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ON

NEW CRETACEOUS FOSSILS

FROM

CALIFORNIA

BY

CHARLES A. WHITE M. D.

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CONTENTS.

ILLUSTRATIONS.

ON NEW CRETACEOUS FOSSILS FROM CALIFORNIA.

By CHARLES A. WHITE.

GENERAL REMARKS.

In Bulletin No. 15 I referred to certain Cretaceous strata which are found in Mendocino County, California, and Todos Santos Bay, Lower California, as belonging to a series which probably occupy a position between the Chico and Shasta Groups. I have not had an opportunity to personally examine the strata at either of the localities referred to, but those of Mendocino County have been examined by Dr. G. F. Becker, of the U. S. Geological Survey, and he has submitted to me for examination a small collection of fossils which he obtained there. Two or three small collections have also been sent to the U. S. National Museum from the Todos Santos Bay locality by Mr. C. R. Orcutt, of San Diego. Owing to the generally disturbed condition of the strata of the Pacific coast region and the limited exposures of the strata in question, comparatively little has been learned as to their relations with the other formations of that region. Dr. Becker found the strata of Mendocino County to consist of a large series of sandstones and sandy shales, with some argillaceous layers. He reports the series there to reach some thousands of feet in thickness, and in general aspect and composition to closely resemble the Chico Group as it is known in California. The exposures which he examined extend from a little north of the town of Wallala[1] to the neighborhood of Fort Ross; and the fossils which he collected from those strata were found near the water's edge upon the shore of the Pacific Ocean, presumably near the base of the series. He found those strata resting unconformably upon a metamorphic series which he believes to be equivalent with the Knoxville beds of the Shasta Group, but he was unable to discover any contact with the strata above them.

The strata at the Todos Santos Bay locality, which upon paleontological grounds I regard as equivalent with the Wallala beds, appear from Mr. Orcutt's notes accompanying his collections to be only slightly exposed there. The locality is about 60 miles south of the southern boundary of the State of California, at the southern shore of the Bay,

[1] This is regarded as the correct spelling by Dr. Becker, but upon some maps the spelling is given as Gualala, and by some persons the name is spelled Walhalla.

and at the base of a sea-cliff some 40 or 50 feet in height. The layer from which Mr. Orcutt obtained the fossils which are described in this bulletin has an exposed thickness of only some 5 or 6 feet, and it is so near the water's edge as to be nearly reached by the tides. From Mr. Orcutt's notes I infer that the whole cliff exposure there does not belong to the same formation, but at present I have no other information than that above given.

Since so little is known of the stratigraphical relations of the Wallala and San Diego beds with other formations, I cannot now discuss them fully, but I shall give them the provisional name of the Wallala Group, referring those of both localities to one and the same formation. Their present discussion must necessarily be mainly paleontological; and although the collections are comparatively so small, they are, in my opinion, of more than usual interest. They indicate a fauna which, while it is of decidedly Cretaceous character, seems to be quite different from any Cretaceous fauna hitherto known upon the Pacific coast.

Although the two localities at which the strata of the Wallala Group have been found exposed are more than 500 miles apart, and no other strata bearing a similar fauna are known in all that region, I feel quite confident that they are not only equivalent with each other, but that they represent a formation which has not hitherto been recognized. Still, the collections which have been made are too small to warrant the publication of such an opinion with that confidence which the study of large collections would give.

The specimens sent by Dr. Becker are all in a bad state of preservation, and a part of them have therefore been determined only generically. The following is a list of them: *Coralliochama or cutti* (n. s.), *Ostrea*, *Inoceramus*, *Pecten*, *Cylichna*, *Turritella*, and *Solarium wallalense* (n. s.). The *Solarium* and *Coralliochama* are described and figured as new species in this bulletin, the latter as the type of a new genus. The *Inoceramus* is a large discoid form, some of the examples having had a diameter of nearly or quite 30 centimeters. All the specimens of this species, however, like those of the remaining members of the foregoing list, are too imperfect to allow of more than generic identification.

