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REPUBLICATION

OF

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CONRAD'S, Timothy Abbott

FOSSIL SHELLS

OF THE

TERTIARY FORMATIONS

OF

NORTH AMERICA.

BY

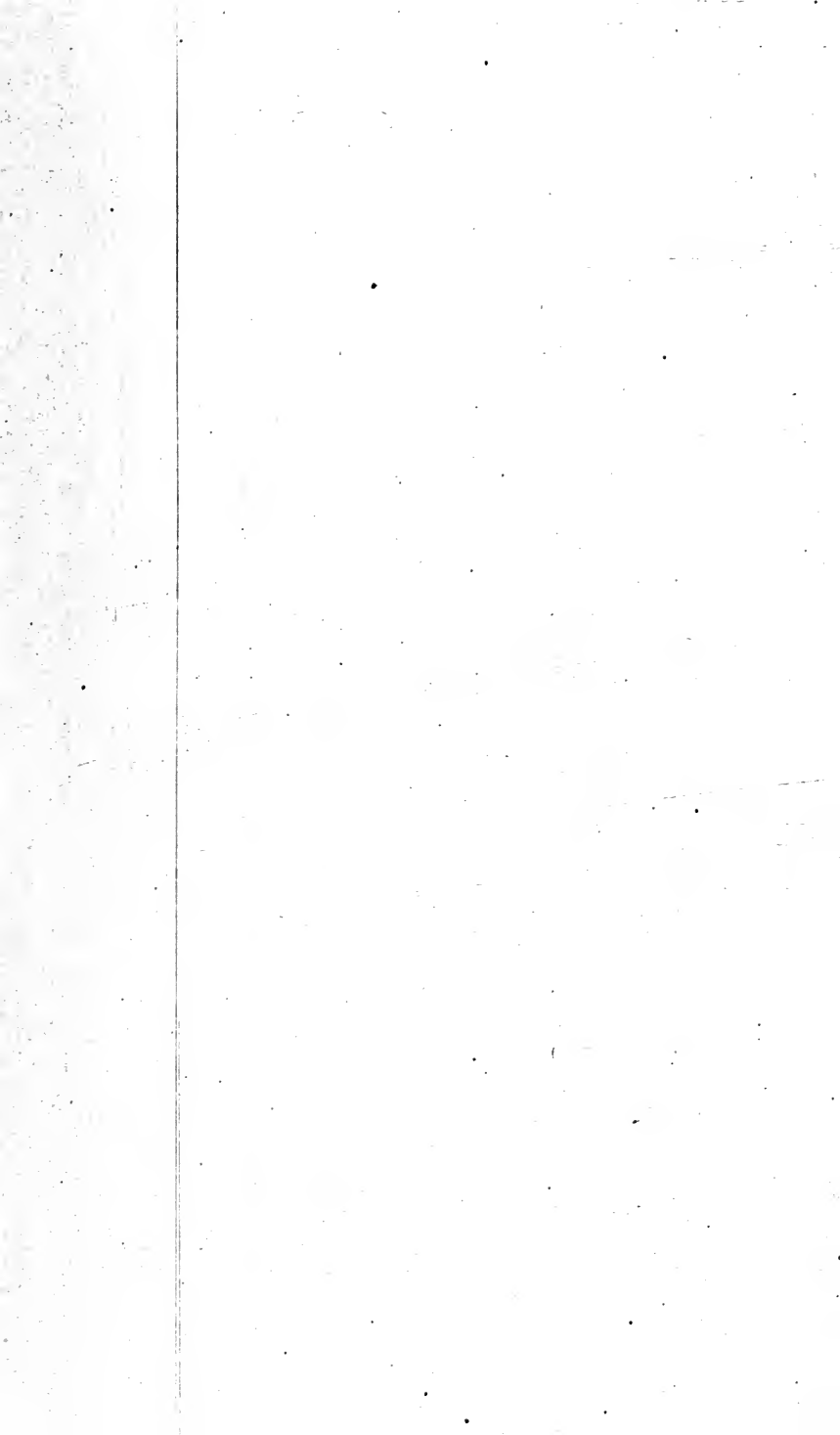
GILBERT DENNISON HARRIS.

WASHINGTON:
RUFUS H. DARBY, PRINTER.
April, 1893.

Sent post-paid to any address within the Postal Union until Nov. 1, 1893, for \$3.00; there-
after, \$3.50. Address G. D. Harris, Smithsonian Institution, Washington, D. C., U. S. A.

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INTRODUCTION.

He who would become versed in the marine Tertiary geology and paleontology of this country must first of all have a thorough understanding of Conrad's FOSSIL SHELLS OF THE TERTIARY FORMATIONS OF NORTH AMERICA : it marks the beginning of systematic research into this period of our continent's history.

This work, published in parts, in small editions and subjected to unusual vicissitudes, is extant now, after the lapse of sixty years, only as "partial" or "fragmentary" copies.* Such scarcity and incompleteness in a work that cannot be ignored, render its very existence a serious impediment to research into the subject of which it treats. Therefore it is believed that the present volume, including as it does all that Conrad ever published under the above mentioned title, will be welcomed by students of Tertiary geology.

Herein the pagination, lining, italicizing, punctuation, orthography, and capitalization correspond throughout with Conrad's editions though the exact form and size of type and page could not well be duplicated. For convenience in reference, a new paging has been given this volume as a whole; the numbers used are placed at the bottom of each page and inclosed in brackets to avoid confusion with the old numbering. Moreover, an index to genera and species has been appended.

The following brief and somewhat miscellaneous notes relating to dates of publication and other important matters of this work, are here inserted inasmuch as it is believed they will be found convenient for reference :

“ Aug. 27th, 1833. Mr. Lea read his paper on ‘Tertiary Formation of Alabama’ before the Academy of Natural Sciences, describing 202 species.

*The following copies, all incomplete, have been examined by the present author.—That formerly belonging to F. B. Meek, and W. H. Dall's, both now at the Smithsonian Institution; that formerly owned by C. A. White, now W. B. Clark's, Johns Hopkins Univ.; the two at the Wagner Free Inst. Sci., and the one at the Phila. Ac. Nat. Sc., Philadelphia, Pa.; the one at the Mus. Nat. Hist., N. Y.; that at the Mus. Comp. Zool., Harvard Univ.; Gabb's old copy, now owned by E. A. Smith, Tuscaloosa, Ala.; Holmes' old copy now owned by T. H. Aldrich, Birmingham, Ala.

A few notes have been obtained from four more copies, viz., that owned by Capt. Vogdes, that at the Cal. Ac. Nat. Sc., and the two owned by de Gregorio, Palermo, Sicily.

Capt. Vogdes states that there is a copy in the library of the Elliott Soc., Charleston, S. C. It is also known that Otto Meyer has a copy in New York City.

Sept. 3d, 1833. Mr. Conrad's work, 'Fossil Shells of the Tertiary formation,' presented to the Library. (Presumed to be to No. 3, inclusive.)

Nov. 26th, 1833. Dr. Morton presented to the Library the 4th No. of Conrad's 'Tertiary Fossils.'

Dec. 10th, 1833. Lea's 'Contributions to Geology,' (including his paper on Tertiary Fossils of Alabama,) presented by the author."—From the Minute Book, Phila. Ac. Nat. Sc. See Am. Journ. Con., vol. 1, 1865, p. 190.

A brief and incomplete bibliography of Conrad's "Fossil Shells" and "Medial Tertiary" by Otto Meyer occurs in the August Number of the American Naturalist, 1888, pp. 726-727. Mr. Meyer's information was apparently derived chiefly from an examination of his own copies and those at the Philadelphia Academy of Natural Sciences.

In his "Monographie de la Faune Eocénique de l'Alabama," 1890, p. 7, M. Antoine de Gregorio gives a very careful account of his two imperfect copies of "Fossil Shells, &c." He first called attention to the fact that there were two editions of pp. iii.-vi., No. 1.

A much more elaborate account of Conrad's "Fossil Shells, &c." and "Medial Tertiary" may be found in vol. xii., Bull. Phil. Soc. Wash., pp. 215-239, Jan., 1893, by William H. Dall. This is of special interest from a historical standpoint since it states the circumstances under which the former work was written and the causes which led to the attempted suppression of some of its Numbers. Additional notes on "Fossil Shells, &c.," by the present writer occur in the April No. of the American Geologist, 1893. The following also contain some new matter :

FOSSIL SHELLS OF THE TERTIARY FORMATIONS OF NORTH AMERICA.

No. 1. Dated October 1, 1832; probably about the true date of publication; 23 species described and figured, nearly all post-Eocene. There were two editions of pp. iii.-vi.; pp. [13-16] represent the original, pp. [19-22] the revised; the date of the latter is not definitely known. (See April No. of Amer. Geol., 1893.)

No. 2. Dated December, 1832; description and illustration of 17 species; about one-half Eocene and one-half post-Eocene.

No. 3. Dated (front cover) August, 1833, (back cover) August 24, 1833; presented to the library of Phila. Ac. Nat. Sci., Sept. 3, 1833 (see notes above); the last may be taken as the true date of publication; description of 40 Claiborne Eocene fossils, plates mentioned but not given. A reprint of this and the following number was made by Capt. A. W. Vogdes in 1879.

No. 4. Dated (front cover) October, 1833, (back cover) Nov. 1, 1833; presented to the library, Phila. Ac. Nat. Sc., Nov. 26, 1833; the last may be taken as the true date of publication; description of 77 Claiborne Eocene species, no plates.

REPUBLICATION OF No. 3.

Dated March 1, 1835; a revision of about two-thirds of the specific descriptions of univalves found in No's 3 and 4, together with new matter, accompanied by illustrations.

The Map.—Just within the front cover of this edition, Conrad placed a small Travellers' guide map of Alabama, on which he indicated the distribution of the different geological formations of the State by various colors, as follows: "Primary"—light red; "Carboniferous or Grauwacke group"—blue; "Bituminous coal"—black; "Greensand"—green; "Newer Cretaceous strata, a link between the Greensand and Eocene"—orange yellow; "Eocene"—pinkish orange; "Recent formation or bed of *Rangia cyrenoides*, a living shell of the gulf estuaries"—yellow.

Between pp. [76-77] of the present volume, a small map, about one-half the scale of Conrad's, is given which shows part of the geographical and all of the geological features of the original.

Observations on the Eocene deposits of the United States.—The two editions of these "Observations" found on pp. [77-84] and pp. [85-92] respectively of the present work, differ but little except on the last page of each, *i. e.*, page 36 of the original. The former is the more common, being found in all but three of the copies examined by the present writer. It was published about March 1, 1835. The edition found on pp. [85-92] is of a later date, either 1836 or 1837. Some of the facts substantiating this statement are as follows:

1. Typographical errors like the omission of the word "to" between "me" and "suppose" on p. [78], the omission of one "s" in the word "thicknes" on page [80], and placing an "r" in

the word "species" on page [83] are corrected in the later edition.

2. The words "Saurian family" are replaced by the compound "Enalio-Sauri" on p. [91]; and the word "shewn," p. [84] is replaced by the more modern form "shown" on p. [92].

3. The arrangement of localities under "Medial Tertiary or Older Pliocene," p. [92], follows no special geographical order, but is the same as that under "Older Pliocene" and "Miocene," p. [84], with the word "Miocene" stricken out.

4. On page xv. of Conrad's "Medial Tertiary," published in January, 1838, he remarks regarding the relative number of recent and extinct species found in this division of the Tertiary: "I was formerly led to believe that we had forty recent in about two hundred species." This belief "formerly" held by Conrad (*i. e.*, prior to Jan., 1838), is clearly stated on page [92] of the present work.

Therefore, it is evident that pp. [85-92] were published subsequent to Mar. 1, 1835, and somewhat prior to Jan., 1838.

Plates 19 and 20.—These plates were apparently never published in the strict sense of the word. They occur bound up with other matter forming a so-called "Appendix" to the copy of "Fossil Shells, &c.," belonging to the Museum of Comparative Zoölogy of Harvard University. The names of all the species but one have been written in with a lead pencil on the plates themselves. Plate 19, figure 1, is evidently a representation of *Cytherea nuttallii* Con., and accordingly it has been designated so on p. 115. Plate 20 is so numbered very faintly on the original.

It seems quite possible that these plates were struck off as proofs for a contemplated Number that should embrace a revision of the Claiborne bivalves similar to that of the univalves (Republication of No. 3). Moreover the revised form of "Observations on the Eocene deposits of the United States," pp. [85-92], may have been intended primarily to accompany this Number which never appeared.

GILBERT D. HARRIS.

Washington, April 6, 1893.

VOL. 1.

NO. 1.

FOSSIL SHELLS

OF

THE TERTIARY FORMATIONS

OF

NORTH AMERICA,

ILLUSTRATED BY FIGURES DRAWN ON STONE,
FROM NATURE.

BY T. A. CONRAD,

Member of the Acad. Nat. Sc. of Philada.

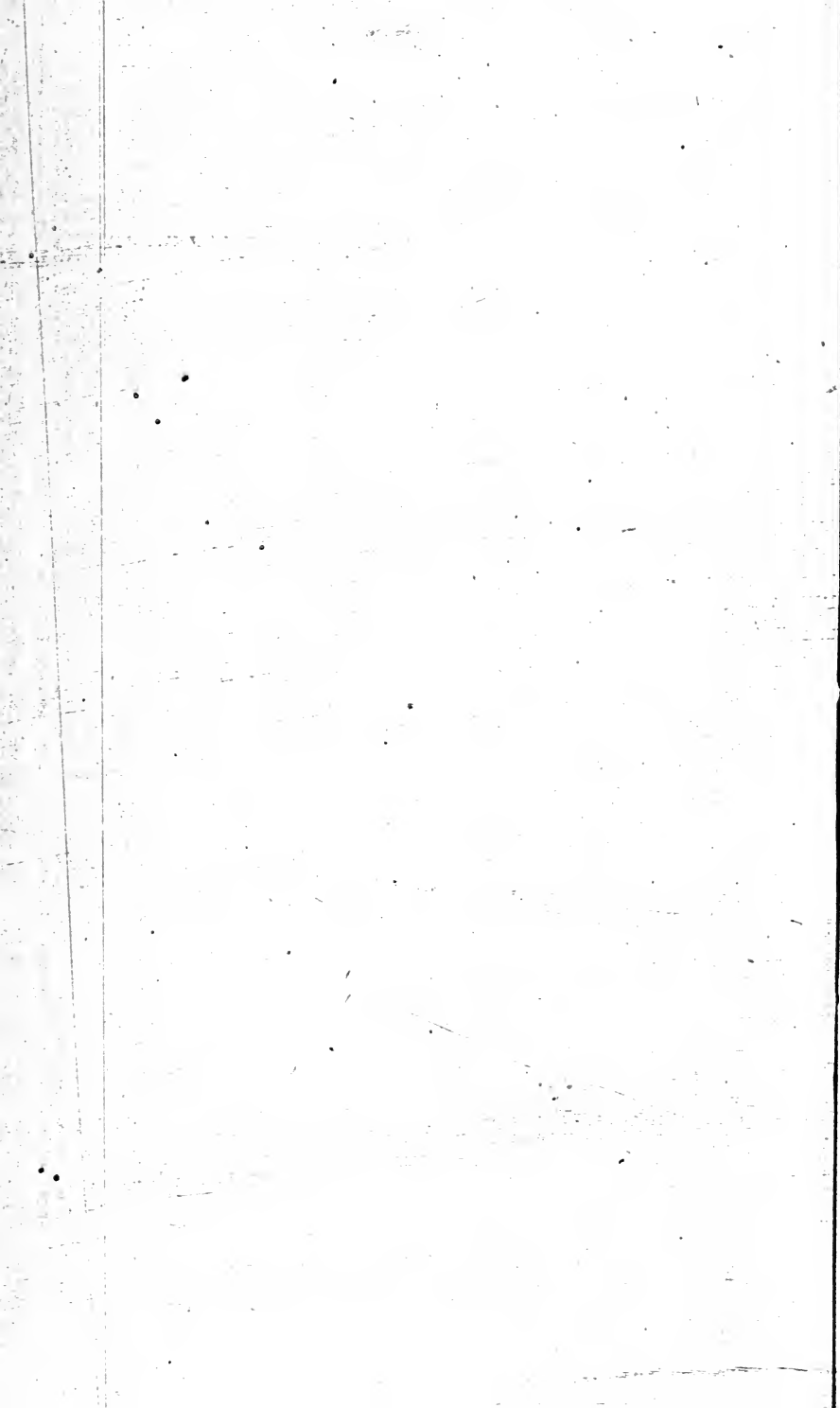
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“ sulcosus,	“ 3.	Artemis acetabulum,	t. 6, f. 1.
“ strumosus,	“ 4.		

PHILADELPHIA :

Sold by JUDAH DOBSON, No. 108, Chestnut St.

October 1, 1832.



FOSSIL SHELLS

OF THE

THE TERTIARY FORMATIONS

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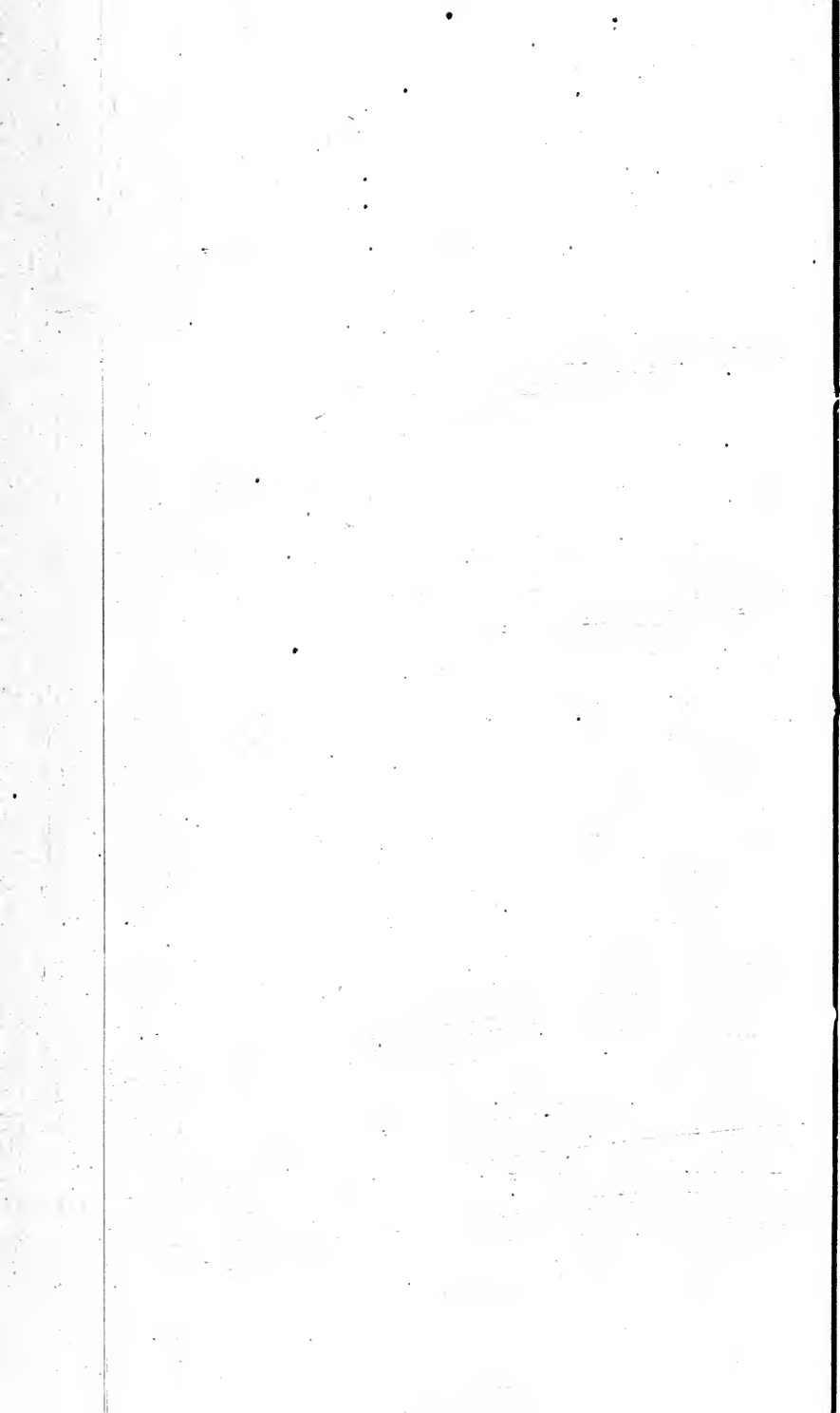
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VOL. I.

PHILADELPHIA :

1832.

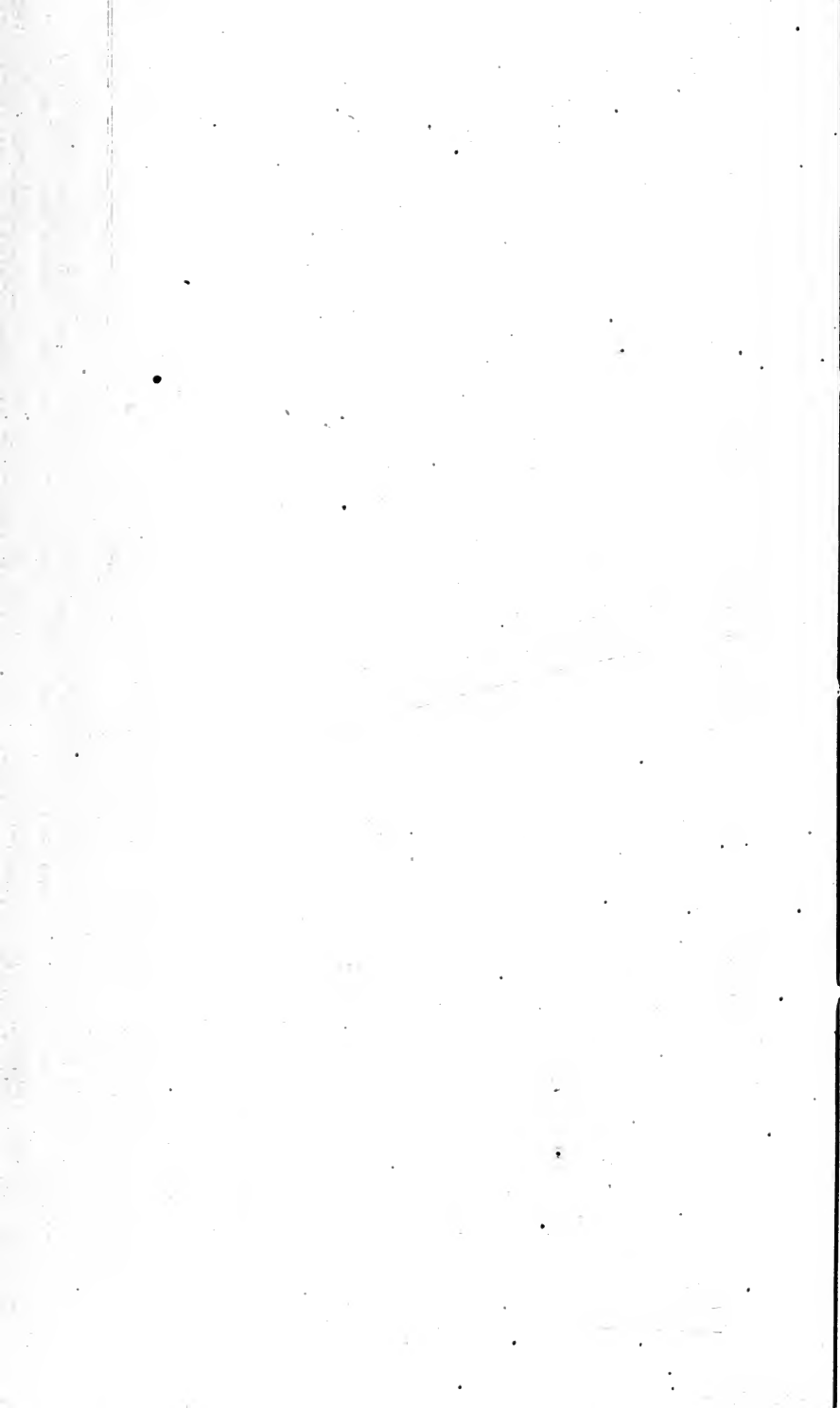


TO
SAMUEL GEORGE MORTON, M. D.

MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY,
CORRESPONDING SECRETARY OF THE ACADEMY OF NATURAL SCIENCES, OF
PHILADELPHIA, &C.

In publishing the fossil shells of our Tertiary formations, it is a pleasure as well as a duty to inscribe to you a work, which, whatever its merits, would not have appeared without your encouragement and assistance. Your zeal for establishing the Geology of our country on its only permanent basis, organic remains, has added a valuable series of American fossils to the splendid collections of the Academy of Natural Sciences, to which I owe the opportunity to figure and describe nearly all the species illustrated in the following pages; but I sincerely regret that your professional duties are too arduous to permit you to undertake a work for which you are so much better qualified than myself; for, with such ample materials, you could not have failed to render it acceptable both to the Geologist and the student in Conchology.

T. A. CONRAD.



PREFACE.

The vast abundance of fossil shells which characterize the Tertiary formations throughout the world, render it necessary to devote particular works to their elucidation, in which accurate figures may enable us to study and compare them under every variety of geographical distribution.

In Europe, they have received that attention they so eminently deserve in a Geological point of view, and particularly those of the environs of Paris have been accurately figured and described by M. Deshayes, and Sowerby's work on the British fossil Testacea has proved an invaluable assistant to inquirers into the history of European formations. Various memoirs on subjects connected with Geology constantly appear in the journals of the day in Europe, replete with interesting details, and illustrated by excellent figures of organic remains, serving to shew and to excite still more the eager curiosity which daily adds new votaries to this fascinating science. To endeavour to awaken in this country the same laudable zeal for extending the boundaries of scientific inquiry, I have undertaken to condense within narrow limits, the history of our numerous species of Tertiary fossils, not doubting that sufficient encouragement will be extended to a publication like the present, as works of reference are absolutely necessary, and certainly the details are more valuable in this condensed form, than when scattered through one, or as generally happens, various miscellaneous and voluminous journals.

The fossil shells of the older Secondary rocks are numerous and very important, and it is my intention to publish them on the conclusion of the present work, if I be not happily anticipated by some abler naturalist. The organic remains of the Ferruginous Sand formation have already been illustrated by Dr. Morton, who is about to republish his essays, with much additional information and with splendid lithographic figures of shells and zoophytes.

The beauty, variety, and peculiar character of our Tertiary fossils, are such as to recommend them to the notice of the mere Conchologist; but when viewed in connexion with Geological phenomena, they will prove, in consequence of their vast extent and continuous beds, even more important than the most celebrated contemporaneous deposits in Europe. This region has scarcely as yet met the eye of a practical Geologist, since the importance of extraneous fossils has been duly appreciated, or surely we should have had a valuable detailed account of the scientific treasures which extend almost without interruption from New Jersey, inclusive, to the Gulf of Mexico.

Three different classes of organic remains will be remarked by every observer of the formations in question; and examples of each are included in the western peninsula of Maryland. The first consists chiefly of extinct species; the second is a mixture of extinct species with others still inhabiting the coast of the United States, and the third embraces existing species alone. It is but lately that deposits similar to the latter have attracted the attention they merit, and they seem to prove that the Tertiary formations pass insensibly into each other, and that a new creation of marine shells had gradually taken the place of the old: It is certain that the lower, or oldest of these strata, always form the western boundary of the newer beds, and the most recent strata rest only on the eastern limits of this middle class of depositions. In those localities where recent and extinct species are indiscriminately mingled, a few shells occur, which although they cannot be satisfactorily referred to existing species, resemble them in such a manner as to excite a suspicion that they may be varieties occasioned by a difference of temperature, &c. between the ancient ocean and the present.

The banks of the larger rivers of the Tertiary region contain incredible numbers of shells, which are profusely scattered on the sands beneath. These banks are often high and perpendicular, composed of sand and clay, so very friable, that immense masses, loosened by the frost, frequently fall, strewing the margins of these rivers with the Pines which skirt their elevated bluffs: thus at a place called the Rocks, on James River, a few miles from the village of Smithfield, it is difficult to walk along the shore, when the tide is in, in consequence of fallen trees, and masses of clay filled with innumerable shells. This

place takes its name from enormous indurated masses evidently broken off from the upper portion of the bank: these are composed of sand charged with shells, casts, and abundance of a small species of *Echinus*, rarely occurring in the inferior strata.

The Upper Marine formation is distinguished by a multiplicity of species, chiefly of bivalve shells, for the univalves are comparatively rare and particular species occur very abundantly in certain localities, which are rare or wanting in others but a few miles distant. The same circumstance is observable in the habits of recent species. M. Marcel De Serres, in his work on the Geology of the South of France, gives an interesting view of facts connected with this subject, and shews that even difference of seasons may have influenced local depositions.

It has been remarked that organic remains found in cold or temperate climates are analogous to, or identical with those of the tropics, or at least of a less degree of latitude than the fossil localities; but in Virginia and North Carolina, some species are found, in no respect differing from shells living on the coasts of Rhode Island and Massachusetts. These are associated with extinct species, and embrace *Maetra tellinoides*, *M. lateralis*, *Nucula limatula*, *N. proxima*, *Lucina contracta*, *L. divaricata*, and several others.

The recent shells have been sought with avidity on the shores of every sea, to adorn the cabinets of the curious with the symmetry and beauty of their forms, or the brilliancy of their colours; but the science of Geology has given to the more homely fossils, a charm which amply compensates for the loss of a portion of exterior ornament, inasmuch as they are mute interpreters of those strange revolutions, of which the memory of man has preserved not a solitary trace. They chronicle the various eras of an unknown world, where one ocean has retired to give place to another with its peculiar tribes of animated beings, whose silent eloquence reveals the mysterious operations of Nature, when the sudden elevation of mountains, irruption of seas, and destruction of various races of animals and plants, were forming in the crust of our globe those numerous strata, the study of which must ever be an inexhaustible source of pleasure and instruction. Thus have long periods of violence and revolution been necessary to create the beautiful variety of

the present surface of the earth, and perhaps to prepare it for the support of man, as all these changes appear to have been effected anterior to the existence of the human race.

In the more ancient oceans existed animals of gigantic size, no living analogies of which are known, while about three hundred species of *Ammonites* floated upon the surface, or lived in vast colonies in the depth of the sea; and yet not a solitary species has been spared by those revolutions of a "past eternity" which now offer to our minds the fascinating study of relics, abstracting us from the present and leading to the contemplation of a former world. But in proportion as we advance in the ascending series of stratification, we find the organic remains approaching more and more to the existing order of nature, until at last we arrive at those not to be distinguished from the present inhabitants of the sea. "Life therefore" observes Cuvier, "has been often disturbed on this earth by terrible events—calamities which, at their commencement, have perhaps moved and overturned to a great depth the entire outer crust of the globe, but which, since these first commotions, have uniformly acted at a less depth and less generally. Numberless living beings have been the victims of these catastrophies; some have been destroyed by sudden inundations, others have been laid dry in consequence of the bottom of the seas being instantaneously elevated. Their races even have become extinct, and have left no memorials of them except some small fragment which the naturalist can scarcely recognize.

"Such are the conclusions which necessarily result from the objects that we meet with at every step of our enquiry, and which we can always verify by examples drawn from almost every country. Every part of the globe bears the impress of these great and terrible events so distinctly, that they must be visible to all who are qualified to read their history in the remains which they have left behind.

"But what is still more astonishing and not less certain, there have not been always living creatures on the earth, and it is easy for the observer to discover the period at which animal productions began to be deposited.

Philadelphia, October 1st, 1832.

TO
SAMUEL GEORGE MORTON, M. D.

MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY,
CORRESPONDING SECRETARY OF THE ACADEMY OF NATURAL SCIENCES, OF
PHILADELPHIA, &C.

In publishing the fossil shells of our Tertiary formations, it is a pleasure as well as a duty to inscribe to you a work, which, whatever its merits, would not have appeared without your encouragement and assistance. Your zeal for establishing the geology of our country on its only permanent basis, organic remains, has added a valuable collection of American fossils to the Academy of Natural Sciences, from which I propose to figure and describe the greater number of species contained in the following pages. I sincerely regret that your professional duties are too arduous to permit you to undertake a work for which you are so much better qualified than myself; for with such ample materials, you could not have failed to render it acceptable both to the geologist and the student in conchology.

T. A. C.

PREFACE.

The vast abundance of fossil shells which characterize the Tertiary formations throughout the world, render it necessary to devote particular works to their elucidation, in which accurate figures may enable us to study and compare them under every variety of geographical distribution.

In Europe they have received that attention they eminently deserve in a Geological point of view, and particularly those of the environs of Paris have been accurately figured and described, while the greater part of the analogous American fossils remain unpublished. The shells peculiar to the Green formation in the United States have been illustrated in a very satisfactory manner by Dr. S. G. Morton, and it now remains to publish those of the Tertiary beds, in order to complete the works of reference necessary to the student in Geology.

The greater part of the deposits in question evidently agree with the Upper Marine of Conybeare and Phillips; but fossils analogous to those of the London Clay or Calcaire Grossier also occur in this country, and are found at Fort Claiboure in Alabama, as well as in some parts of Maryland and Virginia. I have, however, examined *in situ* those of James river, in Virginia, which Mr. Finch has referred to as indicative of the London clay, but they embrace too many recent species, and are entirely deficient in the characteristic genera, as *Cerithium*, *Rostellaria*, &c.

It is a remarkable fact, that so many species still existing upon the coast should be mixed with others, known only in a fossil state, and as they are all littoral shells, there is no probability that the latter exist in deep water. It is true that a single living specimen of *Cerithium giganteum*, a very abundant fossil in the vicinity of Paris, was taken in deep water, off the coast of New Holland; but of such genera as *Balanus*, *Ostrea*, *Panopea*, &c. we would expect to find all the recent species, either inhabiting shallow water, or cast ashore by storms.

The great extent of the Tertiary in this country, will supply us with fossil shells not inferior in numbers and beauty to those of Europe; for it extends from the State of Delaware coastwise to the Gulf of Mexico. The inferior stratum is a lead-coloured clay, and of such thickness, that no excavation appears to have penetrated entirely through it. Above the clay is a bed of sand, the thickness of which, where it encloses organic remains, is very inconsiderable; in some places it is extremely friable, and in others indurated and mixed with comminuted shells. The fossils of both strata are equally abundant, and appear to be the same in both, although a few may perhaps occur more frequently in one than in the other: thus the *Panopea* is most abundant in the clay, and it is an interesting fact, that the individuals of this genus remain in the position assumed by the burrowing bivalves, that is, vertical, with the anterior side pointing downwards. This proves that they had actually burrowed into the beds where they are now found, and that the revolution which destroyed them has not affected the relative position of the strata: indeed no trace of violence nor action of an agitated sea or current, is perceptible in the strata as they remained at the final recession of the sea; but prior to this epoch, another period has been characterized by a violent agitation of the ocean, as the matrix of the present race of fossils is often, in great part, composed of comminuted shells.

The fact that a long period elapsed from the commencement to the termination of the revolution which exposed these submarine beds, is particularly obvious along the north bank of the Potomac river. At Fort Washington, fifteen miles below Washington City, the fossils are more elevated and have a different character from any I have observed elsewhere: they consist chiefly of casts of extinct species, and are characterized by a gigantic *Cucullæa*, resembling an European species and the *Ostrea compressirostra*, which is the analogue of the European *O.bellovacina*. South of this locality, on St. Mary's river, the fossils are very different and embrace many of the common existing species of our coast. This is the most extensive of either of the Tertiary beds. The last deposit of marine reliquiæ consists of shells now inhabiting the coast of the middle and southern States: it occurs on the north bank, and near the mouth of the Potomac. The greatest elevation of these

fossils is only about twelve feet above the level of the sea. This is evidently analogous to what has been termed the newer part of the Crag in England, and may be considered as the equivalent of Brongniart's *Gravier Coquillier*, the effect of the last revolution anterior to the Diluvial epoch.

The shells of this formation are sub-fossilized, and some of them retain their colours; they consist, in Maryland, chiefly of the *Pholas costata*, *Maetra lateralis*, *Arca transversa*, *Nassa trivittata*, *Ranella caudata*, &c. surmounted by a bed of *Ostrea Virginia*. Similar deposits occur in North and South Carolina; and Brongniart has enumerated many localities in various parts of the world, characterized by species which exist in the neighbouring seas. One of the most interesting of these beds occurs on the coast of Valparaiso, and consists of an entire bank of the remarkable shell called *Concholepas*, which still inhabits the adjacent sea. A great part of this same coast was suddenly elevated in 1822, exposing Oysters and Mytili, attached to rocks then elevated from the sea; hence it becomes interesting to inquire whether or no similar causes, acting with greater force and extent in the ancient world, may not have been adequate to upraise the various beds of organic remains to their present level above the ocean.

With regard to the lowest of the Tertiary beds containing organic remains, in the vicinity of Fort Washington, I may remark that they are probably cotemporaneous with the superior strata of the *Terrains Tritoniens* (*Calcaire grossier*) of Brongniart. A characteristic shell of this formation is the *Venericardia planicosta* of Lamarck, a species I have discovered in the deposit above mentioned, which also abounds in a large *Turritella*, never occurring in the upper or more recent beds.

The banks of the Potomac, Rappahannock, James river and their tributaries, present in many places the same interesting Geological features; being abrupt, composed of sand and clay filled with testaceous relics, and so very friable, that immense masses, loosed by the frost, frequently fall, strewing the margins of these rivers with the Pines which skirt their elevated banks, thus at a place called the Rocks, on James River, a few miles from the village of Smithfield, it is difficult to walk along the shore when the tide is in, on account of the fallen trees, and masses of clay filled with innumerable shells. This

Note.—Pages vii and viii of this form of the Preface are identical with pp. [17] and [18].

INTRODUCTION.

BRIEF VIEW OF THE TERTIARY FORMATIONS OF THE UNITED STATES.

SYN. Supercretaceous group; *De la Beche*. Superior order, *Conybeare and Phillips*. Terrains izemiens thalasiques, *Al. Brongniart*.

Each of these great classes is again divided into a number of subordinate deposits, denominated *formations*, of which the Tertiary appears to possess three, called, in Europe, the *Upper Marine*, *London Clay* and *Plastic Clay* formations. The last two of these names are very exceptionable, the one being local and the other far from descriptive. It is therefore proposed in the following work to speak of the three formations according to the order of their succession, and, at the suggestion of a friend, to call them the Upper Tertiary or Upper Marine, the Middle Tertiary and the Lower Tertiary. The relative position of these different formations will be best conveyed by the the following diagram; merely premising that we are fully aware of the objections which have been urged against these divisions, and that we adopt them in the absence of a better nomenclature, as possessing a very convenient, and, we believe, a natural adaptation to the strata.

	<i>Characteristic fossils.</i>	<i>Localities.</i>
Alluvium		
Diluvium	Bones of terrestrial animals.	
Gravier coquillier, of <i>Broug. Crag.</i>	Shells, all of existing species.	Mouth of the Potomac.
Upper Marine, or Upper Tertiary	Shells, chiefly bivalve, all the genera and many of the species existing.	Peninsula of Maryland, and eastern parts of Virginia, N. and S. Carolina, Georg.
Middle Tertiary or London Clay, & Calcaire grossier	Shells, nearly all living genera, but generally extinct species. Large proportion of univalv.	Fort Washington, Md., Virginia? Vance's Ferry, S. C. Claiborne, Alabama.
Lower Tertiary, or Plastic Clay.	Beds of lignite and a few marine shells.	Bordentown, N. J., Martha's Vineyard, &c.

The preceding diagram represents the series so far as it has been developed in this country. In Europe, the Upper Tertiary is not unfrequently alternated with beds of fresh water shells, mostly attributable to a lacustrine origin. No such examples have yet been noticed on this side the Atlantic. Again, the European Tertiary is based upon the Chalk formation; but although in the United States, no Chalk, minearologically speaking, has been observed, Dr. Morton has shewn, in the most satisfactory manner, that we possess its Geological equivalent in the marl of New Jersey, Delaware, &c. which is in fact contemporaneous with the Lower Chalk or Ferruginous Sand formation of Europe; the upper mass, or Chalk of commerce, being wanting.

These formations, collectively, form the Atlantic margin of the United States, from Sandy Hook, in New Jersey, to the peninsula of Florida, from whence they skirt the Gulf of Mexico to the waters of the Mississippi. Of the Geology of the region west of this, very little is known; but on Red River, shells of the Ferruginous Sand formation were discovered by Mr. Nutt during his hazardous journey through the inhospitable wilds of the Arkansas territory, led solely by the love of Science, to which he had nearly fallen a martyr.

This southern portion appears to occupy a much broader space than is observable in the northern sections, but the order of position is of course the same in all. The same formations appear to have an insulated existence in Martha's Vineyard, the Elizabeth Island, Long Island, &c. on the coasts of the the Eastern States. The tract to which we allude is called Alluvial on Mr. Maclure's geological map of the United States; and although the name is incorrect, the geographical boundaries there given are sufficiently accurate for general purposes.

Let us now take a glance at the several subdivisions of the Tertiary class, together with the Alluvial and Diluvial deposits which are frequently found overlying them.

Alluvium. This name is applied to all deposits derived from causes now in operation. Such are the accumulations of mud and other debris at the mouths and along the courses of rivers; the drifting sands of the sea coast; peat bogs, &c. &c. Of all these circumstances we see numerous examples throughout the Atlantic margin of the United States, and especially in

New Jersey. "These operations," observes Mr. Mantell, "even if carried on upon an extended scale, are manifestly unimportant as agents in any of those grand revolutions which constitute the principal objects of Geological enquiry."

Diluvium. On the greater part of the earth's surface are observed beds of sand and clay, with rolled pebbles of various sizes, all bearing marks of the action of a violent current, which has first comminuted and rounded the fragments of rocks, and then strewn them promiscuously on all the other formations. Thus we find the Diluvial beds lying directly on the Primitive, Secondary, and Tertiary rocks; forming what has been termed the mantle of the earth's crust. The Diluvium frequently encloses the remains of large quadrupeds, which appear to have perished in the catastrophe to which these deposits owe their origin. In the great Atlantic tract, now under consideration, the Diluvium is well characterized and in many places very extensive. To it are referred the bones and teeth of the *Mastodon*, found at Pemberton, N. J., and in other places farther south: also the bones of the elephant exhumed in New Jersey, North Carolina, &c., and those of the *Megatherium*, in Georgia. By some Geologists, these remains are considered to be embraced in the Alluvial and not in the Diluvial deposits, and Mr. Featherstonhaugh shews that, in reference to this country at least, the facts are in favour of the former of these opinions.

In the deposits above described, but little order or regularity is perceptible; their various contents are, for the most part, indiscriminately mingled; but those which form the subject of the following remarks, will be found to present a certain and constant order of superposition; particular species will be seen to occur in some of the strata, and to be wanting in others; and, by comparing these remains, we are able to identify a formation, wherever it occurs, and to refer it to its proper place in the Geological scale.

UPPER MARINE FORMATION.

We adopt this formation as defined in the admirable work of Conybeare and Phillips. Its existence in this country was first suggested by Dr. Van Rensselaer, and it was afterwards more specifically examined and illustrated by Dr. Morton, in the Journal of the Academy of Natural Sciences.

Mineralogical characters. These beds are often a slightly argillaceous yellowish sand, in which the fossils are imbedded without cohesion. In other instances the matrix is hard and siliceous, obviously composed of fine sand. In others, again, a yellowish or gray clay forms the strata, and sometimes all these substances are variously mixed, but the lower stratum is invariably a lead coloured clay or argillaceous marl. There is mostly some intermixture of comminuted shells, but that the fossils of these beds have been deposited in a tranquil sea, is obvious from the extreme perfection of the shells, and the constant occurrence of the most delicate bivalves, with both valves in their natural connexion.

Organic characters. Speaking of this formation, in Europe, Conybeare and Phillips remark, that "the shells are found in an excellent state of preservation, and though generally in a confused mixture, are sometimes so disposed, that patches of particular genera and species appear."

"Like fossils of most other strata, this assemblage of shells manifests a peculiar distinctive character. A few shells only, which may be placed among those which are supposed to be lost, or among those which are the inhabitants of the distant seas, are here discoverable, the greater part not appearing to differ specifically, as far as their altered state will allow of determining, from the recent shells of neighbouring seas."

The above description is strikingly applicable to the American Upper Marine beds, in certain districts, but in others a large proportion of extinct species, and such as inhabit distant seas, are of common occurrence, and manifest a difference in the relative ages of the deposits, yet none of those which I am now considering exhibit any of the characters peculiar to the *London clay* and *Calcaire grossier*. For the present, it may suffice to remark, that of all the species which these strata have hitherto afforded, about forty are specifically identical with the living Testacea now inhabiting the coasts of the United States and the islands of the West Indies. A considerable number of species are common to the strata of Europe and America; while some of these very shells are also found recent on both sides of the Atlantic, shewing how extensive may be the distribution, and how long the duration of a single species.

Geographical distribution. This formation first appears in

New Jersey, south-east of Salem, and continues through all the States south of this, forming their Atlantic margins, and extending from one hundred to one hundred and fifty miles west from the sea.

MIDDLE TERTIARY FORMATION.

SYN. London Clay of English authors; Calcaire grossier of the French.

Mineralogical characters. This formation, like most others, presents itself under various Mineralogical appearances; it often exhibits beds of silicious sand, of a brownish colour, and in this the fossils are in the finest preservation. Another variety is a friable granular limestone, containing comminuted fragments of shells, and indeed is sometimes almost wholly composed of them. It is of a light ferruginous colour, and strongly resembles certain varieties of the *Calcaire grossier* of France.

Again, this formation presents a compact tenacious limestone, with a dull granular fracture, and replete with minute green grains. It contains a large proportion of clay, and though abounding in fossils, these are mostly mere casts.

Organic characters. "The testaceous mollusca are very numerous and beautifully preserved, often retaining nearly the appearance of recent shells. There are very few *genera* of recent shells which have not some representation imbedded in this formation, but the specific character is usually different, that difference being often, however, so minute as to escape an unpractised eye: on the other hand, but few of the *extinct genera*, so common in the older formations, occur in this; so that it seems to hold a middle character in this respect between the earlier and more recent beds."

Here again, the analogy which exists in the organic characters of this formation, on both sides of the Atlantic, is not less marked than in the Upper Marine strata.

The *Calcaire grossier*, of the French, is a coarse limestone, more or less hard; some of its beds are sandy and contain green grains of silicate of iron. This division of the *London Clay* is amazingly productive of organic remains; and it will be hereafter shewn that some of its fossils are specifically the same with those of the contemporaneous deposits of this country.

Geographical distribution. In the vicinity of Fort Washington, on the Potomac river, Maryland, this formation first ap-

pears to the north. We have seen fossils peculiar to it, said to be from Virginia, but the exact locality is unknown. It occurs again at Vance's Ferry, South Carolina, and at Claiborne, Alabama, where its fossils are in the greatest abundance and best state of preservation. It is also very interesting in this locality, from the circumstance of its resting on very white friable Secondary limestone, full of *Nummulites*, and containing *Gryphæa*, &c. which again reposes on the *Green Sand*.

LOWER TERTIARY FORMATION.

Plastic Clay, of English authors; Argile plastique, Brong.

Mineralogical characters. These consist in alternating stratified beds of sand and gravel, of various colours; in these beds, and especially in the clay, *Lignite* is an abundant and characteristic substance. Iron pyrites and *Succinite*, Brong., also occur; the former in great abundance. Professor Hitchcock has lately discovered a silicious breccia in the Plastic clay at Gayhead, Martha's Vineyard.

In France, the black clay and Lignites form a superstratum of this formation; the true Plastic clay deposit being absolutely composed of various coloured and seemingly pure clays, used in the potteries, and containing fresh water and marine shells.

Organic characters. Besides the *Lignite*, a few casts of marine shells occur in our Lower Tertiary, apparently referrible to the genera *Venus*, *Tellina*, &c. Professor Hitchcock has also discovered in the quartzose breccia mentioned above, bones and teeth of the shark, crocodile, &c.

