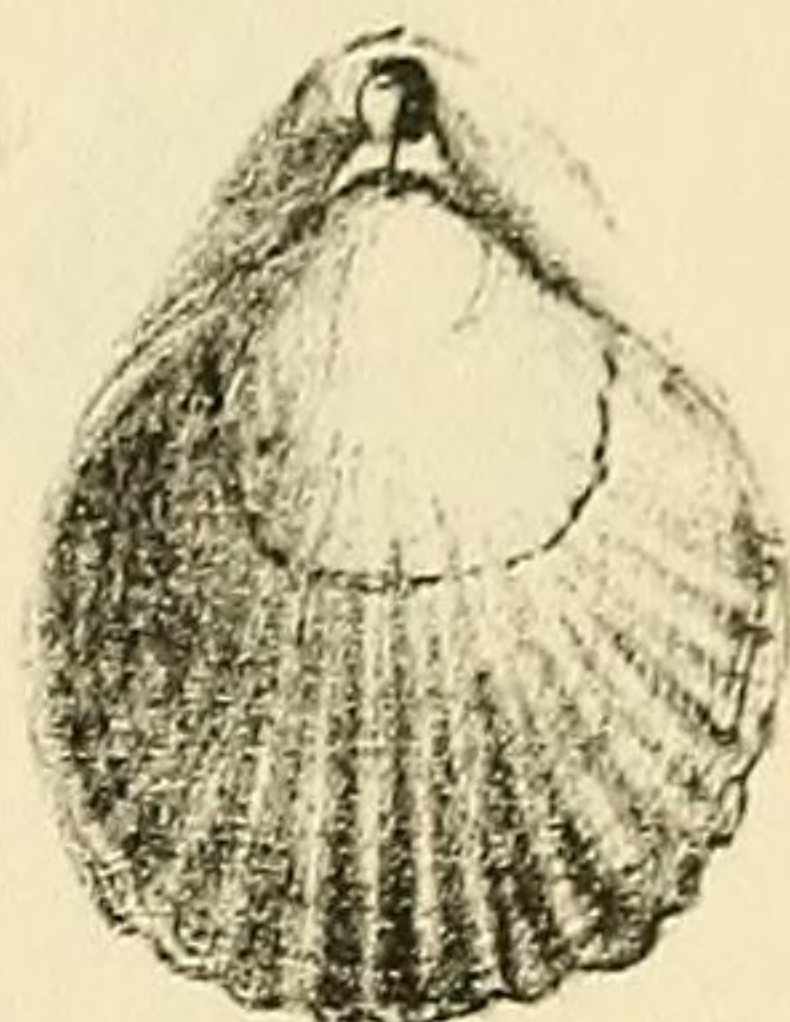
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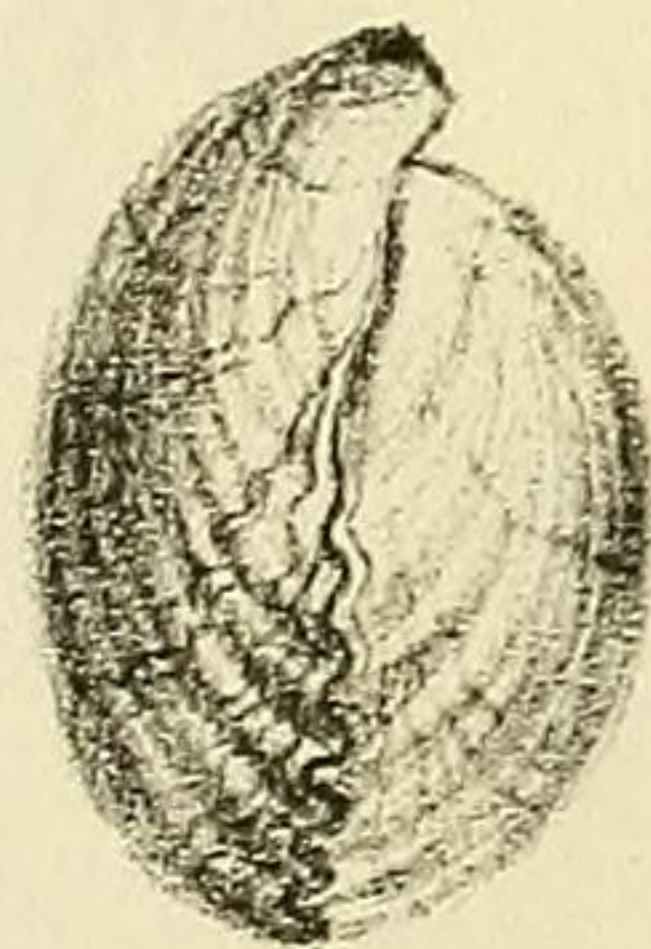
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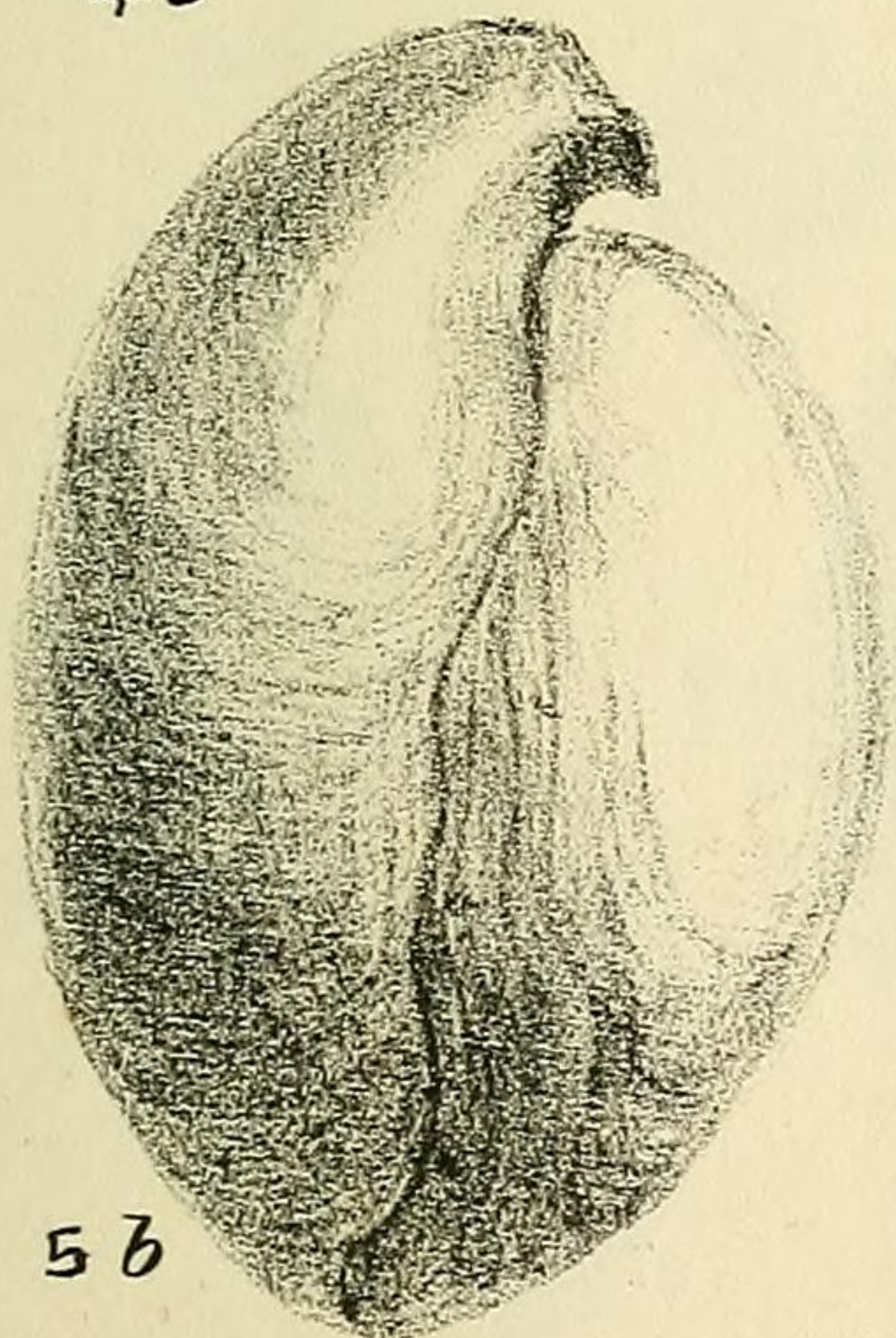
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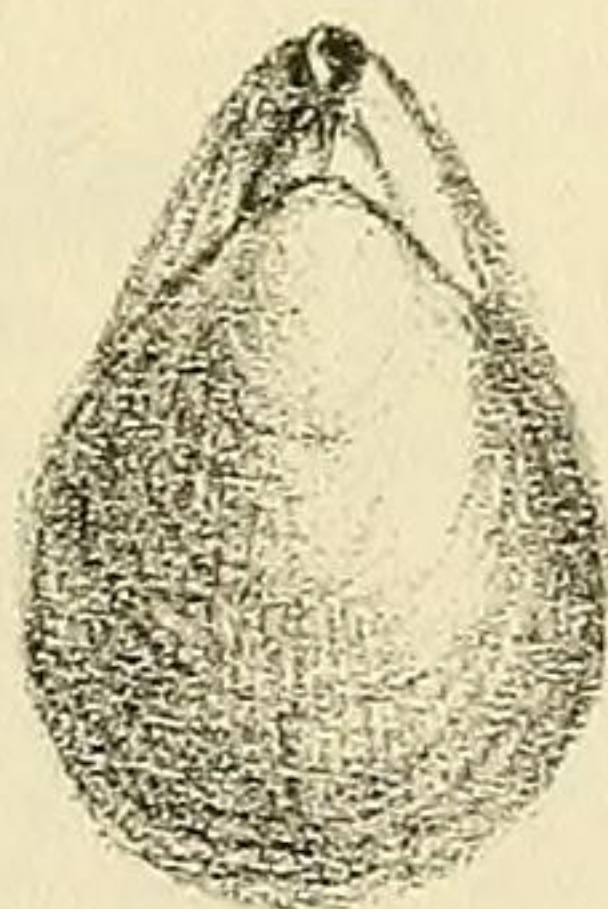
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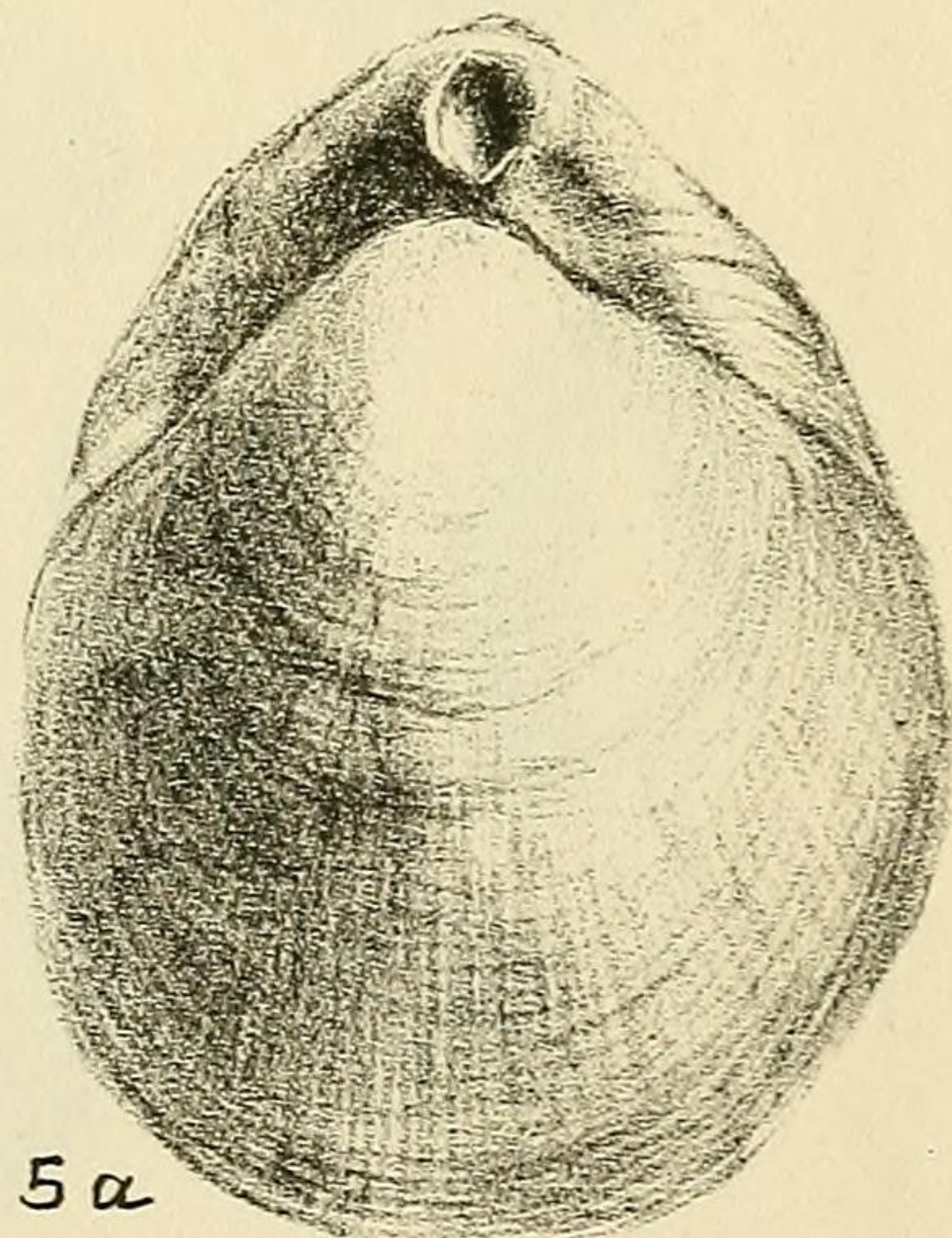
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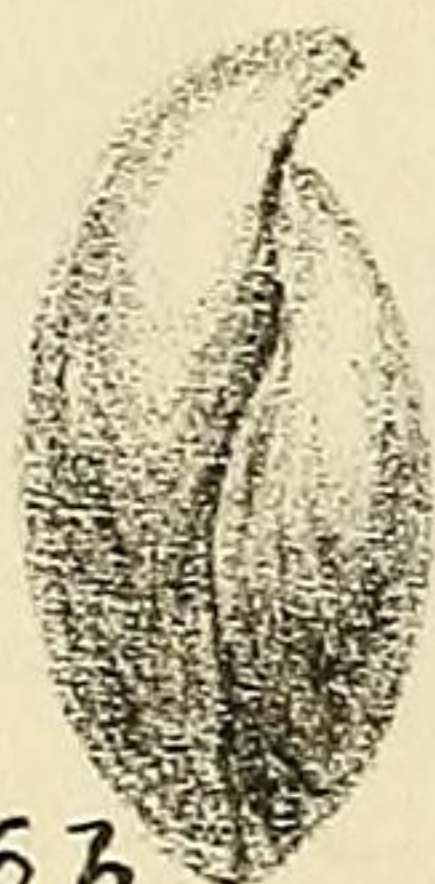
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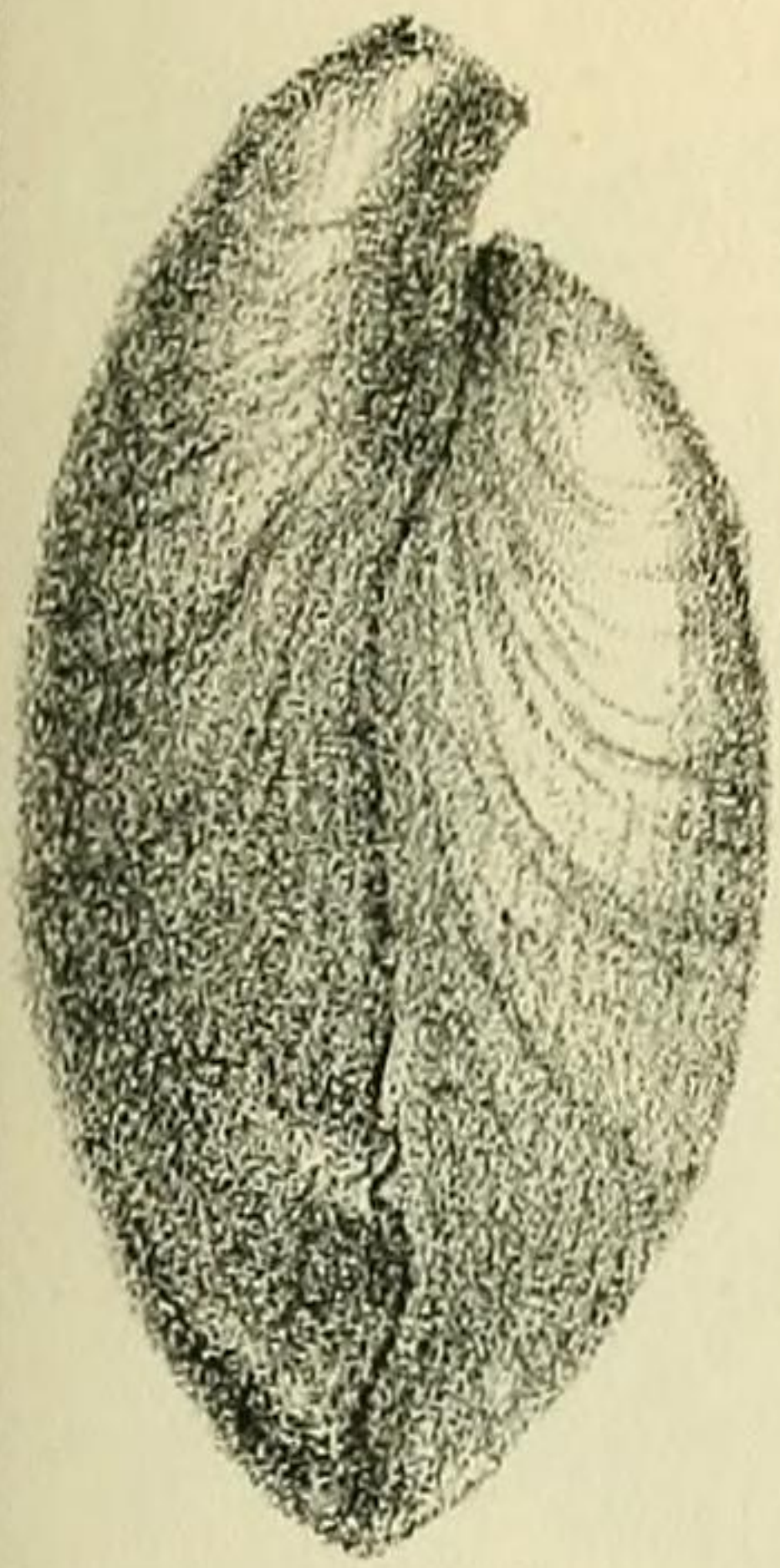
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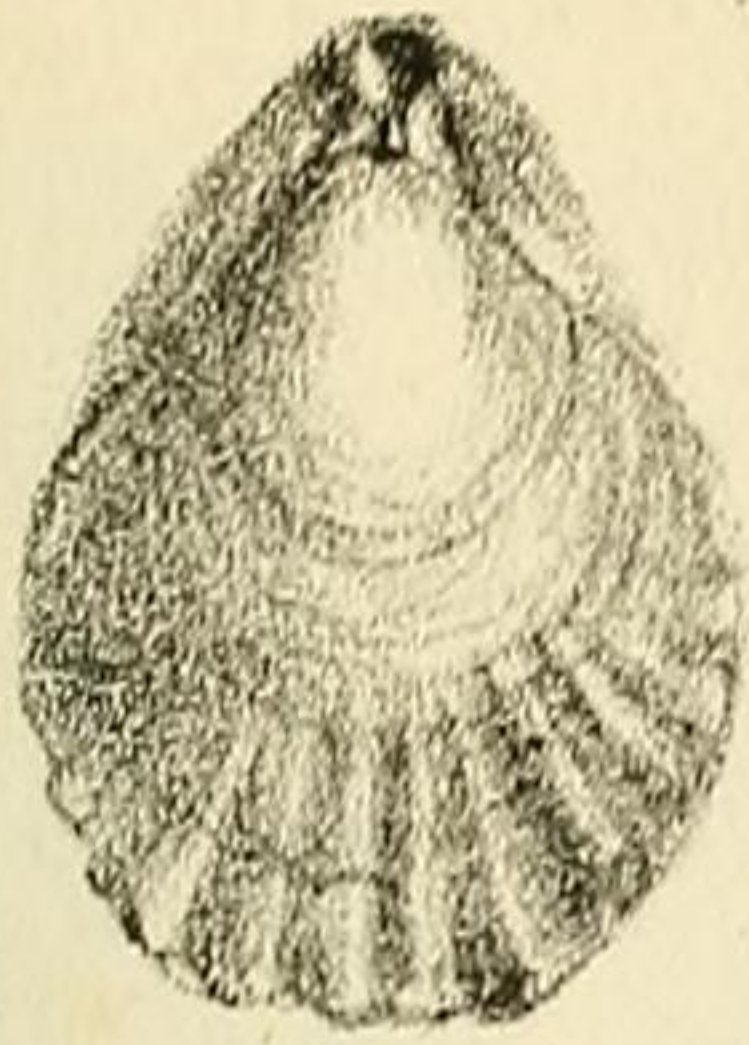
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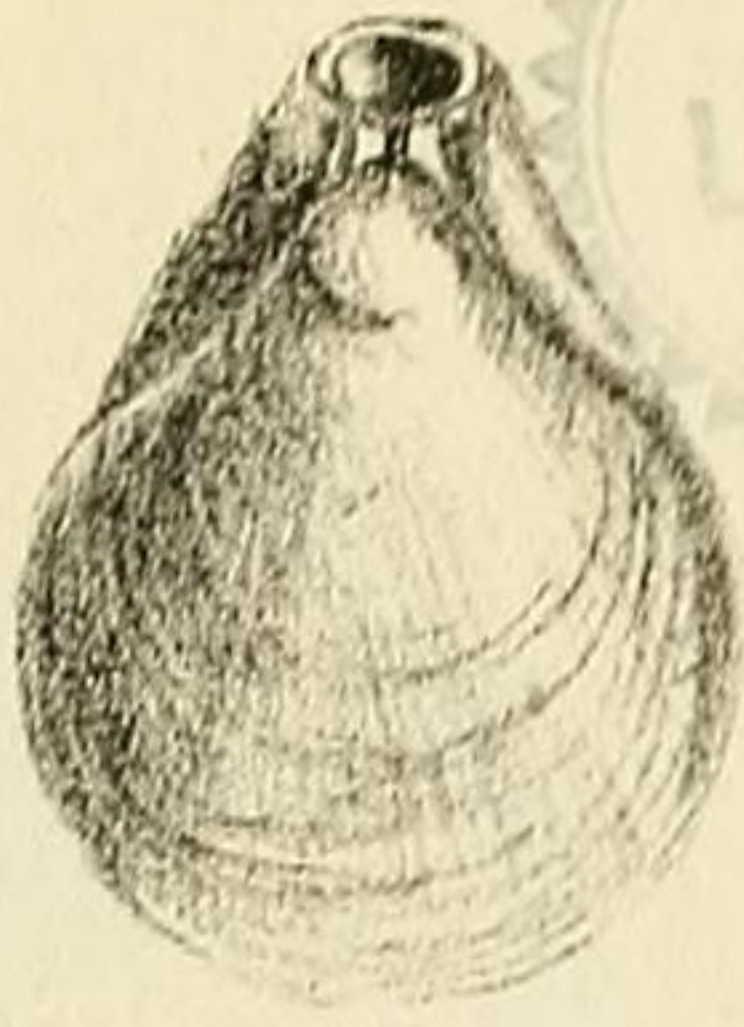
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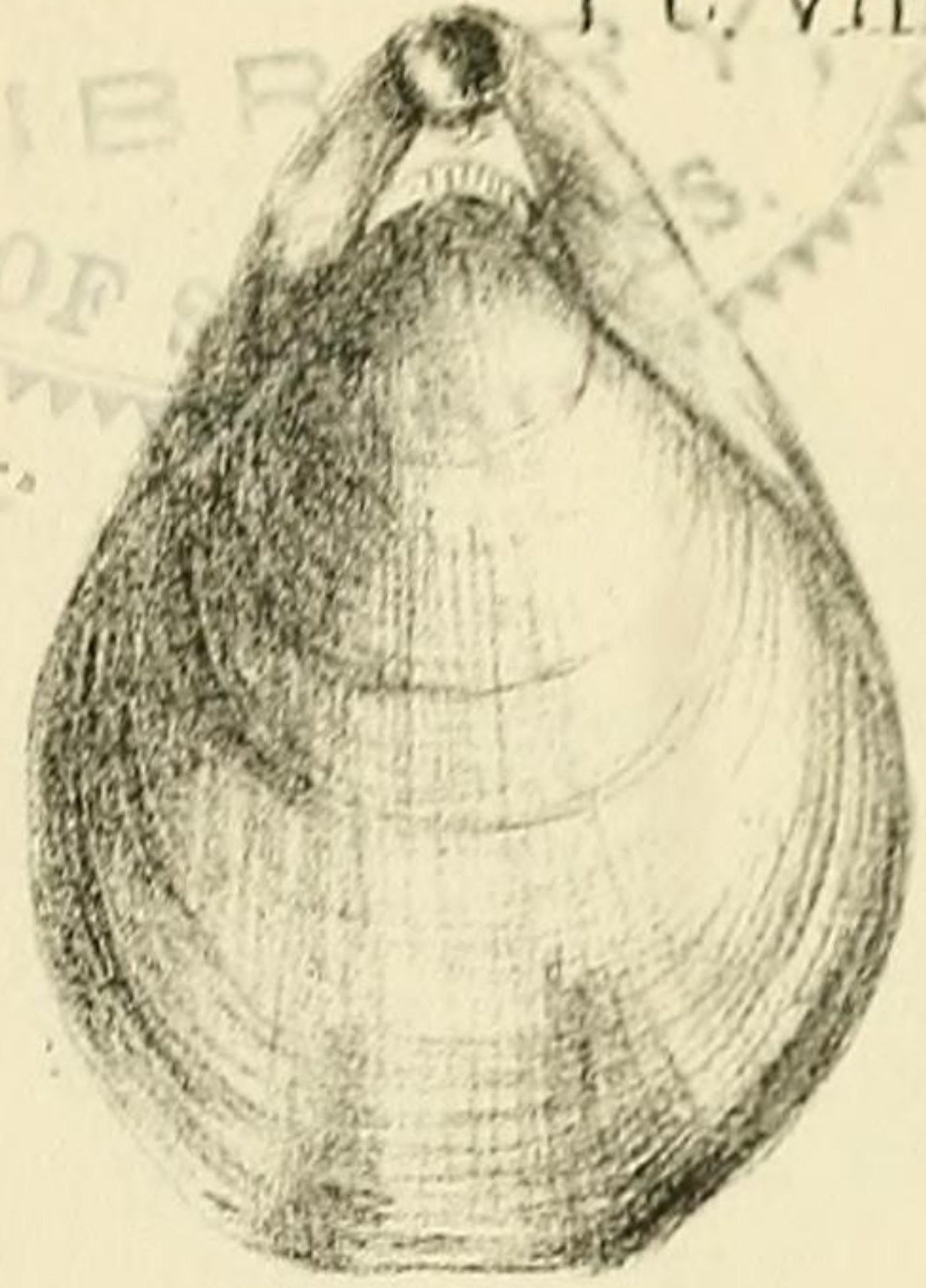
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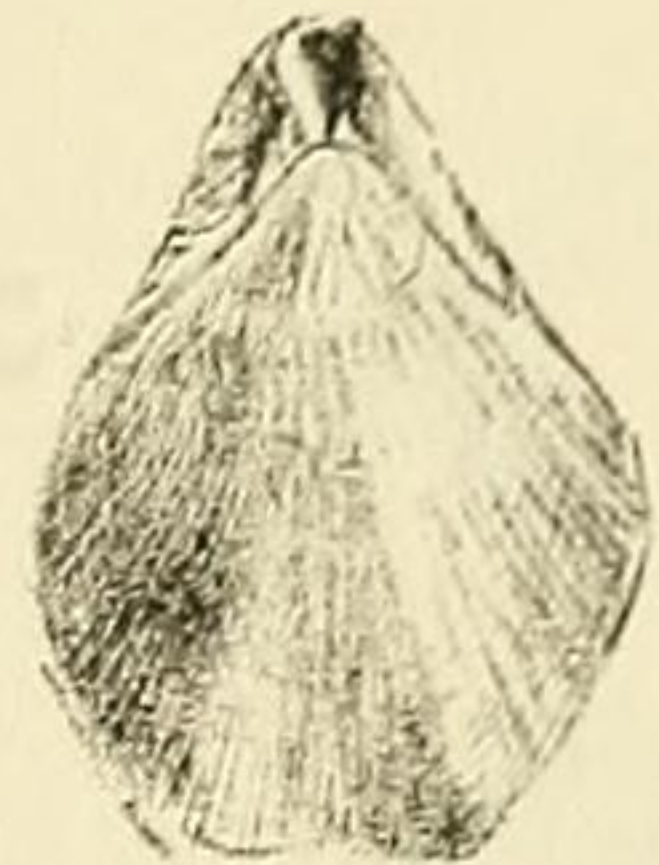
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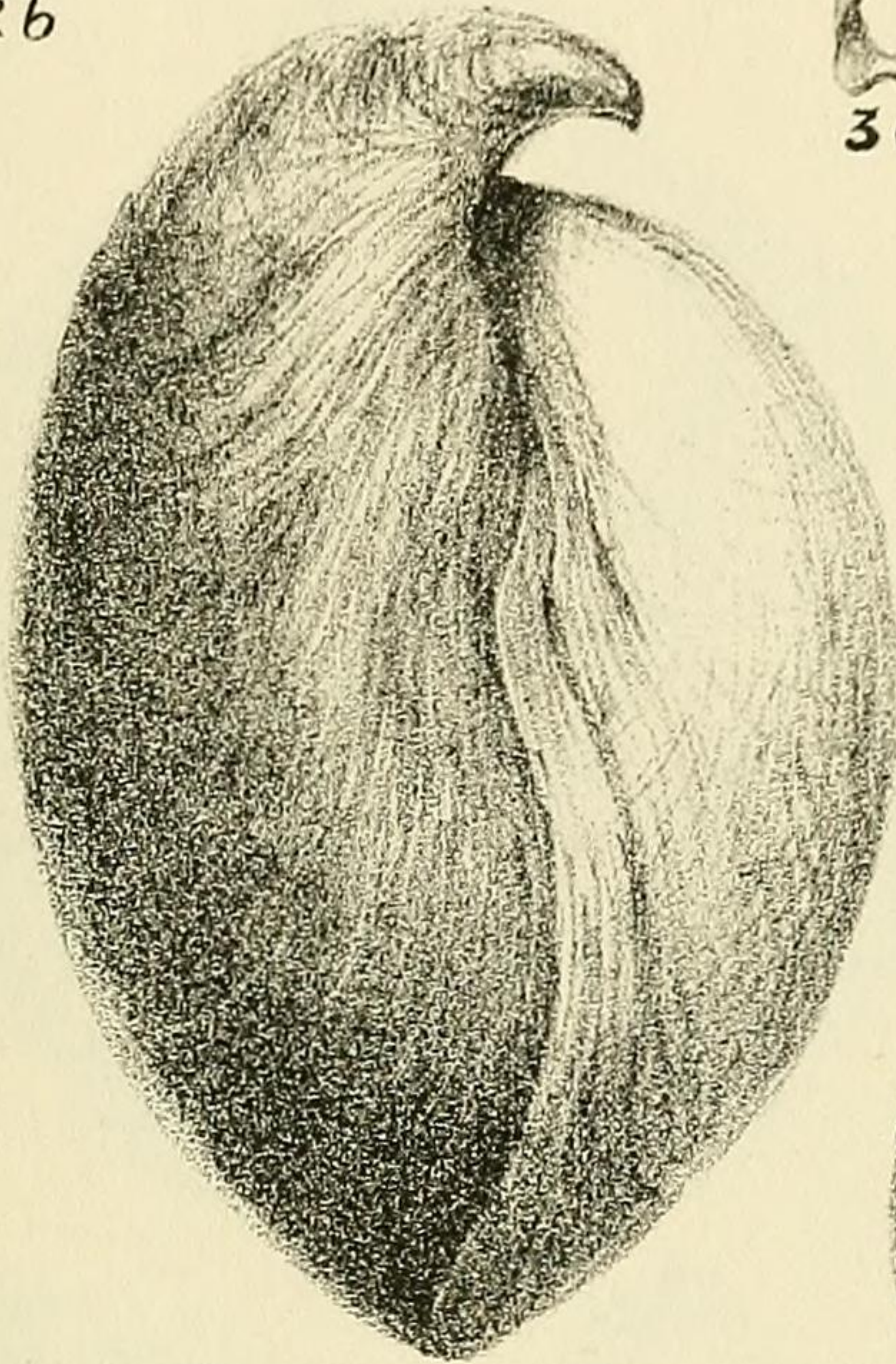
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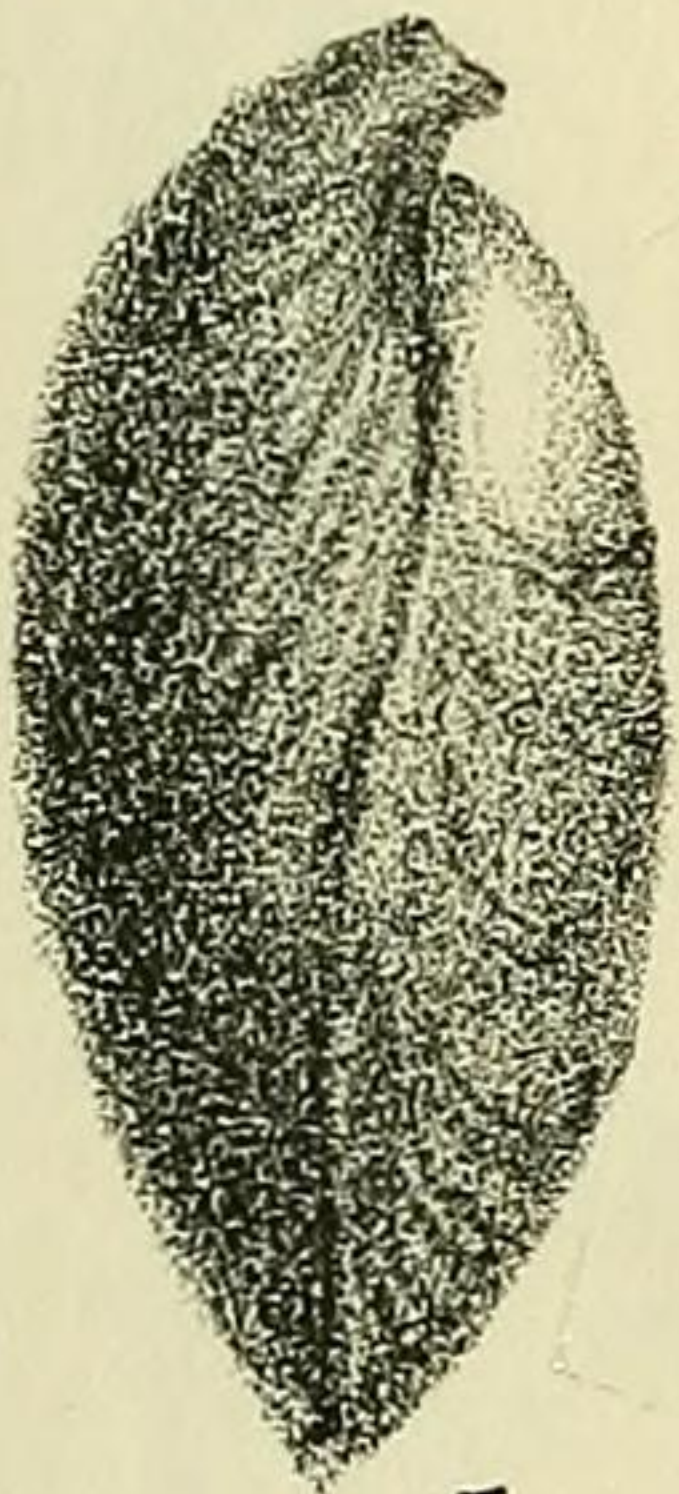
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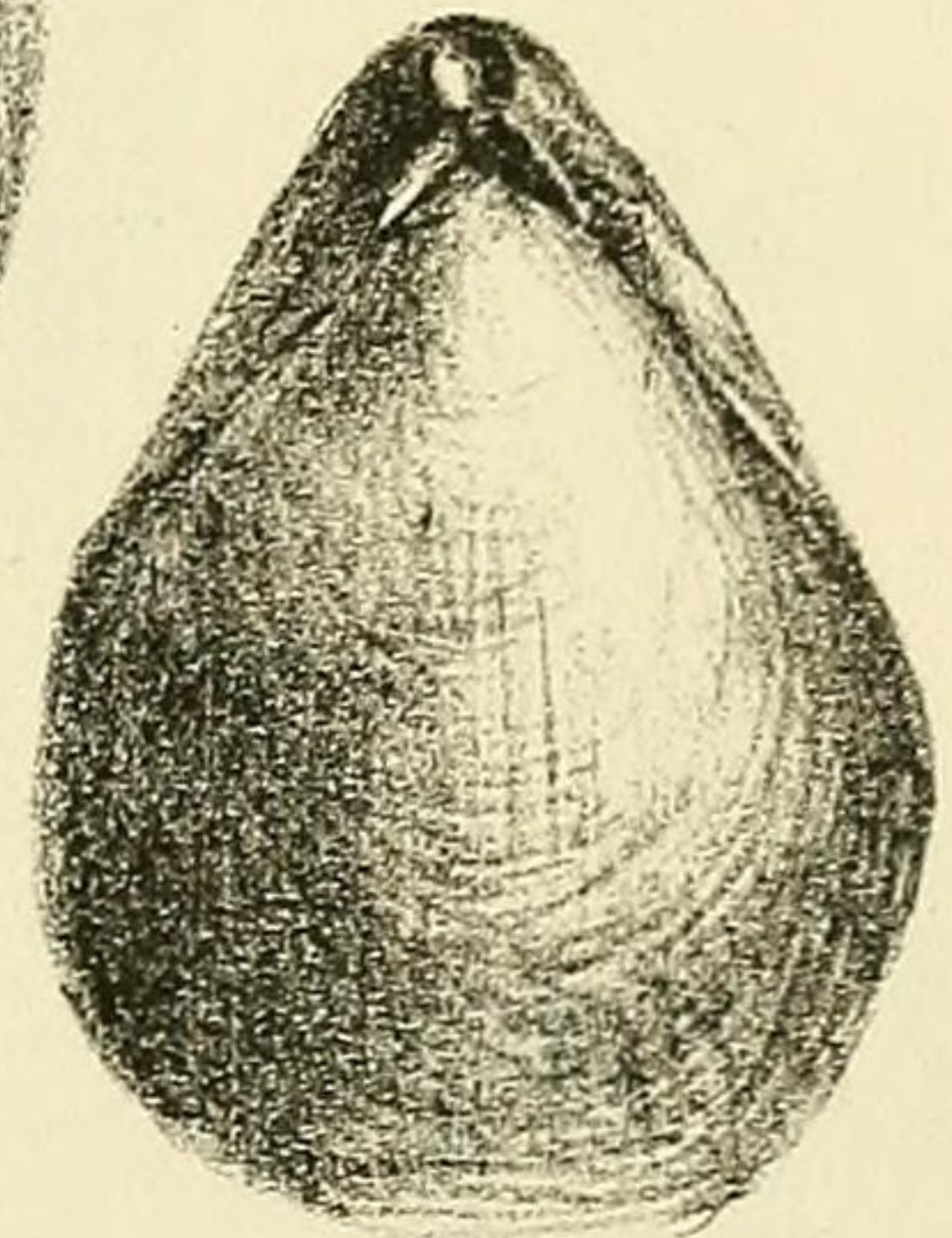
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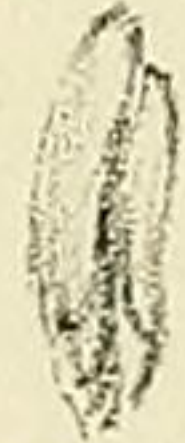
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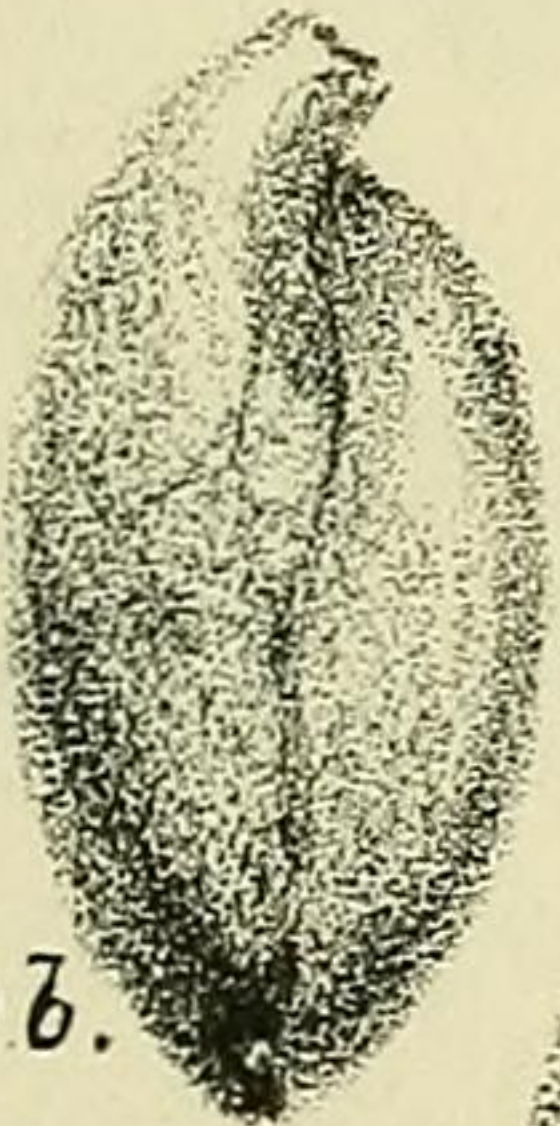
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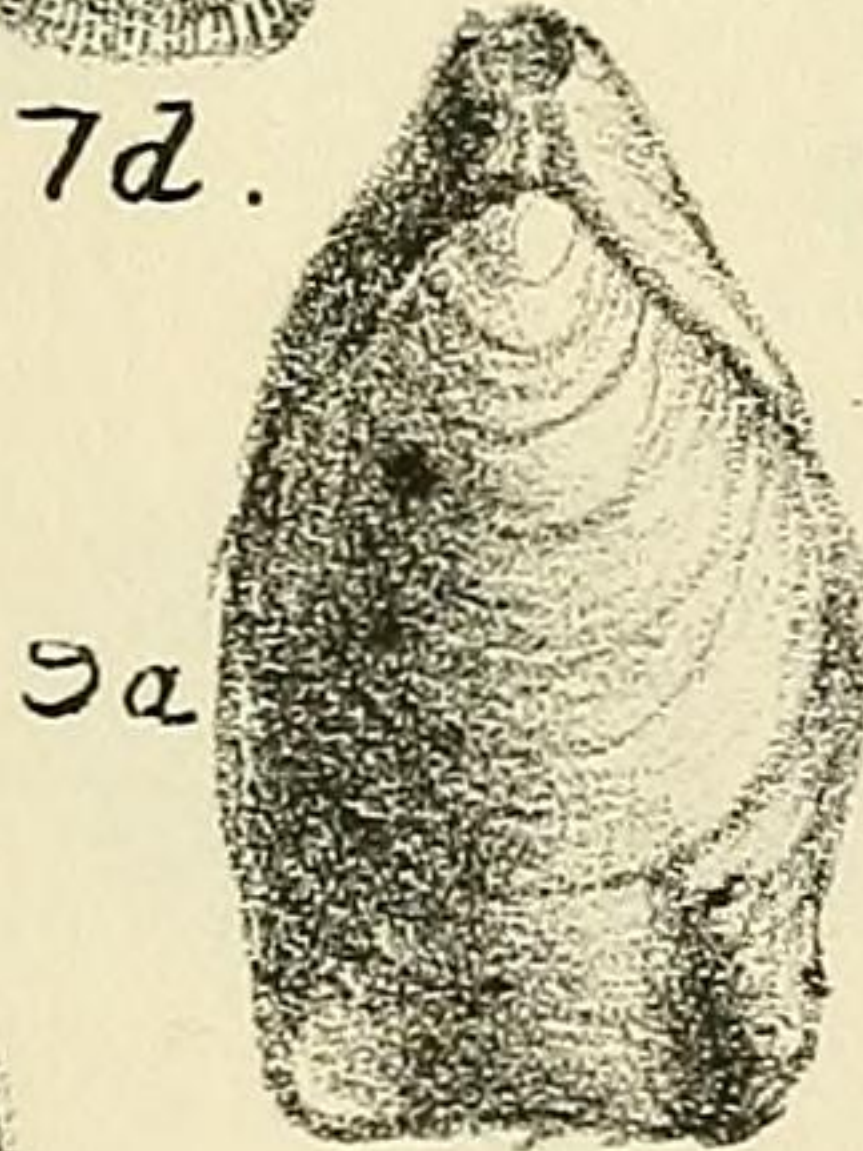
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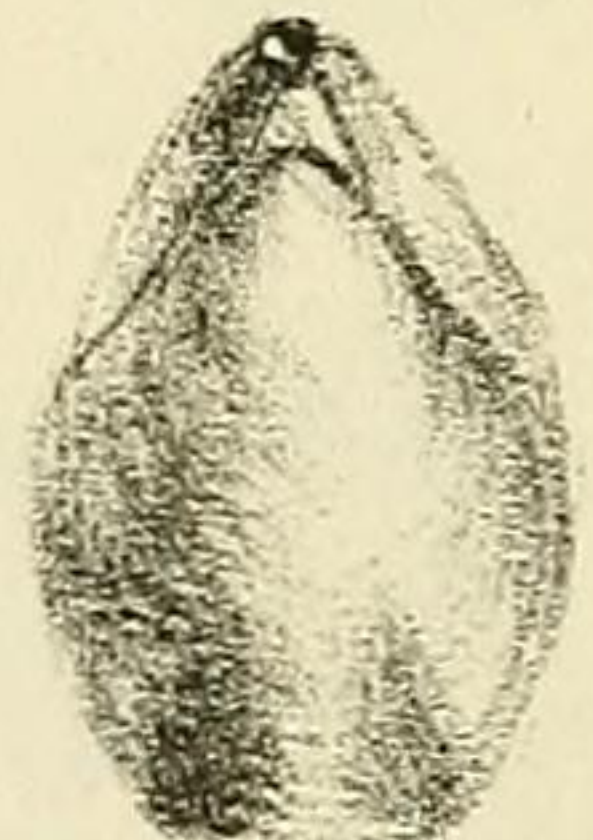
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6a