The specimens which Mr. Orcutt has sent to the National Museum are in a better state of preservation than those of the Wallala locality. They represent the following species: *Coralliochama orcutti*, *Nerita* ———?, *Cerithium pillingi* (n. s.), *C. totium-sanctorum* (n. s.), and *Trochus* (*Oxystele*) *euryostomus* (n. s.). Besides these, there are certain fragments in the collection which indicate the existence of other species. Indeed it is evident that all the fossils which have yet been found at both the Wallala and San Diego localities represent only a small part of the fauna to which they originally belonged. They are, however, regarded as of sufficient importance to warrant their publication in the present form. They represent at least five new species and one new genus; and they seem also to represent the fauna of a Cretaceous for-

mation which has not heretofore been recognized. The character of these fossils seems to indicate for them the age of the Middle Cretaceous; and in some respects they remind one of the Gosau formation of Europe.

CHAMIDÆ.

Genus CORALLIOCHAMA (nov. gen.),

Shells fixed by the apex of the lower, or right, valve, growing separately or in clusters. Test thick, consisting of three layers, the outer one being prismatic, the middle cellular, and the inner porcellanous. The space which was occupied by the animal was very small as compared with the bulk of the shell, and it is situated eccentrically. Lower valve irregularly subconical, more or less distorted, much deeper than the other valve; beak distorted as a consequence of its attachment to a foreign object; ligamental groove more or less distinct, extending from the apex to the hinge margin. Upper valve convex, its beak broad and incurved to the hinge margin of the lower valve; ligamental groove marginal; internal cavity partially divided into unequal parts by a more or less prominent longitudinal septum. Hinge essentially the same as that of *Plagioptychus* Matheron, *Ichthyosarcolithes* Desmarest, and *Caprina* d'Orbigny.

The test of both valves consists of a thin outer prismatic layer, a thick cellular middle layer, and a thin porcellanous inner layer. The middle layer constitutes the bulk of both valves. In the lower valve it consists of slender angular thin-walled tubes which extend the full length of the valve, increasing in number with the increasing size of the shell, each tube being divided into small cells by numerous thin transverse partitions. The structure thus produced somewhat resembles that of a coral of the Favositidæ, and it is also closely similar to that of corresponding parts of *Radiolites* and *Sphærulites*. The inner portion of the middle layer of the upper valve has the same cellular structure as that which has just been described for the lower valve, except that the longitudinal arrangement of the cells is not so evident; and the teeth of both valves are mainly or wholly composed of shell-substance which possesses this cellular structure. The outer portion of the middle layer of the upper valve, however, has a structure similar to that which is possessed by the upper valve of Plagioptychus. It consists of numerous thin, close-set radiating vertical plates or septa which extend from the beak to the free margin, their outer edges abutting against the outer prismatic layer, and at their inner edges they blend with the inner cellular portion of the middle layer.

This proposed new genus stands near to *Plagioptychus*, *Ichthyosarcolithes*, and *Caprina*, agreeing with them all in the general character of the hinge and of the ligamental grooves, and in the presence of an outer prismatic shell-layer. It further agrees with *Plagiotychus* in the struct-

ure of the outer portion of the middle shell-layer of the upper valve; but it disagrees with that genus in the multicellular structure of the thick middle layer of the lower valve, and that of the inner portion of the middle layer of the upper valve; those portions being porcellanous in *Plagioptychus*.[2] Comparing the shell-structure of *Coralliochama* with that of *Ichthyosarcolithes*, the cells of the former are seen to be much more uniform in size; and the large so-called water-chambers in the thick shell-walls of the latter are wanting in those of the former. Also the slender radiating plates or septa of the outer portion of the middle layer of both *Coralliochama* and *Plagioptychus* are apparently wanting in *Ichthyosarcolithes*. At least such a structure seems never to have been described.

It is quite evident, however, that there is homological relationship between *Caprina*, *Plagioptychus*, *Ichthyosarcolithes*, and *Coralliochama*, as regards the cellular character of their shells. The radiating canals of the upper valve of *Caprina* (which seem to be foreshadowed in *Monopleura* by a radiate striation that is sometimes observable), may thus be compared with the narrower interspaces between the radiating septa which characterize the upper valve of *Plagioptychus* and of *Coralliochama*. In like manner the simple so-called water-chambers of the lower valve of *Caprina* may be compared with the complex cellular structure of the corresponding valve of *Ichthyosarcolithes* and of *Coralliochama*, reaching the maximum of subdivision, if not of complexity, in the latter genus.

Coralliochama orcutti (sp. nov.)

(Plates I, II, III, and IV.)