Geographical distribution. We are indebted to Mr. John Finch for the first detailed account of this formation, in America, which appears to extend, in patches, from the islands of New England to the States bordering the Gulf of Mexico. Its most obvious localities are, Martha's Vineyard; Sand's Point, on Long Island; Bordentown, Whitehill, &c. in New Jersey; Telegraph Hill, near Baltimore; Cape Sable, in Maryland, and many other places farther south.

All the preceding formations are based on the *Ferruginous Sand series*; and Dr. Morton has shewn, that so far as his investigations have extended, no species of fossil shell of the latter formation has been detected in the superimposed strata.

FOSSIL SHELLS, &c.

ARCA LIMULA. *Tab. 1, fig 1.*

Oblong, sinuous, rather thin ; ribs numerous, crossed by striæ, which are equally distinct in the interstices ; ribs double on the posterior side where they alternate with fine lines ; umbo angulated behind ; hinge area narrow, oblique, and transversely striated ; basal margin contracted near the middle ; inner margin crenate.

Localities. Newbern, N. C. common ; Mr. Nuttall. James River, Va. very rare. Upper Tertiary.

This shell has a general resemblance to *Arca ponderosa*, of Say, but cannot be confounded with that species.

ARCA TRANSVERSA. *Tab. 1, fig. 2.*

Subrhomboidal, rather narrow and thin, with about 32 ribs ; area very narrow, with two or three undulated grooves ; series of teeth nearly rectilinear ; within sulcated ; margin crenate. *Syn.* ARCA TRANSVERSA, *Say, Journ. A. N. S. v. 2, p. 269.*

Localities. Newbern, N. C. Mr. Nuttall. Suffolk, Va. in the Upper Marine. Near the mouth of the Potomac, in the Crag.

This species still inhabits our coast. The fossil specimens are larger and more variable in shape than the recent, except in that deposit which I term *Crag*, whenever its strata are alluded to. The species is here abundant and exactly resembles those found upon the beach. Mr. Nuttall favoured me with the specimens represented in the plate.

ARCA STILLICIDIUM. *Tab. 1, fig. 3.*

Subcordate, inequivalve and rather thick, with about 30 flattened ribs, crenulated on the larger valve ; ribs of the opposite

valve plain, except those on the anterior side, which are crenulated; beaks prominent; margin profoundly crenate.

Locality. St. Mary's River, Md. Upper Tertiary.
It resembles *A. incongrua*, Say (*A. nodosa*, Wood.)

ARCA IDONEA. *Tab 1, fig. 5.*

Cordate, inequivalve, ventricose, and slightly sinuous; ribs about 25, narrow and crenulated; the crenulations most distinct on the larger valve; beaks very prominent and distant; area with undulated grooves; hinge with the series of teeth contracted in the centre, and a little decurved at the ends.

Locality. St. Mary's River. Md. Upper Tertiary.

ARCA CENTENARIA. *Table 1, fig. 4.*

Oval or subrhomboidal, obsoletely contracted at base, with numerous radiating striæ, alternating in size; anterior and posterior margins obtusely rounded; beaks approximate, not prominent; area much contracted and transversely sulcated; series of teeth decurved at the extremities; teeth obsolete under the beaks; muscular impressions a little raised, with a groove along the sides; margin entire.

Syn. ARCA CENTENARIA. *Say, Journ. A. N. S. v. 4, p. 138, t. 10, fig. 2.*

Locality. York Town, Va. Upper Tertiary.

ARCA INCILE. *Table 2, fig. 1.*

Rhomboidal; ribs about 27, finely granulated and alternated with fine lines posterior to the middle of the valve; beaks near the anterior end; not prominent; apex acute; area with transverse lines on the anterior portion, behind which is a single oblique groove extending from the apex to a little behind the middle; series of teeth rectilinear; margin crenate.

Syn. ARCA INCILE, *Say, Journ. A. N. S. v. 4, p. 139, t. 10, fig. 3.*

Locality. James River, near Smithfield, Va. Upper Tertiary.

This species varies considerably in form, and young shells are often deeply emarginate at the posterior extremity.

PECTUNCULUS PULVINATUS, *Tab. 2, fig. 2.*

Orbicular, convex, subequilateral, with numerous radiating striæ; beaks small, central; hinge edentulous in the centre; inner margin with approximate angular lines or teeth.

Localities. York Town, Suffolk, Va. Upper Tertiary.

Syn. PECTUNCULUS PULVINATUS, *Lam. An. sans Vert. vol. 6. p. 54.*

This shell is very common in France and Italy. Lamarck describes three varieties, and observes that he believes it to be analogous to *P. glycimeris*.

In the vicinity of York Town, it is washed out of the high sandy banks, accompanied by the following species, from which it can always be distinguished by its orbicular form, &c.

PECTUNCULUS SUBOVATUS, *Tab. 2, fig. 3.*

Suborbicular or sobovate; inequilateral; with radiating sulci, becoming obsolete with age; hinge, with the series of teeth cut off, and nearly obliterated in the centre, by a rectilinear line; teeth largest on the shorter side of the valve; marginal teeth broad and separated.

Syn. PECTUNCULUS SUBOVATUS, *Say. Journ. A. N. S. v. 4, p.*

PECTUNCULUS VARIABILIS? *Sow. Min. Con. v. 5, t. 471.*

Localities. York Town, abundant; Suffolk, Va. Upper Ter.

If this should prove to be identical with *P. variabilis*, it will be an interesting species in consequence of its being characteristic of the same formation in Europe and America.

MUREX UMBRIFER. *Tab. 3, fig. 1.*

Fusiform, with 6 foliated reflected laminae; whorls angular and carinated; aperture obovate; beak recurved.

Localities. James River; York Town, Va. Upper Tertiary.

FUSUS EXILIS. *Tab. 3, fig. 2.*

Fusiform, elongated, with longitudinal undulated ribs, and revolving striæ, acute, elevated and alternately smaller; beak produced, nearly straight; aperture half the length of the shell.

Locality. James River, Va. Upper Tertiary.

FUSUS SULCOSUS. *Tab. 3, fig. 3.*

Pyriform, ventricose, cancellated, with revolving crenulated ribs; whorls flattened above; beak produced, straight; right lip striated within.

Syn. PYRULA SULCOSA, nob. *Journ. A. N. S. v. 6, t. 9, fig. 8.*

Locality. James River, near Smithfield, Va. Upper Ter.

FUSUS STRUMOSUS. *Tab. 3, fig. 4.*

Fusiform; cancellated; body whorl subquadrangular, with revolving tuberculated ribs, alternated in size; whorls of the spire striated, and tuberculated at the angle; beak straight.

Locality. James River, near Smithfield, Va. Upper Ter.

FUSUS TROSSULUS. *Tab. 3, fig. 5.*

Fusiform; cancellated, with longitudinal ribs and revolving striæ, alternated in size; whorls rounded and regular; beak short, slightly recurved; right lip thick, striated within.

Locality. James River, near Smithfield, Va. Upper Ter.

FUSUS TETRICUS. *Tab. 3, fig. 6.*

Fusiform; with longitudinal acute ribs, terminating above in short spines; whorls angular and flattened above; beak long and recurved.

Locality. James River, near Smithfield, Va. Upper Ter.

FUSUS RUSTICUS. *Tab. 4, fig. 1.*

Fusiform; with spiral unequal impressed lines; whorls concave above, with short longitudinal undulations at the angle; margin of the right lip plicated; beak short, recurved.

Syn. FUSUS RUSTICUS, nob. *Journ. A. N. S. v. 6, t. 9, fig. 2.*

Locality. St. Mary's River, Md. Upper Tertiary.

FUSUS PARILIS. *Tab. 4, fig. 2.*

Fusiform, elongated, with longitudinal ribs or undulations, and rather distant revolving subacute ribs, between which are

6 or 7 fine, minutely crenulated or wrinkled striæ; beak produced and slightly reflected.

Locality. St. Mary's River, Md. Upper Tertiary.

FUSUS CINEREUS. *Tab. 4, fig. 3.*

Short fusiform, with large longitudinal rounded ribs and spiral elevated lines somewhat alternately smaller; beak short and slightly reflected.

Syn. FUSUS CINEREUS, *Say, Journ. A. N. S. v. 2, p. 236.*

American Conch. No. 3, t. 29.

Locality. James River, near Smithfield, Va. Upper Ter.

A common species on many parts of our coast, frequenting oyster beds, to which it has proved so destructive in Raritan Bay, that the owners have been obliged to remove certain beds to escape the depredations of this little univalve.

BUCCINUM PORCINUM. *Tab. 4, fig. 4.*

Subovate acute, thick, with numerous slight longitudinal undulations, and spiral little elevated striæ; body whorl ventricose; spire tapering and acute at the apex; aperture rather small; right lip striated within.

Syn. BUCCINUM PORCINUM, *Say, Journ. A. N. S. v. 4, p. 126.*

Locality. York Town, Va. Upper Tertiary.

BUCCINUM LAQUEATUM. *Tab. 4, fig. 5.*

Ovate conical, with spiral striæ, and minute spiral lines between; ribs or folds elevated, subacute, obsolete on the inferior half of the body whorl.

Locality. James River, near Smithfield, Va. Upper Tertiary.

BUCCINUM ALFILE. *Tab. 4, fig. 6.*

Subovate, with numerous longitudinal undulations and obtuse spiral striæ; body whorl rather ventricose; spire conical; apex obtuse.

Locality. James River, near Smithfield, Va. Upper Tertiary.

CYPRICARDIA ARATA. *Tab. 5, fig. 1.*

Oblong, with about 15 profoundly elevated scaly ribs ; dorsal and basal margins parallel ; anterior side very short ; posterior margin oblique, angular above ; inner margin crenate.

Localities. Newbern, N. C. Mr. Nuttall ; James River, near Smithfield, and York Town, Va. ; near Easton, Md. ; Cumberland county, N. J.

CARDITA PLANICOSTA. *Tab. 5, fig. 2.*

Cordate ; ribs about 22, broad and flattened, separated by a narrow groove which becomes obsolete at the base ; ribs near the posterior end narrow, indistinct, and crossed by numerous strong wrinkles ; lunule small, cordate, profoundly impressed ; inner margin crenate.

Syn. VENERICARDIA PLANICOSTA, *Lam. An. des Mus. v. 9, pl. 31, fig. 10. An. sans vert. v. 5, p. 609. Sowerby. Min. Conch. v. 1, t. 50.*

Localities. Piscataway, Md. Claiborne, Alab. Middle Ter.

This characteristic fossil is found in the equivalents of the *London Clay*, in England, France, Italy, Piedmont, and Florence. *Lam.* The figure is from an individual found in Maryland ; those from Alabama are smaller and more perfect.

ARTEMIS ACETABULUM. *Tab. 6, fig. 1.*

Lentiform, with numerous concentric striæ, which are rather sharp and elevated on the anterior and posterior sides ; cardinal fosset large, oblong, profound ; with age, almost obliterating the posterior tooth ; right valve with three teeth, the posterior one long and sulcated longitudinally ; two anterior teeth approximate ; left valve with four teeth, three of them distant ; the anterior tooth somewhat pyramidal and entering a groove formed by two slight elevations in the opposite valve.

Localities. St. Mary's River, and Easton, Md. ; James River, near Smithfield, and Suffolk, Va. Upper Tertiary.

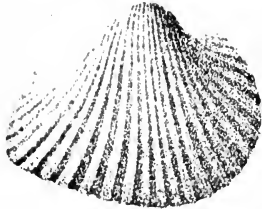
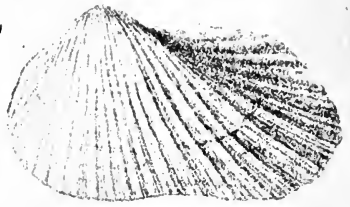
This shell has been confounded with *Artemis concentrica*, (*Cytherea concentrica*) of our coast.

The species of this genus are still referred to *Cytherea* by

Plate 1.



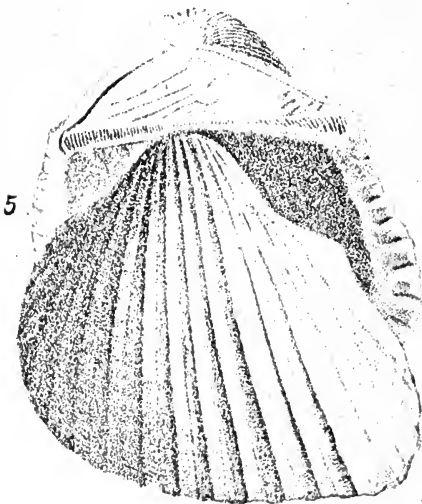
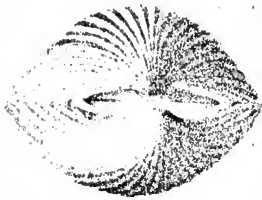
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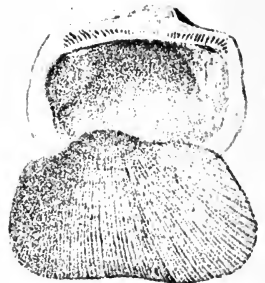
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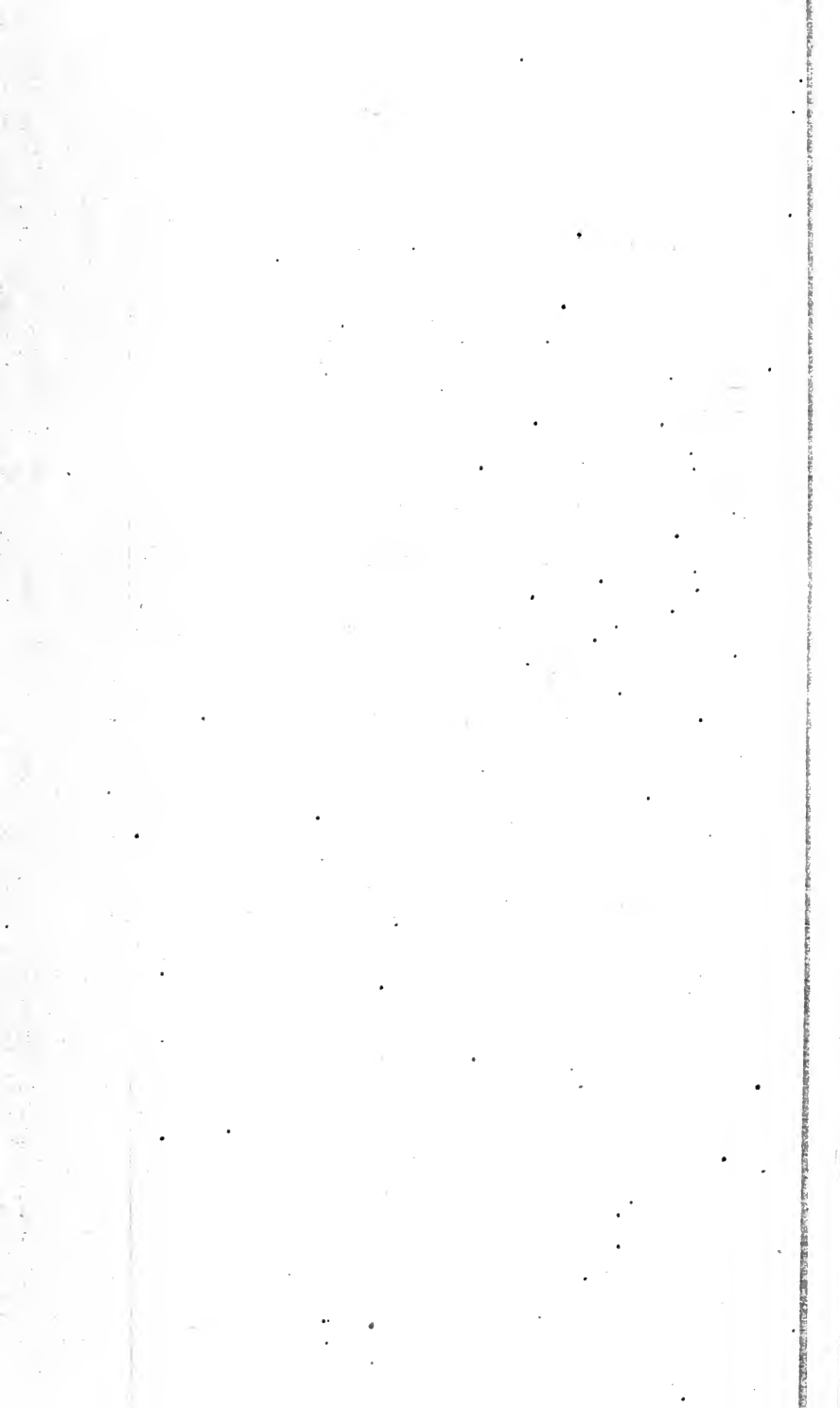


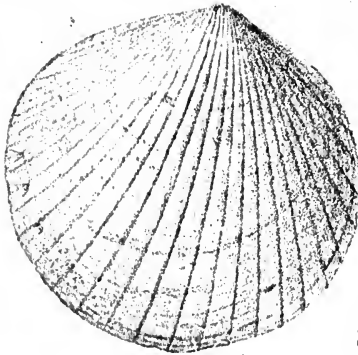
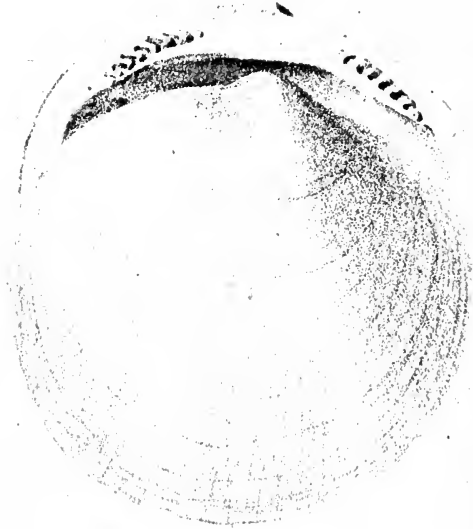
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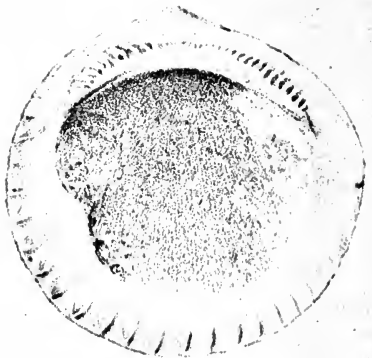
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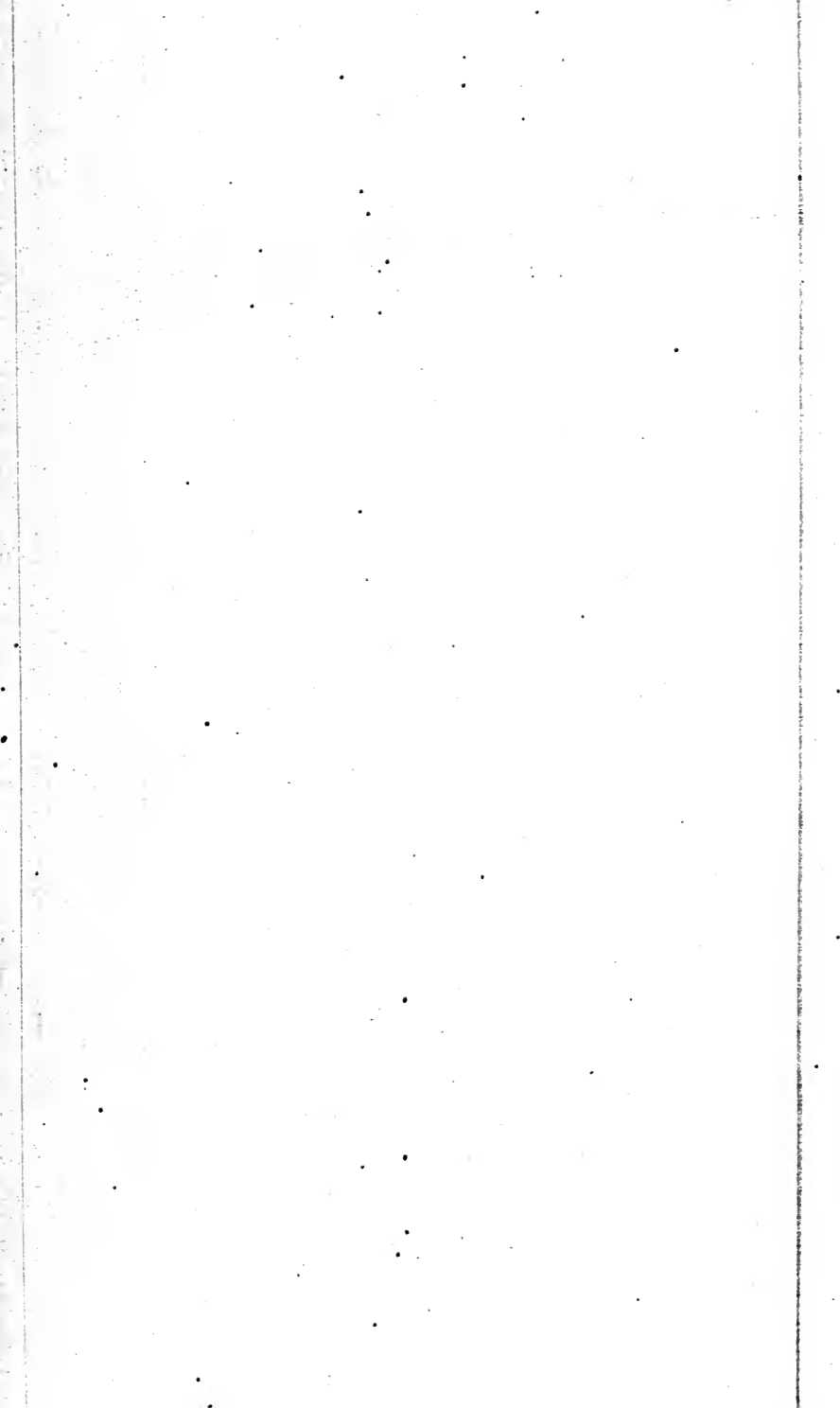
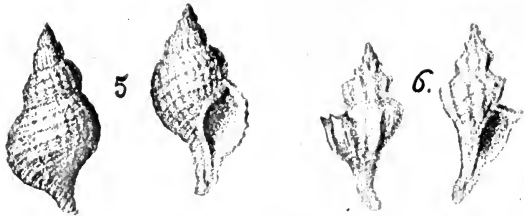
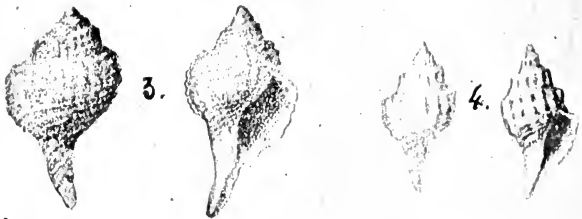
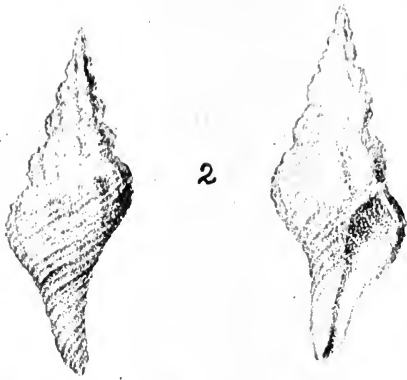
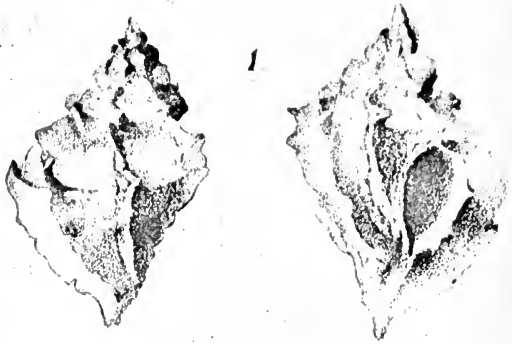