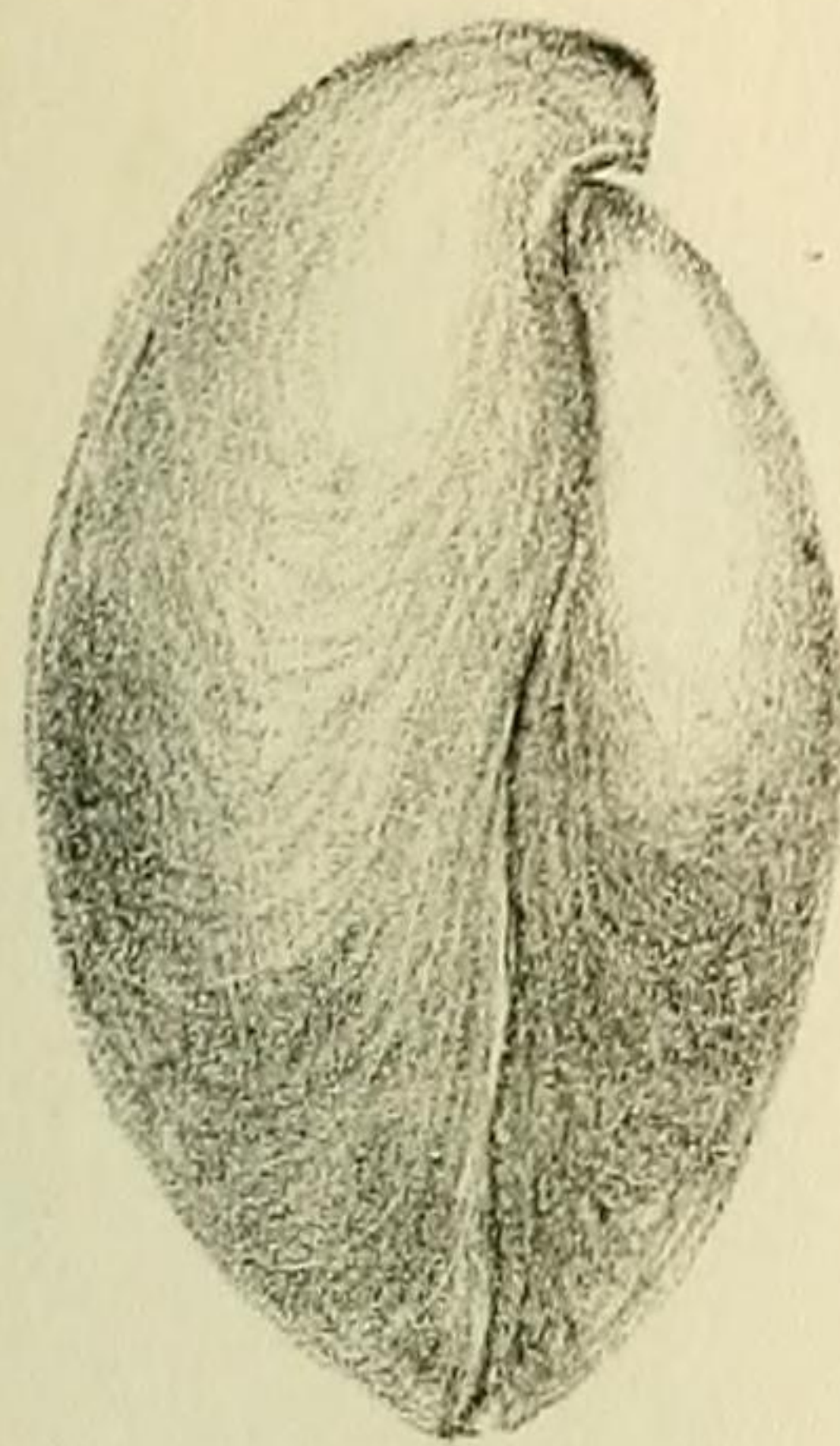
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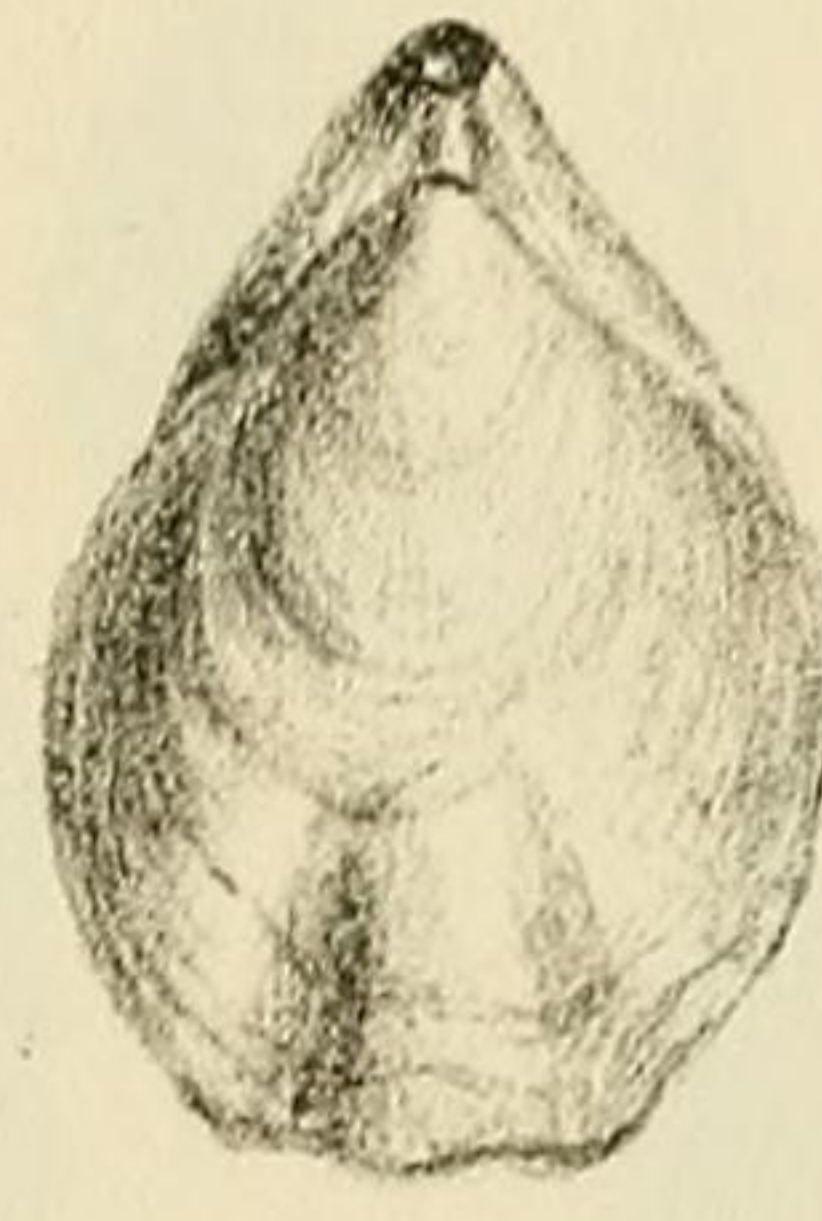
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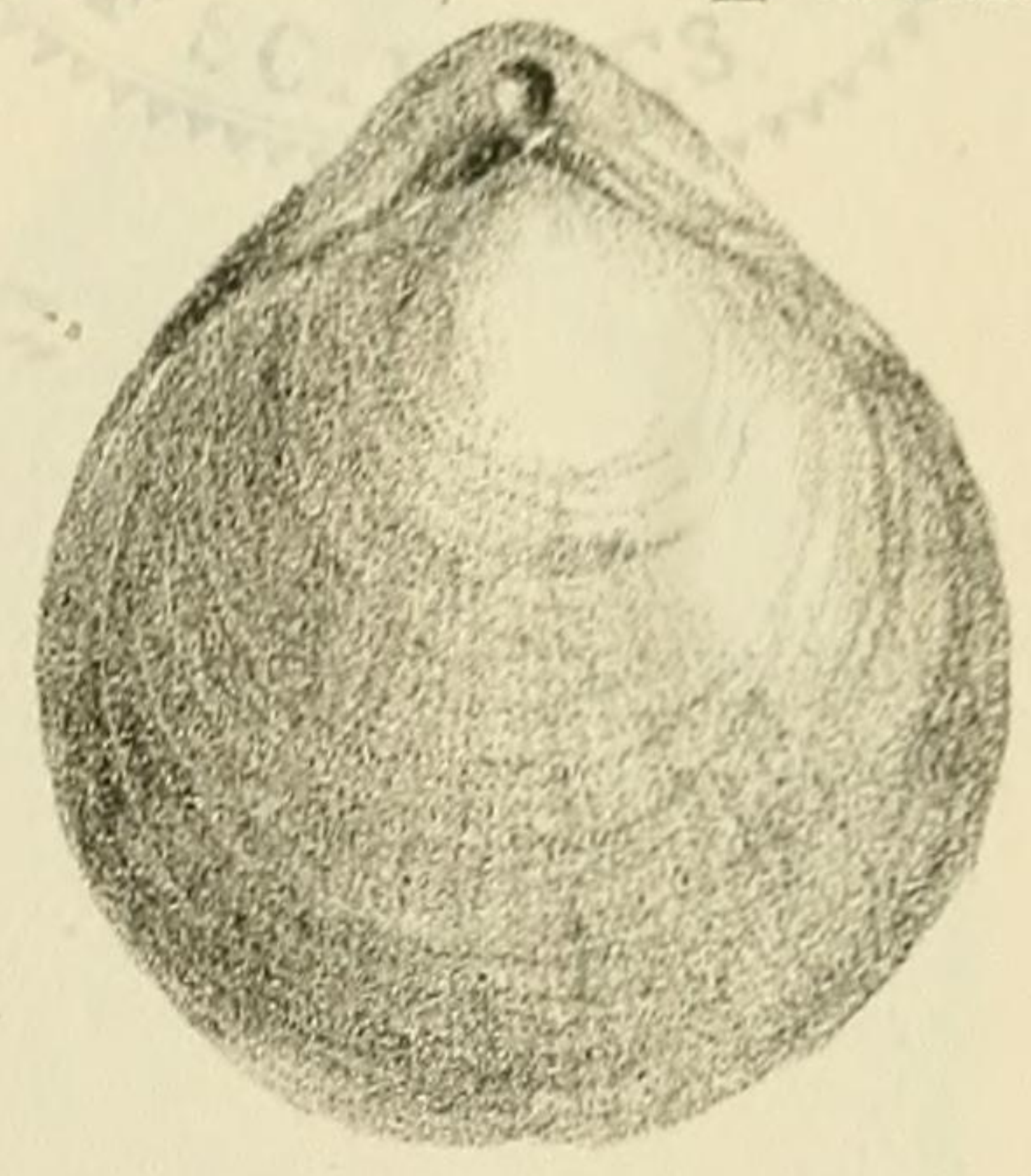
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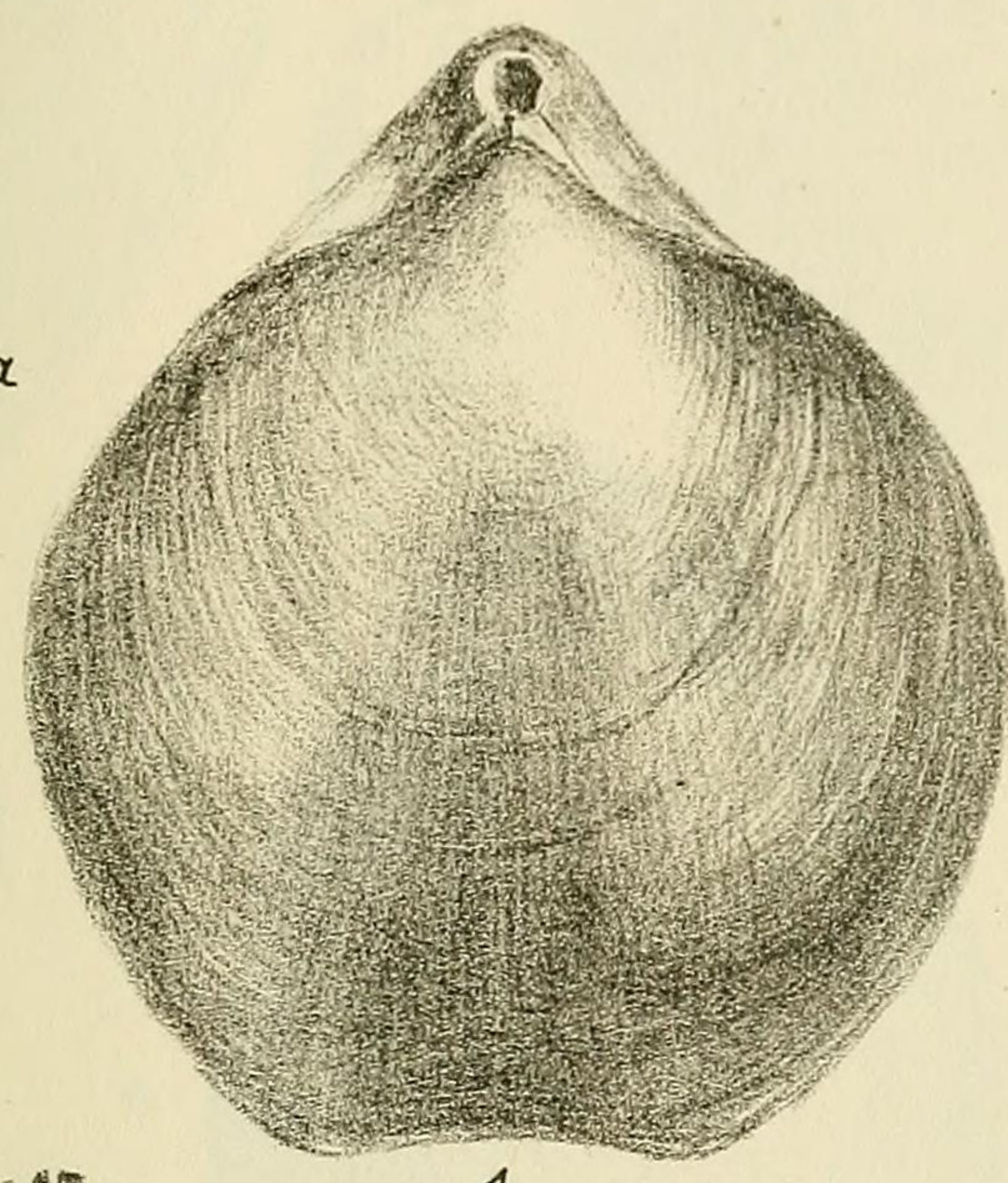
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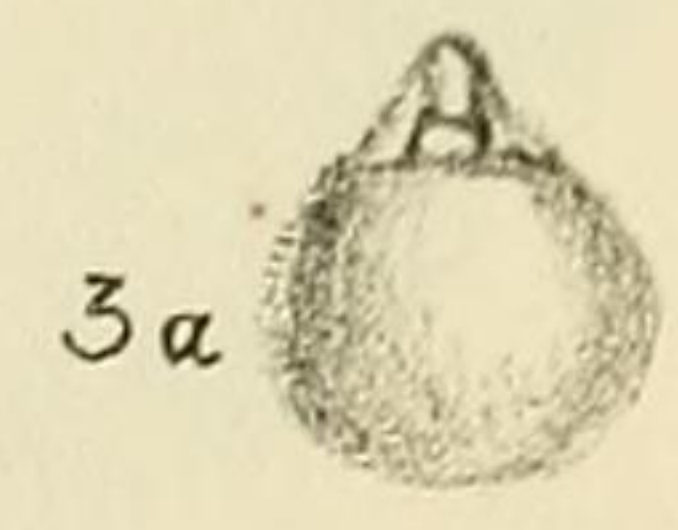
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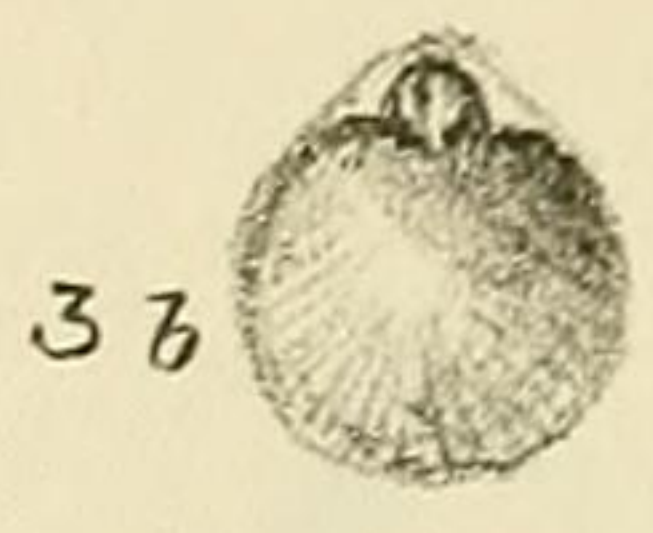
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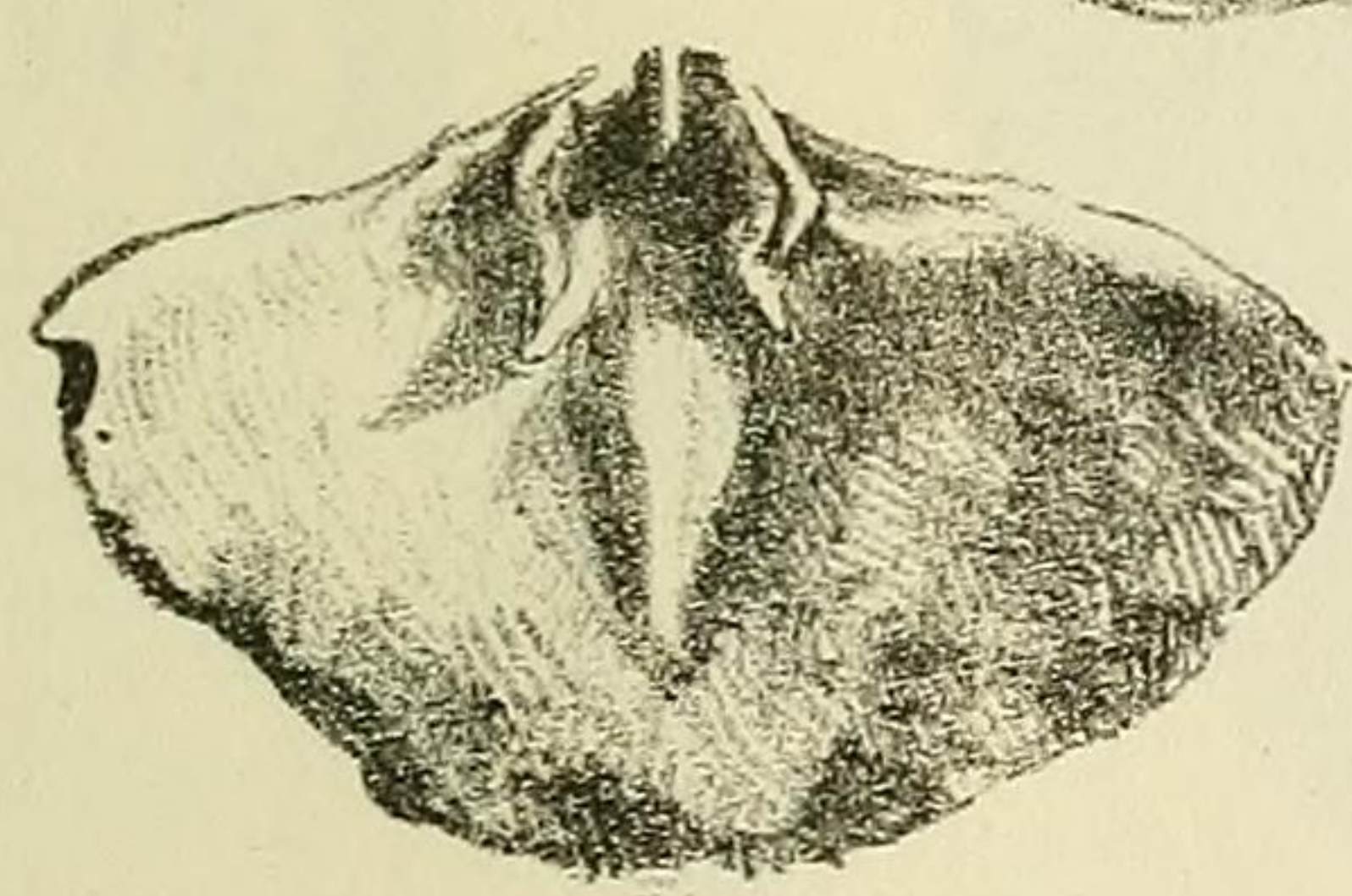
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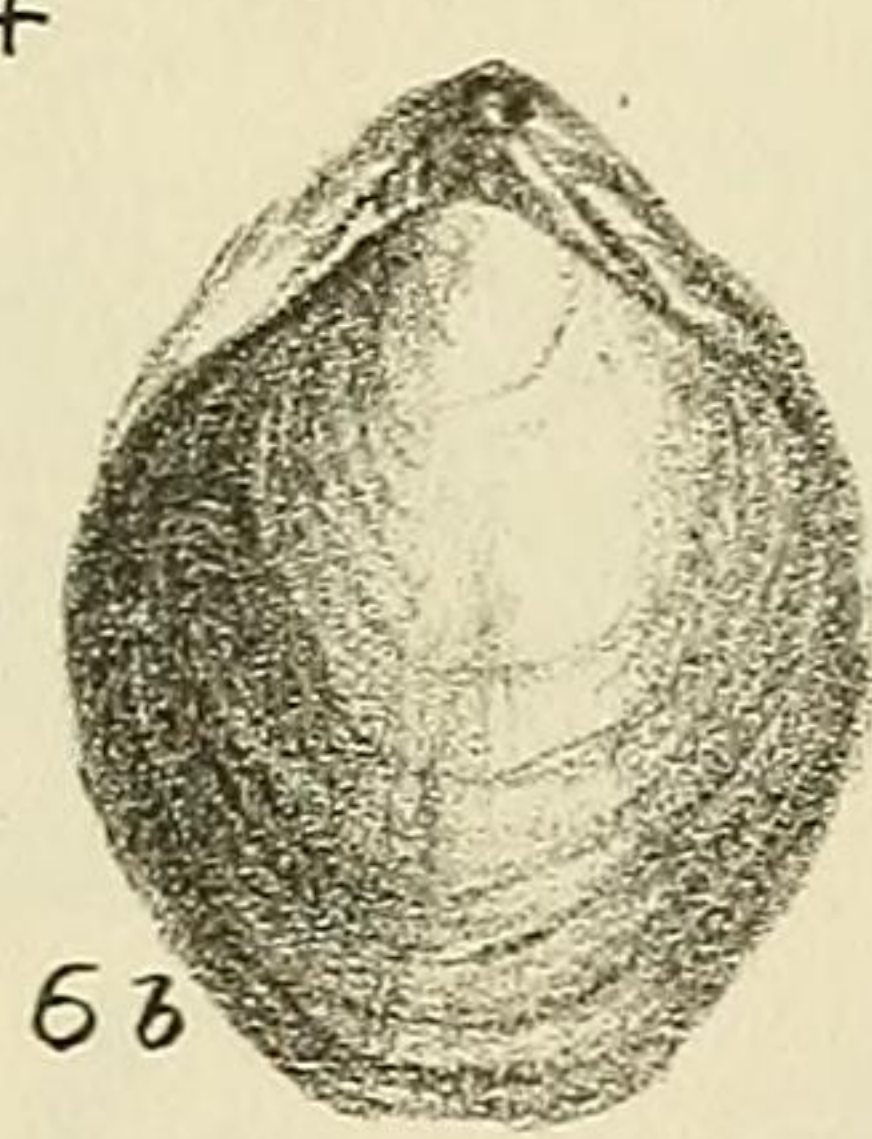
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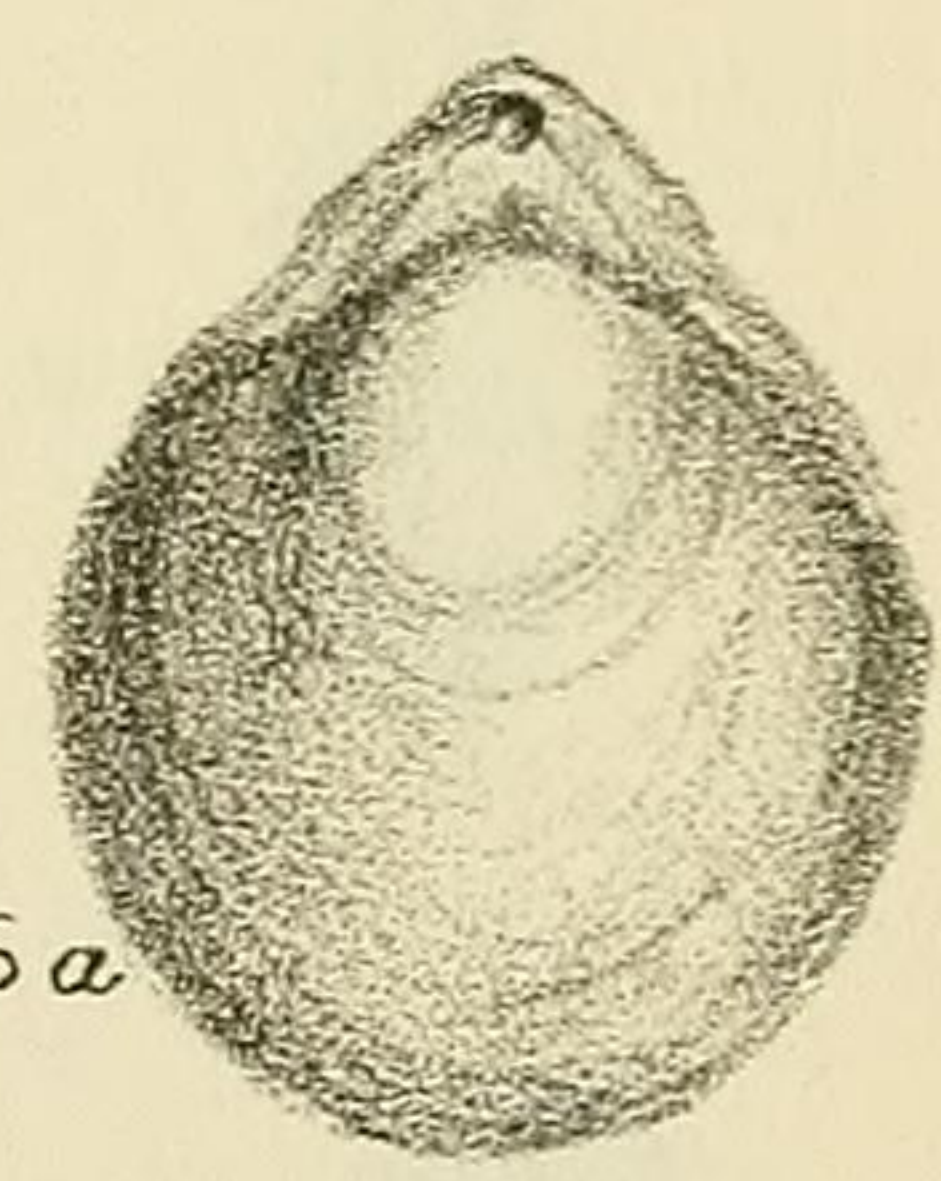
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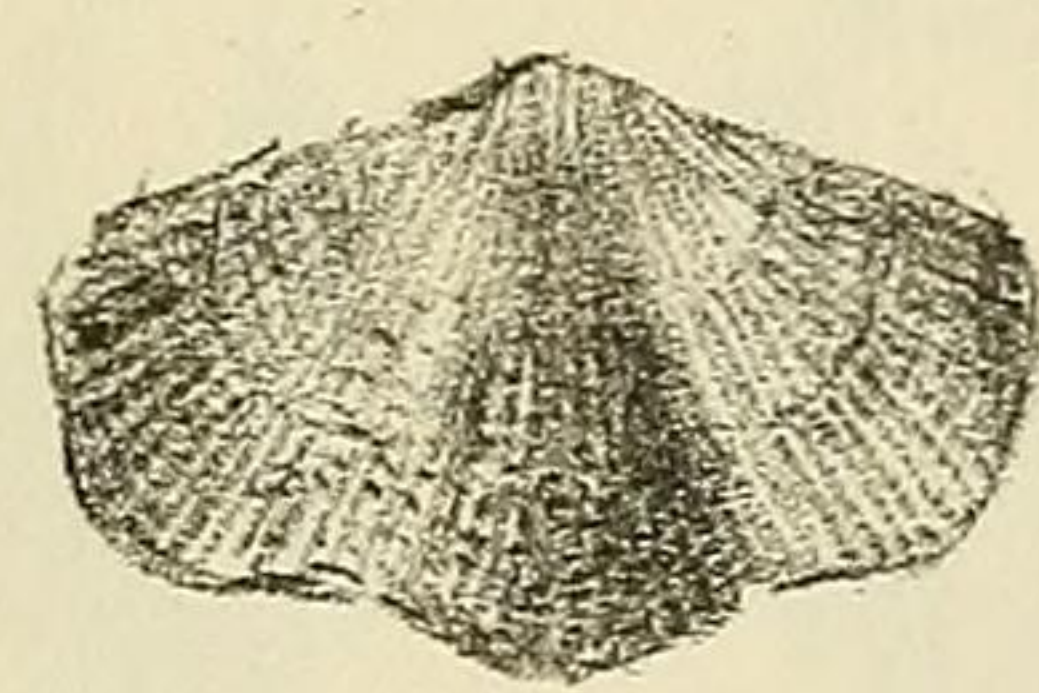
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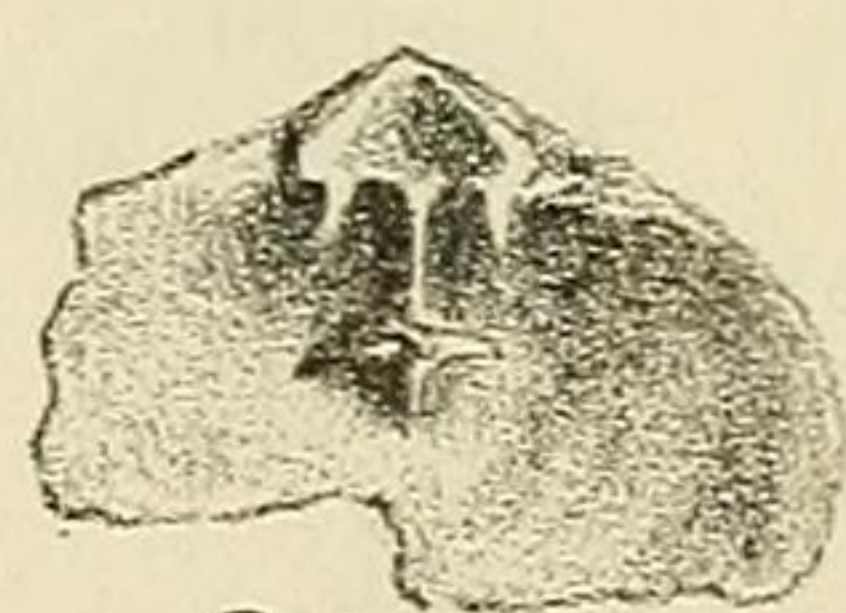
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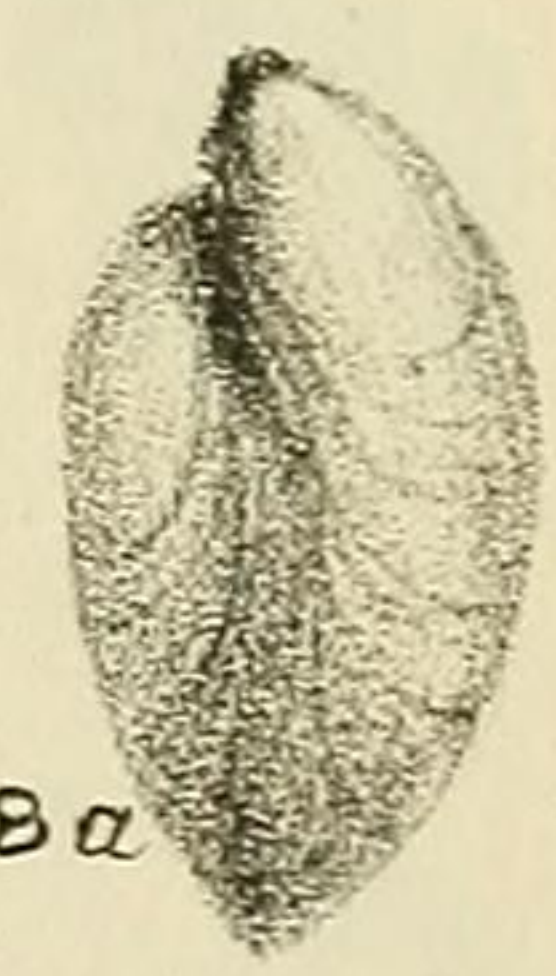
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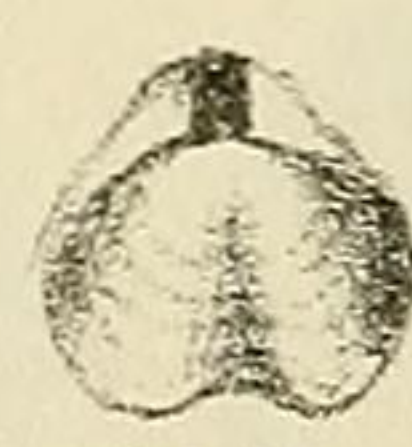
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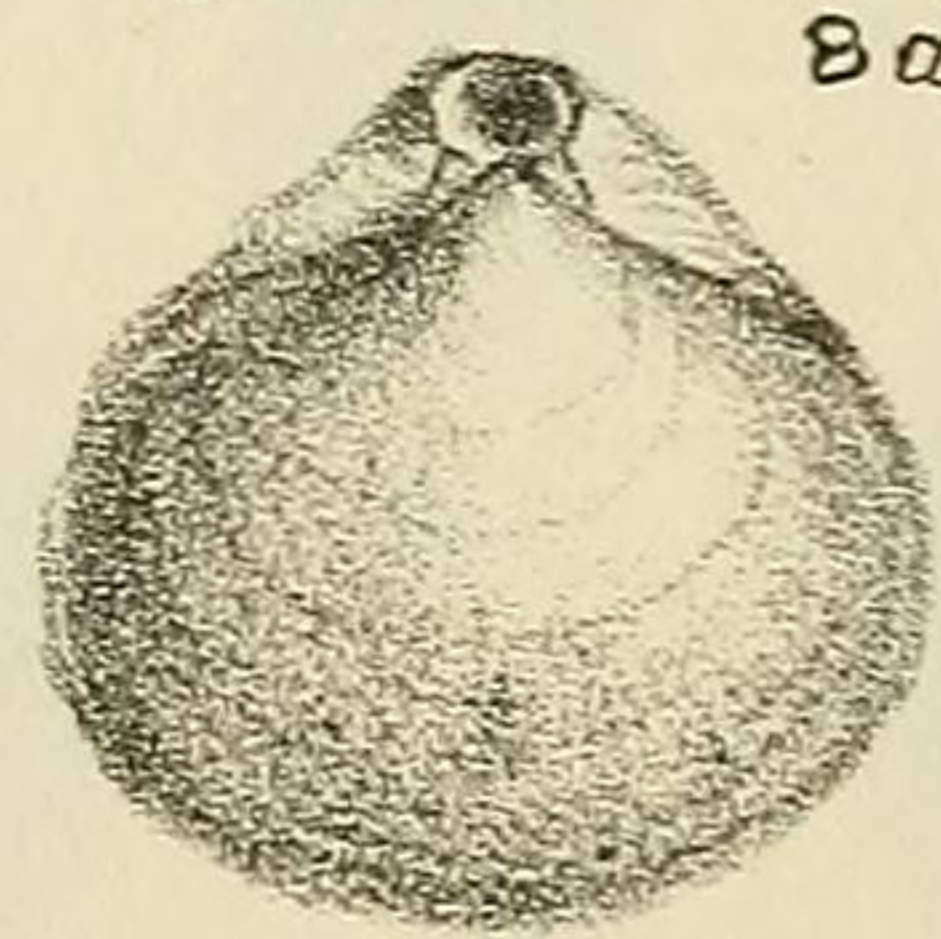
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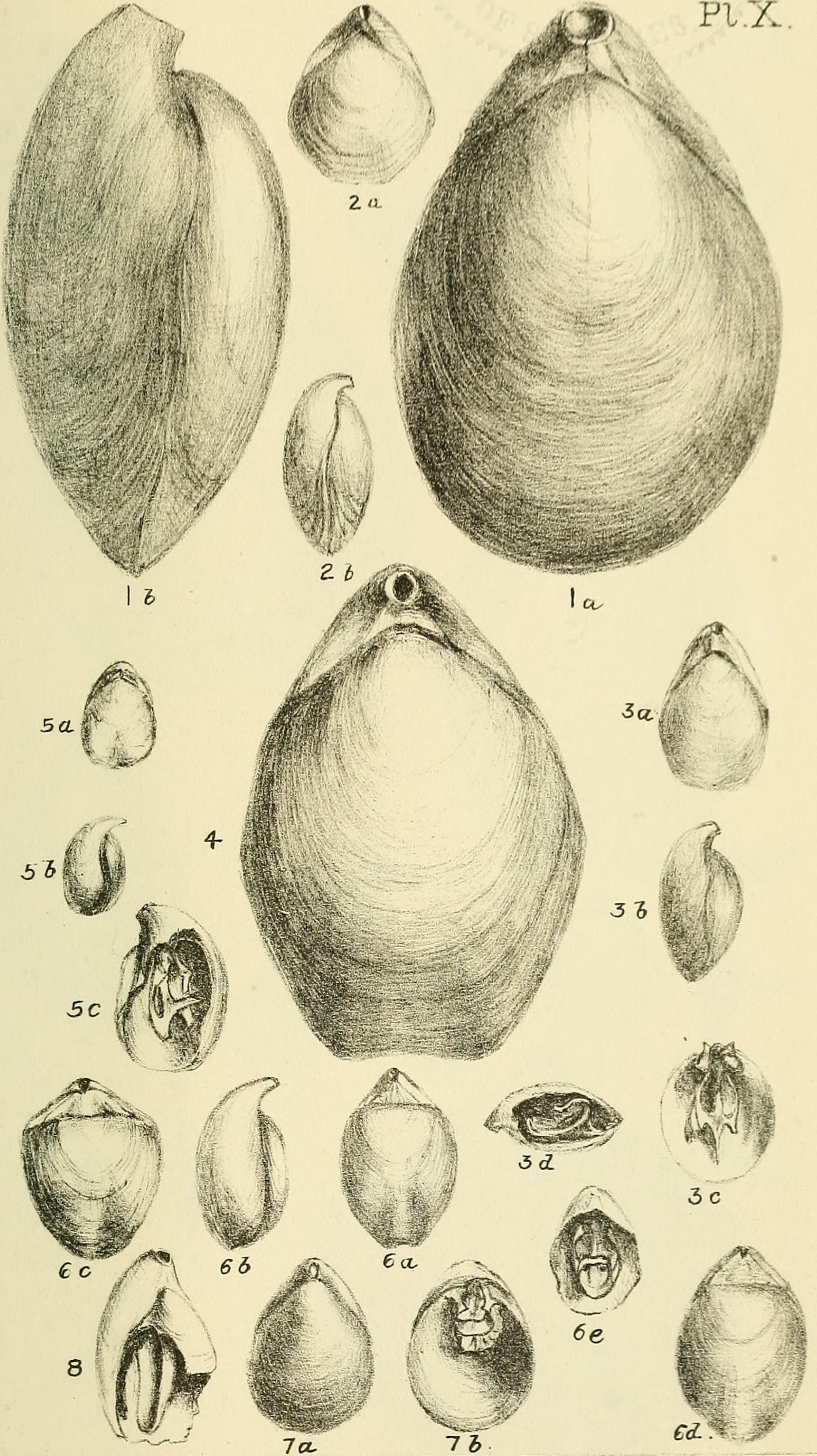
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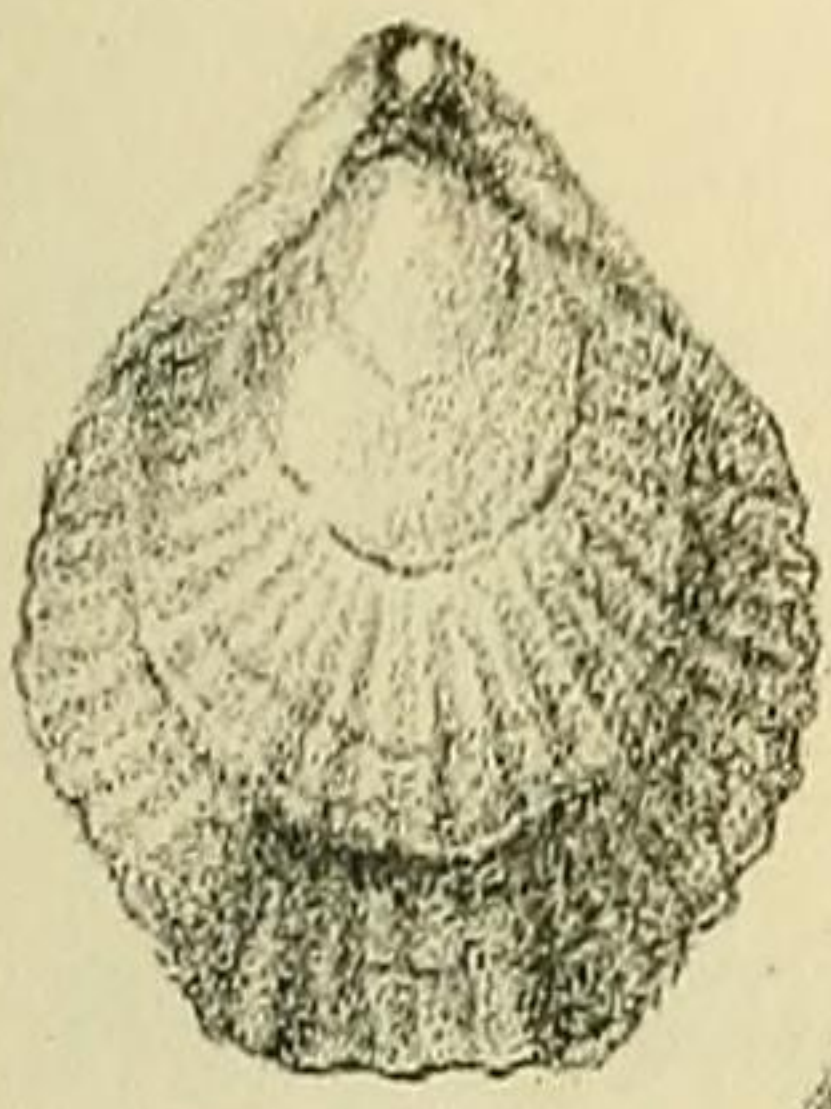