Sphærulites? White, 1885, Bull. U. S. Geol. Survey No. 15, page—

Shell reaching a large size, growing both singly and in clusters, one example in the collection showing a cluster of eight individuals. Lower valve irregularly subpyramidal, usually much elongated and more or less distorted; its free border transverse or oblique, the posterior side in the latter case being the lower; ligamental groove somewhat distinct; the space which was occupied by the animal comparatively small, eccentric, the thinnest portion of the shell-wall being at the part which

[2] It is proper to remark that in all these comparisons with the genera named, I have had in mind the emended generic diagnoses which are given in Zittel and Schimper's Handbuch der Palæontqlogie; and which seem to me to be correctly set forth by those authors. The genus *Plagioptychus* has not hitherto been known in North America, and I have not had an opportunity to examine the shell-structure of authentic specimens of that genus; but I cannot believe that those eminent savants would have overlooked in *Plagioptychus* such a multicellular structure as characterizes the genus here proposed, and which is its distinguishing characteristic. It will be seen that this proposed new genus rests mainly or wholly upon the multicellular structure of the principal part of the shell; and that this structure is in especial contrast with the porcellanous texture of the corresponding parts of *Plagioptychus*.

corresponds to the postero-basal part in ordinary bivalves. Surface, when the outer prismatic layer is present, marked by fine longitudinal lines, and somewhat more distinct concentric lines of growth. The coarser markings of the valve consist of a greater or less number of concentric undulations, which are crossed by longitudinal corrugations that are usually more conspicuous upon the side which bears the hinge, especially the part adjacent to the hinge margin. The prismatic layer is moderately thin, and is composed of minute vertical prisms which are visible only under a lens. The middle shell-layer reaches a maximum thickness in old shells of nearly or quite 30mm. This layer is composed throughout of a mass of very small, angular thin-walled cells. The cells have a good degree of uniformity of size, their longitudinal arrangement and angular shape being quite distinctly seen by side view of weathered specimens. By vertical view they are seen to be of irregular shape and arrangement, but concentric lines of accretion are sometimes observable in cross sections of the valve. The inner porcellanous layer is thin, and under a lens it is seen to consist of numerous concentric laminæ.

The upper valve is broadly convex, becoming large and strongly arched in old shells; beak prominent, broad, incurved and usually directed a little forward, but sometimes it has a slight backward inclination. Surface, when the outer prismatic layer is present, having an approximately smooth aspect; but it is marked by numerous lines of growth and a multitude of very fine radiating lines. Specimens having the prismatic layer exfoliated or weathered off show the edges of the numerous close-set radiating septa of the outer portion of the middle layer. These septa are moderately deep, and are so joined together by their inner edges in pairs and double pairs, that the innermost spaces between them are wider than those which appear at the outer surface of the layer. The inner portion of the middle layer has a structure essentially the same as that which the whole of the middle layer of the lower valve possesses, but at the thinnest portion of the upper valve this cellular portion of the middle layer is obsolete or wanting especially in young shells. The fact that the specimens of this collection are so frequently crushed by pressure shows that they were not so strong as their great thickness would indicate.

All the details of the hinge have not been clearly ascertained. The principal tooth of the lower valve is known to have been very large and prominent, filling a large part of the space upon the posterior side of the septum of the upper valve. The anterior tooth of the upper valve is not well defined from the cardinal end of the septum, but the posterior tooth is narrow, prominent, comparatively long, and curved outward.

Fully adult shells reached a length of more than 200mm, and a diameter at the free margins of 90mm or more.

Upon a preliminary examination of the collections sent by Mr. Orcutt, and the less perfect examples obtained by Dr. Becker, owing to the

multicellular structure of the shell, which was conspicuously seen, I regarded this form as belonging to the genus *Sphærulites*. But after a more careful study, and working a separated upper valve out of its imbedding matrix, it was found to possess the hinge-structure that has just been described. The specific name is given in honor of Mr. C. R. Orcutt, who first discovered it. (Museum No. 12698.)

Locality: Shore of Todos Santos Bay, Lower California; and near the town of Wallala, Mendocino County, California.

TROCHIDÆ.

Genus TROCHUS Linnæus.

Subgenus OXYSTELE Philippi.

Trochus (Oxystele) euryostomus (sp. nov.).

(Plate V, Figs. 9, 10, and 11.)