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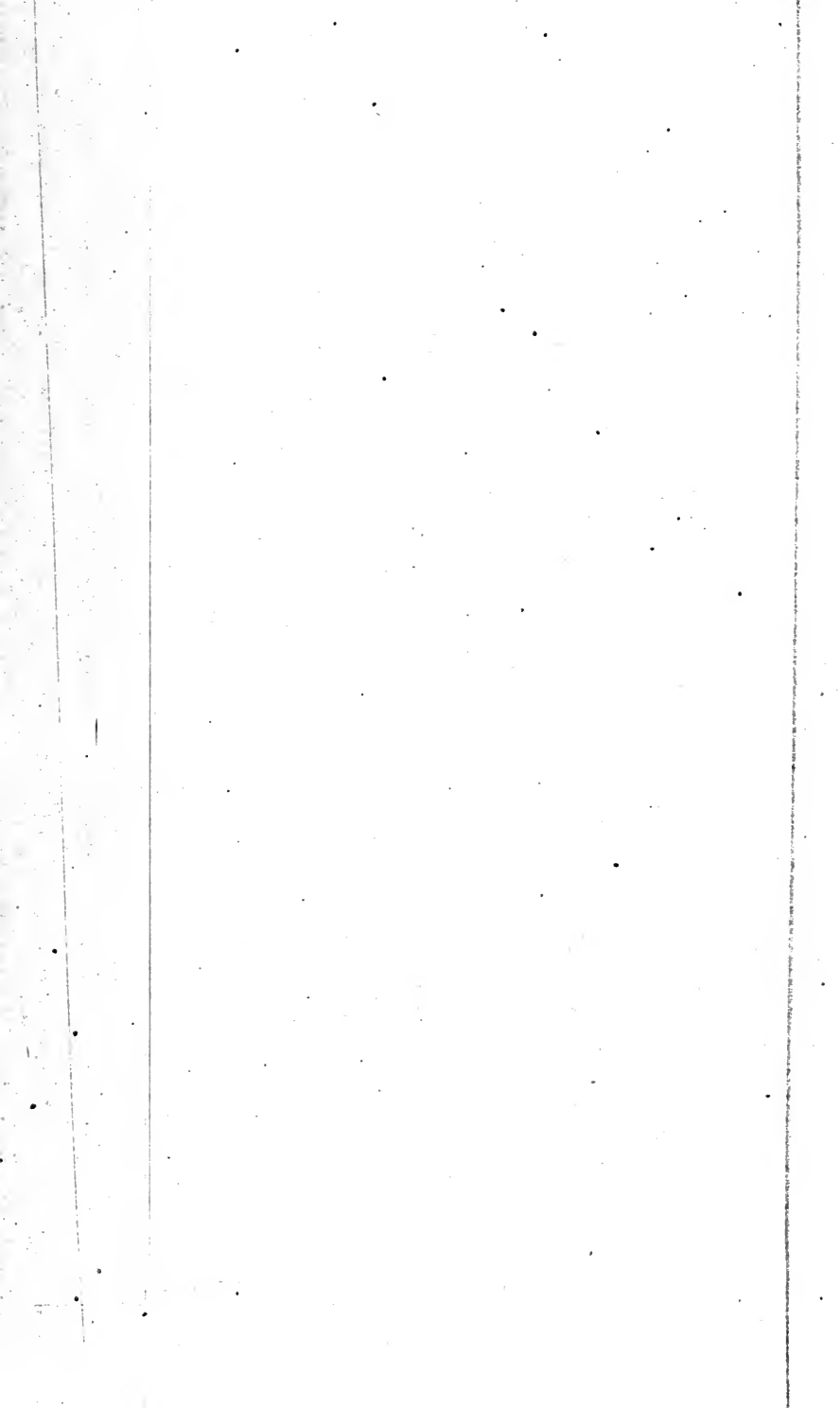
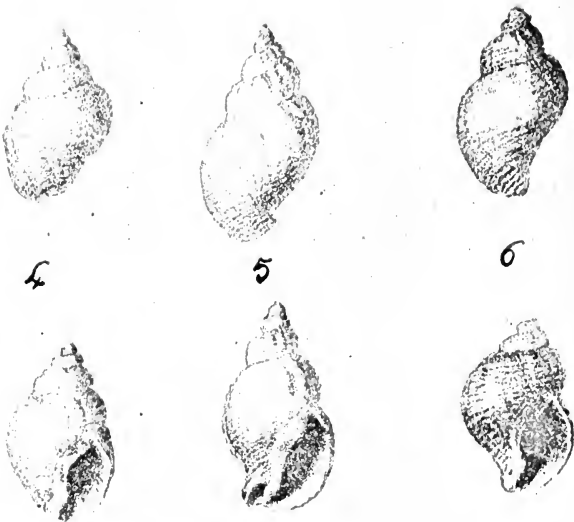
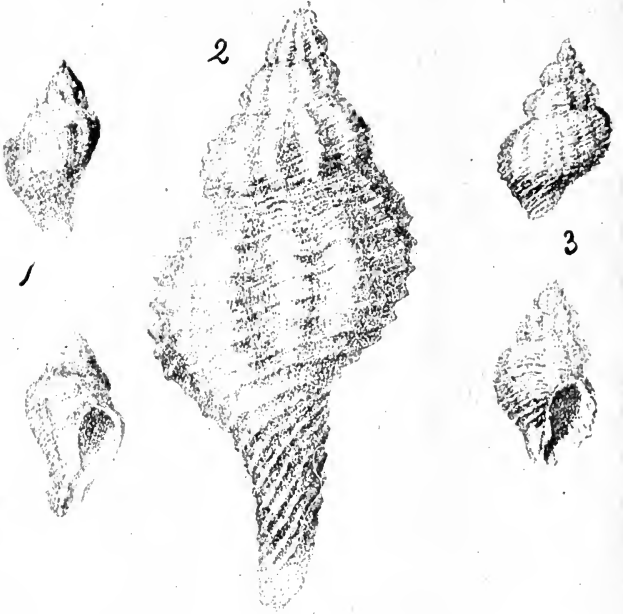
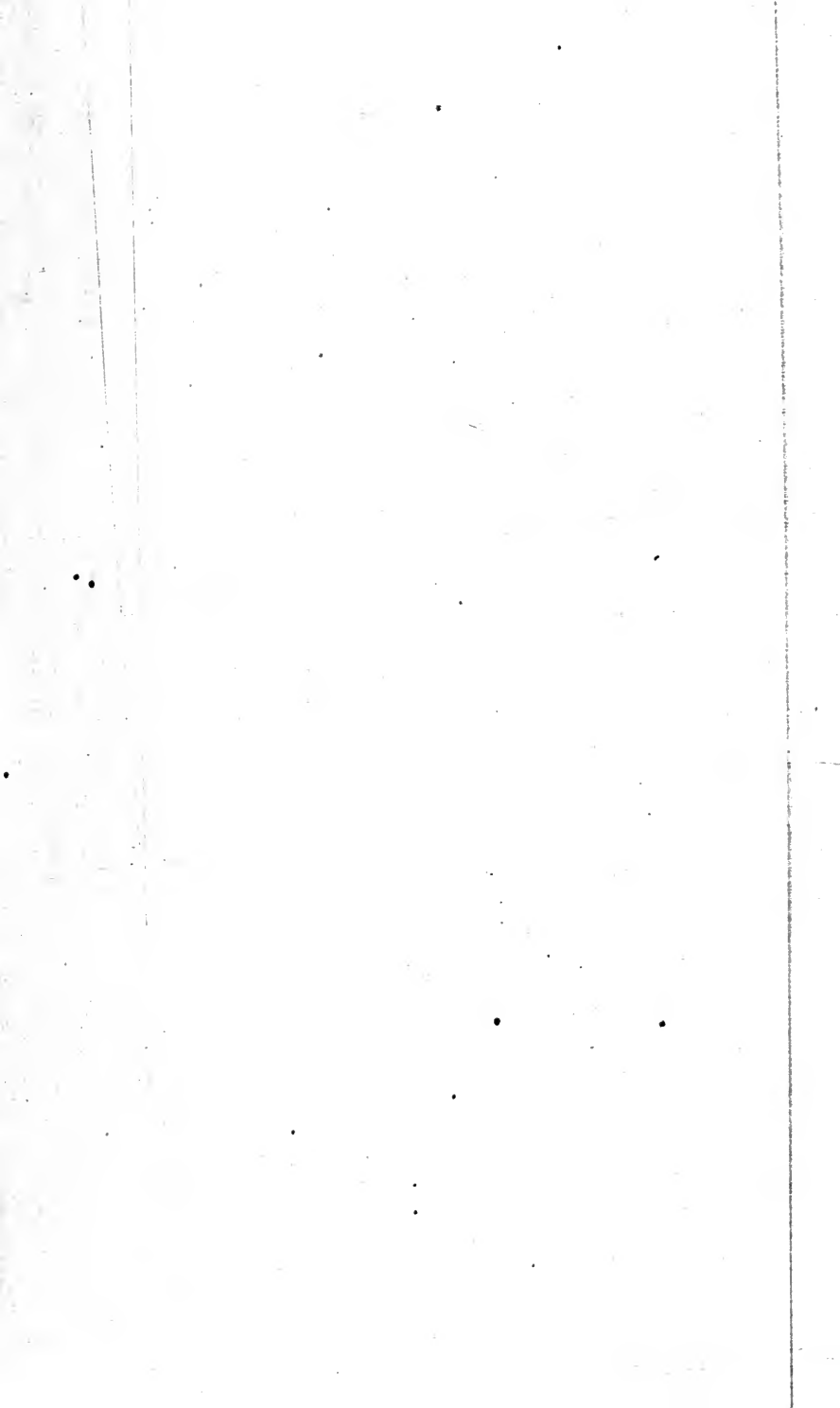
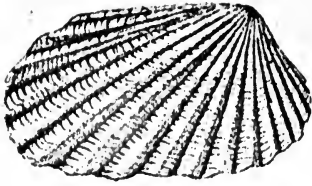


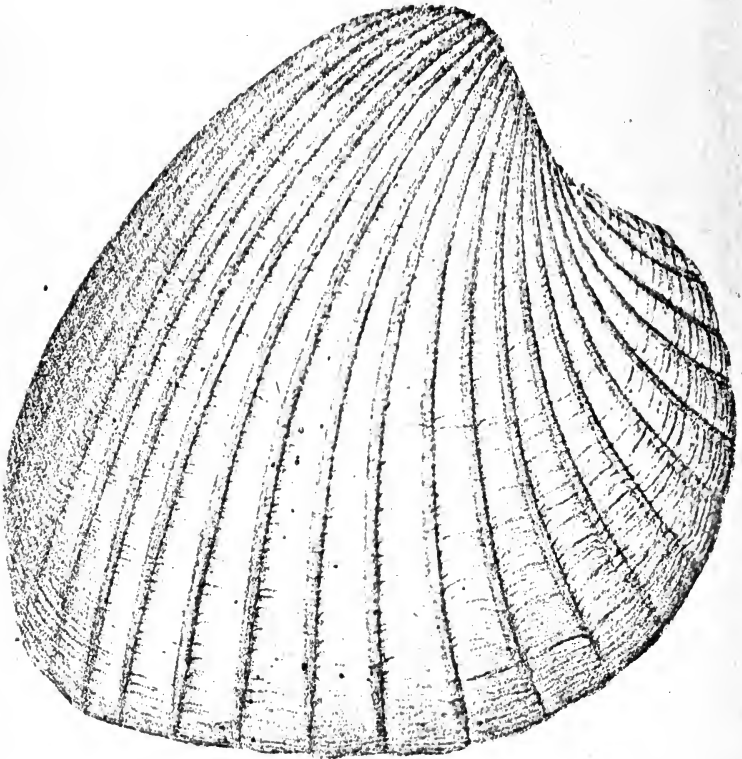
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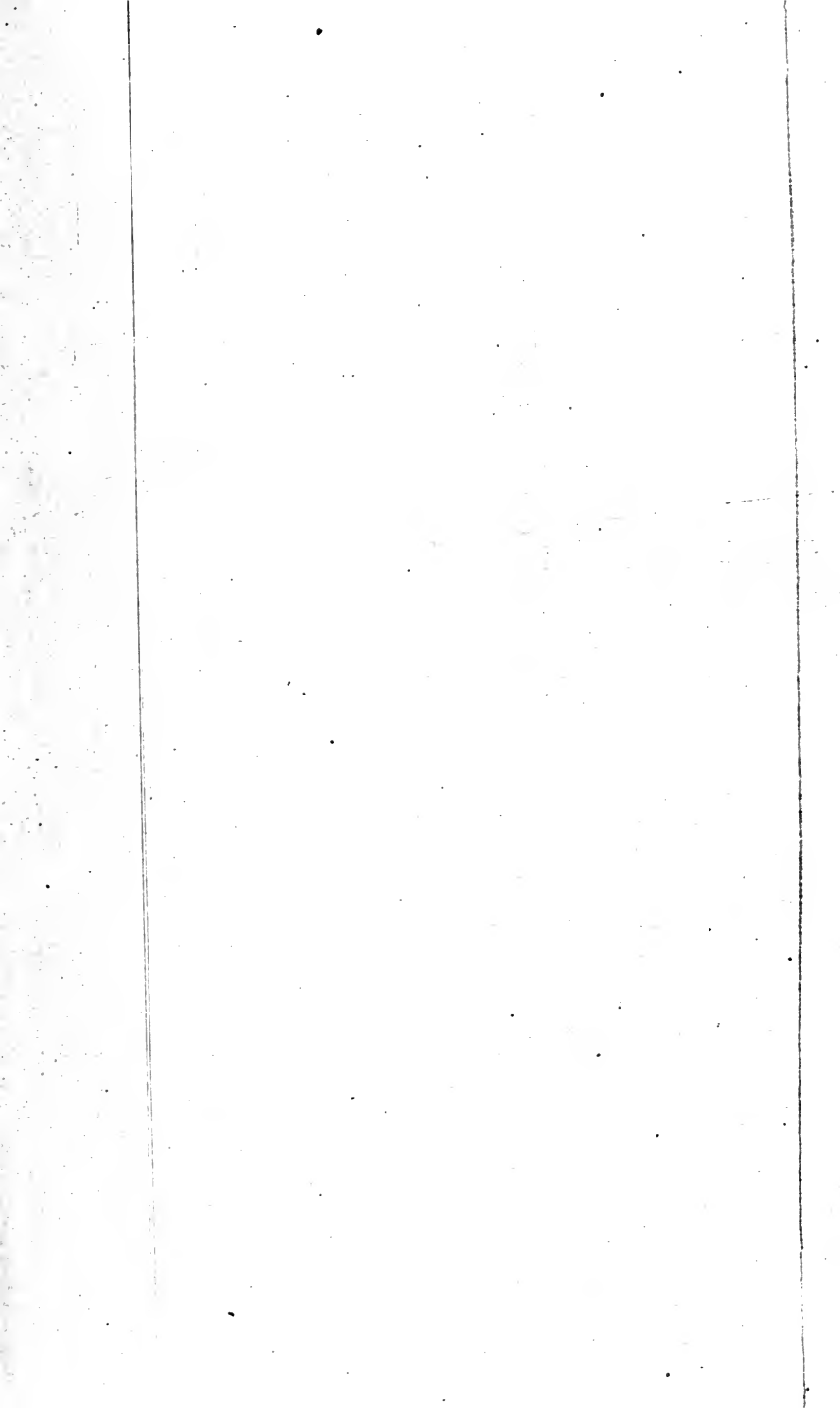


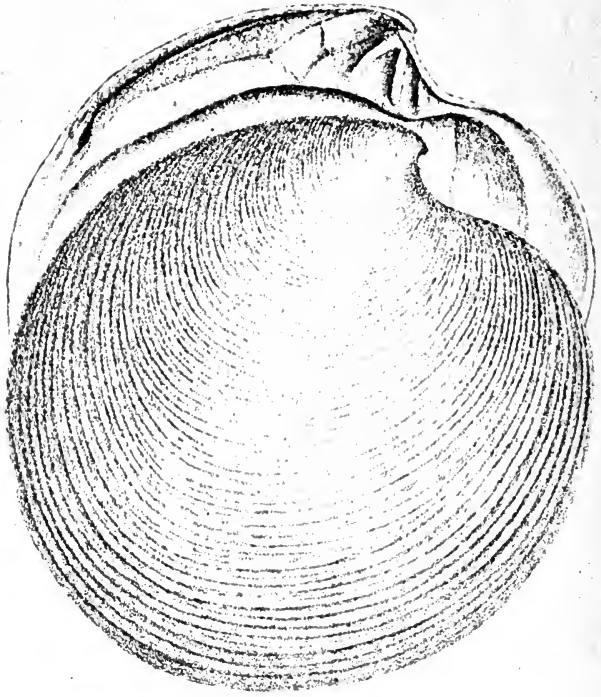


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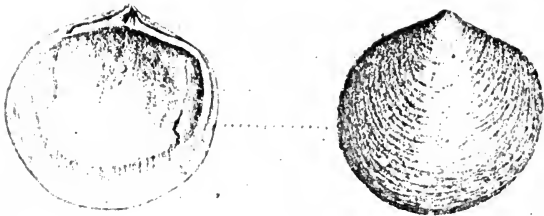


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VOL. 1.

NO. 2.

FOSSIL SHELLS

OF

THE TERTIARY FORMATIONS

OF

NORTH AMERICA,

ILLUSTRATED BY FIGURES DRAWN ON STONE,
FROM NATURE.

BY T. A. CONRAD,

Member of the Acad. Nat. Sc. of Philada.

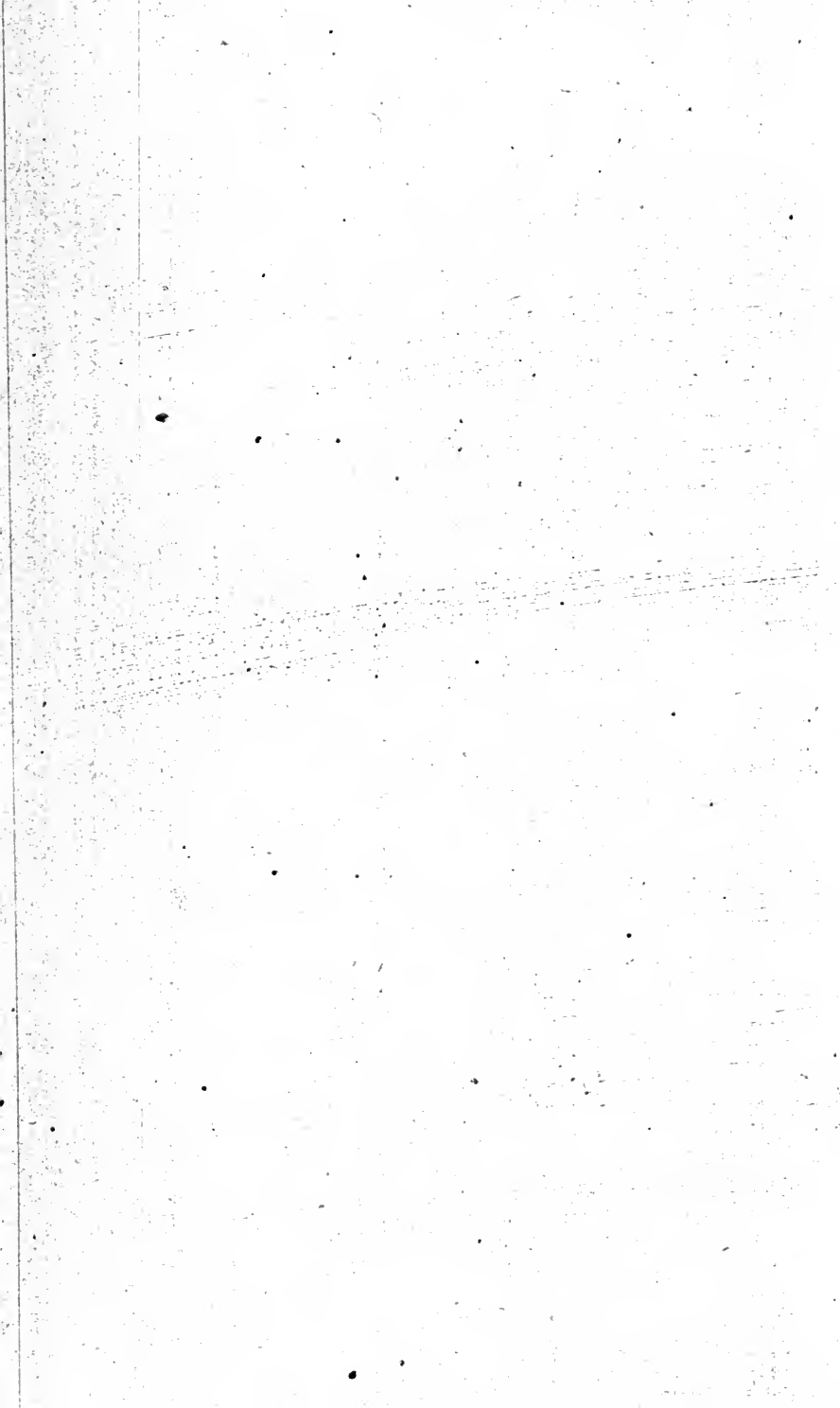
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December, 1832.

W. P. Gibbons, Pr.



many authors, but the hinge differs essentially, and has more the character of *Lucina*, which also has frequently the fosset under the apex. *Orbiculus*, Megerle, *Lentillaria*, Schumacher, *Exoleta*, Brown, are synonymes of the present genus which is very different from *Artemis* of Oken, an example of which is *Venus pectinata* of Chemnitz. I adopt the name given by Poli, on the authority of Blainville, as I have not seen the work in which it was originally described.

LUCINA ACCLINIS. *Tab. 6, fig. 2.*

Suborbicular, or lentiform, a little oblique, with strong lines of growth; hinge with 2 diverging teeth in each valve; posterior tooth of the right valve bifid; anterior muscular impression not profoundly elongated.

Locality. York-town, Va. Upper Tertiary.

This species I obtained only in a very circumscribed spot, at a considerable elevation, in sand composed chiefly of comminuted shells. This calcareous sand prevails more or less in every part of the high bank at York-town, and as it is formed of shells not partially decomposed but comminuted by attrition, the fact is obvious that it has been subjected to a violent action of the waters at a period anterior to the deposition of the perfect shells it encloses, which could only have been effected in a tranquil sea.

CRASSATELLA ALTA. *Tab. 7.*

Suboval, thick and ponderous, compressed; anterior margin obtusely rounded; posterior margin broad and slightly angular; beaks with regular concentric grooves, and somewhat angulated behind; inner margin crenulated.

Locality. Claiborne, Alab. Middle Tertiary.

This fine species is allied to *C. tumida*, Lam. but is proportionably shorter, and the beaks more central. The cartilage still remains in the valve here represented, and the shell is in the finest state of preservation.

CRASSATELLA MARYLANDICA. Tab. 8, f. 1.

Ovate oblong, thick and ponderous; posterior side narrowed and produced, with the extremity slightly angular or obtusely rounded; umbonial slope subangular; inner margin entire.

Locality. Choptank river, near Easton, Md. Upper Ter.

This species is very common and perfect, the valves being generally in their natural connexion. It is distinguished from other American *Crassatellæ* by its smooth and entire surface.

The bank of the Choptank river, where this species is found, is twenty-five or thirty feet high and perpendicular from the water when the tide is in. A stratum at the base, about twelve feet thick, is composed almost entirely of bivalve shells, the most abundant of which are a large species of *Cytherea* and the shell above described, neither of which have I yet seen in any other deposit.

It is remarkable that although our Upper Marine contains several species of *Crassatella*, all of which are abundant, yet this appears to be the only genus of that formation, with the exception of a *Pholadomya*, without a living representative on the coast of North America.

Blainville observes, that this genus is remarkable from the circumstance, that all the recent species which it contains, eleven in number, exist only in the seas of Australasia, although there are seven in the fossil state in France. De France, with some doubt, enumerates twenty in the inferior Chalk.

CRASSATELLA PROTEXTA. Tab. 8, fig. 2.

Elongated; umbonial slope angular or obscurely plicated; the posterior side produced, or rostrated with age, and the extremity obliquely truncated; beaks with concentric grooves; inner margin crenulated.

Locality. Claiborne, Alab. Middle Tertiary.

This fine shell, though variable in outline, is distinguished by a length, in proportion to the height, unusual in the genus, it is abundant, and a single valve measures $2\frac{1}{2}$ inches in length and 1 inch and 3 tenths in height.

CRASSATELLA UNDULATA. *Tab. 9, fig. 1.*

Oblong subovate, much compressed, with coarse concentric lines; umbo flattened, and with regular concentric grooves; apex subacute; inner margin entire.