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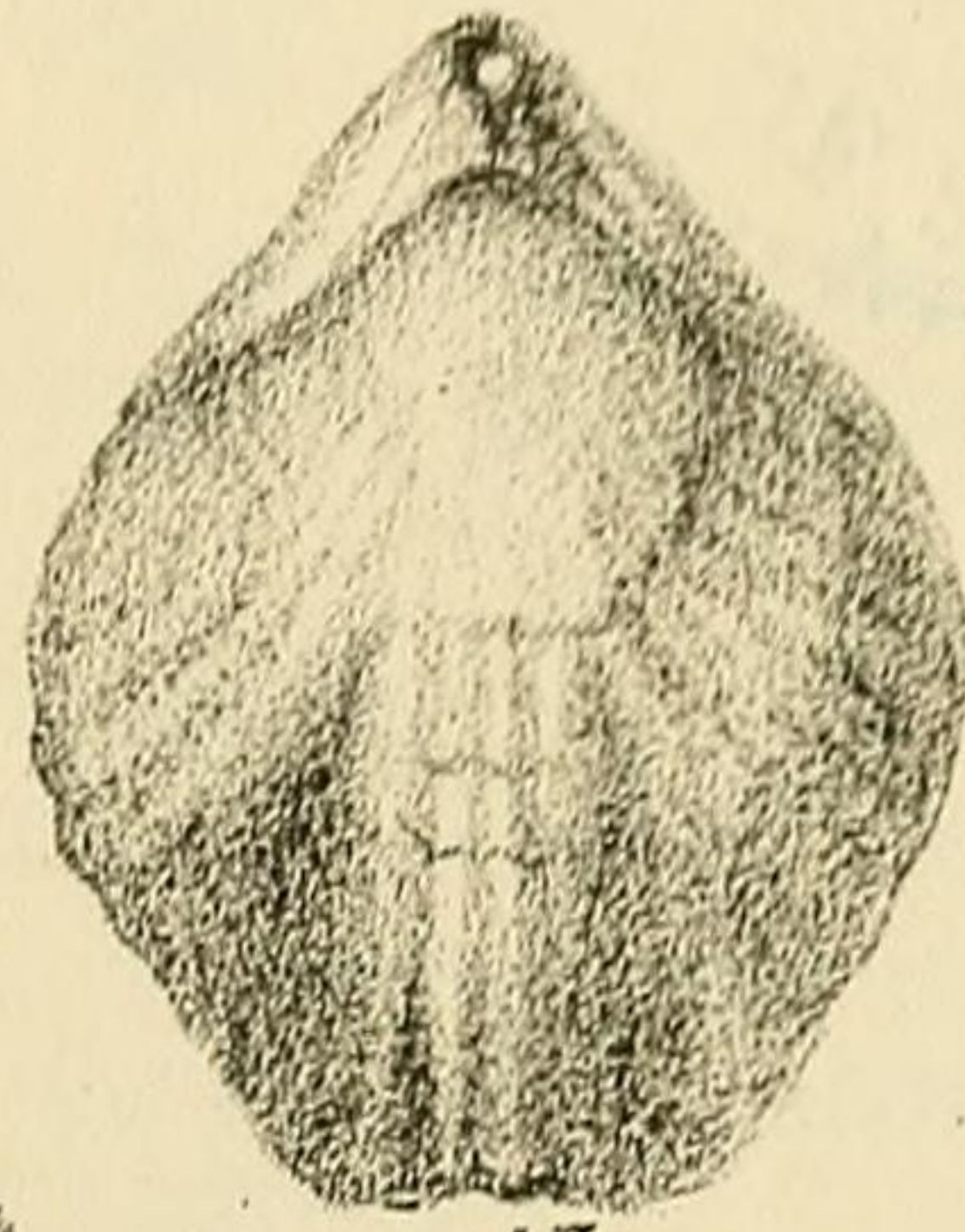