Shell small, depressed-subturbinate; volutions about four in number, rounded, and, at the distal border, more or less distinctly appressed against the preceding volution; aperture comparatively large, and, in adult shells, the inner lip is appressed against the last volution as a callus covering of a portion of the base of the shell, but its margin being a little elevated, it forms, together with the thin outer lip, a continuous margin to the aperture. In immature shells the callus of the inner lip is not formed, and the margin of the aperture is therefore not then continuous. Surface marked by numerous sharply raised revolving, somewhat crenulated ridges, separated by grooves of similar width. (Museum No. 13410.)

Height, 6^{mm}; greatest diameter of the last volution, 8^{mm}.

Locality: Shore of Todos Santos Bay, Lower California.

NERITIDÆ.

Genus NERITA Linnæus.

Nerita——?

(Plate V, Figs. 7 and 8.)

Among the fossils which Mr. Orcutt obtained at the Todos Santos Bay locality are a few examples of a small species of *Nerita*. The largest examples are only some 5 or 6^{mm} in diameter, and, although nearly perfect, they do not possess sufficiently salient features to enable one to diagnose them satisfactorily from the very numerous simple forms of that genus already known. (Museum No. 13411.)

CERITHIIDÆ.

Genus CERITHIUM Bruguiere.

Cerithium pillingi (sp. nov.).

(Plate V, Figs. 3, 4, 5, and 6.)

Shell small; spire comparatively short; volutions four or five in number; each volution bearing four or five prominent longitudinal folds, which are usually so arranged upon the spire as to form continuous ridges along its whole length. These long ridges, together with the flattening of the sides of the volutions between them, give a distinctly angular aspect to the shell. Volutions marked by numerous revolving crenulated or tuberculated coarse lines or slender ridges, and the anterior side of the last one is marked in a similar manner; suture not readily distinguishable from the interspaces between the revolving ridges of the spire; aperture, when occurring between the longitudinal folds, comparatively small; beak short; canal narrow.

Height of the largest example in the collection, 12^{mm}; greatest diameter of the last volution, 7^{mm}.

In general aspect, this shell resembles the *C. sexangulatum* of Zekeli from the Gosau formation of Europe, but it differs from that species in being proportionally shorter, in the character of its revolving ridges, and in having the spaces between the longitudinal folds upon the spire more flattened.

The specific name is given in honor of Mr. J. C. Pilling, of the United States Geological Survey. (Museum No. 13408.)

Locality: Shore of Todos Santos Bay, Lower California.

Cerithium totium-sanctorum (sp. nov.).

(Plate V, Figs. 12 and 13.)

Shell small, slender; sides of the spire straight or slightly concave; volutions eleven or twelve in number, not convex; each volution marked by four tuberculated revolving ridges, the anterior one being usually a little more prominent than the other three; at irregular and somewhat wide intervals upon the volutions there are moderately prominent longitudinal folds which are sometimes arranged approximately in rows along the spire, but they are as often scattered; suture impressed, its presence being indicated by a space between the revolving ridges which is a little wider than the other spaces; anterior side of the last volution marked by small revolving ridges, but they are crenulated and not tuberculate like those upon the sides of the spire; beak moderately small; canal narrow.

Length, 20^{mm}; diameter of the last volution, 7^{mm}. (Museum No. 13409.)

Locality: Shore of Todos Santos Bay, Lower California.

SOLARIIDÆ.

Genus SOLARIUM Lamarck.

Solarium wallalense (sp. nov.).

(Plate V, Figs. 1 and 2.)

Shell of medium size, depressed; volutions about four in number, increasing somewhat rapidly in size, carinate at the periphery, broadly convex between that carina and the suture; umbilicus of medium size, having an obtuse carina at its margin; the space between the peripheral and umbilical carinas is flattened, and marked by numerous very small obliquely-radiating ridges, the inner surface of the umbilicus also marked by numerous very small radiating lines or ridges which are made crenulate by the presence of numerous revolving lines. The type specimen shows that the volutions of the spire also bore obliquely-crenulated markings, but it has been so much weathered that they are nearly obliterated.

Height, about 17^{mm}; greatest diameter, about 25^{mm}.

The only example that has been obtained is quite imperfect, but it is described and named for the purpose of presenting the fauna of the Wallala Group as fully as practicable. (Museum No. 13412.)

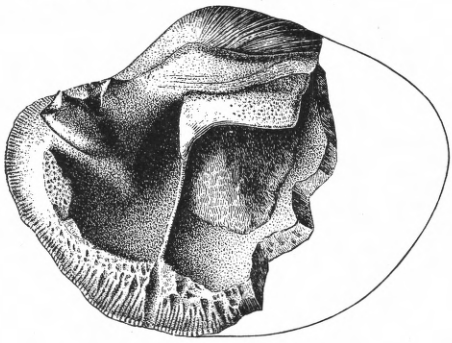
Locality: Near the town of Wallala, Mendocino County, California.