Syn. CRASSATELLA UNDULATA, *Say. Journ. A. N. S. v. 4, pl. xi, fig. 2.*

Localities. James River, near Smithfield, Va.; abundant; York-town, Va. Upper Tertiary.

Variety, A. Thick and ponderous; not much compressed. A specimen in the collection of the Academy is marked St. Mary's county, Md.

Young shells of this species closely resemble *C. compressa* of Lamarck, as figured in Deshayes' *Coq. Fos. des env. de Par.*

 CRASSATELLA MELINA. *Tab. 9, fig. 2.*

Ovate, thick, not compressed; anterior margin obtusely rounded; posterior margin oblique and angular; dorsal margin nearly straight; concentric lines coarse; umbonial slope subangular and scarcely curved; beaks with concentric grooves; inner margin entire.

Locality. Cumberland Co. N. J. Upper Tertiary.

This shell is intermediate to *C. undulata* and *Marylandica*, but is perfectly distinct from both. It occurs abundantly in the tertiary marl, accompanied by *Perna maxillata* and several new and interesting species. The existence of this formation in New Jersey was first ascertained by means of some fossils brought very lately from Stow creek, by Mr. Samuel Griscom, who has since accompanied me to the spot. We traced it several miles north of Stow creek, and in one instance found its surface composed of a bed of the *Ostrea virginiana* or common oyster, erroneously supposed to have been deposited by the Indians. These beds occur in the same manner at Easton, Md. and except in the *Crag* on the Potomac, always present fragments of *Pecten madisonius*, and other extinct species. There can be little doubt that all those beds of oyster shells beneath the

superficial soil, and elevated above the level of the sea, on the coasts of New Jersey and Long Island, are referrible to the Upper Marine formation.

TURBINELLA PYRULOIDES. *Tab. 10, fig. 1.*

Pyriiform, ventricôse, smooth; with obscure spiral striæ on the inferior half of the body whorl; spire very short; apex slightly mammillated; columella with 4 distant oblique plaits.

Locality. Claiborne, Alab.; very abundant. Middle Ter.

Mr. Vanuxem obtained this species in Georgia, replaced by silex and translucent; it accompanied a species of *Cytherea* which also occurs at Claiborne, and probably the fossils of these silicious beds, when further examined, will enable us to refer them to the middle tertiary. This formation extends west of the Mississippi, as I have lately ascertained by means of specimens of ferruginous marl, sent, by Judge Bry of Louisiana, from a locality on the Ouachitta river. They were presented to the American Philosophical Society, and are almost entirely composed of a species of *Corbula*, very common and characteristic in the sandy deposits at Claiborne, and hardly to be distinguished from *C. angustata* of Sowerby, figured in the Transactions of the Geological Society.

ANCILLARIA ALTILE. *Tab. 10, fig. 2.*

Obovate acute; body whorl ventricose; spire rather abruptly contracted, subulate towards the apex which is acute; suture obsolete; columella callous, much thickened and projecting above.

Locality. Claiborne, Alab. Middle Tertiary.

The genus *Ancillaria* appears to be very characteristic of the equivalents of the *London Clay*, most of the known species appertaining to that formation. In the superior beds I have not detected a single species, nor does any exist upon our coast.

ANCILLARIA SUBGLOBOSA. *Table 10, fig. 3.*

Subglobose or suboval; spire convex, with the tip suddenly exerted and subulate; apex acute; suture obsolete; columella profoundly callous, and projecting in the middle.

Locality. Claiborne, Alab. Middle Tertiary.

This singular species is perhaps the most ventricose of the genus, but has all the characters of *Ancillaria*. As several individuals were sent among other shells collected at random, they are probably abundant.

ANCILLARIA SCAMBA. *Tab. 10, fig. 4.*

Subulate, turreted; spire elevated; suture obsolete; columella concave and callous; aperture about half the length of the shell and effuse at the base; right lip emarginate at the superior termination; callus at the base elevated and defined by two angular lines.

Locality. Claiborne, Alab. Middle Tertiary.

ANCILLARIA STAMINEA. *Tab. 10, fig. 5.*

Cylindrical, with strong longitudinal lines and minute revolving wrinkled striæ; a slight elevation crowns the whorls, defined by a separating line; spire very short, apex rather obtuse; suture distinct; inferior portion of the columella with an elevated profoundly striated callus, above which are three or four lines revolving to the base; aperture gradually contracted above and effuse at the base.

Locality. Claiborne, Alab. Middle Tertiary.

Of the species described by Lamarck, this shell approaches nearest to *A. canalifera*. These two species do not correspond entirely with the genus *Ancillaria*, as the aperture is much longer, the shells are striated, and the suture is somewhat channeled. They might constitute a separate genus by the name of OLIVULA, and would connect *Ancillaria* with *Oliva*.

MACTRA DELUMBIS. *Tab. 11.*

Suboval, thin and fragile, with a fold on the posterior submargin; umbo prominent; beaks nearly central, approximate; lunule much elongated, lanceolate, slightly impressed.

Localities. James River, near Smithfield; Suffolk, Va. Upper Tertiary.

This fine species is not uncommon in the blue marl of certain districts, but is so extremely fragile that entire valves can rarely be obtained. In the banks of St. Mary's river, Maryland, a *Mactra* has been discovered, which, so far as a very imperfect valve admits of determining, appears to be identical with the present species.

PHOLADOMYA ABRUPTA. *Tab. 12.*

Oblong oval, much compressed, with from three to five subacute distant ribs or ridges diverging from the apex; one side rather thick and strong, rounded at the extremity; the opposite side extremely thin, and reflected, with a truncated margin; muscular and palleal impressions distinct.

Locality. York-town, Va. Upper Tertiary.

This rare shell has been found only in the locality above mentioned, where I procured two imperfect valves, and Mr. Finch informs me that he also obtained a broken specimen.

The genus *Pholadomya* embraces but few species, and they chiefly belong to Secondary formations. M. Marcel de Serres, however, has detected this genus in the tertiary marls of the South of France, and one recent species is known, which is figured in Sowerby's *Genera of Shells*.

OSTREA RADIANS. *Tab. 13, fig. 1.*

Oblong, compressed, lobed and flexuous on one side; the ribs numerous, radiated; beaks very small, not prominent, pointed and a little curved laterally.

Localities. Vance's Ferry, S. C.; Claiborne, Alab. Middle Tertiary.

This elegant species, remarkable for the regularity of the ribs, was found in the former of these localities by my friend Dr. Blanding, and others have come under my observation, from Claiborne, where they form an entire bed or stratum, but are almost all in fragments, firmly united by a calcareous cement.

OSTREA SELLÆFORMIS. *Tab. 13, fig. 2.*

Oblong, convex, thick and ponderous, lobed; one side of the larger valve profoundly sinuous and the opposite side gibbous; smaller valve sinuous and little convex; dorsal margin long and slightly arched, with both extremities obtusely rounded.

Localities. Claiborne, Alab. Middle Tertiary.

This singular shell does not vary greatly in its outline, and is very unlike any other species of this country with which we are acquainted. It is often extremely thick and ponderous.

OSTREA CAROLINENSIS. *Tab. 14, fig. 1.*

Obovate, oblique, thick, compressed; superior valve flat; inferior valve convex, with concentric imbricated laminæ which are transversely plicated; beaks broad and prominent; fosset large and defined by broad prominent lateral ridges.

Locality. Santee Canal, S. C.

A large and handsomely plicated oyster, having considerable resemblance to *O. compressirostra* of Say, but the beaks in that species are very small and compressed, whilst in the former they are broad and prominent, and the shell attains a greater size and thickness with an approach to a falcate form.

Numbers were thrown up in excavating the Santee canal, and from its abundance in South Carolina, I have given the specific name of *Carolinensis*. As I have not seen it *in situ*, and am ignorant of its accompanying fossils, I cannot positively refer it to the Middle Tertiary, to which it probably belongs.

OSTREA VIRGINIANA, VAR. *Tab. 14, fig. 2.*

Obovate, profoundly plicated, and with concentric imbricated laminae; superior valve flat, plicated, beaks laterally curved.

Syn. OSTREA VIRGINIANA, *Gmel.*

OSTREA VIRGINICA, *Lam. An. sans vert, v. 6, p. 207.*

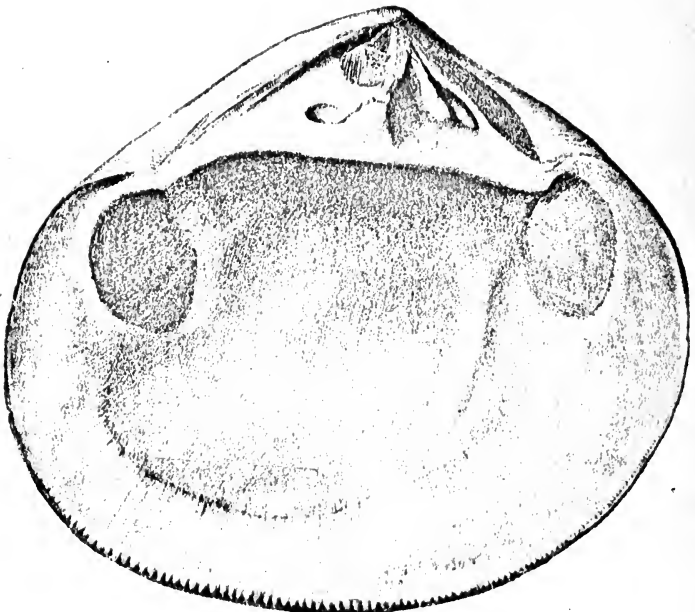
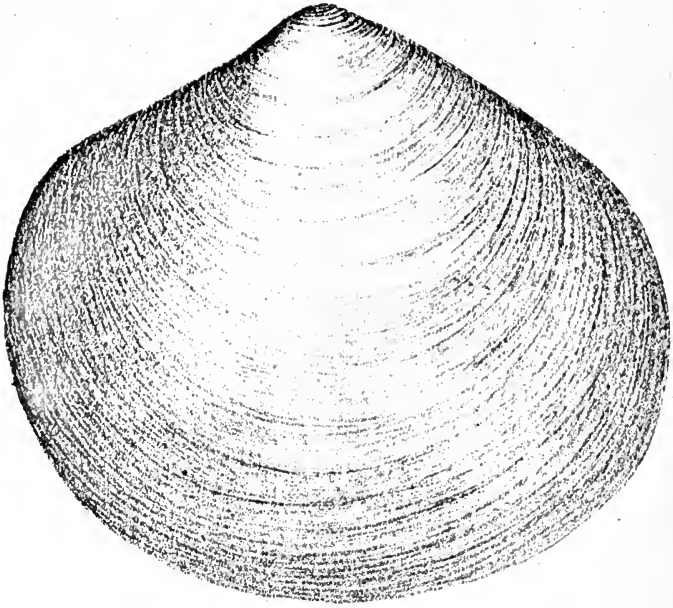
Locality. Suffolk, Va. Upper Tertiary.

A common variety of this species, both in a recent and fossil state, and fine specimens of the former may be obtained on the coast of New Jersey.

As a fossil, the *O. Virginiana* is no less variable than when recent, and occurs in a stratum with but little intermixture of other shells, which, wherever found, constitutes the superior bed of the formation it belongs to, although detached shells may be taken from any portion of the various deposits. Even in the *Crag* it exhibits the same relative position, and seems to have been the last bed deposited by the waters of the retiring ocean. The town of Easton, on the Eastern Shore of Maryland, stands upon a bank of these oyster shells, which in many places in the vicinity of the town, may be seen, very entire, and mingled with the superficial soil; beneath them are the Tertiary marls, containing the usual characteristic species, but so far decomposed as to be scarcely recognizable. This species is also found in various parts of Europe, and is considered by Brongniart as a characteristic fossil.

A very large oyster, probably identical with the present, extends in a continuous bed through South Carolina, Georgia, Alabama, and Mississippi. Mr. Finch considers this a distinct formation, and terms it *Calcaire Ostree*; but before we adopt it as such, it is necessary that it should be carefully examined, and therefore a detailed account of it will be reserved for a future number of this work.

Plate 7.



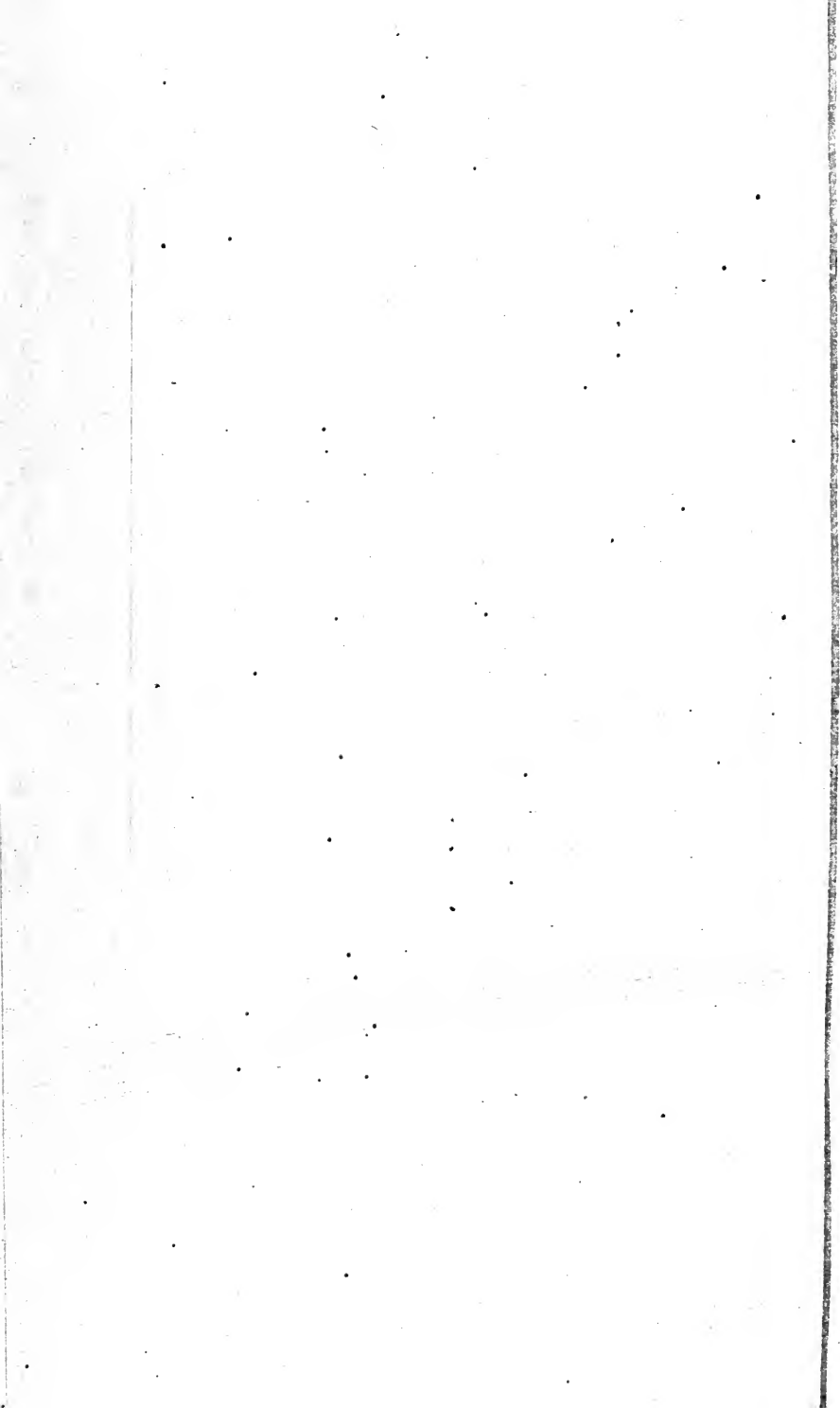
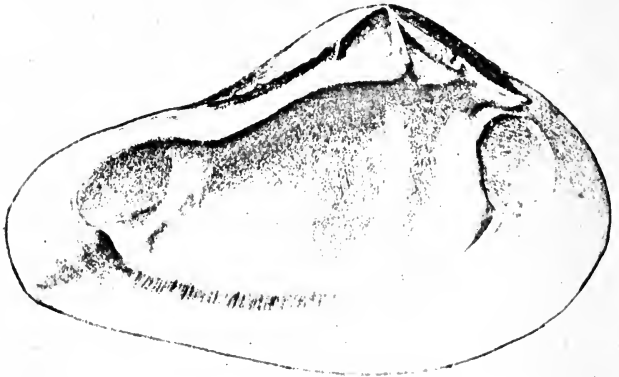
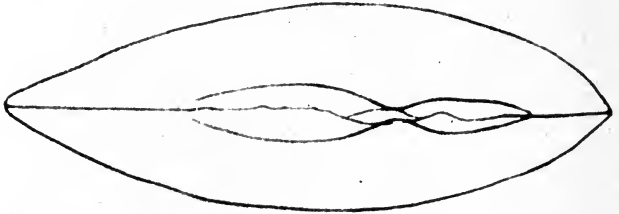
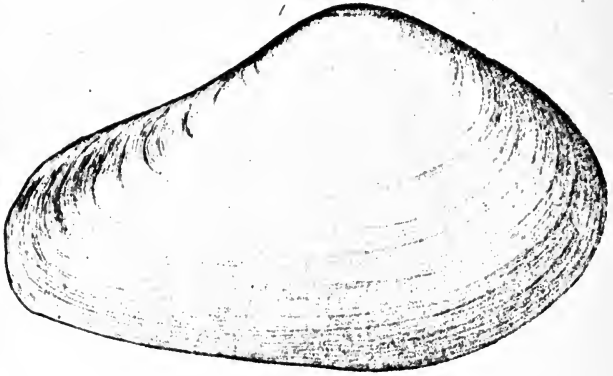


Plate 8.

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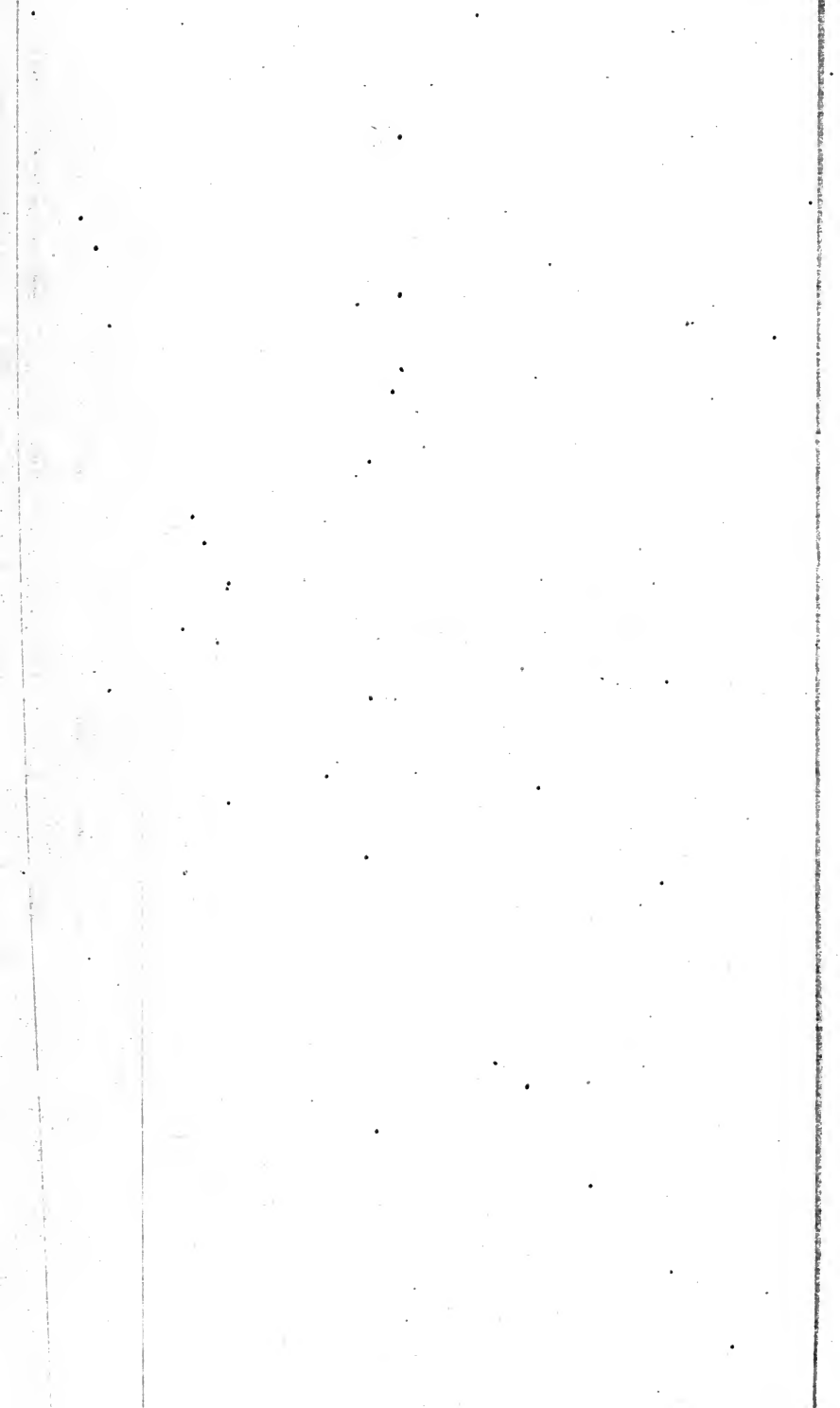
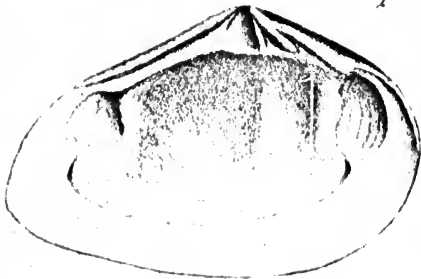
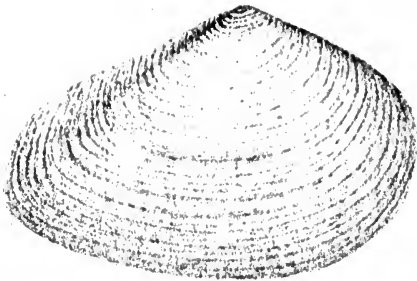
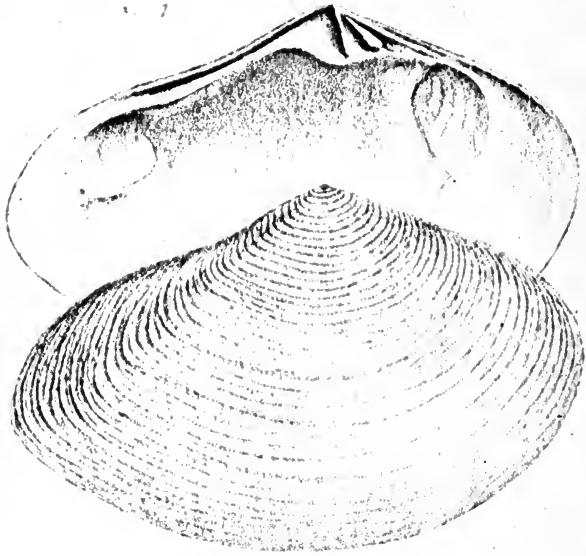


Plate 9.