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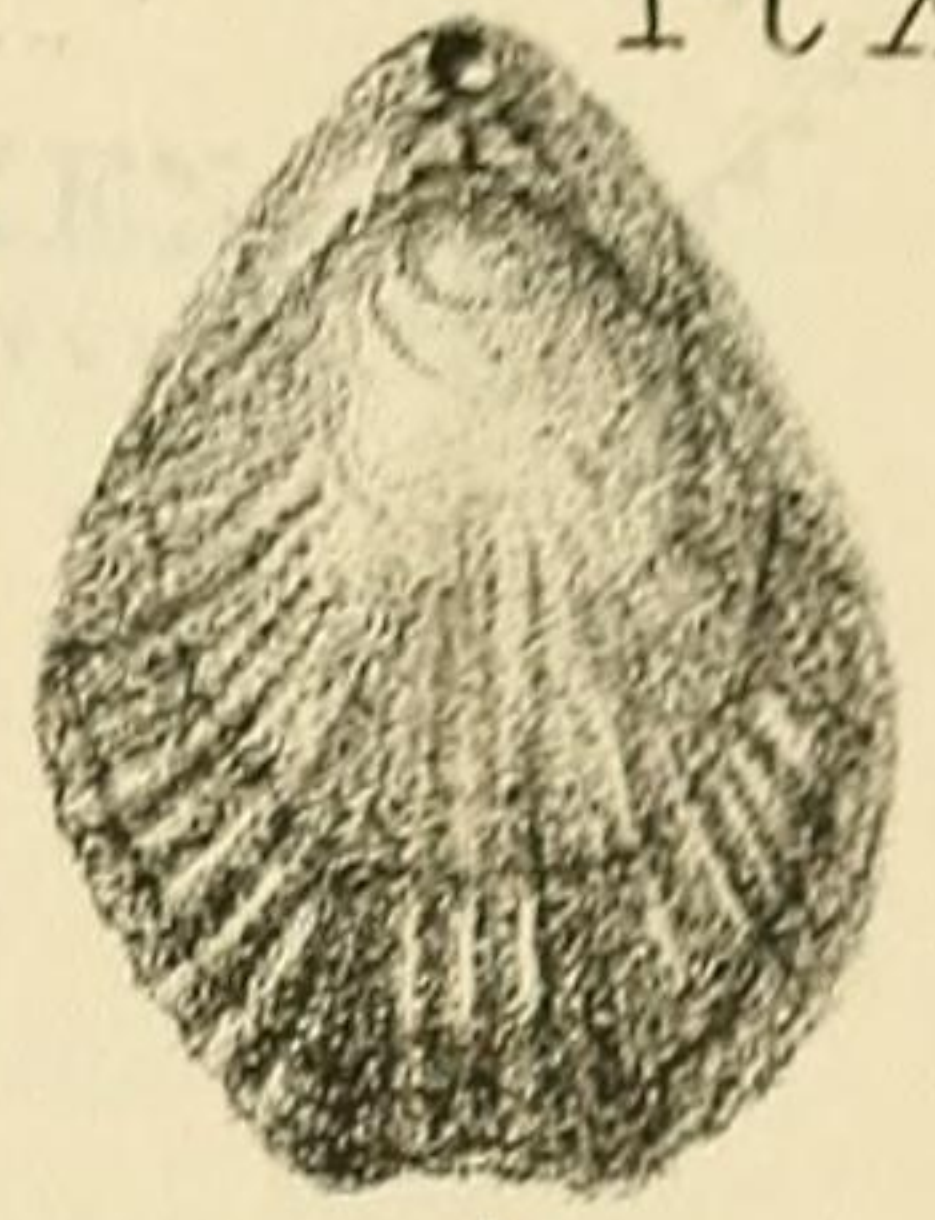