EXPLANATION OF PLATES.

PLATE I.

CORALLIOCHAMA ORCUTTI (page 10).

Fig. 1. View of the cardinal side of a partly grown specimen; **natural size.**
Fig. 2. Lateral view of the same example.
Fig. 3. Interior view of a broken upper valve, showing the hinge.
Fig. 4. A fragment of a lower valve, showing the cellular structure.
Fig. 5. Another fragment showing the same structure.



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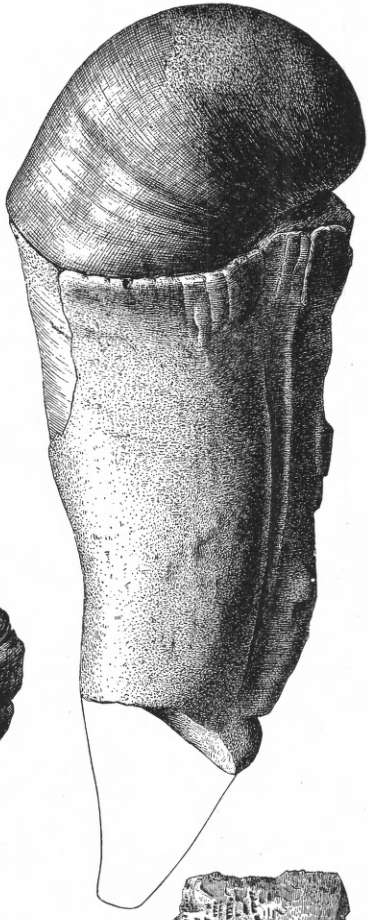

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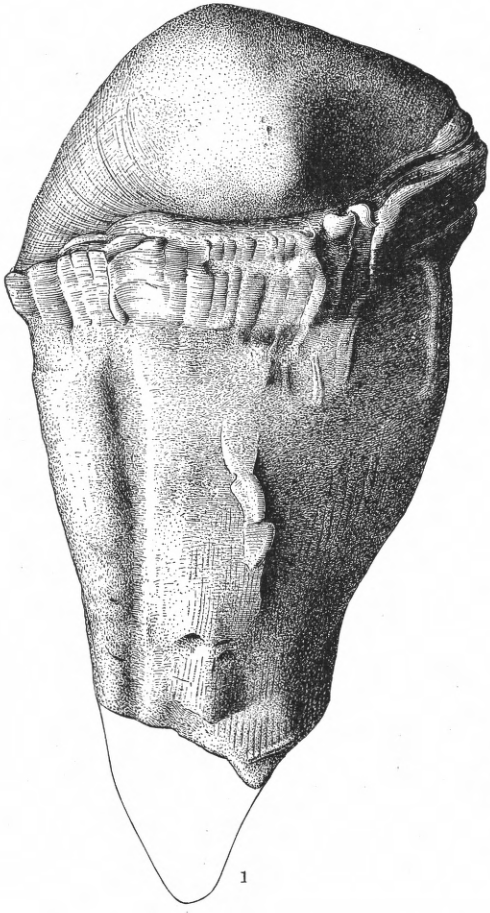

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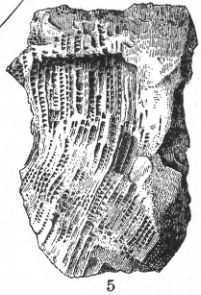

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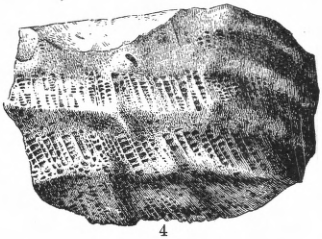