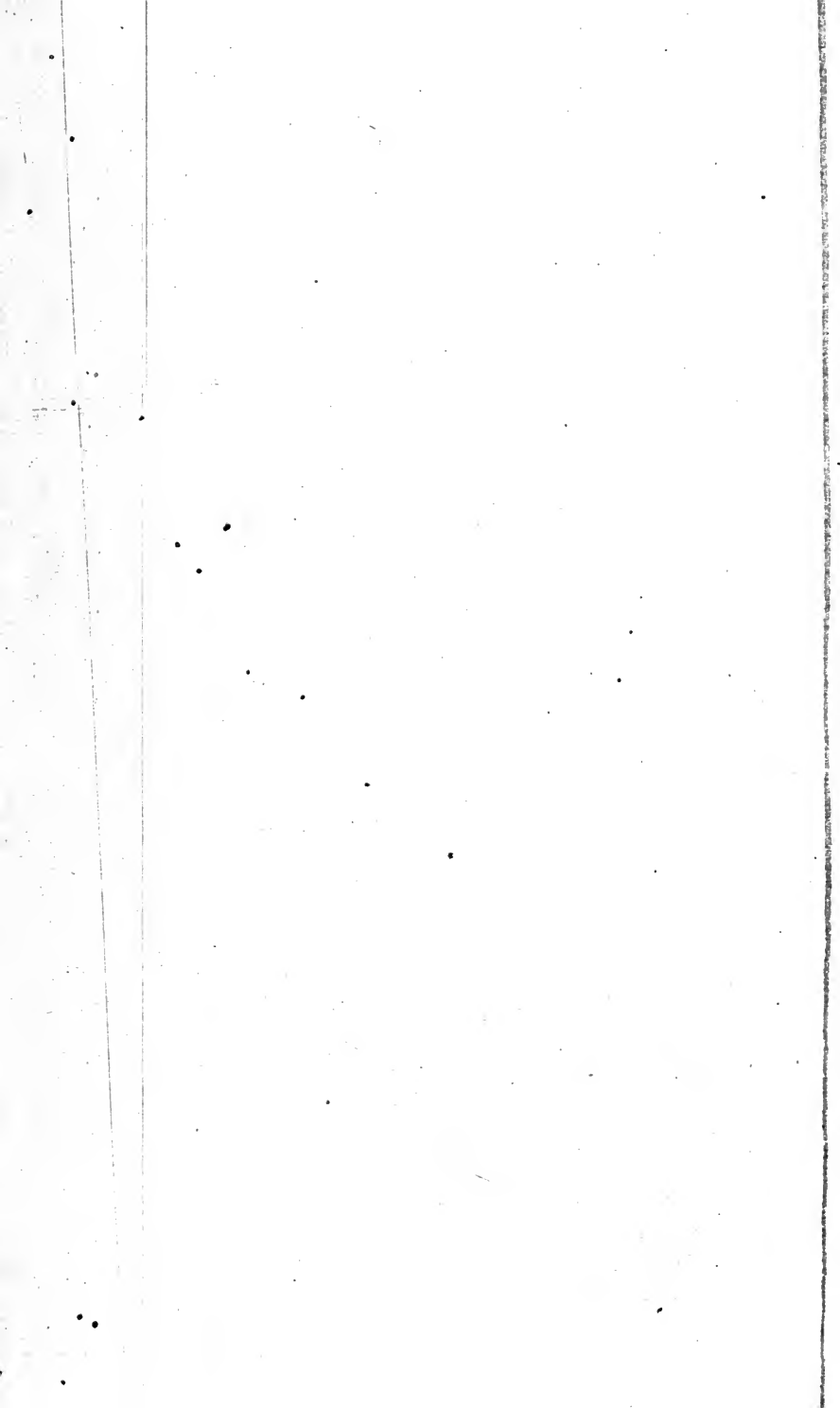
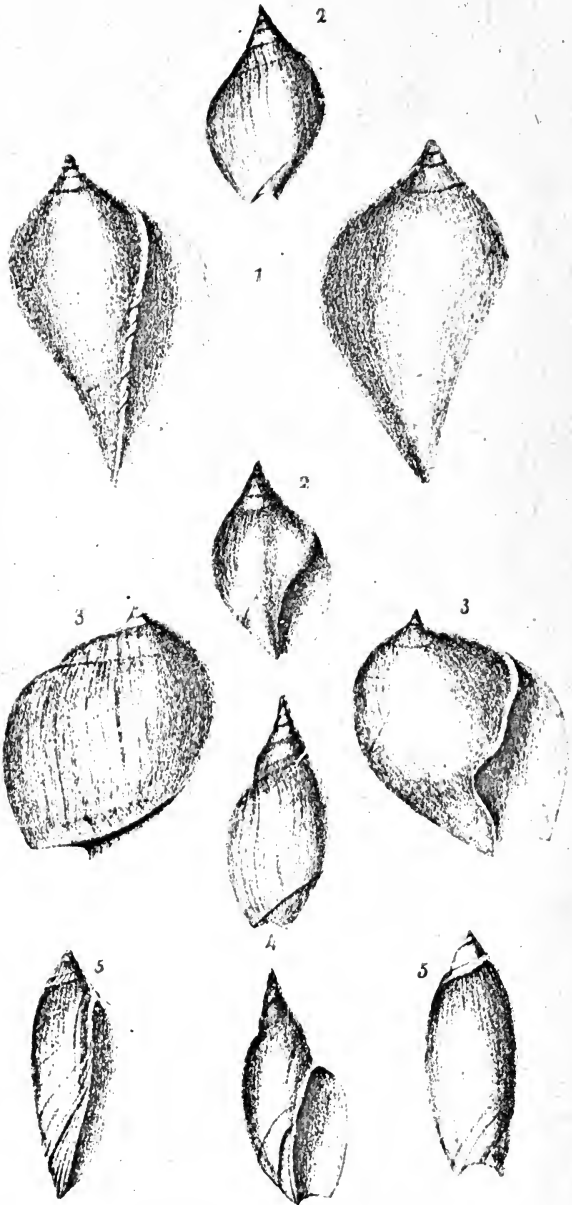
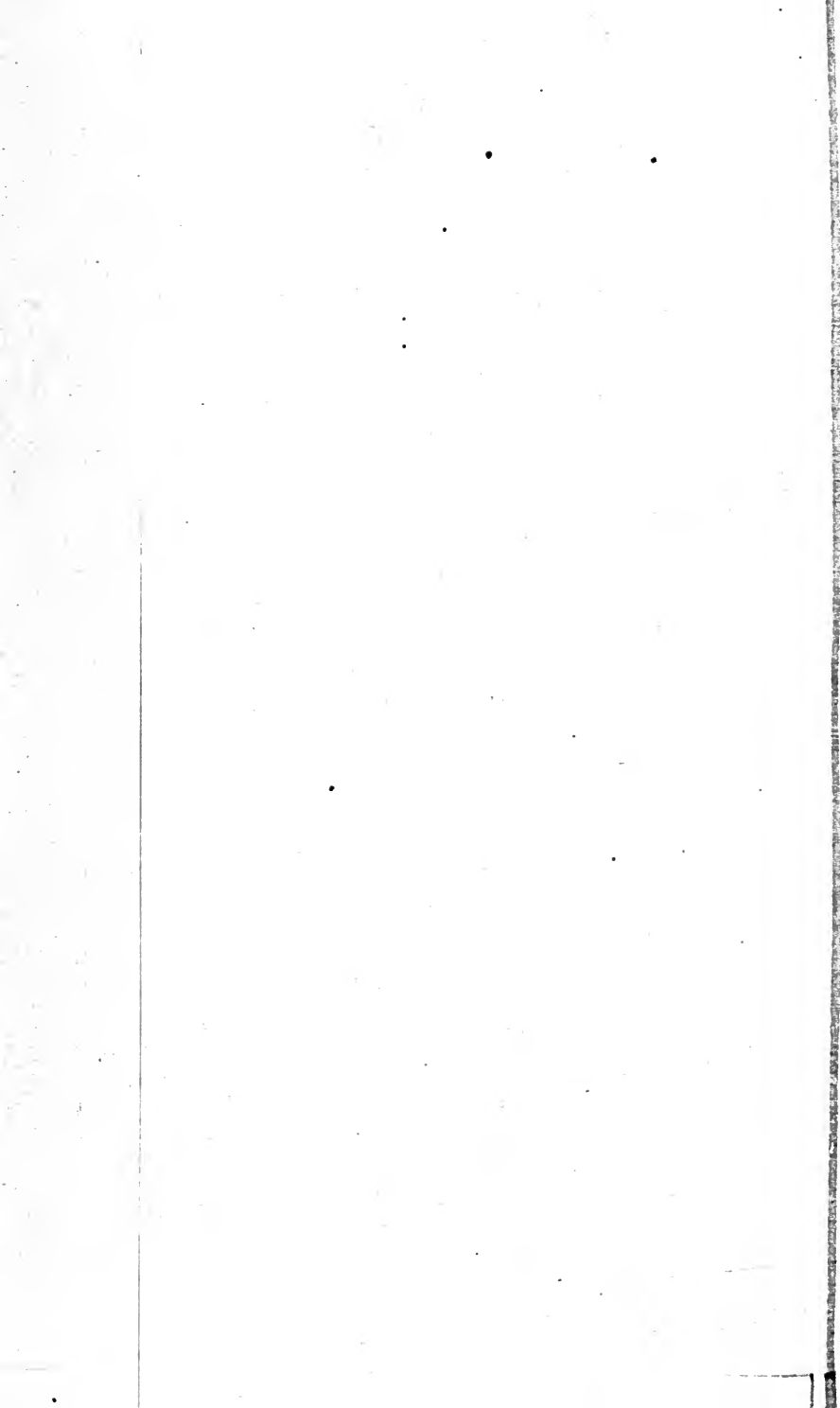
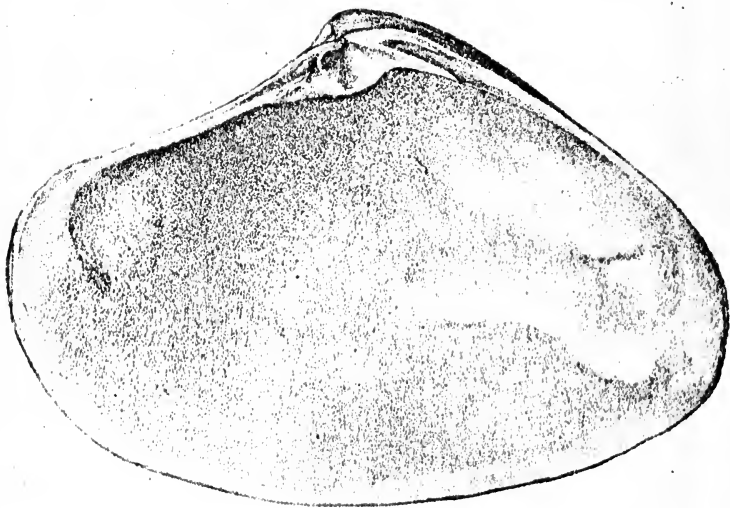
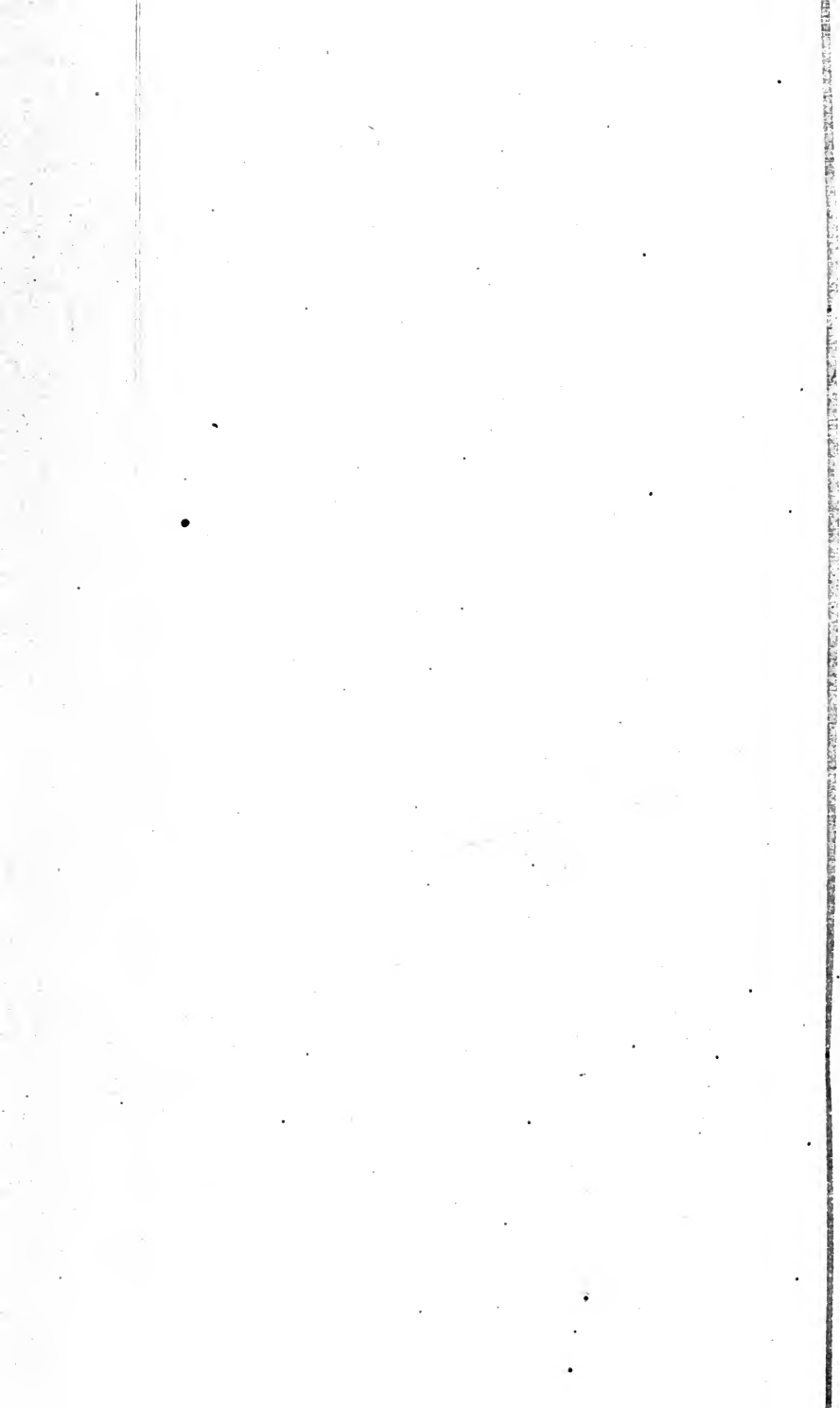


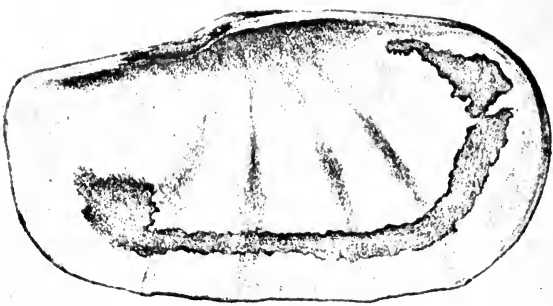
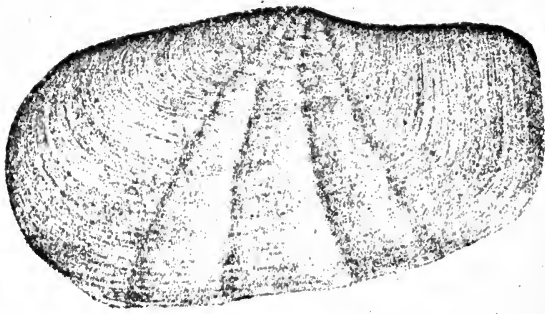
Plate 10.

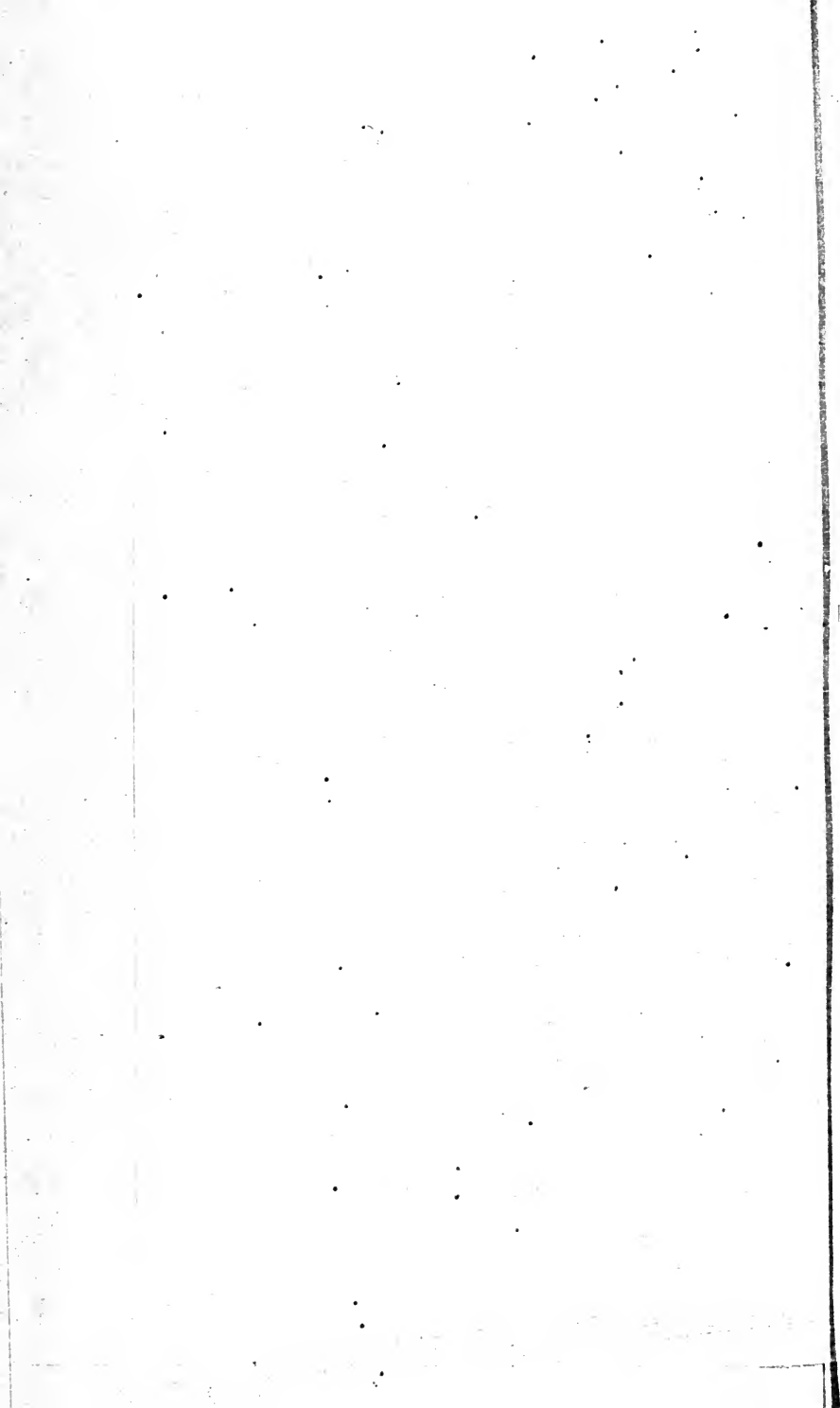


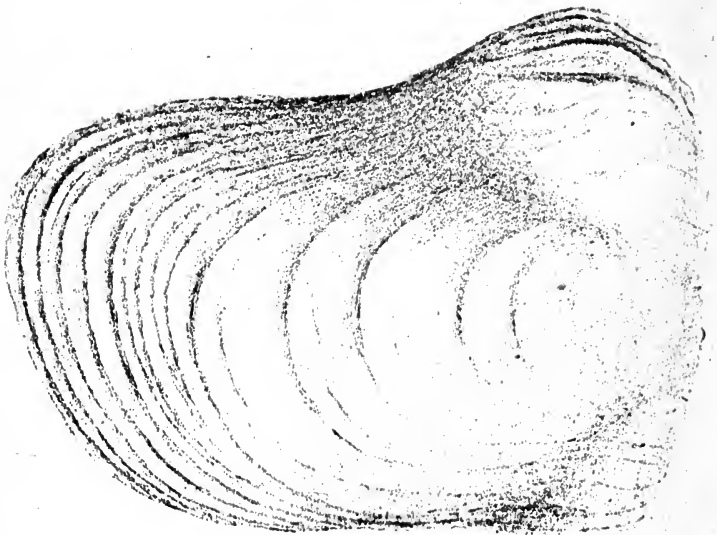
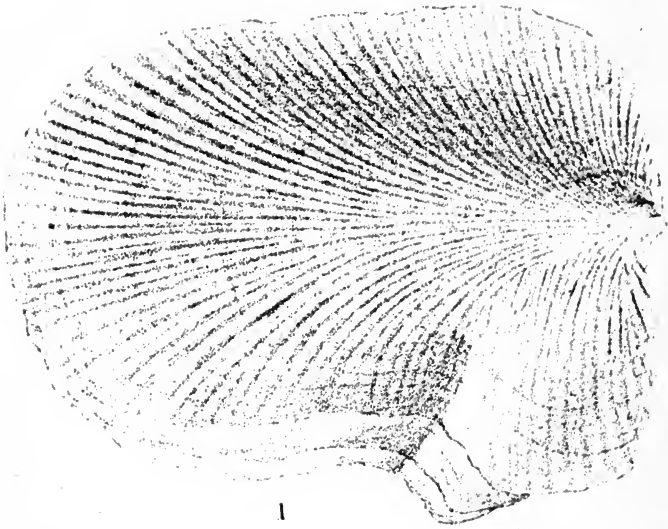