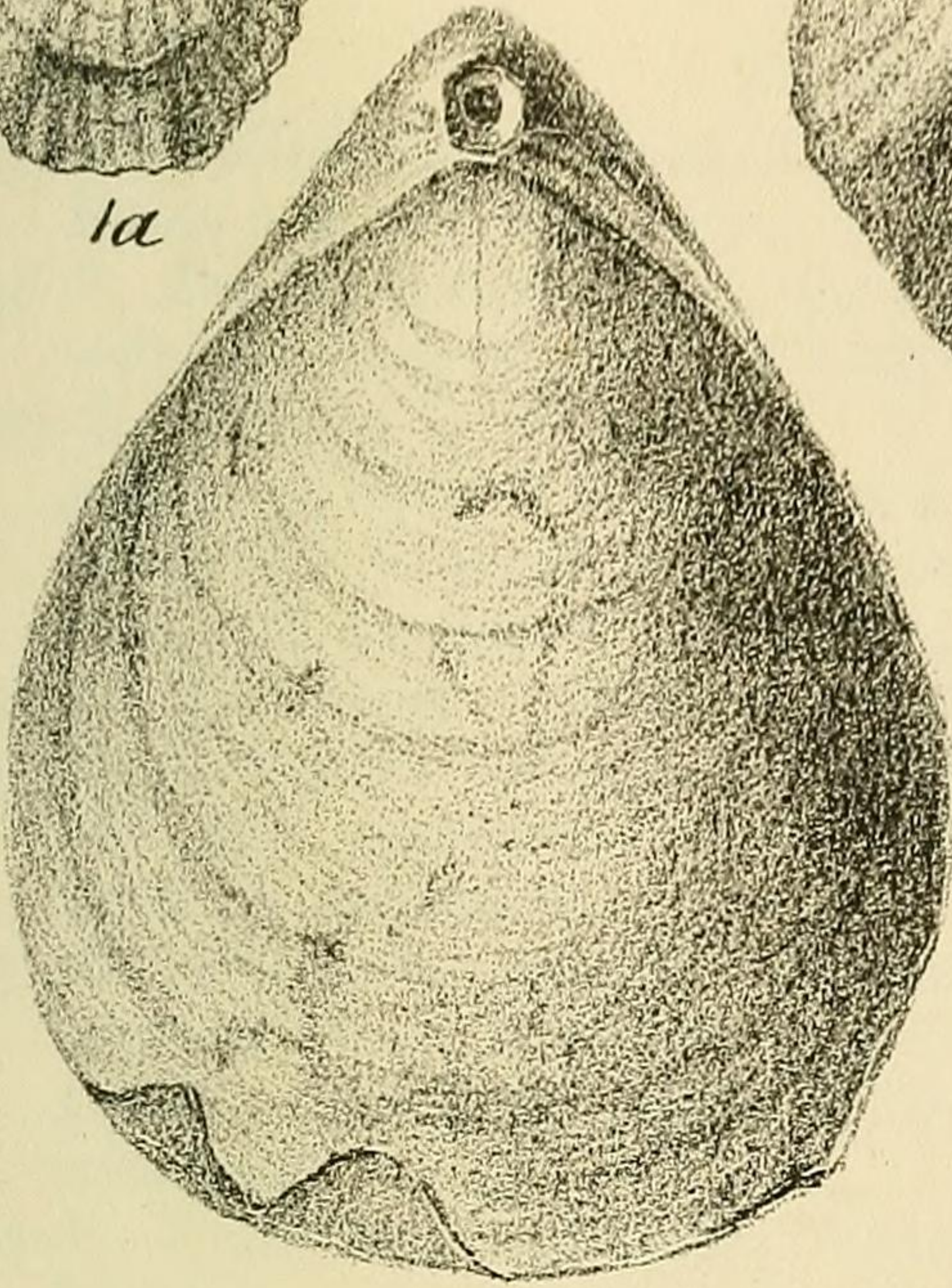
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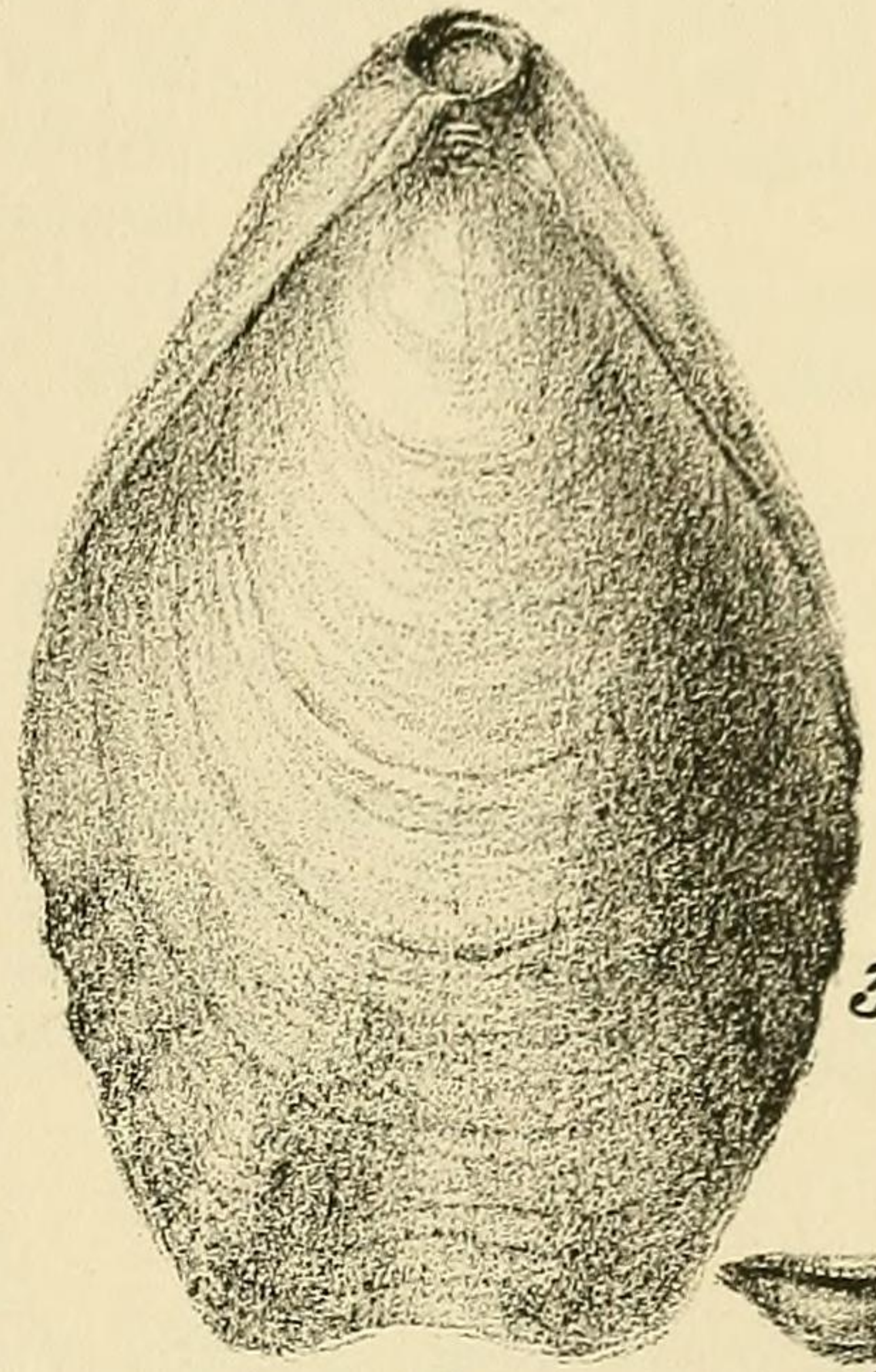
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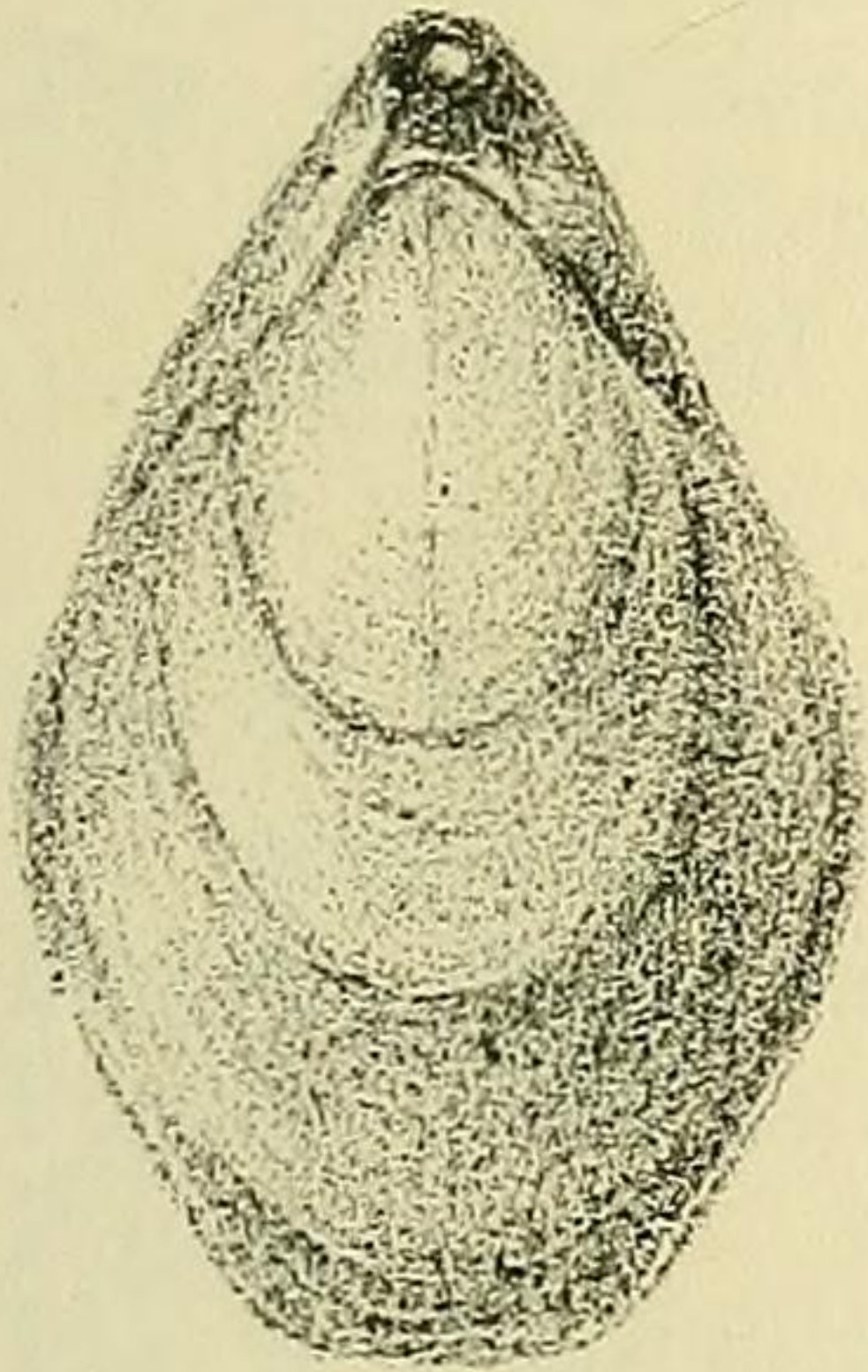
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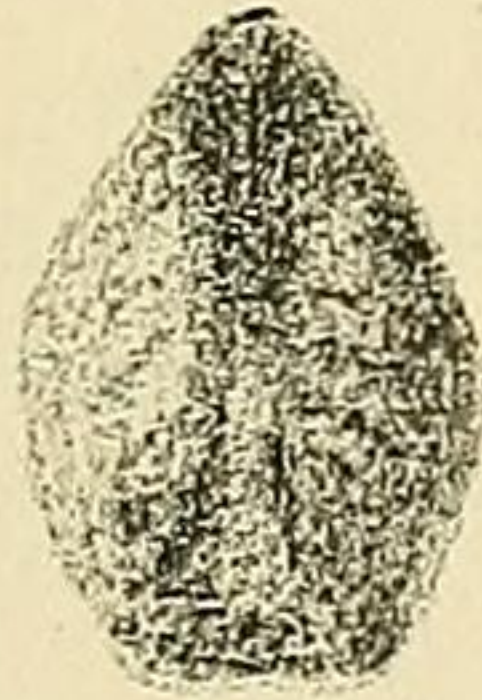
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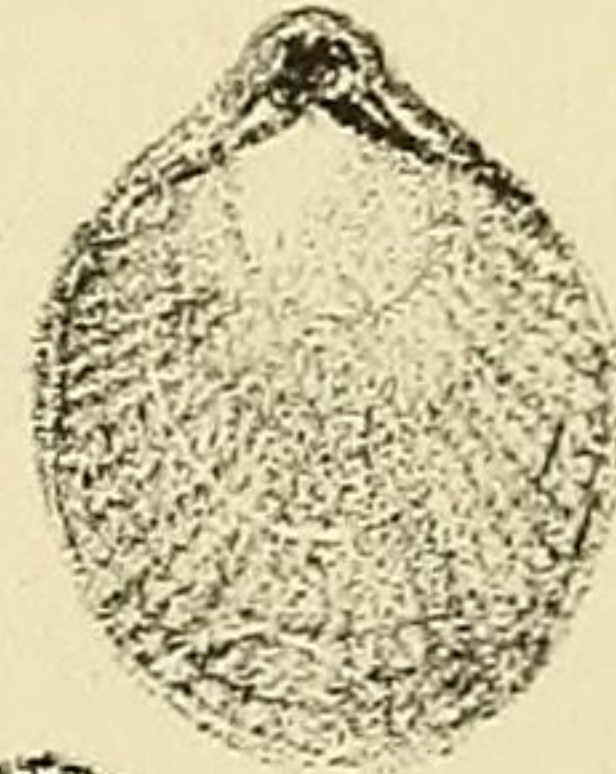
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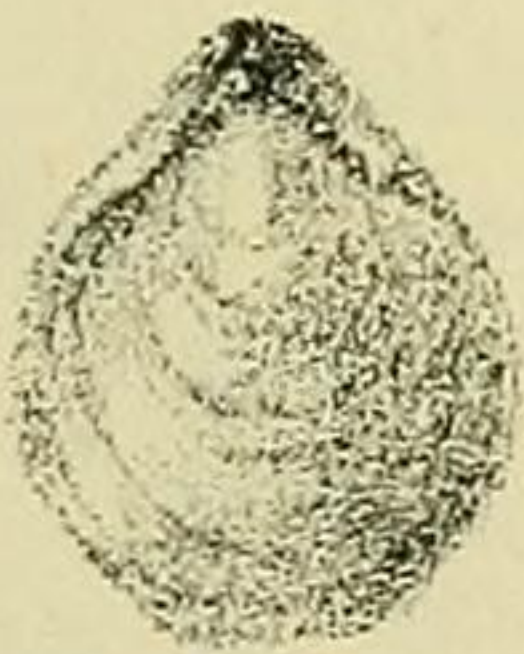
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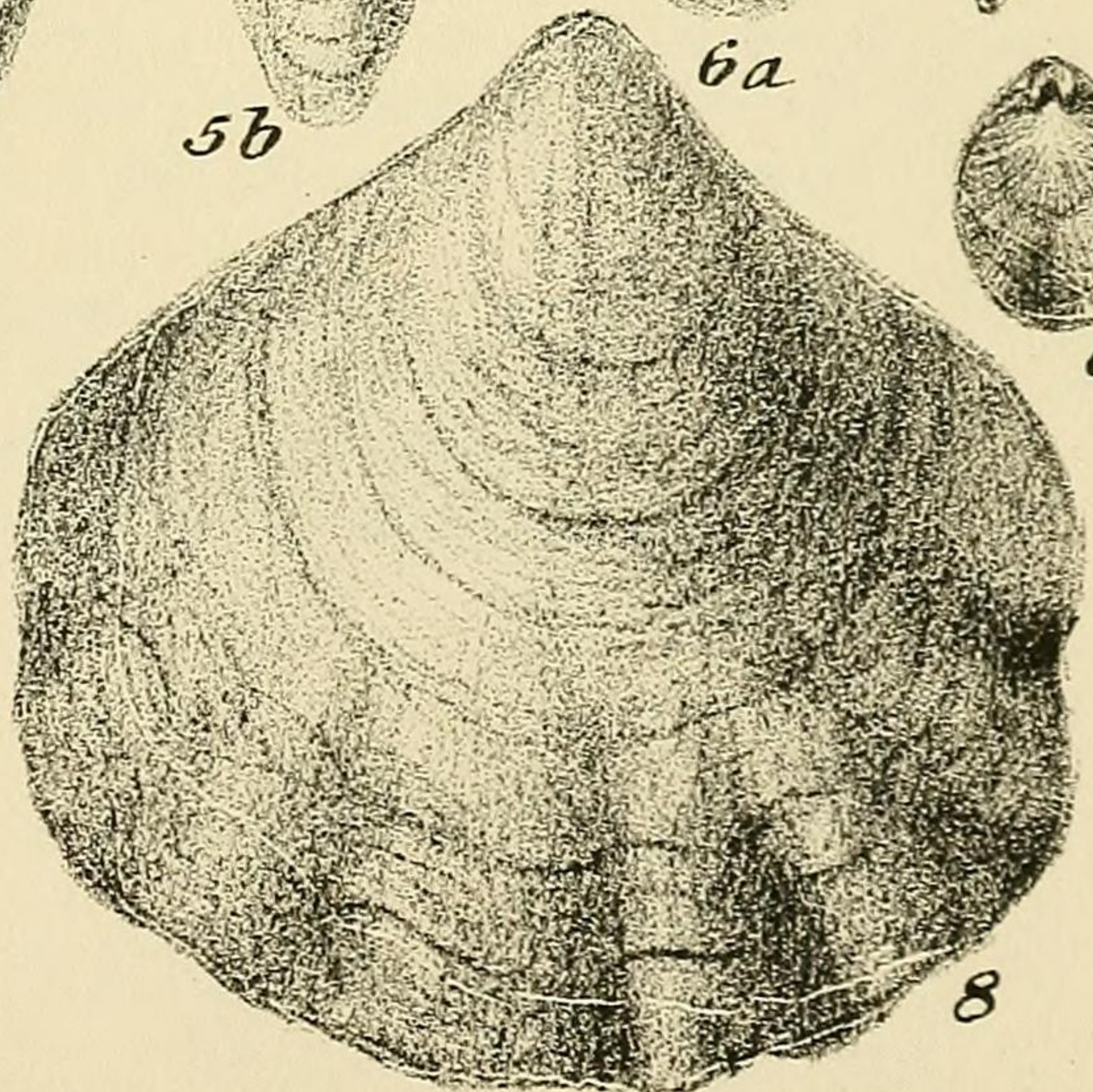
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[Begin Page: Page 140]

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On the Australian Tertiary

Palliobranchs.