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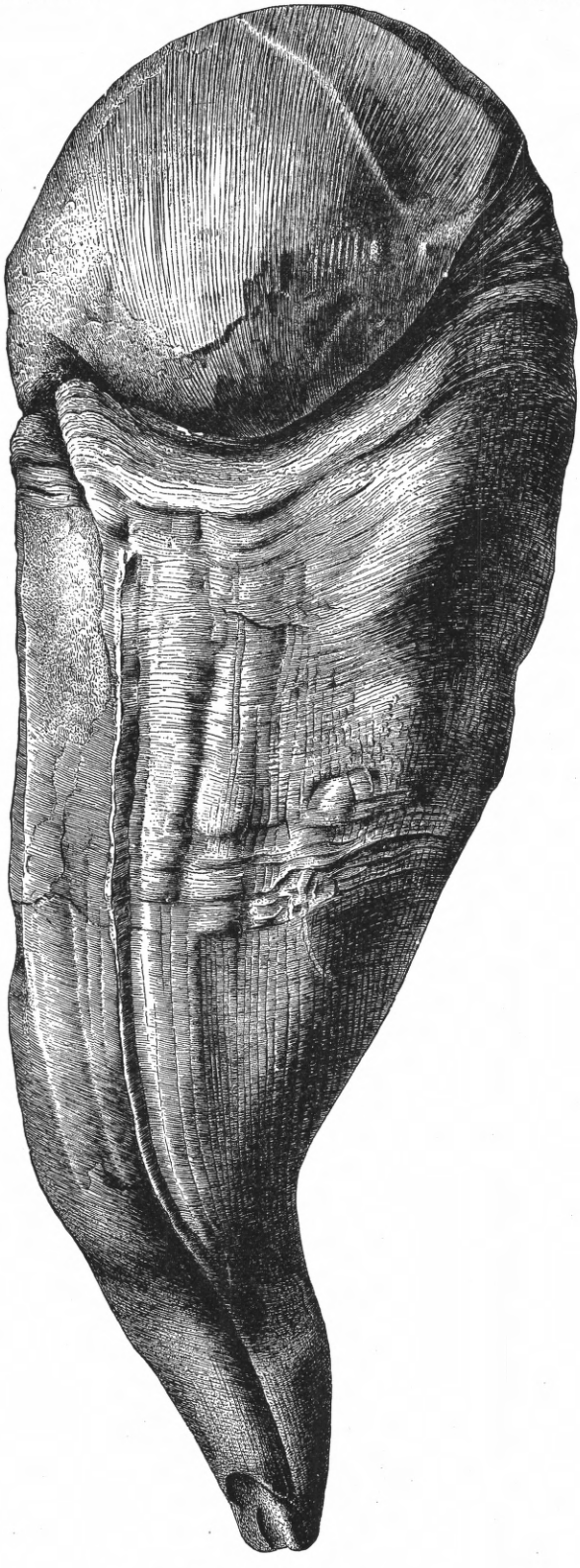
CORALLIOCHAMA ORCUTTI.

PLATE II.

CORALLIOCHAMA ORCUTTI (page 10).

Fig. 1. Cardinal view of an adult example; natural size.



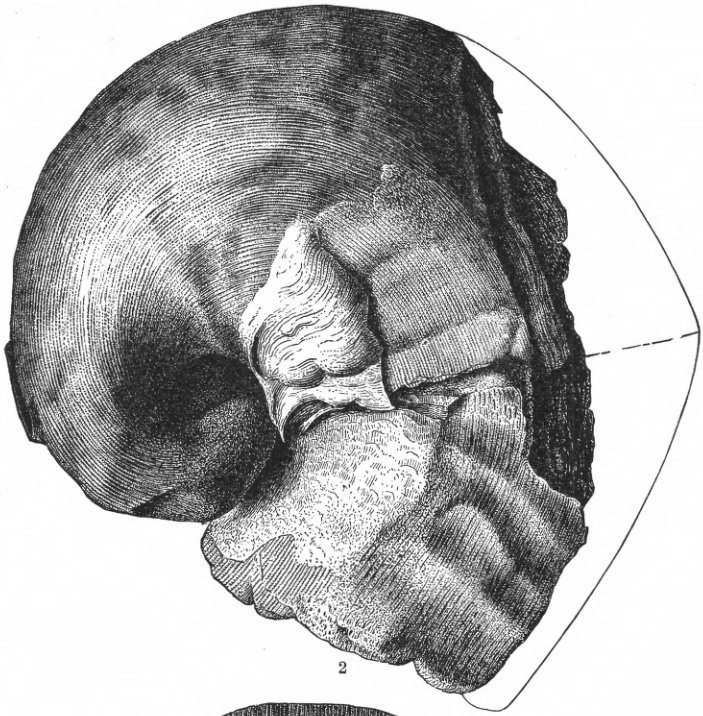
CORALLIOCHAMA ORCUTTI.