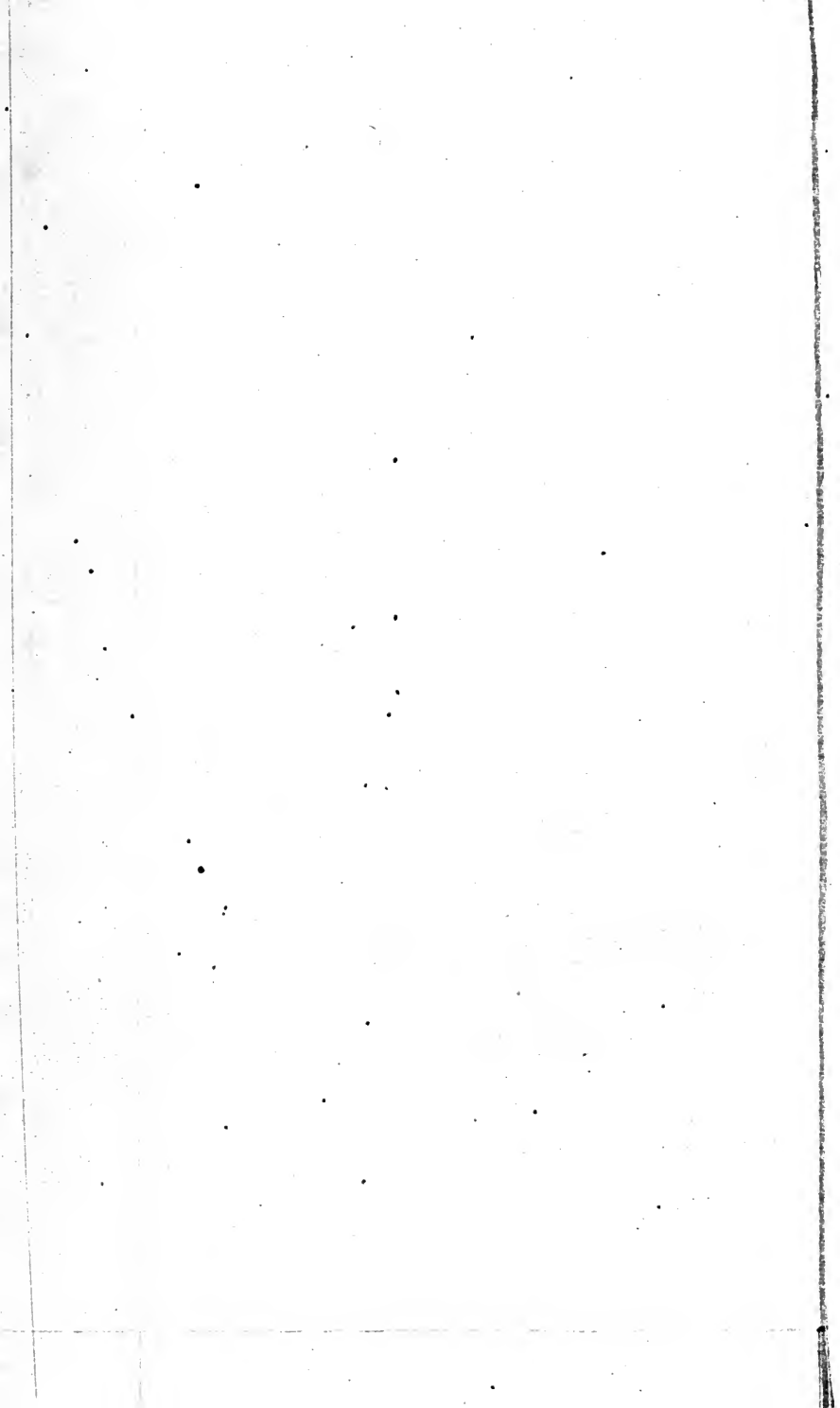


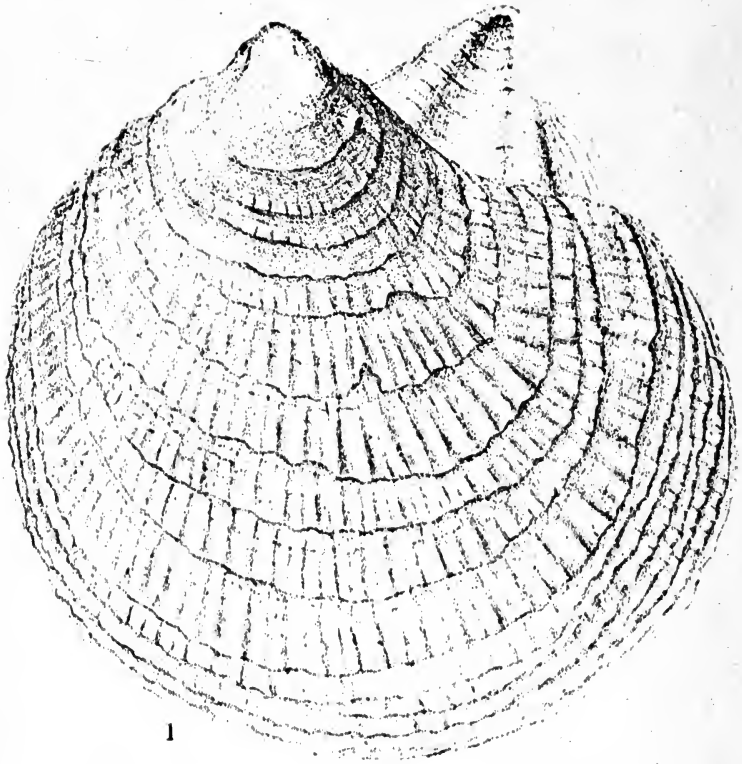




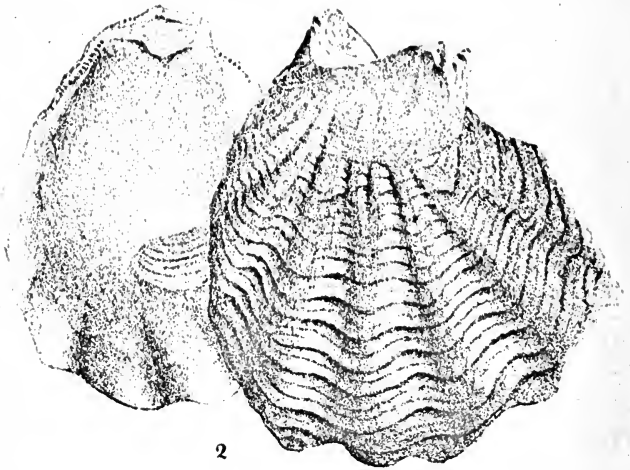




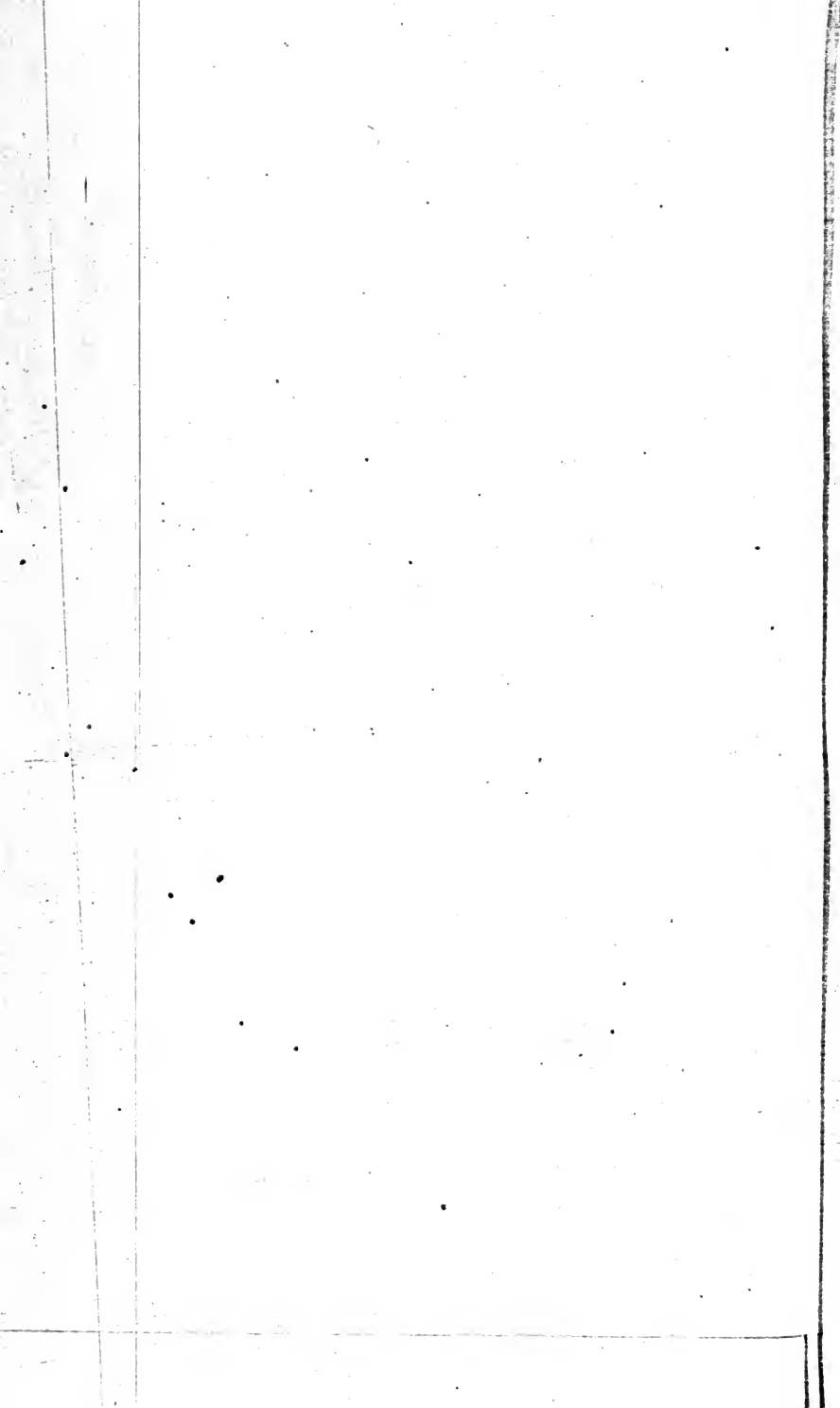




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From the liberal patronage extended to similar publications in Europe, and the interest which Geology has excited in this country, the author of the present humble work was induced to hope that he would at least dispose of a sufficient number of copies to defray the expenses of the first number; but he has been disappointed. The second number is now, however, offered to the friends of science, with *eight* lithographic plates illustrating *seventeen* species, *fifteen* of which have never before been figured; and the author begs leave to state, that if sufficient encouragement is extended, he will include in twelve numbers at least *one hundred plates* and *three hundred species*, a much greater number of American tertiary fossils than at present exist in our collections, but which the author expects to obtain whilst on a visit to the Southern States in the course of the present winter; a journey which he confidently believes will furnish novel and interesting facts in the Geological relations of extensive beds of organic remains, adding greatly to the value of his present publication.

The *Third number* will appear when the sale of the first shall warrant its publication, and the work will be completed, so far as the material can be procured, within two years from the date of the 3d No.

Terms. One dollar each number.

VOL. 1.

NO. 3.

FOSSIL SHELLS

OF

THE TERTIARY FORMATIONS

OF

NORTH AMERICA.

ILLUSTRATED BY FIGURES DRAWN ON STONE,
FROM NATURE.

BY T. A. CONRAD,

Member of the Acad. Nat. Sc. of Philada.

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Cytherea discoidalis.
Cytherea perovata.
Nucula magnifica.
Arca cuculloides.
Corbula nasuta.
Astarte callosa.
Astarte proruta.
Plicatula filamentosa.

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VOLUTA.

1. *V. Sayana*. Pl. 15. fig. 1.

Shell ventricose, with numerous distinct longitudinal striæ: body whorl, with about fourteen longitudinal undulations, having two or three small tubercles on the shoulder of each: transverse striæ numerous, more profound near the base: spire acute, tuberculated, elevated; four folds on the columella, one of them obsolete. Length $2\frac{1}{2}$ inches.

Locality. Claiborne, Alab.

Bears a general resemblance to *V. luctator*, Sowerby.

Cab. Acad. N. S.

I dedicate this species to my distinguished friend Mr. T. Say.

2. *V. petrosa*. Pl. 15. fig. 2.

Shell subglabrous; body whorl marked with from eight to ten longitudinal folds, terminating on the shoulder in compressed subacute tubercles, which are also distinct on the spire: transversely striated at base: two folds on the columella. Length $1\frac{1}{2}$ inches.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

FUSUS.

F. trabeatus. Pl. 15. fig. 3.

Shell subfusiform, ventricose, with revolving elevated striæ at the base, and more obscure ones on the spire: body whorl with two distinct rows of tubercles, humeral one continued on the spire. Length $1\frac{1}{2}$ inches.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

2. *F. papillatus*. Pl. 15. fig. 4.

Shell fusiform, obliquely striated; beak rather long, and subcylindrical: shoulder with subspurious tubercles, spire short, twisted, mammilliform. Length about 1 inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

3. *F. inauratus*. Pl. 15. fig. 5.

Shell ventricose, smooth, unarmed; suture of the body

whorl somewhat channelled; spire short, pointed, with small tubercles near the summit: beak slightly curved, rather open. Length 1 inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

4. *F. thoracicus*. Pl. 15. fig. 6.

Shell fusiform, with seven or eight revolving, elevated costæ on the body whorl, and longitudinal raised striæ: sutures deeply channelled: whorls six; two costæ on each whorl of the spire. Length about an inch.

Locality, Claiborne, Alab.

Somewhat resembles *F. quadricostatus*, Say.

Cab. Acad. N. S.

MELONGENA.

M? armigera. Pl. 16. fig. 1.

Shell subglobose, ponderous; body whorl with a double row of short, thick spires, one on the shoulder, the other near the middle: three or four strongly impressed lines towards the base: columella and lip callous; basal emargination profound, spire subconical, convex, constituting nearly half of the shell, the humeral spires revolving upon it. Length 2½ inches. Breadth 2 inches.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

MUREX.

M. engonatus. Pl. 16. fig. 2.

Shell thick, fusiform, transversely striated, umbilicated, with six angular varices on the body whorl, the striæ passing over them; whorls six in number, and the varices continued in direct lines to the apex: beak rather thick; canal narrow. Length 1½ inches.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

SCALARIA.

S. nassula. Pl. 16. fig. 3.

Shell elongated, with eight ventricose, transversely grooved whorls, and numerous delicate costæ, about twenty of which are on the body whorl: basal margin carinated. Length $\frac{3}{4}$ of an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

SOLARIUM.

1. *S. alveatum.* Pl. 16. fig. 4.

Shell discoidal, smooth, with two revolving striæ near the sutures; periphery of the body whorl acutely carinated; beneath obscurely striated, with an elevated carina and groove near the periphery: umbilicus with conical denticulations. Diameter $\frac{3}{4}$ of an inch.

Locality, Claiborne, Alab.

2. *S. antrosum.* Pl. 18. fig. 1.

Shell convex, subconical, with numerous crenulated lines; periphery of the body whorl acute; beneath with about eight grooves, in each of which is a slightly elevated line: umbilicus large, crenulated upon the edge of the whorls, and with a distinct elevated line on the middle of each whorl internally: aperture angular, subquadrate. Diameter nearly an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

ROSTELLARIA.

R. velata. Pl. 16. fig. 6.

Shell subfusiform, longitudinally ribbed and transversely striated, but often coated more or less with a smooth, polished calcareous deposit, bounded by a deep groove running upon the spire and returning towards the base: outer lip not expanded; margin thick and reflected. Length $1\frac{1}{2}$ inches.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

The young and even the adult shells of this singular species are often without the calcareous tunic; sometimes the latter only exists partially, showing the costæ around it; and again the costæ are occasionally wanting, probably from age.

OLIVA.

1. *O. Alabamensis*. Pl. 17. fig. 1.

Shell subfusiform, spire conical, acute, the whorls contracted, and defined by an impressed line above the suture. Length $1\frac{1}{2}$ inches.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

2. *O. bombylis*. Pl. 18. fig. 5.

Shell slender, subcylindrical, acute; aperture narrow; sutural canal well defined; columella with about seven striæ. Length $\frac{3}{4}$ of an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

INFUNDIBULUM.

I. urticosum. Pl. 17. fig. 3.

Shell convex, thin, subconical, with three or four volutions terminating in a subcentral apex: dorsum covered with short tubular spires; base with obscure diverging striæ, umbilicated. Diameter 1 inch.

Variety, B. Flattened or discoidal: smooth on the back.

Variety, C. Elevated, smooth.

I at first thought there might be two or three species among these fossils, but a comparison of a great number of individuals has convinced me of their specific identity.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

PYRULA.

P. penita. Pl. 17. fig. 4.

Shell subfusiform, reticulated, with three carinations on the

body whorl: striæ alternating in size: five volutions; spire elevated and pointed. Lip thickened towards the margin.

Variety, C. Destitute of carinations, and probably the young shell. Length about an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

FISSURELLA.

F. tenebrosa. Pl. 17. fig. 5.

Shell ovate or oval, elevated, with numerous delicate raised costæ, decussated by transverse striæ; inferior margin with impressed lines: apex pointed. Length 1 inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

CONUS.

C. sauridens. Pl. 17. fig. 6.

Shell smooth except at base, which is obliquely striated; whorls of the spire flattened, striated; apex pointed; mouth narrow; shoulder angular. Length 1 inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

MARGINELLA.

1. *M. larvata*. Pl. 17. fig. 7.

Shell smooth, thick; spire obsolete; with from six to eight teeth on the columella. Length $\frac{3}{4}$ of an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

2. *M. crassilabra*. Pl. 17. fig. 8.

Shell smooth, thick; spire elevated; varix on the outer lip very thick and extending upon the spire; lip crenated on its inner edge; nine or ten teeth on the columella. Length less than $\frac{1}{2}$ an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

DENTALIUM.

D. thalloides. Pl. 18. fig. 1.

Shell elongated, slightly curved, with nine distinct longitudinal costæ, and intermediate smaller ones, the latter generally three in number; the middle one being the largest. Length 2 inches.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

VOLVARIA.

V. galba. Pl. 18. fig. 2.

Shell subcylindrical, with fine transverse obsolete striæ: spire umbilicated at base; umbilicus replaced by an impressed line. Length $\frac{3}{4}$ of an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

MITRA.

1. *M. bolaris.* Pl. 18. fig. 3.

Shell subfusiform, transversely striated; whorls five; spire rather short, mammillated; columella with four teeth. Length about one inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

2. *M. doliata.* Pl. 18. fig. 4.

Shell subturbinate, ventricose, striated towards the base, unarmed; shoulder rounded; spire a little elevated, obtuse; columella five toothed. Length about one inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

BUCCINUM.

B. sagemum. Pl. 18. fig. 5.

Shell conic-acute, with elevated, distinct, acute costæ, about fifteen of which are on the body whorl, and decussated by numerous regular, slightly elevated transverse striæ; somewhat indented above the shoulder: volutions about eight, the four

on the apex nearly smooth; aperture about one-third of the length of the shell: right lip striated within. Length $\frac{2}{3}$ of an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

CANCELLARIA.

C. gemmata. Pl. 18. fig. 6.

Shell conical, acute, scalariform, with longitudinal costæ; transverse lines not very distinct; shoulder acute; columella three toothed: labrum internally with about nine raised lines; umbilicus open: aperture triangular. Length $\frac{2}{3}$ of an inch.

Locality, Claiborne, Alab:

Cab. Acad. N. S.

LITTORINA.

L. antiquata. Pl. 18. fig. 7.

Shell conic-acute, somewhat ventricose, with numerous revolving, very elevated lines, alternating with smaller ones, and longitudinal, approximate, regular striæ; sutures deeply impressed; whorls convex; umbilicus distinct, rounded; mouth orbicular, slightly contracted by the rotundity of the penultimate whorl. Length $\frac{1}{2}$ an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

MELANIA.

M? vetusta. Pl. 18. fig. 8.

Shell turritid, acute, with numerous revolving, slightly elevated lines, alternately larger and smaller, and longitudinal minute, much arcuated wrinkles: suture obvious, not deeply impressed: canal patulous; aperture about one-fourth of the length. Length $1\frac{1}{4}$ inches.

This seemingly fresh water shell occurs with the marine testacea in the arenaceous strata near Claiborne, Alab.

Cab. Acad. N. S.

SILICUARIA.

S. vitis. Pl. 18. fig. 9.

Shell irregularly spiral towards the top, with slightly elevated longitudinal lines; fissure narrow. Greatest diameter $\frac{1}{4}$ of an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

CYTHEREA.

1. *C. Poulsoni*. Pl. 19. fig. 1.

Shell ventricose, cordate, with fine concentric striæ; beaks prominent, curved towards the lunule, which is heart shaped: cavity of the beaks very deep. Diameter about 2 inches, the length and breadth being nearly equal.

The beaks are not unlike those of *Isocardia*, and the shell resembles *C. Sayana*, (*nobis*) but the latter wants the concentric striæ. I dedicate this shell to my kind friend, Mr. Charles A. Poulson.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

2. *C. Hydana*. Pl. 19. fig. 2.

Shell subtriangular, inequilateral; posterior side slightly channelled; posterior end cuneiform; lunule lanceolate, elliptical.

I gladly name this fine species in compliment to Mr. William Hyde, one of the most successful and zealous cultivators of American Conchology. Length 2 inches. Breadth $1\frac{1}{2}$ inches.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

3. *C. æquorea*. Pl. 19. fig. 3.

Shell subovate, inequilateral, compressed, with regular, distinct concentric sulci; lunule cordiform, two cardinal teeth in the right valve, parallel and approximate. Length $1\frac{1}{2}$ inches. Breadth $1\frac{1}{2}$ inches.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

4. *C. discoidalis*. Pl. 19. fig. 4.

Shell ventricose, thick, suborbicular, gradually narrowed to the beaks, with concentric striae rather deeply impressed, giving the shell a rough exterior: beaks anterior to the middle; inner margin crenulated; lunule cordate, not very distinct. Diameter 1 inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

5. *C. perovata*. Pl. 19. fig. 5.

Shell cuneiform-ovate, convex, smooth, and polished, slightly sulcated on the inferior half of the valves; posterior side slightly compressed and cuneate; umbo tumid, beaks almost anterior; two anterior cardinal teeth in the right valve, approximate and parallel; lunule cordate and defined by a simple depressed line. Length $1\frac{1}{2}$ inches. Breadth 1 inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

 NUCULA.
N. magnifica. Pl. 20. fig. 3.

Shell obliquely subtriangular, very inequilateral, smooth, thick, with obscure reticular striae; anterior side truncated; posterior side elongated or cuneiform; basal margin crenated; hinge teeth elongated; within pearly or purplish. Length nearly $\frac{3}{4}$ of an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

 ARCA.
Arca cuculoides. Pl. 20. fig. 1.

Shell compressed, thick, inequivalve, reticulated; with a broad subcentral sinus, passing from the beak to the basal margin: posterior side elongated, strongly ribbed, and carinated; anterior side with numerous striae; anterior end truncated. Length $2\frac{1}{4}$ inches. Breadth $1\frac{1}{2}$ inches.

The hinge of this shell approaches cucullæa, in the interval between the beaks, having arcuated grooves under the beak;

line of series of hinge teeth widely interrupted, and transverse at the extremities.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

CORBULA.

C. nasuta. Pl. 20. fig. 2.

Shell ventricose, beaks subcentral; posterior side produced, angular and carinated; anterior side rounded; valves with concentric sulci. Length $\frac{3}{4}$ of an inch.

Locality, Claiborne, Alab.

Cab. Acad. N. S.

ASTARTE.

1. *A. callosa*. Pl. 20. fig. 3.

Shell rounded, compressed, with concentric sulci, stronger on the middle; slightly angulated and compressed posteriorly; beaks not compressed, rather prominent and acute; lunule rather deeply impressed, nearly smooth; posterior muscular impression a little elevated; inner margin crenulated.

The sulci of this species have considerable resemblance to those of *A. tellenoides*, (nobis.)

2. *A. proruta*. Pl. 20. fig. 4.

Shell longitudinally suboval; umbonal slope terminating anteriorly in a prominent angle; surface with distinct sulci, obsolete beneath, and terminating posterior to the umbonal slope in wrinkles; apex acute, not compressed; lunule narrow, depressed, smooth; margin crenulated..

Locality, Claiborne, Alab.

Cab. Acad. N. S.

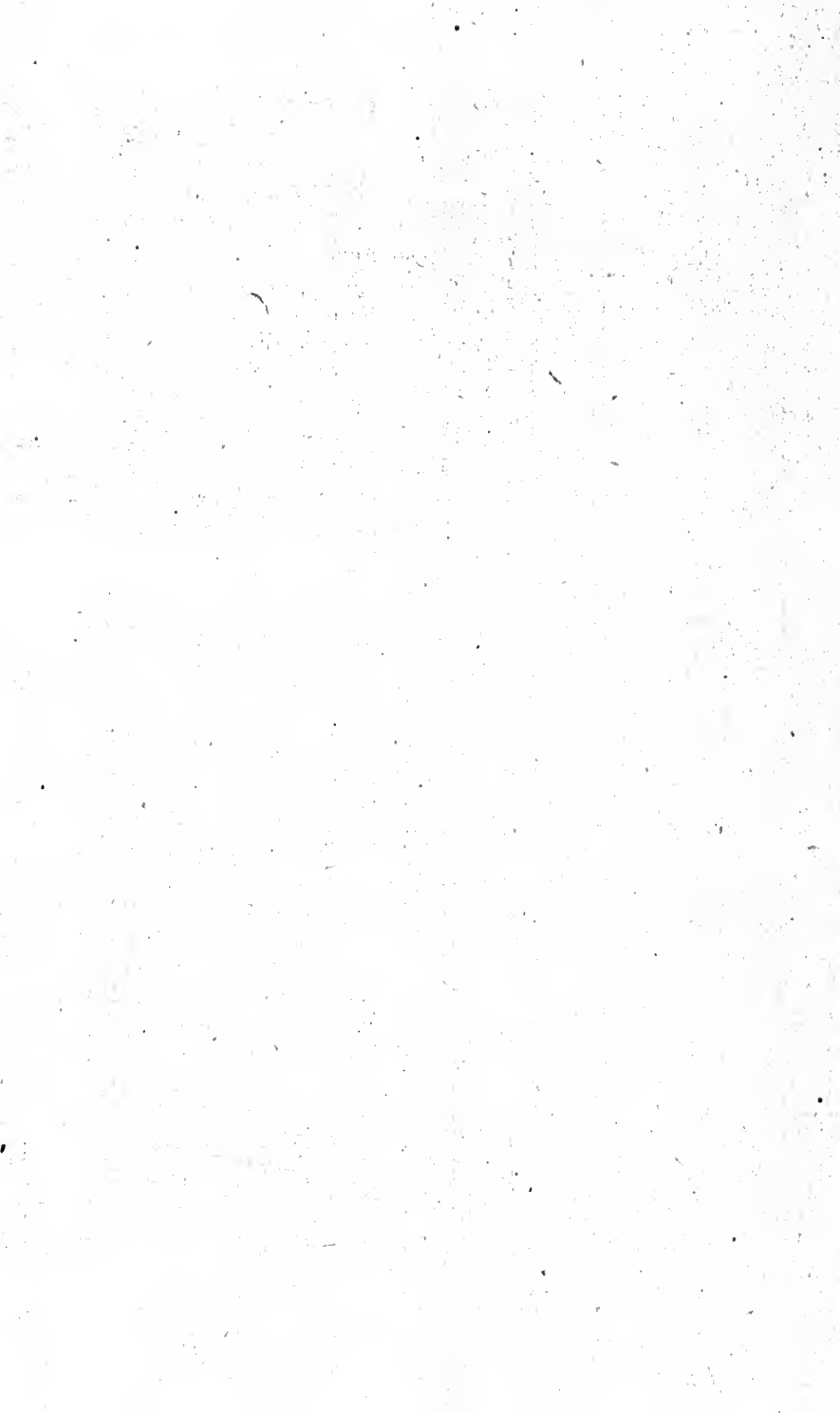
PLICATULA.