By Professor Ralph Tate, F.G.S., &c, President.

Plates VII.— XI.

[Read October 5th, 1880.]

Bibliography. — Among the fossils collected by Captain Sturt during his journey down the River Murray, and figured in his work "Two Expeditions into the Interior of South Australia," 1834, is one terebratulid. The shell has been described and variously named by subsequent authors, and is referred to in this paper as *Waldkeimia Garibaldiana*, Davidson. Mr. G. B. Sowerby, in Count Strzelecki's "Physical Description of New South Wales and Van Diemen's Land," 1845, describes and figures a second palliobranch as *Terebratula compta*, which I have removed to the genus *Magasella*. In 1862 Mr. Davidson described Sturt's terebratulid in the "Geologist," vol. v., under the name of *Waldkeimia Garibaldiana*, at that time believing it to be from the Tertiary beds of Malta. In the same year appeared the Rev. J. E. Tenison "Woods' "Geological Observations in South Australia," in which Sturt's terebratula is

confounded with *T. compta*, Sow. ; but in the "Trans. Phil. Soc, Adelaide," for 1865, he figures and describes it as a new species under the name of *Waldkeimia imbricata*. In the same paper Mr. AVoods describes *Waldkeimia gigas*, *W. Crouckii*, and shows that *Terebratula compta* belongs to *Terebratella*, in which genus he describes a second, species as *T. Tenisoni*. Additional species are made known by Mr. R. Etheridge, jun., in a paper entitled

' On some Species of *Terebratulina*, *Waldheimia*, and *Terebratella* from Mount Gambier and the Murray River Cliffs."

(Annals and Mag. of Nat. Hist., 1876). Of the five species herein described and figured: — *Waldkeimia Gambierensis*, which is identical with *W. grandis*, Woods, and *W. Garibaldiana*, were previously known ; a *Terebratella* is erroneously referred to *T compta*, it is a species closely allied to the recent *JTagasella Cumingiana*, I have named it *M. Woodsiana*. The remaining two species, *Waldkeimia Taylori* and *Terebratulina Davidsoni*, are decidedly new.

The Rev. J. E. Tenison "Woods describes and figures (Trans. Roy. Soc, JST.S.W., 1878) some palliobranchs from the Miocene

[Begin Page: Page 141]

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beds at Table Cape, Tasmania, collected by Mr. It. M. Johnston.

Unfortunately the species are very inadequately illustrated ; and also because of the very brief characters given, it is almost impossible to understand the species. However, I have been favoured by Mr. Johnston with the loan of the very excellent drawings of the original specimens, and of some specimens named from the types. The species represented are, so far as I can judge, *Waldheimia Garibaldiana*, and the previously undescribed *Terebratula vitreoides*, *Waldheimia Tateana*, and a species erroneously referred to *W. Corioensis*, McCoy. The last may be a *Terebratella* ; it is unknown to me. An undescribed *Tthynchonella* is also referred to in the text.

Professor McCoy, in the " Fifth Decade of the Palaeontology of Victoria," 1877, figures and describes a new and remarkable *Waldheimia* as *W. Corioensis*, and adult forms of *W. Garibaldiana* under the name of *W. macropora*.

From these sources nine species have been well established, and the existence of three or four others are indicated. Adding to these the species now described for the first time, the total number of palliobranches from the Australian Tertiaries is 33, generically distributed as follows : — *Terebratula*, 4 ; "*Waldheimia*, 15 ; *Terebratulina*, 4 ; *Terebratella*, 4 ; *Magasella*, 4 ; *Thecidium*, 1 ; and *Phynchonella*, 1.

Localities and Horizons. — The surpassing richness in palliobranches of most fossiliferous localities in South Australia is imperfectly indicated by the fact that all the above species, •excepting *Terebratella Woodsii* and *Thecidium australe*, have

been collected within the province. My experience as a collector beyond the limits of the colony is limited to the Muddy Creek beds, near Hamilton, Victoria. In many of the sections the profusion of palliobranchs and echinoderms recalls a feature of the Jurassic formations. Their generally good state of preservation, and the comparative facility with which the interiors can be dissected out, have enabled me to discriminate species with a much greater degree of confidence than is usually possible. Indeed, no criterion as to generic position can be drawn from the external characters alone. Thus, without a knowledge of the interior of *Terebratula Aldinga*, that shell might very well have been referred to *Waldheimia*, if not indeed associated with *W. insolita*. Again, the external characters by which *Terebratella furculifera* is separable from *W. insolita* are so trivial in themselves, though nevertheless practical tests, that one might well hesitate to regard them of specific value. In consequence of a mimetic resemblance among some species in different genera, I have hesitated to assign to its genus any species whose interior characters have not been ascertained. In such cases of

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uncertainty the generic name employed has a note of interrogation affixed.

The uppermost set of marine fossiliferous beds of the South Australian Tertiaries is almost devoid of palliobranchs ; and only in one locality — near Morgan, on the River Murray — have specimens been gathered in a sufficiently good state of preservation for accurate determination. The superior beds of the River Murray cliffs, or Upper Murravian, I have elsewhere endeavoured to prove are contemporaneous with the celebrated fossiliferous strata of Muddy Creek, in Victoria. In both of them the palliobranchs are all of small size, and are for the most part dwarfed examples of species which have passed up from lower horizons. The species in common are *Waldheimia Garibaldiana*, *W. Tateana*, and *Terebratulina Scoulari*, all rare and small. The Muddy Creek beds have yielded in addition — *Terebratulina Davidsoni*, very rare and small ; *Magasella Woodsiana*, small form, though not rare ; *Bhynchonella squamosa*, very rare ; *Thecidium australe* and *Waldheimia Oorioensis*, rare. In the basal beds of the Upper Murravian, about Blanchetown, a large *Waldheimia* (*W. MacLeani*) is profusely abundant.

The Middle Murravian beds contain *Terebratulina Scoulari*, *Waldheimia gigas*, and *W. Garibaldiana* in great abundance.

The Lower Murravian beds of the northern section of the Lower Murray cliffs have not yielded any examples of the class, except *Magasella Woodsiana*, at one locality only (Moorundi, near Blanchetown), where it occurs in great plenty and of large size. But in the cliffs about Mannum and on the River Bremer palliobranchs occur in great variety and abundance. The commoner forms are *Terebratulina Davidsoni*,

Magasella compta, *M. Woodsiana*, and *Waldheimia* (?) *divaricata*.

In correlated beds we have in the white limestone at Mount
GTambier *Magasella Woodsiana* and *Terebratulina Davidsoni* in
abundance ; and in the yellow Polyzoal calcareous sands of
Aldinga Bay *Magasella Woodsiana*, var., and *Waldheimia furcata*
of infrequent occurrence. The Table Cape beds, Tasmania, are
probably not older than the above series ; and though the class
is represented in them by seven species, yet individuals seem
to be rare.

Descending in the scale of our Tertiary deposits we encounter
in the glauconitic limestones of the cliffs in Aldinga Bay, and
in their probable representatives on the opposite shore of St.
Vincent's Gulf, and in the chalk of the Bunda Cliffs in the
Great Australian Bight, a palliobranch fauna with a facies very
distinct from that of higher horizons. The total number of
species collected from them is twenty-one, or seven-elevenths
of the known Australian Tertiary species. Of these fifteen do
not pass to higher stages of the formation. Many of the

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species occur in abundance, such as *Waldheimia pectoralis*, *W.*
suffiata, *Terebratulina lenticularis*, and *Terebratula subcarnea*;
Waldheimia Tateana, which is profusely abundant, *Terebratula*

vitreoides, *Terebratulina Scoulari*, and *T. Davidsoni* occur here of a much larger size than in the higher beds to which they pass up.

In an appended table I have set forth the stratigraphical and geographical distribution of the species.

Alliances. — The facies of our Tertiary palliobranch fauna is, so far as regards genera, inost decidedly modern ; but the specific points of contact are few. They are notably *Terebratula vitreoides*, *Waldlieimia Garibaldiana*, *Terebratulina Scoulari*, *Magasella Woodsiana*, *Thecidium australe*, and *Uliynclionella squamosa*. Nevertheless, not one of the fossil forms is actually known to be represented in living creation. Of the above *T. vitreoides* and *Th. australe* are related to living Mediterranean species, whilst the others have near recent allies in the Australasian region. On the other hand, the great richness in species of *Waldlieimia*, more than half of which are of exceedingly large size, gives to the faunula a character peculiarly its own. The presence, moreover, of several bipliated species of that genus is another fact which increases the contrast between our Tertiary and living palliobranch faunas.

A general resemblance seems to subsist between our Tertiary species and those of the European Miocene ; but if the *Terebratulae* of the latter are correctly so assigned, then the resemblance is in part at least mimetic rather than actual.

Thus *Waldlieimia grandis* approaches *Terebratula Pedemontana* ; *W. insolita* to *Terebratula Hilarionis* ; and other similitudes

might be pointed out.

The absence of the genera *Megerlia*, *Platidia*, and *Argiope* from our Tertiary fauna, also the paucity of *Mhynchonella*, and the presence of *Magasella*, offer great difficulties to the establishment of any well-defined relationship between the European and Australian Tertiary palliobranch faunas. If we select *Terebratula subcarnea* and the *Terebratulinas* (excepting *T. Scoulari*), we might, as equally well, claim for the Australian Tertiary palliobranch fauna a Cretaceous facies.

Viewed in its entirety our Tertiary palliobranch fauna has as much a character of its own, as it has affinity with that of the European Cretaceous or to that of recent Australia. But viewed in its duality, then the older is seen to be far removed from recent types, whilst the newer is seen to possess more pronounced affinities with members of the class inhabiting the seas around and adjacent to this continent. In respect to the older fauna, it may be well to recall the fact that two at least of its species (*Waldieimia insolita* and *Blyncionella squamosa*) are constituents of the fauna of the Upper Eocene

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of New Zealand ; and I have reason for the opinion that when a careful comparison shall have been instituted between the

fossils of the Eocene of New Zealand and those from the Aldinga beds great specific identity will be found to obtain.

Description of Species.

Terebratula vitreoides, T. Woods. Plate viii., fig. 5a 5b. Plate x.,

figs. 1a— 1b.

Bef.— Trans. Roy. Soc. New South Wales, 1878, p. 78,

figs. 4a — d.

" A small, smooth, orbicular species, with very conspicuous concentric lines of growth. Foramen small. Of this fossil Mr. Davidson says — ' This is another of those undecided forms that resemble many things described as distinct species. It has some resemblance to *T. vitrea* or to *T. orbicularis*, Sequenza, I would not like to assign it positively to any species, although I would not assign to it any very distinguishable features.' " —
T. Woods.

The specimen which I have figured Plate viii., fig. 5, under the above name is one of a small series from the lower beds at Aldinga, agreeing very well with Woods' description and figures, except that the foramen is usually larger. Of the Aldinga examples I have not been able to dissect out the interior ; but somewhat similar shells from the Kiver Murray cliffs prove to have the loop of a *Terebratula*, see plate x., fig. 7. Of the latter I have only been successful in collecting

three examples, all of which are smaller than the Aldinga specimens, and differ in being more gibbous with depressed sides, and in having a smaller foramen, characters which approximate it more to *T. vitrea*, Born., whilst the Aldinga specimens make an approach to *T. elliptica*, Sequenza. The differences, which may be due to age, are too slight to justify the specific separation of the two forms.

The loop of *T. vitreoides* differs from that of *T. vitrea* in being relatively shorter and stouter, the breadth of the curved front portion is much greater, and the crural processes are inconspicuously developed.

Dimensions. — A large specimen from Aldinga has the following measures : — Length, T45 ; breadth, T05 ; thickness, '7 inch.

One from the Murray cliffs : — Length, 1*0 ; breadth, S ; thickness, "5 inch.

Locality and Horizon. — Lower Aldinga — glauconitic limestones, Blanche Point, Aldinga Bay ; and Middle Murravian, calcareous sands at Blanchetown. (Tate).

Table Cape, Tasmania. (R. M. Johnston).

Terebratula Aldingae, spec. nov. Plate x., figs. 2a— 26.

Shell obtusely five-sided ; a little longer than wide ; broadest

about the anterior third ; straight or slightly indented in front.

Valves moderately convex, the brachial valve more depressed.

Surface marked with inequidistant concentric imbricate lamellae of growth. Punctations of test not visible under a pocket lens, except in thin sections when viewed by transmitted light ; punctations minute, widely separated. Beak small incurved and obliquely truncated by a small oval foramen, separated from the umbo of the brachial valve by a small triangular deeply impressed deltidial plate (elements not distinguishable) . Interior without a medial septum ; of the loop the part posterior to the crura only known. These portions are longer, more slender, and less divergent than in *T. vitreoides*.

Dimensions. — Length, .9 ; breadth, .75 ; thickness, .45 inch.

Obs. — Young examples of this terebratulid and *Terebratella furculifera* closely resemble each other, but the latter is at once known by its densely punctated shell structure and foramen. From *Terebratula vitreoides* it differs especially in its nearly flat brachial valve and pentagonal shape.

Locality and Horizon. — In the glauconitic limestones, north side of Blanche Point, Aldinga Bay. (Twelve examples).

Terebratula (?) *subcarnea*, spec. nov. Plate ix., figs. 1a — 1b.

The interior of this species is not known, and the external characters which belong to *Waldheimia* are not presented by it.

It so closely resembles *T. carnea* of the European Cretaceous rocks, that it is only after very careful comparison with many specimens of that species that differences are found to exist.

T. subcarnea has a larger, though small, foramen ; the brachial valve is not so gibbous ; and its greatest breadth is nearly medial. These characters partly serve to separate it from *T. cameoides** Gruppy, of the Antillian Miocene, to which must be added that the front margin of our shell is either straight or slightly depressed.

Dimensions of a large specimen : — Length, 1½ inches nearly ; breadth, 1¼ inches ; thickness, 1 inch nearly.

Locality and Horizon. — In the top-bed of chalk, Bunda Cliffs, Great Australian Bight. (For the geology of, see vol. ii. p. 104, of this Society's Transactions).

Terebratula (?) *bulbosa*, spec. nov. Plate vii., figs. 5a— b.

Shell ovate, longer than wide, rounded laterally and attenuated towards the narrow, nearly straight, slightly crenulated front.

Brachial valve very convex, slightly depressed near the

* Quart. Journ. Geol. Soc, London, vol. xxi., t. 19, fig. 3, p. 296, 1866 ;
and Davidson, Geol. Mag., 1874, t. 8, fig. 11, p. 158.

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front ; interior unknown. Peduncular valve as deep as the
opposite valve ; beak large, incurved, and obliquely truncated
by a large obovate foramen.

Surface smooth, marked by moderate lines and striae of
growth.

Dimensions. — Length, 1.5 ; breadth, 1.35 ; thickness, 1.3 inch.

Locality and Horizon. — In the coarse limestones forming the
low sea-cliff on the south side of the jetty at Edinborough,
Yorke's Peninsula. (One example).

Waldheimia G-aribaldiana, Davidson. Plate xi., figs. la— U.

Bef.— Geologist, vol. v., p. 446, t. 24, f. 9, 1862.

Id. R. Etheridge, jun., Ann. and Mag. Nat. Hist., vol.
17, p. 17, t. 1, f. 2, 1876.

Syn. — *Terebratula* sp., Sturt. Two Exped. in S. Aust.,
vol. ii., t. 3, f. 15, 1834.

Terebratula compta, Woods. Geol. Obs. in S. Aust., p. 74,
wdct., 1862 (non Sow).

Waldheimia imbricata, Woods. Proc. Phil. Soc, Adelaide,
fig. 3, 1865 ; and Trans. Eoy. Soc. of K.S.W., p. 79, f. 1, 1878.

Waldheimia macropora, McCoy. Prod. Pal. of Victoria,
decade v., pi. 43, figs. 4 and 6, 1877.

W. imbricata, *W. Garibaldiana*, and *W. macropora*,
Etheridge. Cat. Aust. Fossils, 1878.

W. Garibaldiana is the commonest palliobranch in the middle
beds of the River Murray cliffs, and exhibits some slight
variation of form and ornament, more particularly in respect
to age. The example figured by Etheridge is exceptionally
large, and is more angular in outline and more deeply sulcated
than the majority of adult specimens which I have seen. In
its adolescent stage of growth, which is represented by Sturt's
figure, the outline of shell is more or less circular, with
slightly convex valves, which are fimbriated ; but the front is
not depressed, nor is there an appearance of biplication.

The form varies from nearly circular to ovate ; and the
pentagonal outline, though never obscure in the adult, varies
in its angularity, and in the depth of the sulci exhibits much

variation, as also the height and number of ribs. The medial depression is occupied with from three to six longitudinal ribs, and the lateral portions of the valves have usually about ten curved ribs on each side.

The loop is that of a *Waldheimia* reaching nearly to the front in a gentle curve, the reflected portion approximating to the long slender erect cruras which are rather distant from the hinge plate.

The shell structure is conspicuously punctate as viewed with a pocket lens. The pores are large circular, but not so

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numerous as in *W. fiavescens* in the proportion of about five to eight.

Dimensions. — A senile example : length, 1.75 inch ; breadth, 1/5 inch ; depth, 1 inch.

The specimen figured by Mr. Etheridge, another aged form :

— Length, 1/5 ; breadth, 1.25 ; depth, - 8 inch.

A rather large example, in which the diverging ribs of the peduncular valve and the arched front have not acquired

prominence, has length, 1*2, breadth 1*0, depth 075 inch.

Alliance. — *W. Garibaldiana* bears some resemblance to *W. flavescens*, now living off the eastern and southern coasts of Australia ; but as pointed out by Mr. Davidson, is less ovate, the beak is less elongated, and it has a smaller foramen ; and to which differences has been added by Prof. McCoy that of the very much larger pores of the test of the fossil species. In its adult state *W. flavescens* never acquires that remarkable development of the frontal sinus and longitudinal ridges observable in all aged examples of *W. Garibaldiana* .

Observations. — Mr. E. Etheridge, jun., is evidently wrong in referring Sturt's terebratulid to *Terebratella compta*, as Sturt's figure represents a fimbriated shell, and in other respects is totally unlike *T. compta*. The error is traceable perhaps to Mr. "Woods, who reproduced Sturt's figure, and applied to it the name of *T. compta* ; a rectification was, however, made by him a few years later, when he described it as a new species under the name of *Waldheimia imbricata*. Though he does not refer to the figure in his " Geological Observations," nor to Sturt's, yet as the drawing which accompanied his paper in the Transactions of the Philosophical Society of Adelaide seems to be a reproduction of one or the other, there cannot be a doubt that Sturt's terebratula and "Woods' *Waldheimia imbricata* belong to the one species.

That *W. imbricata*, Woods, is a young example of *W. Gari-*

baldiana, Etheridge, is an opinion formed after the examination of many score of specimens of the species, ranging from less than one-third inch in diameter to more than one and a half inches in diameter. *W. macropora*, McCoy, is a somewhat intermediate form.

I have selected from a large series collected from the same stratum at Blanchetown three specimens (pi. xi., figs. 1a — 1c), which illustrate as many stages of growth, and to which the names of *W. imbricata*, *W. onacropora*, and *W. Garibaldiana* have been respectively applied.

The shell, which Mr. Woods has figured (Trans. Roy. Soc, N.S.W., p. 79, fig. 2) as the young of this species, differs not only in its well-developed longitudinal ribs from juvenile examples of *W. Garibaldiana*, but seems rather to have the

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characters belonging to a *Terabratulma*. It bears some resemblance to my *T. triangularis*.

Mr. Etheridge, 1. cit., January, 187G, writes : — " When originally described, *W. Garibaldiana* was supposed to have come from the Tertiary beds of Malta ; but Mr. Davidson afterwards satisfied himself that it in reality came from Mount

Gambier. The nature of the matrix filling the valves bears out this view, for it agrees exactly in lithological character with that adhering to authenticated specimens from the same locality." One would think from this that all doubt as to the habitat of the species was set at rest. But not so Mr. Davidson supplies a note to Mr. Woods (Trans. Eoy. Soc, N.S.W., p. 78, 1878), to the effect that the Tasmanian shell referred to under the name of *W. imbricata*, nobis, *W. macropora*, McCoy, M.S., "is a new but allied species, and has also a little resemblance to my *W. Garibaldiana*, although I think not the same species." Prof. McCoy says of it, however : — "I do not know how it can be separated from Davidson's *W. Garibaldiana*." Nevertheless, Prof. McCoy remarks in an appendix to his description of *W. macropora* : — "I should have thought Mr. Davidson's *W. Garibaldiana* identical with this species, but in a letter I have seen from him to the Rev. Mr. Tenison Woods — [referred to above] — he thinks differently." I think it not improbable that Prof. McCoy has misinterpreted Mr. Davidson's remarks, which bear solely upon the possible separation of the Tasmanian shell from *W. Garibaldiana*, and do not necessarily imply that the type of the species is not Australian. As Mr. Davidson observes, "the subpentahedral elongated shape — [of the Tasmanian shell] — is remarkable ;" but it can be matched with examples from the Paver Murray cliffs, and is nothing more than one of the forms of this variable species.

The publication of Davidson's name has priority over that of *W. imbricata*, whilst the latter antedates that of *W. micropora*

by several years.

Locality and Horizon.— -Upper Murravian, near Morgan, and Muddy Creek, Hamilton ; rare and of stunted growth. (Tate.)

Middle Murravian, River Murray cliffs,]S"orth-west Bend, Blanchetown, &c. (Sturt, Tate, &c.)

Lower Murravian, River Murray cliffs at Mannum ; on the River Bremer, three miles south from Callington ; rare. (Tate.)

Mount Gambier (Woods) ; between Mount Eliza and Mount Martha (McCoy) ; Table Cape, Tasmania (R. M. Johnston.)