PLATE III.

CORALLIOCHAMA ORCUTTI (page 10).

Fig. 1. A fragment of a large example, showing the extreme convexity of the upper valve; natural size.

Fig. 2. Lateral view of the same example.



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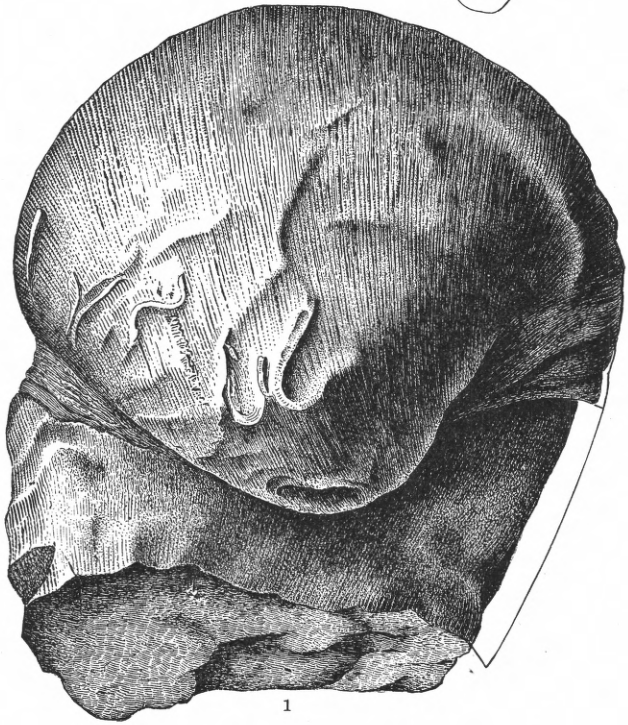


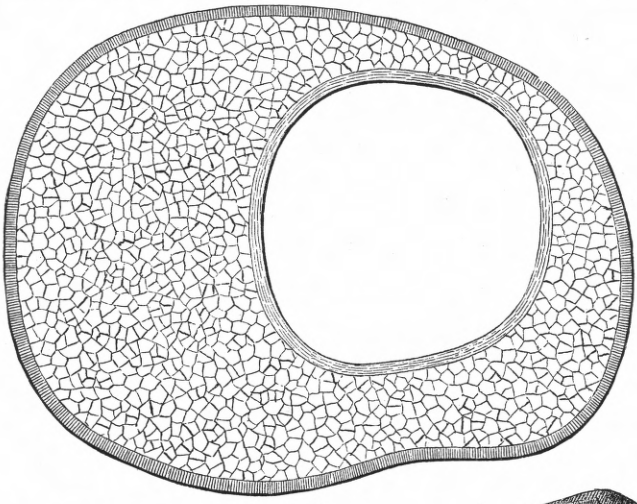
1

CORALLIOCHAMA ORCUTTI.

PLATE IV.

CORALLIOCHAMA ORCUTTI (page 10).

Fig. 1. Cardinal view of a partly grown example; natural size.
Fig. 2. Opposite view of another example.
Fig. 3. Section of a portion of an upper valve, showing the outer prismatic layer, the inner porcellanous layer, and the cellular inner layer, with the vertical plates of the outer portion of the latter layer. Partly diagrammatic; natural size.
Fig. 4. Diagram of a transverse section of a lower valve, showing the outer prismatic layer, the inner porcellanous layer, and the middle cellular layer.



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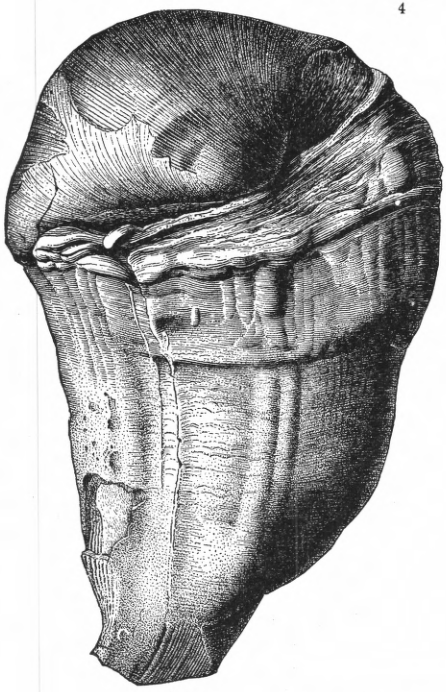