Waldheimia furcata, spec. nov. Plate vii., figs. 2a — 2b.

Shell obscurely pentagonal, inflated ; valves about equally convex, ornamented with sub-acute ribs, which commence from

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the umbonal region and increase in number by bifurcation towards the front, and numerous and close-set transverse lamella?.

The line of contact of the two valves is in one plane, and is only slightly indented by ridges and sulci.

Beak produced, sub-erect to slightly incurved, truncated by a small foramen, and separated from the hinge line by a deltidium. Pores of the test circular few and large, as in *W.*

Garibaldiana, but not so numerous in the proportion of four to five. Eeflected portion of loop unknown ; septum very prominent, extending for about half the length of the valve. Crurse very short ; loop towards its origin, rather broadly compressed, and falcately excavated on the upper side.

Dimensions. — Length, 8 inch ; breadth, 6 inch ; depth, 5 inch.

Observations. — In its sub-pentagonal form and small foramen it closely resembles *W. Garibaldiana*, from which it is separable by its inflated form, straight front margin, and by the bifurcation of its strongly fimbriated ribs, and in certain details of the loop. It comes nearer to *W. flauescens* than *W. Garibaldiana* does, but, as with that shell, it has a much smaller foramen and fewer and larger pores.

Locality and Horizon. — Rather rare in the Polyzoal calciferous sands forming the lower part of the sea-cliffs immediately to the south of Port Willunga jetty, Aldinga Bay, and at Seaford, near mouth of the River Onkaparinga, St. Vincent's Gkilf ; at Surveyor's Point, Torke's Peninsula.

Waldheimia (?) *divaricata*, spec. nov.. Plate viii., figs. 8a— 86.

This species has some resemblance to *W. Garibaldiana*, but is a narrower shell. The brachial valve is less inflated and much depressed in front, and the convexity of this valve is more or less interrupted by a median longitudinal depression, corresponding to which in the other valve is a strong truncated keel. The beak is more depressed, the deltidial area broader, and the beak ridges more conspicuous.

The ribs are enclievra, rarely inconspicuous. It also presents in form some agreement with *Magasella Woodsiana*, but in that shell the valves are regularly convex, and the front margin is not angulated.

The loop is unknown, but there is a well-developed septum, which extends for about half the length of the valve. There are no signs of transverse attachments.

Dimensions. — Length, 1 inch ; breadth, .75 inch ; depth, .5 inch.

Locality and Horizon. — In the red raggy limestones of the River Murray cliffs at Mannum (many examples) .

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Waldheimia Tateana, Woods. Plate vii., ligs. 6a — 6f ; plate viii., figs.

6a — 6c ; plate ix., fig. 2.

Ref. — *Terebratula Tateana*, Tenison Woods.

Trans. Boy. Soc, KS.W., p. 79, f. 5, 1878.

Shell longitudinally oval, narrow, widest about the middle ; sides slightly rounded, nearly straight in front. Valves moderately convex ; surface smooth, marked with a few concentric striae of growth. Beak long, narrow, sub-erect, truncated by a small circular foramen.

Shell structure conspicuously punctate under a lens ; pores oval, large, crowded, rather larger than in *W. Garibaldiana*, but about equal in number.

The loop offers no particular character ; in a specimen of a total length of $\frac{1}{8}$ inch the loop reaches within 1[^] lines of the front.

Dimensions of a median-sized example. — Length, $\frac{1}{8}$; breadth, $\frac{1}{55}$; thickness, $\frac{1}{35}$ inch.

Observation. — The species exhibits considerable variation ; typical specimens are insensibly connected with an ovate form, with rounded sides and front. Another phase of its variability is exhibited by the development of a biplicated front, which gives to the shell a subpentagonal outline. In this latter variety the peduncular valve has a broad shallow depression in

the middle line bounded by obtuse folds, corresponding with which, in the brachial valve, is a broad median ridge, bounded by two short almost marginal sulci. There are imperceptible gradations connecting the oval, ovate, and subpentagonal shapes ; the sulcations are always shallow and limited.

The specimens upon which the species was founded prove on actual examination to be immature examples, though they present the leading characteristics of the adults which I have selected as typical of the species.

Locality and Horizon. — Tipper Murravian, near Morgan, R. Murray ; Muddy Creek, Hamilton (Tate) ; Table Cape, Tasmania (Woods). Abundant in the glauconitic limestone to the north of Blanche Point, Aldinga (Tate) ; Muloowortie clays, Yorke's Peninsula (Tepper).

Waldheimia (?) *fimbriata*, spec. nov. Plate viii., figs, 1a— 26.

Shell longitudinally ovate, sides and front rounded. Valves moderately convex, the peduncular much the deeper. Surface marked by rounded radial ribs, which extend to about one-third ; about five ribs occupy the front, and a like number on each side ; the rest of the surface is smooth, with a few concentric striae of growth. Shell structure conspicuously punctate under a lens.

Beak largish, suberect, and truncated by a large foramen.

Loop unknown.

This species has much affinity with *W. Tateana*, particularly with the biplicated variety of it, but the more pronounced costations and the larger foramen separate it.

Dimensions. — Length, "9 inch ; breadth, "7 inch ; depth, *55 inch.

Locality and Horizon. — Græuconitic limestones, Blanche Point, Aldinga Bay (a few examples).

Waldheimia (?) *Johnstoniana*, spec. nov. Plate viii., figs. 9a— 9&.

Shell elongate, oval, subpentagonal ; much longer than wide, with nearly parallel sides, attenuating somewhat rapidly to the beak, but truncated in front. Front margin bispinuate, the sulci shallow and very short, flanked on each side by faint plicae.

Valves about equally and regularly convex, not inflated.

Surface smooth, with a few inequidistant concentric lines of growth. Test minutely and densely punctate, visible under a pocket lens.

Beak short and stout, erect, transversely truncated by a rather large circular foramen ; deltidial pieces small, fused together ; beak ridges inconspicuous.

Loop unknown, but the brachial valve shows a strongly impressed medial line.

Dimensions. — Length, 1*2 ; breath, - 7 ; thickness, *6 inch.

Observations. — It is allied to *W. Tateana*, through the bipli-cated variety of that species, but is relatively longer and narrower, and its foramen is much larger, and the beak shorter and stouter.

Locality and Horizon. — Grlauconitic limestone, north side of Blanche Point, Aldinga Bay (nine examples).

The species is named after Mr. R. M. Johnston, F.L.S., to whom Australian geologists are indebted for much of their knowledge on the Miocene fauna and geology of Table Cape, Tasmania.

Waldheimia (?) *insolita*, spec. nov. Plate ix., figs. 6a— 6&.

Shell oval, nearly as long as wide ; sides and front margins curved ; valves moderately convex ; surface smooth, with a few concentric lines of growth.

Beak small, erect, depressed, with strong beak ridges,
obliquely truncated by a rather small circular foramen.

Deltidial pieces well-developed.

Loop that of *Waldheimia*, septum about one-third the length
of the brachial valve. Punctations of test visible under a
pocket lens.

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Specimens collected from a marly band in Blanche Point
Cliff, Aldinga, exhibit radial flashes of colour.

Dimensions. — Length, 11 ; breadth, 9 ; thickness, .45 inch.

Observations. — This species has some external resemblance to
Terebratula Aldinyce, but differs in its rounded outline, in the
shape of its beak, and in its smaller foramen. It varies in the
degree of convexity of the valves, the more depressed forms re-
calling the inflated variety of the Liassic *W. mmismalis*, but
without its circular shape and minute foramen. It also bears
a striking likeness to *Terebratula Hilarionis*, Meneghini, from
the Eocene of Italy (vide *Geol. Mag.*, 1870, p. 401, t. 17, f. 4, 5).

Locality and Horizon. — Glauconitic limestones, Aldinga Bay ;

upper part of chalk rock, Bunda Cliffs, Great Australian Bight (R. T.) ; Upper Eocene, New Zealand, the identification based on specimens kindly forwarded by Dr. Hector.

Waldheimia grandis, T. Woods. Pl. xi., figs. 3 and 4.

Ref— Trans. Adelaide Phil. Soc, 1865, t. 2, fig. 1.

Syn. — "W. Gainbierensis, Etheridge, jun., Annals and Mag. Nat. Hist., vol. 17, p. 19, t. 2, fig. 4 (1876).

" Shell smooth, very thick, elongated, convex ; ventral valve subcarinated, margin with two obscure plaits in the older specimens ; beak short, obtuse, obliquely truncated, with a large circular cup-shaped thickened foramen. Loop two-thirds as long as the dorsal valve ; lamellae slender, straight, reflection unknown ; septum, as long as loop, gradually tapering ; crura? thick, semicircular. Length 22 inches, breadth 1 - 4 • inches. It is a very variable shell." — T. "Woods.

Etheridge's figure represents the adult form of the species, though its dimensions are below the average of fully developed examples. The Rev. J. E. Tenison "Woods' illustrations of this species are of a large but somewhat immature specimen, in which the biplicated front, characteristically shown in Mr. Etheridge's drawings, is only commencing to be formed. There cannot be a doubt of the relationship existing between the two shells ; they, moreover, came from the same locality.

Etheridge referred his species to *Waldheimia*, solely because a mesial septum was indicated by an impressed line on the brachial valve. Tenison "Woods, however, proceeds with more caution, and states that he is not certain if it be probably referred to that genus, though the unreflected portion of the loop was alone unknown to him. Having been fortunate in obtaining a full display of the interior, uncertainty as to the generic position of the species is entirely removed. The loop presents no character worthy of note.

Mr. T. Davidson says : — " It approaches to the Italian

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Tertiary T. Pedemontana, but still distinct, being more regularly oval."

My notes referring to *W. Tateana* and reproduced by Mr. Woods, Trans. Roy. Soc., N.S.W., have been by mistake transferred by him to *W. Gambierensis*.

Dimensions of a large example : — -Length, 2'4 ; breadth, 15 ; thickness, 1'3 inches.

Locality and Horizon. — Very abundant in the calciferous-sands occupying the middle portion of the River Murray cliffs

about Blanchetown and Morgan ; rare in the red yellow calciferous sandstone forming the upper part of the Mannum cliffs on the River Murray ; River Bremer, four miles south from Callington (Tate). Rather rare in the coralline limestone of Mount Gambier (Woods). Table Cape, Tasmania (R. M. Johnston).

Waldheimia (?) *Crouchii*, T. Woods. Plate xi., fig. 8.

Be/.— Trans. Phil. Soc, Adelaide, 1865, t. 2, fig. 2.

This species is founded on a brachial valve of nearly circular outline, and with seven large angular plaits on the anterior margin.

Dimensions. — Length, 23 inches ; breadth, 2'2 inches.

Locality. — Mount Gambier (Woods).

Observations. — This appears to be very distinct from its congeners, but I suspect it to be closely related to *W. grandis*.

Waldheimia MacLeani, spec. nov. Plate vii., figs, 1a— 1c.

Shell large, a little longer than wide, with a sub-pentagonal outline, convex ; greatest width about the anterior third of the whole length, rapidly attenuating posteriorly and gradually narrowing anteriorly to the truncated front margin. Lateral

margins narrowly plicate, front margin sinuous. Brachial valve regularly convex and deep, ornamented by a few curved costae, which are limited to near the margin, with an ill-defined medial longitudinal fold bounded by two short depressions. Peduncular valve convex deep, the marginal plications more pronounced and longer than in the brachial valve ; a shallow depression extends from about the middle of the front, where it is bounded by two rounded plaits each equal in width to the depression. Beak moderately produced, sub-erect, truncated by a large circular foramen. Surface of both valves with concentric lines of growth.

Young shell ovate, without plicae, the line of junction of the valves is in one plane.

Dimensions in inches : —

Length. Width. Depth.

(1.) 1175 1-3 -45

(2.) 19 1-4 '5

M

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Observations. — The general shape of *W. MacLeani* is that of *W. Qaribaldiana*, but its outline is not so angular, it is more convex, the plications shorter and stouter, and it wants the angular folds of the peduncular valve and the depressed angular front ; the foramen is, moreover, very much larger, and the beak more voluminous. Young shells of these two species are very distinct from one another.

The alliance of *W. MacLeani* is rather with *W. grandis*, though strikingly different in shape. Young shells of these species at the same stage of growth show the following distinctive characters : —

W. MacLeani. *W. grandis.*

Rounded front Narrowed front

no fold mesial folds

margin in one plane margin flexuous

larger foramen. smaller foramen.

The species is named after my friend D. MacLean, Esq., J. P.,
•who has rendered great service in the cause of South Australian palaeontology, particularly by the bringing to light under great difficulties the cranium of a balamoid whale imbedded in the Eiver Murray Cliffs at Murbko, fifteen miles north of

Blanchetown.

• Locality and Horizon. — *W. MacLeani* is profusely abundant in a chalky limestone, which commences the limestone and shell beds forming the Upper Murravian series at Blanchetown and northward for about 18 miles. Many of the fossils in this stratum, at a point about three-quarters of a mile south from Mr. MacLean's residence, Glenforslan, are pseudomorphs after selenite, but in the case of the "*Waldheimias* their tests are of the original substance, though their interiors are for the most filled with gypsum. By breaking the shell away there may be obtained most beautiful casts enclosing the loop, the opacity of which makes it a well-defined object as seen through the transparent gypsum.

Waldheimia Vincentiana, spec. nov. Plate x., figs, 1 and 8.

Shell elongated, oval, much longer than wide, greatest breadth in the middle, whence the shell tapers gradually towards the front and beak ; marked with inequidistant concentric lines of growth. Test thick, densely punctated.

Valves nearly equally convex ; the brachial valve most convex in the umbonal region. Lateral margin of the valves nearly straight, front margin slightly bisinuated.

Beak short, prolonged, and transversely truncated by a circular foramen of large dimensions. Deltoidal pieces dis-

tinct, rather small and narrow, beaks moderately well defined.

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An impressed line on the surface of the brachial valve, extending for about one-third its length, indicates the existence of a mesial septum. Interior unknown.

A small shell, bearing an external resemblance rather to *W. Vincentiam* than to any other known species, possesses internal characters totally different from those of any *Waldheimia*. The septum is remarkably long, extending through a distance of .65 inch of a total curvilinear length of the brachial valve of .85. The loop is broadly compressed, the forward limb is conduplicate, and is excessively expanded anteriorly and confluent with the returning portion of the loop ; at this point the depth is $\frac{1}{4}$ th of an inch.

Dimensions. — Length, .25 inches; breadth, $\frac{1}{4}$ inch; depth, $\frac{1}{4}$ inch.

Observation. — The only species from the Australian Tertiaries that bears any resemblance to *W. Vincentiana* is *W. gijas* (T. Woods), which has, however, a more elongated shape, and is more attenuated and conspicuously biplicated at the front.

Locality and Horizon. — In the raggy limestones about one mile south from Port Vincent (or Surveyor's Point), west coast of St. Vincent's Grulf (two examples).

Waldheimia Taylori, Etheridge. Plate xi., fig. 2.

Ref. — Annals and Mag. of Nat. Hist., vol. xvii., p. 18, t. 1, f. 3. 1876.

" Shell elongato-ovate, longer than wide ; greatest width near the middle. Peduncular valve exceedingly convex, with two slightly diverging obtusely-rounded ridges proceeding from the beak towards the front, where they become lost, and enclosing between them a narrow space which in its upper part is rounded, and becomes flattened or a little concave towards the front of the shell ; the lateral portions of the valve are also flattened, but not concave ; beak produced, incurved, and truncated by an oblique circular foramen contiguous to the umbo of the brachial valve, but separated from it by a small deltidium. Brachial valve, slightly convex in the umbonal region, becoming almost flat towards the front, but presenting in its longitudinal outline a gentle continuous convexity. Lateral margins a little flexuous ; surface marked by a few concentric lines of growth ; shell distinctly punctate.

Length, 2 inches 3| lines ; width, 1 inch 10 lines ; depth, 1 inch 5 lines.

Locality and Horizon.— Coralline limestone of the Murray

Eiver cliffs, near the Great Bend, S. Aust. Mas. Prac. Geology,
London." Etheridge.

This shell is imknown to me, unless I have mistaken for it
a narrow form of *W. Corioensis*, which occurs at Mannum. It

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is, however, distinguishable from the Mannum fossil by its-
broad front and the tripartite division of the peduncular
valve. *W. Taylori*, *TV. Corioensis*, and *W. sufflata*, which are of
about equal size, are among the largest species of the genus.

Waldheimia Corioensis, McCoy. Plate ix., figs 4 and 7 ; plate x., fig. 4.

Ref. — Palaeontology of Victoria, Decade v., tab. 43, figs. 1 — 3,

1877.

Shell sub-ovate, greatest width about the middle, margin of
.sides convex in the middle. Pedunculated valve very convex
or very obtusely carinated along the middle, sides flattened,
very slightly convex, becoming slightly concave near the
lateral margins ; in profile it is much arched near the large
incurved beak, becoming tangentially straight towards the
front, which is elevated at the margin into a deep sinus

(bisinuate when old). Brachial valve flattened in the umbonal half, with lateral margins abruptly deflected at right angles towards the other valve, becoming gradually depressed in the middle towards the narrowed front ; in old specimens the mesial depression is divided by a wide slight convexity.

Eoramen moderate, deltidium tripartite, the narrow middle portion convex ; beak ridges moderate, angulated.

Surface smooth, with moderate lines of growth. Mesial septum about one-half the length of the shell. Length, 2-3 inches. (Abridged from the original diagnosis.)

A few large terebratulids obtained at Mannum seem to agree generally with the example of *W. Corioensis*, represented by the woodcut on p. 11. The least imperfect of them is shown by fig. 4, pi. x.

A fragment of the umbonal half of a large brachial valve shows some peculiarities of the rostral boss. The hinge plate is broad and deeply concave, the cardinal process is deeply tripartite , the central lobe erect, thick, and compressed, the laterals are divaricate, lamellar, and confluent with the crura?. (Pl. ix., fig. 7.)

A single specimen of another large terebratulid (fig. 4, pi. ix.), though differing greatly in its wide and deep mesial depression, is provisionally referred to this species.

Locality and Horizon. — Lower Murravian, rare in raggy limestones at Mannum (Tate).

Miocene Tertiary, Corio Bay, Geelong ; Jan Juc (abundant), more rare at Muddy Creek (McCoy).

Dimensions of the specimen, fig. 4, pi. x : — Length, 2'65 inches ; breadth, 1*8 inch ; thickness, 1"6 inch. Of the variety, fig. 4, p. ix) : — Length, 22 ; breadth, 2 • thickness, 1*2 inches.

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Waldheimia pectoralis, spec. nov. PL vii., figs, la— d.

Shell elongate to elongate-ovate, longer than wide ; greatest width near the middle \ valves very unequal, lateral margins strongly curved, deflected. Brachial valve strongly convex longitudinally ; at the anterior third flattened ; with a shallow sulcus proceeding from the beak and widening out to the front margin, which is sinuated or slightly plicate. Peduncular valve very convex and deep, with a flattish triangular area corresponding with the sulcus of the other valve.

Loop reaching to near the front margin ; lamellae slender, with a slight curve towards the central line ; reflected portion

opening out to three times the width of the other ; septum high, extending for three-sevenths of the length of the brachial valve.

Beak produced sub-erect, truncated by a very small foramen, and separated by a large crescentric deltidium of one piece, which is corrugated transversely to its length. Surface of the shell with concentric lamellae of growth ; densely and minutely punctated. Immature shell with a shallow sulcus extending to the front margin, which is depressed and sinuous.

Dimensions — Length, 225 inches ; breadth, 1'8 ; thickness, 1*1 inch.

Locality and Horizon. — Xot uncommon in the glauconitic limestone, which forms the base of Blanche Point Cliff, Aldinga.

Waldheimia (?) *sufflata*, spec. nov. Plate vii., fig. 3 ; plate viii., fig. 4.

Shell subovate, greatest width about the middle ; lateral margins convex in the middle, becoming straight or slightly bisinuated (rarely biplicate) towards the narrow rounded front.

Test thick, surface smooth, with numerous moderately strong lines of growth. Shell structure minutely and closely punctate, as viewed under a lens. Peduncular valve A r ery convex in a longitudinal direction, and regularly convex transversely.

Beak strongly incurved, slender, fox'amen minute. Deltidium of one piece, broadly triangular and deeply concave. Brachial

valve very convex, faintly impressed or flattened medially, becoming gradually depressed in the middle towards the somewhat narrowed front.

Septum a little less than half the length of the valve. Loop unknown.

Dimensions. — Length of a large specimen, 265 inches ; width, 18 ; depth, 1-6.

Observations. — This species has the minute foramen and slender beak of *W. pectoralis*, but in other respects the differences are very great. Some examples partake of the shape of certain varieties of *W. Corioensis*, but despite this

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general resemblance, *W. snjllata* is at once known by its incurved, minutely perforated beak.

Locality and Horizon. — Bare in the yellow Polyzoal calciferous sands, forming the base of the sea cliffs, south side of AVillunga JettyAldiriga Bay; and rough shelly limestones at Surveyor's Point and Stansbury, Yorke's Peninsula. Many examples.

Terebratulina Scoulari, »pec. nov. Plate viii., figs. 3a— 3d.

Shell pentagonal, about half as long again as wide, broadest about the middle, tapering gradually towards the truncated front ; sides and front slightly curved. Peduncular valve uniformly convex, with a slight median depression in the anterior half of the valve. Brachial valve moderately convex. Surface ornamented with very numerous radiating rounded ribs, which are repeatedly bifurcated ; the interspaces rather narrower than the breadth of the ribs ; the entire surface crossed by close-set concentric lines of growth ; the ribs about the margins of the umbonal regions with imbricating scales.

Hinge line narrow, arched ; beak moderate ; foramen, in the adult, complete, circular, moderate, laterally margined by small deltidial plates.

Loop that of *Terebratulina*.

Dimensions. — Length, 1/2 inch ; breadth, '75 ; thickness, '5.

Observations. — *T. Scoulari* belongs to the group typified by *T. caput-serjpentis*, from which it differs in being more depressed and attenuated towards the front, and in having the ribs and concentric lines more numerous and finer; the form of the loop is also different. In shape it closely agrees with *T. Jctpohica*, as also to the recent Australian species *T. cancellata*. From the latter it differs in its more pentagonal outline, less inflated valves, and coarser ribbing ; characters which are very pro-

nounced in the young. The annulus of the loop of *T. Scoulari* is rather subcircular ; it is smaller and more contracted than that of either of the above.

The specific name is in compliment to Mr. Gavin Scoular, who has so ably worked out the geology of Munno Para.

Locality and Habitat. — Bare in the Upper Murravian, near Morgan, and at Muddy Creek, Victoria (Tate). Common in the Middle Murravian white calciferous sand rock. Not uncommon in the glauconitic limestones of Aldinga Bay (Tate). Bare in the Muloowurtie clays, Torke's Peninsula (Temper).

Terebratulina Davidsoni, Etheridge. Pl. xi., figs. 6a— 6d.

fief.—*T. (?) Davidsoni*, Annals and Mag. of Nat. Hist., 1876 r t. 1, f. 1, p. 16.

" Shell small, oval, flattened, tapering towards the beak, rounded towards the front ; lateral margins in one plane, noi

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sinuous. Peduncular valve slightly convex, with the beak but little produced, truncated by a slightly oblique foramen more or less below the apex of the beak, excavated out of its sub-

stance, and completed by the two small deltidial plates and the umbo of the brachial valve. Brachial valve almost flat, with the slightest indication of a mesial sinus in the front ; hinge-line a little arched. Surface of both valves ornamented with a large number of fine radiating ribs, occasionally bifurcating, and a few concentric lines of growth; margins crenulate." — JStheridge.

The founder of this species, being unacquainted with its internal portions, placed it with a doubt in the genera *Terebrattdina*, but having seen the loop, which offers no special character, I can confidently refer it to that genus.

The shell is conspicuous from its almost hemispherical shape ; the peduncular valve being strongly convex and the brachial valve flat, or with a slight medial depression. The ribs, which are usually somewhat thick and crowded, are crenulated and nodulated towards the front by strong lines of growth. The edge of the valves is conspicuously crenulate.

Dimensions of a large and narrow specimen — Length, '46 width, "35. One of the ordinary size gives — Length, - 35 ; width *3 ; depth, "28 inch.

Locality and Horizon. — This is one of the most widely diffused of our palliobranchs, though not generally abundant. More commonly the valves are widely gaping.

In the Upper Murravian beds near Morgan on the River

Murray and cotemporaneous beds of Muddy Creek, near Hamilton, Victoria (Tate).

In the Lower Murravian at Mannum (Tate), and in the coralline limestone at Mount Gambier ("Woods and Tate).

In the glauconitic limestones, Aldinga Bay, and corresponding beds at Surveyor's Point and Stansbury, Torke's Peninsula (Tate).

Terebratulina lenticularis, spec. nov. Plate vii., figs. 4a— c.

Shell small, broadly oval, a very little longer than wide.

Brachial valve regularly convex deeper than the peduncular valve, which is moderately convex and slightly impressed in the middle line towards the front. Surface ornamented with numerous rounded, bifurcating radial ribs, crowded towards the front, and with imbricating concentric lines of growth towards the same region. Beak stout, obtuse ; hinge line narrow, slightly arched ; fissure large, deltidial pieces inconspicuous.

Dimensions. — Length, *35 ; breadth, - 3 ; depth, *15 of aa inch.

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Observations. — This species is with some difficulty to be distinguished from *T. Seebachi*, Schloenbach, from the Upper Chalk of Hauover and Oligocene of Saxony, as it resembles it in shape and ornamentation. *T. lenticularis* differs, however, in its arched hinge line, smaller and obtuse beak, and in the limited development of the deltidium.

Locality and Horizon. — Abundant in the glauconitic limestones, north of Blanche Point, Aldinga Cliffs (Tate), and in the yellow clays at Muloowurtie, Yorke's Peninsula (Tepper).

Terebratulina triangularis, spec. nov. Plate viii., figs. 1a— 1d.

Shell triangularly ovate, a little longer than wide ; widest at about the anterior — third ; front and sides rounded. Surface ornamented with acute ribs, bifurcating ; interspaces linear, fimbriated by imbricating lines of growth. Brachial valve flattish, slightly convex in the posterior part, with a faint median depression towards the anterior, which produces a faintly sinuous front margin. Peduncular valve regularly convex. Beak prominent, acute ; hinge line narrow and straight ; foramen longitudinal, large, and triangular.

Dimensions. — Length, .35 inch ; breadth, .3 inch ; depth, .15 inch.

Locality and Horizon. — In the marls at Blanche Point,

Aldinga Cliffs, and in the chalky limestone, Bunda Cliffs, Great Australian Bight.

Terebratella Tepperi, spec. nov. Plate ix., figs. 8a — 8c.

Hounded, moderately inflated, smooth, with concentric lines of growth. Front margin plane.

Brachial valve regularly and moderately convex to nearly flat. Peduncular valve inflated and medially subangulated. Beak broad, blunt, foramen large, deltidia small, separate.

Loop imperfectly known ; but so much as remains in the sole specimen which has been found to afford internal characters is clearly that of *Terebratella*. The medial septum is remarkably short, being less than one-third the length of the valve.

This species belongs to the group typified by the recent *JSTew Zealand T. rubicunda*, Solander, for which it cannot be mistaken.

Dimensions. — Length, "85 ; breadth, "8 ; thickness, "45 of an inch.

Locality and Horizon. — " Muloowurtie Clays," near Ardrosan, Yorke's Peninsula (five examples). Collected by Mr. Tepper, to whom the species is dedicated. For an account of

the geology of the Muloowurtie Cliffs see his paper Trans, of this Society, vol. ii., p. 74.

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Terebratella (?) *pentagonalis*, spec. nov. Plate ix., figs. 5a— 56,

Shell small, obtusely pentagonal, longer than wide, broadest about the middle. Valves moderately convex, flattened along the middle ; surface marked with imbricating lamella; concentric with the lines of growth.

Beak large, rather produced, obtuse ; foramen large, oblong, incomplete ; deltidial pieces small. Interior unknown, but the shell is placed in the genus *Terebratella*, because of its incomplete foramen, and general resemblance to *T. rubicunda* and its allies.

Dimensions. — Length, .65 ; breadth, .5 ; thickness, .35 of an inch.

Locality and Horizon. — Grlauconitic limestone, north side of Blanche Point, Aldinga Bay. Two examples.

Terebratella furculifera, spec. nov. Plate xi., figs. 1a— 7c.

Shell orbicular-oval, a little longer than wide ; side and front margins in one plane. Valves moderately convex, the peduncular valve a little the deeper, obtusely carinated in the rostral half. Surface smooth, with a few concentric lines of growth ; conspicuously punctate under a lens.

Beak small, erect, depressed with strong ridges ; truncated -by a small triangular foramen ; deltidial pieces rather large, dis-united.

Septum less than half the length of the valve. Loop doubly attached, first to the diverging portions by transverse processes from the end of the septum, and secondly by a forked process which unites the abruptly truncated terminal bend of the loop to the summit of the extremity of the septum. I have no less than five specimens showing this peculiar conformation of the oop.

Dimensions. — Length, "65 ; breadth, - 55 ; depth, "3 of an inch.

Observations. — Externally the species resembles *Terebratula Aldingae* and *Waldheimia insolita*, but may be recognised by the form of its incomplete foramen.

Locality and Horizon. — In the glauconitic limestones, Blanche, Point, Aldinga Bay. Six examples.

Terebratella (?) *Woodsii*, spec. nov. PL ix., figs. 10a — 10c.

Bef. — *Waldheimia Corioensis*, Trans. Boyal Society, N.S.W. ;
p. 79, fig. 3a— 3c, 1878.

The Rev. Mr. Woods referred a small shell with a deep depression on the smaller valve from Table Cape to *W. Corioensis*, McCoy. But until young shells of that species are known, it would be well to regard the identification as bad. The only palliobranch from our Tertiaries, which possess a mesial depression and somewhat similar shape to it is the young

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shell of *Magasella compta*, but the beak and foramen of the latter are very small. The excellent figures of the species, drawn by Mr. M. Johnston, which I have had reproduced, show a large incomplete foramen, and may therefore indicate a young *Terebratula* or allied form. If the shell be an adult, then it probably belongs to *Terebratella*, where I have ventured to place it.

Locality and Horizon. — Miocene strata, Table Cape, Tasmania (Johnston).

GENUS *MAGASELLA*, Dall.

The four following species are referred to *Magasella*, because

of the strong resemblance they bear to *Terebratella* (7) *Gumingiana*, now transferred by Mr. Davidson to Dall's genus, whose description has not yet reached me. They agree externally in having a prominent beak with a small foramen and the deltidium blended with the shell ; the loop presents the characters of *Terebratella*, whilst in others it seems to be related to that of *Magas*.

Magasella compta, Sowerby. Pl. x., figs. 6a— 6e.

JRef. — *Terebratella compta*, Sow., in Strezlecki's *Phy. Desc. of N.S.W., &c*, 1845, p. 297, t. 19, f. 4 (*JVon Woods' Geol. Obs. S. Aust.*, p. 74, 1862).

Terebratella compta, Woods, *Trans. Phil. Soc, Adelaide*, f. 4>a — b (? non 4c — e), 1865. (*JSfon Etheridge, jun., Ann. and Mag. Nat. Hist. t. 2, f. 5, p. 19, 1876.*)

" Shell smooth, thin trapeziform ; lateral margins sub-incurved, anterior margin small obtuse. Hinge area large, with a longitudinal depressed line at either side. Brachial valve triangular, rounded slightly, truncated in front with a small median sinus ; peduncular valve faintly keeled. Foramen terminal, small, and round." — Sowerby. To which description Mr. Woods has added brachial valve sub-cordiform, flat, and both valves marked with concentric lines of growth.

The young is nearly circular in outline, with a marginal

median sinus in the brachial valve ; beak and foramen small,
with little or no deltidial area.

The loop is only known by one example (fig. 6e) ; compared
with that of 31. Gumingiana, the following differences are
observable : — In M. Gumingiana the erect and thick projection
of the septum has, in reality, two distinct slender loops
attached to it. But in the example before us the loop at its
reflection is broadly expanded, and embraces the elevated part
of the septum ; it then extends into an almost complete circle.
It thus has considerable analogy with that of Magas (sensu
strictu). The different dispositions of the loop in M.

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Cumingiana and 31. compta arise from the relative massiveness-
of the septum and loop ; in the former the slender loop is lost
in the excessively stout septum along which it may be
considered to be decurrent, till it becomes again free, and
forms the second annulus ; whereas in 31. compta the septum
is lost as it were in the much greater mass of the broad
lamella 1 of the loop, and the loop seems to be only once
attached to the septum.

Dimensions of a larger specimen : — -Length, 9 ; breadth, '7 ;,
depth, # 5 of an inch.

Observations. — 31. *compta* being the oldest described among the related forms need not here be compared with them ; its salient characters may, however, be pointed out. Trapeziform, contracted, depressed and biangulated in front ; hinge line straight, very broad ; beak suberect ; deltidial area very large. The species has hitherto been almost unknown except by Sowerby's figures and descriptions, as the common shell which is commonly referred to it, is a distinct though allied species. Figs, ia and 4c of Mr. "Woods' paper, op. cit., doubtlessly represent Sowerby's shell ; but his fig. 4c agrees well with 31. *Woodsiana*, mini, and I strongly suspect that the interiors shown by figs. 4d and 4e belong to the same. A comparison of the original figures of *T. compta*, and those of *T. compta*, Etheridge, op. cit., cannot fail to convince one that two species are represented by them.

Locality and Horizon. — Not rare in the Lower Murravian beds at Mannum on the B. Murray, and near Callington, on the E. Bremer. Eare at Stansbury, Surveyor's Point (Tate), at Muloowurtie, Torke's Peninsula (Tepper) ; Mount Gambier, South Australia, and Portland, Victoria (Woods).

The types were obtained " from a raised beach at Point Fairy," on the Cape Otway coast, Victoria ; but as in other instances, Strezlecki mistook our Older Tertiary deposits for Post Tertiary beaches.

Magasella Woodsiana, spec. nov. Plate x., figs. 3«— 3d.

Syn. — *Terebratella compta* (pars), Woods, loc. cit., fig. 4c — 4e
(1865).

id., Etheridge, loc. cit., 1876.

Shell pyriformly ovate, longer than wide, margins flexuous.

Valves unequally convex, peduncular valve much the deeper,
which is longitudinally and obtusely carinate. Brachial
valve regularly convex in the umbonal half, medial depressed
towards the front.

Beak broad and stout, slightly incurved and truncated by a
nearly transverse circular foramen of moderate dimensions.

Hinge line much arched, beak ridges sharply defined, enclosing

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a large triangular area, somewhat concave except where inter-
rupted by a broad medial longitudinal ridge.

Surface with concentric stria? and a few ridges of growth ;
test thin, conspicuously punctate.

A portion of the loop has been illustrated by Mr Etheridge,
and very little more of the interior of the adult shell than is

there shown is known to me, though a great number of specimens have been sacrificed.

In the adult the medial septum is continued to near the front of the valve, and at about half its length it gives off on each side a flatly expanded process by which it is connected with the diverging portions of the loop. The septum does not appear to have been elevated, as in 31. *Gamingiana*. If the specimen to which the following description refers belongs to 31. *Woodsiana*, then little remains to complete our knowledge of the interior of the species. Mr. Woods writes : — " Septum round and solid, lamella? of loop widening to the point of attachment, becoming again contracted at the reflection, and then extending into an almost complete circle with a slight projection towards the hinge."

In young specimens the septum assumes different forms, as I have proved by the examination of more than a dozen specimens from the River Murray cliffs and Muddy Creek. In one from near Morgan the septum is actually adherent to the opposite valve, and the loop shows the same disposition as in 31. *compta* (pi. x., fig. 6e). Between this form of septum and that of the adult every possible gradation is exhibited.

Dimensions.- — Length, "75 ; breadth, "55 ; depth, - 4 of an inch.

Observations. — 31 *agasella Woodsiana* bears a considerable external resemblance to the recent 31. *Cumingiana*, but differs

in its less trapezoidal shape, and in the greater breadth and height of the deltidial area. Internally the characters are widely different in detail, and the thick mesial ridge in the interior of the peduncular valve of 31. *Cumingiana* is peculiar to that shell. The Port Jackson specimens of *Magasella* presented by the Rev. Mr. Woods, who directed my attention to the similarity between it and the Mount Gambier fossil, seems to me to agree better with Reeve's *Boucliardia Jibula* than with *Terebratella Cumingiana*, but which Mr. T. Davidson believes to be only a varietal form of the latter.

Locality and Horizon. — Upper Murravian, near Morgan, and at Muddy Creek (Tate) ; Lower Murravian, at Morrundi, on the River Murray, near Blauchetown ; Mannuin ; and near Callington (Tate). Mount Gambier (Woods & Tate). Yellow calciferous sands, Aldinga Bay ; and at Stansbury (Tate).

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Magasella Tenisoni, Woods. Plate xi., fig. 5a— 5c.

Reference. — *Terebratella Tenisoni*, Trans. Phil.JSoc, Adelaide, 1865, t. ii., figs. 5a, 5b, and 6.

"Shell elongated, usually convex. Peduncular valve, trapeziform, keeled deeply, and terminating in a notch at the anterior margin. Brachial valve orbicular and tapering to a point

which fits into the notch on the other valve. Beak obtuse, deltidium striated, foramen oblong.

" Septum thickened, curved, and produced so as to touch the opposite valve ; attachments of the loops at the centre, and nearer to the shell than to the edge of the septum. Muscular impressions deep. Hinge and crura sloping away from the septum, with a deep sinus in the centre.

" Size, variable, but adult specimens 0"7, breadth 0'4 of an inch.

"This curious species has strong points of resemblance to T. JEvansii, but whose individual characters are very distinct. In both the septum is produced so as to touch the opposite valve." — Woods.

Locality. — Mount Gambier and Portland (Woods).

Magasella deformis, spec. nov. Plate x., figs. 5a— 5c.

Shell oblong-ovate, margins of sides convex in the middle. Peduncular valve very convex, obtusely carinated along the middle, sides convex becoming flat or slightly concave near the lateral margins. Brachial valve regularly convex in the umbonal half, with lateral margins abruptly reflected, becoming abruptly and considerably depressed towards the narrowed front.

Beak depressed, truncated by a minute foramen ; deltidial area broad and concave ; beak ridges well defined.

Surface with a few lines of growth ; malleated punctate under a lens.

Mesial septum thick, about half the length of the valve, abruptly produced so as to touch the opposite valve ; diverging; lamellae of loop nearly parallel, connected by short transverse processes to the point of origin of the septal projection ; thence continued beyond for about half as far again, widening at the inflection, and apparently becoming attached near the apex of the septal projection.

Dimensions. — Length, '45 ; breadth, - 3 ; depth, "27 of an inch.

Observations. — The reflection of the lateral margins of the valves is a character belonging to the adult shell. In its young state it resembles *M. compta*, and somewhat *M. Woodsiana* at the same stage of growth, but is at once distinguished by its beak and its malleated test.

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Locality and Horizon. — In the glauconitic limestones Blanche Point, Aldinga Bay. Nine examples.

Thecidium australe, *pec. nov. Plate ix., figs. 3a— 3c.

Shell minute, one-eighth of an inch in diameter, triangular-ovate, inequilateral, attached by the umbonal surface of the peduncular valve. Surface smooth, conspicuously punctate, and ornamented by a few thick folds of growth.

Brachial valve flattish ; hinge line straight, but interrupted in the middle by a small subquadrate cardinal process ; interior unknown.

Peduncular valve, inflated and produced at the umbo, which is obliquely truncated by the surface of attachment ; interior with coarse radial stria?, which crenulate the thin margin.

Hinge teeth prominent. Within the umbonal cavity is a cup-shaped cavity for the attachment of the adductor muscles, divided longitudinally by a septum, which is continued half as far again beyond it.

This notice is, I believe, the first record of the occurrence of the genus, either recent or fossil in the southern hemisphere.

Locality and Horizon. — In the Miocene strata at Muddy Creek, from which I obtained one perfect shell and four peduncular valves.

Rhynchonella squamosa, Hutton. Pl. ix., figs. 9a— 96.

Ref— Cat. Tertiary Mollusca of New Zealand, p. 37, 1873.

Syn. — *Rhynchonella coelata* (McCoy, MS.), Woods, Trans.

Eoy. Soc, N.S.W., p. 77, 1878.

Rhynchonella lucida, McCoy, M.S. (jion Gould, 1860).

"Shell irregular, more or less orbicular ; valves inequal, the ventral flatter with a deep groove ; dorsal valve very convex ; both with fine radiating scaly stria?. Length, "7 ; breadth, "75 ; height, 5. Easily distinguished from *R. nigricans* by its more numerous stria?." — Hutton.

Remarks. — The task of establishing a correct synonym of manuscript names is one that is very properly unattempted by monographers ; but in this instance the manuscript names of McCoy have a fictitious value from the fact that they have been published with such remarks as may lead up to their identification. The *Rhynchonella* found at Table Cape, Tasmania, was pronounced by Tenison Woods (Trans. Roy. Soc. Tasm., p. 15, 1874) to be identical with *R. lucida* of McCoy, common in the Geelong Miocene beds ; subsequently we find the same author (Trans. Roy. Soc, N.S.W., 1878) referring to it as *R. coelata*, McCoy. Doubtless the two names have been given to the same shell ; and it is probable that the change of denomination was

necessitated by the knowledge of the prior occupation of the cognomen lucida by a recent shell described by Gould in 1860.*

The identity of *R. coelata* with *R. squamosa*, Hutton, rests upon the characters given to it by Mr. Woods, and upon the observations of Mr. Davidson published therewith (op. cit. p. 77).

"Rounded trigonal, with a strong mesial fold, with many fine imbricating ribs." — T. Woods.

" A most beautiful species, very closely related to *R. nigricans*, from New Zealand. Some examples ill external shape cannot be distinguished, but I have not observed on any recent *R. nigricans* such prominent and strongly marked imbricated stripe. The fold and sinus seem more strongly marked on the fossil form. The ribs also seem smaller or more delicate than on real *nigricans*." — T. Davidson.

It will be observed that Mr. Davidson uses the same characters to distinguish the fossil from the recent *R. nigricans* as Prof. Hutton had previously employed in founding the species *R. squamosa*.

Locality and Horizon. — In the glauconitic limestone, north of

Blanche Point, Aldinga Cliffs (Tate) ; yellow clays of Mulloowurtie (Tepper), and at Stansbury (Tate), Yorke's Peninsula; on the R. Bremer, at Salem, near Callington (Tate).

Muddy Creek, Hamilton (Tate), and from several Miocene beds in Victoria (3fcCog) ; Table Cape, Tasmania (T. Woods) ; Oamaru Formation (Eocene) Broken River, New Zealand (Hutton) .

Explanation of Plates.

Plate VII.

Fig. 1. *Waldheimia pectoralis*, natural sizes. Aldinga. a and o,

two views of an adult shell ; c and d, id of a young shell.

Fig. 2a-b. *Waldheimia furcata*, natural size. Aldinga.

Fig. 3. *Waldheimia suffiata*, natural size. Surveyor's Point.

Fig. 4. *Terebratulina lenticularis*, much enlarged. Aldinga.

a, brachial valve ; h, lateral view of both valves ; c, front

view.

Fig. 5. *Terebratida bulbosa*, a-b, two views, natural size.

Edithburgh.

Fig. 6. *Waldheimia Tateana*, a-b, two views of the same

specimen, natural size. Aldinga.

* This species is described as " sub-circular— under the lens radiately striated," and has no analogy with our fossil.

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Plate VIII.

Fig. 1. *Waltlheimia Macleani*. Blanchetown. a-b, two views of

the same specimen, natural size ; c, brachial valve of a

young shell, natural size.

Fig. 2. *Waldheimia jimbrata*. Aldinga. a-b, two views of the

same specimen, natural size.

Fig. 3. *Terebratulina Scouhtri*. Blanchetown ; a, brachial valve

natural size ; b, enlarged view of portion of the same ;

c, slightly enlarged view of the loop of another specimen ;

d, a young shell, slightly enlarged.

Fig. 4. *Waldheimia suffiata* ; lateral view of specimen, natural

size, plate vii., fig. 3.

Fig. 5. *Terebratula vitreoides* ; a-b, two views of the same specimen, natural size. Aldinga.

Fig. 6. *Waldheimia Tateana* ; a-c, three views of a biplicated example, natural size. Aldinga.

Fig. 7. *Terebratulina triangularis*, slightly enlarged ; a-c, three views of a specimen from Aldinga ; d, brachial valve from Bunda Cliffs.

Fig. 8. *Waldheimia divaricata* ; a-b, two views of the same specimen, natural size. Mannum.

Fig. 9. *Waldheimia Johnstoniana* ; a-b, two views, natural size. Aldinga.

Plate IX.

Fig. 1. *Terebratula subcamea* ; a-b, two views of the same specimen, natural size. Bunda Cliffs.

Fig. 2. *Waldheimia Tateana*, natural size. Stansbury.

Fig. 3. *Thecidium australe*. enlarged views. Muddy Creek.
a, brachial Ar valve ; b, interior of peduncular valve, a portion of the hinge area has been removed to show the adductor impressions ; c, lateral view of the specimen, fig. 3a.

Fig. 4. *Waldheimia Corioensis*, McCoy (?) ; natural size. Man-
num (?)

Fig 5. *Terebratella pentagonalis* ; a-b, two views, natural size.
Aldinga.

Fig. 6. *Waldheimia insolita*, natural sizes ; a, from Bunda
Cliffs ; b, from Aldinga.

Fig. 7. *Waldheimia Corioensis* ; interior view of the umbonal
part of a brachial valve, natural size. Mannum.

Fig. 8. *Terebratella Tepperi*. Muloowurtie ; a-b, two views of
the same shell, natural size ; c, interior of brachial valve
of another specimen, natural size.

Fig 9. *JRhynchonella squamosa*, natural sizes ; a, fragment of a
peduncular valve, B. Bremer ; b, perfect shell from
Aldinga.

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