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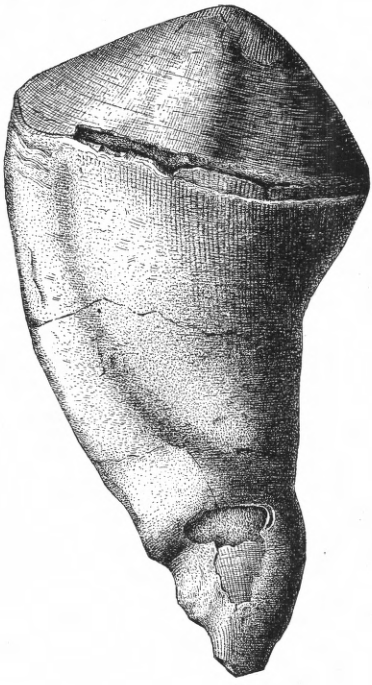

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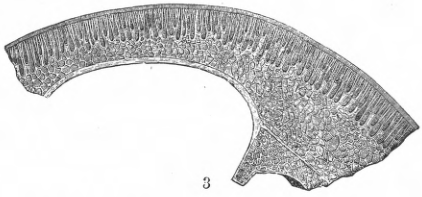

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CORALLIOCHAMA ORCUTTI

PLATE V.

SOLARIUM WALLENSIS (page 14).

Fig. 1. Lateral view, natural size.
Fig. 2. Umbilical view of the same example.

CERITHIUM PILLINGI (page 13).

Fig. 3. Lateral view, natural size and enlarged.
Fig. 4. Similar views of another example.
Fig. 5. Similar views of a third example.
Fig. 6. Similar views of another example, showing the aperture.

NERITA —— (page 12).

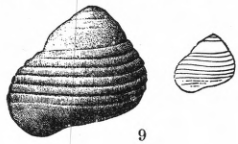
Fig. 7. Lateral view, natural size and enlarged, showing original color-markings.
Fig. 8. Similar views, showing the aperture and inner lip. These examples were received after the notice of the species on page 12 was printed. They are sufficiently perfect to warrant the application of a new name. I therefore propose the name *Nerita californiensis*.

TROCHUS (OXYSTELE) EURYOSTOMUS (page 12).

Fig. 9. Lateral view, natural size and enlarged.
Fig. 10. Basal view of the same example, showing aperture and callous inner lip.
Fig. 11. Lateral view of another example not quite mature, and in which the inner lip had not become thickened.

CERITHIUM TOTIUM SANCTORUM (page 12).

Fig. 12. Lateral view, natural size and enlarged, of a nearly perfect example.
Fig. 13. Similar view of a fragment of another example.



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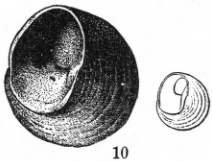

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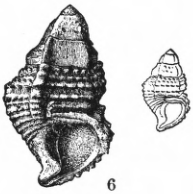

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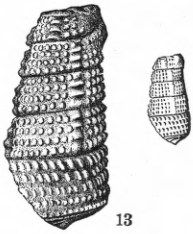

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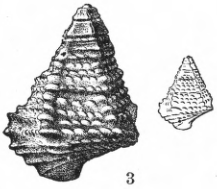

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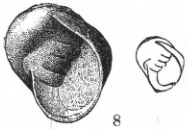

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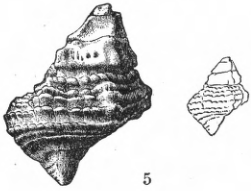

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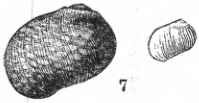

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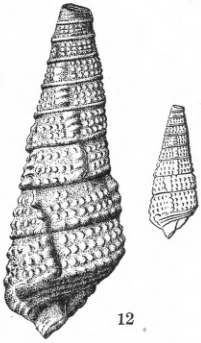
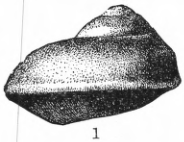
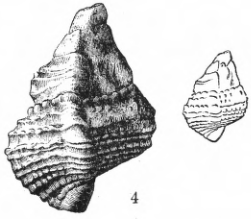


12



1



4

2

1, 2. Solarium wallalensis.
3–6. Cerithium pillingi.
7, 8. Nerita ——?
9–11. Trochus (Oxystele) euryostomus.
12, 13. Cerithium totium-sanctorum.