P. filamentosa. Pl. 29. fig. 5.

Shell suborbicular, narrowing towards the apex, much compressed; with seven costæ; and densely imbricated with small, irregular, concentric wrinkles, and with minute radiating lines. Breadth and length about $\frac{3}{4}$ of an inch. .

Locality, Claiborne, Alab.

Cab. Acad. N. S.



Persons desirous of having a series of tertiary fossils from Alabama and the other southern States, embracing about eighty species, may obtain them on application to Wm. P. GIBBONS, at his Printing Office, corner of Sixth and Cherry Streets. Price of the collection \$15.

The plates illustrative of this number are in progress, and will be published with No. 4. which is nearly ready for the press.

The *length* of the bivalves in this paper is measured from the anterior to the posterior extremity.

August 24.

FOSSIL SHELLS
OF
THE TERTIARY FORMATIONS
OF
NORTH AMERICA.

ILLUSTRATED BY FIGURES, DRAWN ON STONE,
FROM NATURE.

BY **T. A. CONRAD.**

Member of the Acad. Nat. Sc. of Philada.

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Fam. MYTILIDÆ, Gen. STALAGMIUM, (Nobis.)

Generic character.—An obovate, equivalve, marine bivalve, with the hinge margin crenulated, and an oblique, linear, cardinal fossel for the cartilage; two rather elongated lateral muscular impressions; palleal impression entire; nacre perlaceous.

Obs. I know of but two species of this genus, one of which is minute, and is an abundant fossil in the arenaceous stratum of Claiborne, Alabama. The other is a larger species, recent upon the coast of Rhode Island.

STALAGMIUM.

S. margarataceum. Shell very small, obovate, convex, with distinct radiating striæ; beaks prominent and curved forward; lunule short, cordate, slightly impressed; inner margin minutely crenulated.

Locality. Claiborne, Alabama.

AVICULA.

A. limula. Shell convex, with slight concentric undulations; umbo tapering gradually towards the apex, which is acute, but not prominent; wings large and very oblique; sinus of the posterior margin not profound; nacre very pearly and iridescent. Height, $1\frac{1}{4}$ inches.

PECTUNCULUS.

P. idoneus. Shell suborbicular, thick, convex; oblique, with rather obscure radiating striæ, and minute, intervening lines; umbo convex; beaks distant, rather prominent and pointed; cardinal teeth large; truncated in the centre by a rectilinear line; cavity capacious; margin crenate. Length $1\frac{1}{4}$ in.

P. aviculoides. Shell suboval, very oblique, with minute radiating lines interrupted by regular, prominent concentric striæ; umbo prominent; beaks rather elevated; apex acute; series of cardinal teeth interrupted in the centre, by a triangular fossel; cavity capacious, margin crenulated. Length $\frac{1}{2}$ of an inch.

P. declivis. Shell ovate acute, rather compressed, with fine concentric crowded lines, and very minute and obscure radiating lines, which become very distinct on the posterior side, near the extremity; posterior side cuneiform; beaks small, pointed and recurved; series of cardinal teeth interrupted under the beaks; margin entire. Length $\frac{3}{4}$ of an inch.

P. deciusus. Shell longitudinally suboval, equilateral, with obsolete radiating striæ; posterior end obliquely truncated, umbonal slope angulated, incurved; beaks small, pointed and re-

curved; cardinal teeth small and crowded; series not much arcuated; margin entire. Length $\frac{1}{2}$ an inch.

P. corbuloides. Subtriangular, with one side cuneate and angulated on the submargin; beaks central; cavity capacious; margin entire.

LUCINA.

L. symmetrica. Shell lentiform, equilateral, thick, with regular crowded and prominent acute concentric striæ, and two or three profound concentric sulci near the base: anterior side, with a short submarginal muscular impression, profoundly elongated.

L. subvexa. Shell suborbicular; ventricose; with fine concentric and minute obscure radiating lines; posterior side with an obscure fold, anterior side elevated and subangulated above; hinge edentulous; anterior muscular impression not profoundly elongated; cavity very capacious; surface punctate.

L. pandata. Shell oval, compressed, obscurely cancellated; anterior side somewhat corrugated; beaks nearly central; teeth three in one valve; anterior muscular impression profoundly elongated; lunule excavated, minute. Length $1\frac{1}{4}$ inches.

Amer. Jour. of Sc. vol. 23. This shell is allied to *Lucina mutabilis*, Lam.

L. dolabra. Shell elevated, with distant concentric imbricated and obscure radiating striæ; posterior submargin profoundly channeled, beaks prominent and curved forwards; lunule impressed, cordate; inner margin crenulated. Length half an inch.

Amer. Jour. of Sc. vol. 23.

L. alveata. Shell suborbicular, or rather elevated ventricose; with two or three profound and numerous small concentric sulci; posterior end subtruncated; posterior side with a submarginal fold; beaks prominent; cardinal and lateral teeth distinct; lunule minute, short, cordate, impressed; margin minutely crenulated.

L. carinifera. Shell suborbicular, subequilateral ventricose, with equidistant, acute, prominent concentric striæ; anterior side with a profound fold, or obtuse elevation, and a cordate undulated depression; posterior side with a profound indented fold, emarginating the base; anterior end emarginate above the fold; beaks prominent and incurved; cardinal and lateral teeth distinct; cavity capacious; margin crenulated.

L. pomilia. Shell suborbicular, equilateral, obscurely cancellated, with three or four profound concentric sulci; and an indented fold on both sides, terminating in an emargination of the ends; beaks prominent, lunule profoundly impressed, cordate; cardinal and lateral teeth very distinct; margin crenulated.

TELLINA.

T. alta. Shell suborbicular or suboval, equilateral, convex, with prominent, acute, concentric striæ, and concave intervening spaces, and with minute radiating lines; lunule small; lanceolate, slightly impressed; cardinal teeth and anterior lateral tooth compressed and prominent; posterior lateral tooth small but distinct.

T. papyria. Shell elliptical, equilateral, much compressed; extremely thin and fragile, with regular concentric impressed striæ, most distinct on the anterior side; posterior extremity angulated; lunule linear, impressed; beaks not prominent; apex acute; cardinal teeth prominent; lateral teeth none.

CORBIS.

C. lamellosa. Elliptical, cancellate, with elevated, concentric, remote laminae; interstices with crowded, regular, transverse striæ; inner margin crenulated.

Corbis lamellosa, *Lam.* An. sans Vert. vol. v. page 587. Encyc. Meth. pl. 286, fig. 2, a, b, c.

C. distans. Shell oval, convex, equilateral, with twelve concentric costæ, profoundly elevated and thick, except on the umbo, and lamellar on the posterior side; radiating striæ distinct; lunule impressed and carinated; posterior end subtruncated; margin crenulated.

C. undata. Suboval, convex, with radiating striæ, and elevated concentric undulations on the umbo, and impressed lines on the inferior portion of the valve, where the radiating lines are obsolete; umbo rather ventricose; beaks central, inner margin crenate.

LUTRARIA.

L. papyria. Shell ovate, extremely thin and fragile, inflated anteriorly; with concentric sulci, profound at the anterior and posterior sides, and obsolete at the middle; and with numerous radiating, interrupted, wrinkled lines; anterior end obtusely rounded; posterior end cuneiform, compressed and gaping; beaks elevated, and about one third the length the shell from the anterior end. This shell is allied to *L. canaliculata* of SAY, but is sufficiently distinct.

ROSTELLARIA.

R. laqueata. Subulate, with acute longitudinal ribs, and fine spiral striæ: base coarsely striated.

Obs. I at first thought this might be the young of *R. velata*, (nobis,) but a comparison of many specimens proves it entirely distinct.

ERYCINA.

E. cequorea. Shell subtriangular, equilateral, thick; umbonial slope angulated and submarginal; umbo a little flattened, apex acute; hinge callous; cardinal and lateral teeth compressed and prominent; fosset oblique, obovate; lunule large, elliptical, defined by an impressed line.

E. rectilinearis. Shell subtriangular, compressed: subequilateral; anterior and posterior margins nearly rectilinear from the apex, which is acute; umbo flattened; beaks prominent; lunule elliptical, not well defined; a slightly impressed line extends from the anterior end towards the apex.

MACTRA.

M. decisa. Shell subtriangular, inflated, thin; posterior side short and flattened; umbonial slope angulated; a few prominent acute lines on the posterior depression; fosset oblique, obovate, lateral teeth compressed and much elevated; cavity very capacious.

M. pretennis. Shell subtriangular compressed, equilateral, thin and fragile; umbonial slope submarginal, nearly rectilinear, carinated; beaks slightly prominent; lunule narrow elliptical; two slightly prominent lines behind the umbonial slope.

M. parilis. Shell triangular, equilateral, smooth and polished; both ends depressed and striated; lunule none; cavity capacious.

DONAX.

D. limatula. Shell subtriangular, with obscure radiating striae; posterior side produced and cuneiform; rounded at the end; dorsal margin subrectilinear; beaks prominent pointed; lunule very small, marked by a profound groove; margin minutely crenulated; cavity moderately capacious.

AMPHIDESMA.

A. linosa. Shell longitudinally subovate, with fine concentric raised striae; posterior side short, folded, subtruncated at the end; beaks slightly prominent; cardinal and lateral teeth compressed; fosset narrow-elliptical, elongated; cavity not capacious.

PSAMMOBIA.

P. filosa. Shell elongated, with concentric acute striae, very prominent on the smaller side, which is narrowed and subangulated at the end; beaks not prominent; anterior dorsal margin straight, and the end obtusely rounded; basal margin straight.

P. eborea. Shell oblong-oval, compressed; posterior side longest and obliquely truncated at the end; dorsal margin straight; beaks slightly prominent.

FUSUS.

F. protectus. Fusiform; volutions six or seven; those of the spire longitudinally costated, and spirally striated; whorls indented below the suture; body whorl short and abruptly rounded; beak straight, and much elongated.

F. rannelloides. Short-fusiform, with seven rounded volutions, spirally striated, or sulcated; whorls with two or three broad, rounded costæ, more numerous on the whorls near the apex; spire and beak nearly equal in length; body whorl ventricose; labrum crenulated within.

Obs. The peculiar disposition of the costæ, give this species a resemblance to the genus *Ranella*.

F. thalloides. Narrow-fusiform, with rather distant, spiral, elevated striæ; spire subulate, longer than the beak; superior volutions with obscure longitudinal undulations; aperture small, elliptical; beak straight; channel contracted.

F. allilis. Fusiform, inflated, with coarse spiral striæ; shoulder of the body whorl, and base of the whorls of the spire armed with short foliated spines; body whorl with longitudinal undulations; beak broad, slightly reflected at the base.

F. explicatus. Fusiform, destitute of striæ; spire short, volutions slightly concave, apex papillated; shoulder of the body whorl, with short foliated spines, which are obsolete on the spire; beak long and slightly reflected at the base.

F. stamineus. Fusiform, with spiral striæ of different sizes; volutions, with a single row of short tubercles with a stria passing over the summit of each; beak rather longer than the spire; reflected.

F. proscissus. Short-fusiform, with spiral costæ and longitudinal undulations; summit of the whorl somewhat indented; beak short, thick, reflected; labrum with dislocated lines on the interior surface.

F. bellus. Fusiform, with spiral elevated striæ and longitudinal costæ; spine elevated, acute; beak short and reflected; labrum with the submargin thickened, and with short elevated lines; margin waved.

F. limulus. Fusiform, with spiral lines alternating in size, and oblique nodiform costæ, which do not extend to the middle of the body whorl; volutions subangular; spire elevated, acute; beak short, reflected; aperture nearly half the length of the shell.

F. prorutus. Fusiform, smooth, with seven volutions, a little convex, and with an indented line immediately below the suture; spire longer than the beak, which is striated at the base; aperture more than half the length the shell; labrum striated within.

F. decisus. Subfusiform, with about six convex volutions, crossed by spiral elevated striæ; spire elevated; beak extremely

short, reflected; columella subumbilicated; aperture suborbicular, and with oblique rather distant costæ.

EMARGINULA.

E. arata. Subovate, with numerous angular or acute ribs, alternating in size; crossed by fine regular striæ; apex nearly central, pointed and incurved; fissure wide, extending about one seventh the length from the apex; inner margin waved.

MONOCEROS.

M. vetusta. Subglobose, with revolving striæ, obscure, except the base, where they are distinct; spire short, rapidly narrowing to the apex, which is acute; tooth short and robust, placed at the termination of an exterior groove; basal emargination profound; labrum acute on the margin.

M. armigera. SYN. *Melongena armigera* (nobis.) More perfect specimens prove the existence of a tooth on the labrum of this shell.

ANCILLARIA.

A. lynneoides. Subulate, with an elevated fold on the centre of the columella; labrum somewhat expanded.

SOLARIUM.

S. scrobiculatum. Slightly elevated, with smooth, somewhat concave volutions, crenulated at the sutures; periphery crenulated; beneath indented near the margin; margin of the umbilicus profoundly crenulated; aperture rhomboidal.

S. stalagmium. Depressed, perlaceous, with two large crenulated striæ on each side whorl, and numerous smaller crenulated lines; volutions channeled at the suture; periphery obtusely rounded; beneath rounded with minute striæ, and irregular impressed lines diverging from the umbilical margin; umbilicus narrow; aperture large, orbicular.

S. funginum. Convex above, flat beneath; volutions smooth, with short raised lines diverging from the suture; periphery with an obtuse, slightly elevated, minutely crenulated carina; margin of the umbilicus profoundly crenulated, with a submarginal impressed line, and diverging striæ.

S. azacuum. Discoid, with revolving acute lines; whorls with a wide indentation at the suture; submargin widely indented, and the periphery acutely carinated; beneath flattened; umbilicus smooth; aperture subovate.

S. amœnum. Depressed; whorls smooth, with three raised lines at the suture, the intermediate one smallest and the outer one crenulated; periphery crenulated and bordered by a crenulated line; beneath with an elevated submarginal line; margin of the umbilicus profoundly crenulated, from which diverge numerous strong lines, interrupted by two approximate impressed submarginal striæ, and two subcentral approximate impressed lines; umbilicus contracted.

CANCELLARIA.

C. alveata. Turrited, with oblique acute costæ, and revolving elevated lines; volutions six, the two terminal ones smooth; aperture semilunar; three folds on the columella, the lower one obsolete; labrum obscurely striated.

ACTEON.

A. pomilius. Narrow, with revolving narrow sulci which are transversely striated; fold on the columella much elevated and distant from the base; labrum thick, with a sharp waved edge.

A. idoneus. Narrow-elliptical, with narrow transversely striated sulci, which are distant on the superior portion of the body whorl; fold on the columella elevated and very obtuse; labrum thickened.

A. costellatus. Slightly ventricose, with revolving costæ, or sulci which are transversely striated; fold obsolete or wanting; umbilicated.

SIGARETUS.

S. arctatus. Discoid, with wrinkled spiral raised striæ; umbilicus very small; beneath flattened; aperture oblong-oval.

S. declivus. Obliquely suboval, with distinct impressed and intermediate fine striæ; spine slightly prominent; umbilicus small, partly closed by the callus; aperture patulous.

SCALARIA.

S. sessilis. Subulate, with rather thick longitudinal costæ, and minute crowded spiral lines; whorls nine, sessile or contiguous; base of the body whorl carinated.

TURRITELLA.

T. obruta. Subulate, with about eleven slightly convex volutions, with about seven sharp elevated striæ on each, and intermediate fine crowded lines; space about the suture indented.

BUCCINUM.

B. perlatum. Subulate, with prominent longitudinal lines; and obsolete spiral striæ; volutions about twelve, acutely subturrited.

B. prorsum. Fusiform, with six convex volutions; spirally striated; striæ obsolete on the middle of the whorls; spire subulate; base very slightly reflected; aperture narrow-elliptical, more than half the length of the shell.

B. amenum. Subulate, with about six slightly convex volutions; with distant obtuse longitudinal ribs, and acute prominent equidistant spiral striæ; aperture contracted, less than half the length of the shell; base very slightly reflected.

TURBINELLA.

T. prisca. Inflated, thin; spire depressed, apex papillated; whorls pliated at the suture; base strongly striated; columella with four oblique folds; aperture effuse at base; the colored markings exhibit spiral series of dark quadrangular spots.

T. pratensis. Subfusiform, thin, ventricose, with spiral impressed lines; spire prominent; apex very obtuse; volutions slightly indented; columella four plaited; base narrowed and somewhat elongated.

CASSIS.

C. nuperus. Subglobose, with spiral impressed striæ, and fine longitudinal lines; whorls of the apex convex, and cancellated; columella with prominent tranverse lines, obsolete in the centre; labrum thickened with irregular prominent lines on the submargin.

PLEUROTOMA.

P. elaborata. Subulate, with numerous oblique elliptical nodules, and spiral impressed striæ; beak very short, aperture small; emargination of the labrum profound.

P. tabulata. Turrited or scalariform volutione eight; cancellated with fine striæ, the spiral ones most distinct; angle of the whorls somewhat carinated; profoundly umbilicated.

P. alternata. Subulate or subfusiform; cancellated; spiral, striæ distinct; middle of each whorl crenulated; beak somewhat produced.

P. depygis. Subulate, with nine angulated volutione, nodulous in the middle; and with fine rounded spiral striæ; beak very short.

P. nupera. Fusiform, with eight angular volutione, crenulated in the middle, and fine spiral wrinkled striæ; body whorl slightly ventricose; shoulder with oblique crenulations, beak somewhat produced.

NATICA.

N. atiles. Subglobose, spire very short, umbilicus large, contracted by the callus, and with a prominent, obtuse, broad carina revolving within it; aperture semilunar.

N. emicula. Obovate, with smooth convex volutione and a prominent conical spire; umbilicus elliptical, not contracted by the callus; aperture obovate, rather more than half the length of the shell.

N. limula. Obliquely suboval, smooth, with a short convex spire; umbilicus nearly closed by a profound callus; aperture elliptical.

N. eborea. Smooth and polished; spire slightly prominent, with convex whorls; body whorl subcompressed; umbilicus minute, with a groove beneath it; aperture small, circular.

PYRAMIDELLA.

P. larcata. Subulate, with nine smooth volutione, indented at the sutures, the indentation margined above by a slightly prominent line; body whorl with a spiral indented line near the middle; fold on the columella prominent.

MITRA.

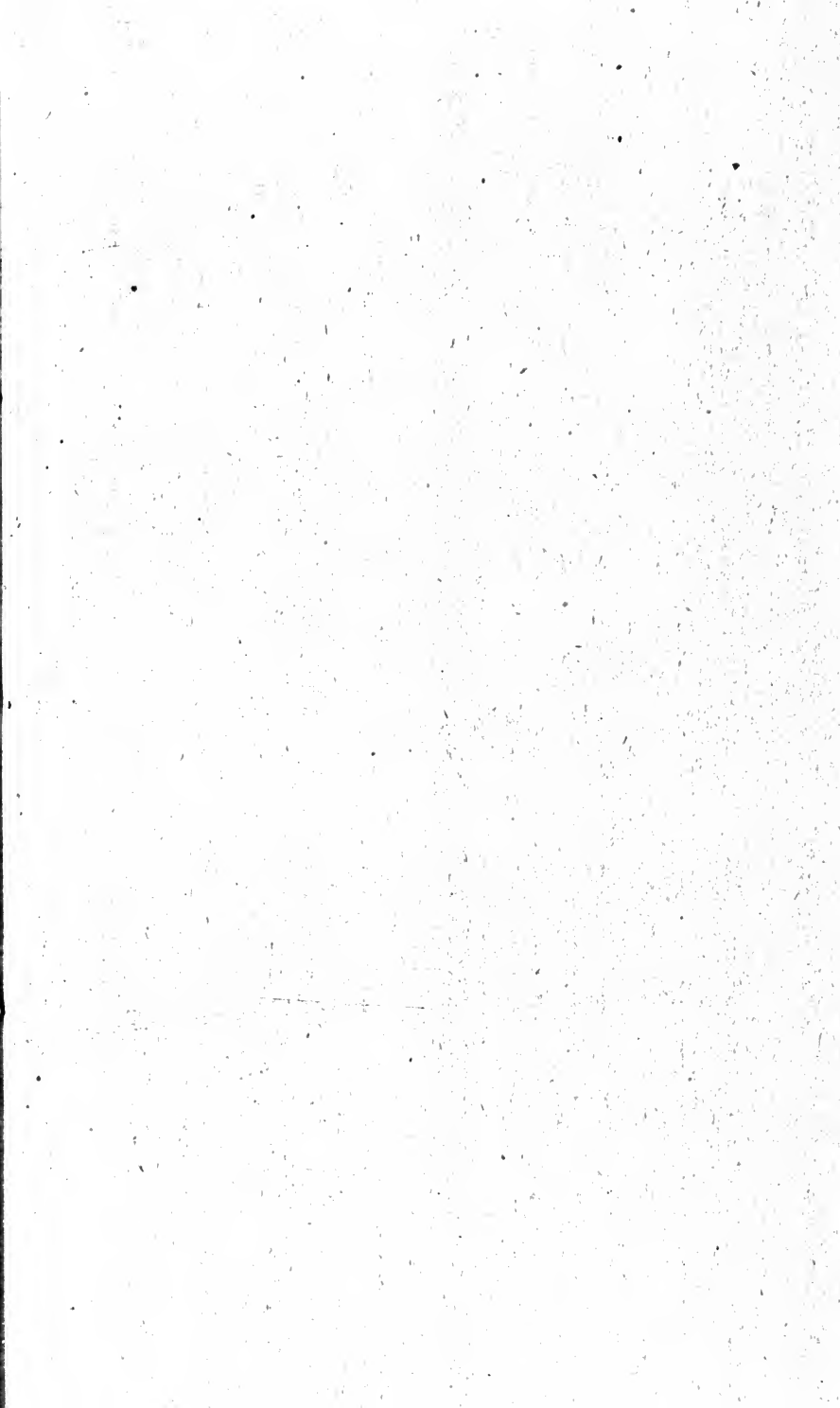
M. pacifica. Subfusiform, with seven volutione, a single row of nodules on each, except the two from the apex, which are smooth; apex papillated; spire elevated; columella with four folds; aperture nearly half the length of the shell.

M. percellis. Narrow-fusiform, with seven smooth convex volutione; base strongly striated; aperture contracted; less than half the length of the shell; columella with three plaits.

NUCULA.

N. equalis. Convex, with obtuse central beaks, and regular concentric striæ; anterior end slightly recurved, with a carinated submarginal line.

N. apulenta. Elongated, compressed, with regular concentric sulci; anterior side rostrated, and with a submarginal carinated line; space between it and the margin with regular prominent striæ; beaks posterior to the middle.



The last number of this work was exclusively devoted to the fossil shells of the CALCAIRE GROSSIER, or middle tertiary deposits of Alabama, and I now continue this interesting part of my subject. I have to regret the necessity of publishing at the distance of a thousand miles from my present domicile; an arrangement that may possibly involve a few inaccuracies in my papers. But, as I hope to return to Philadelphia in the spring of next year, I shall then employ my time assiduously in arranging the numbers of this work in a single volume, which will be illustrated by upwards of thirty plates, and embrace an accurate view of the strata containing the fossils hereinafter described.

T. A. CONRAD.

Claiborne, Alabama. Nov. 1, 1833.

Vol. 1.

No. 3.

FOSSIL SHELLS

OF THE

TERTIARY FORMATIONS

OF

NORTH AMERICA.

BY T. A. CONRAD,

Member of the Academy of Natural Sciences
of Philada. and Geological Society
of Pennsylvania.

CONTENTS.

EOCENE FOSSILS OF CLAIBORNE,

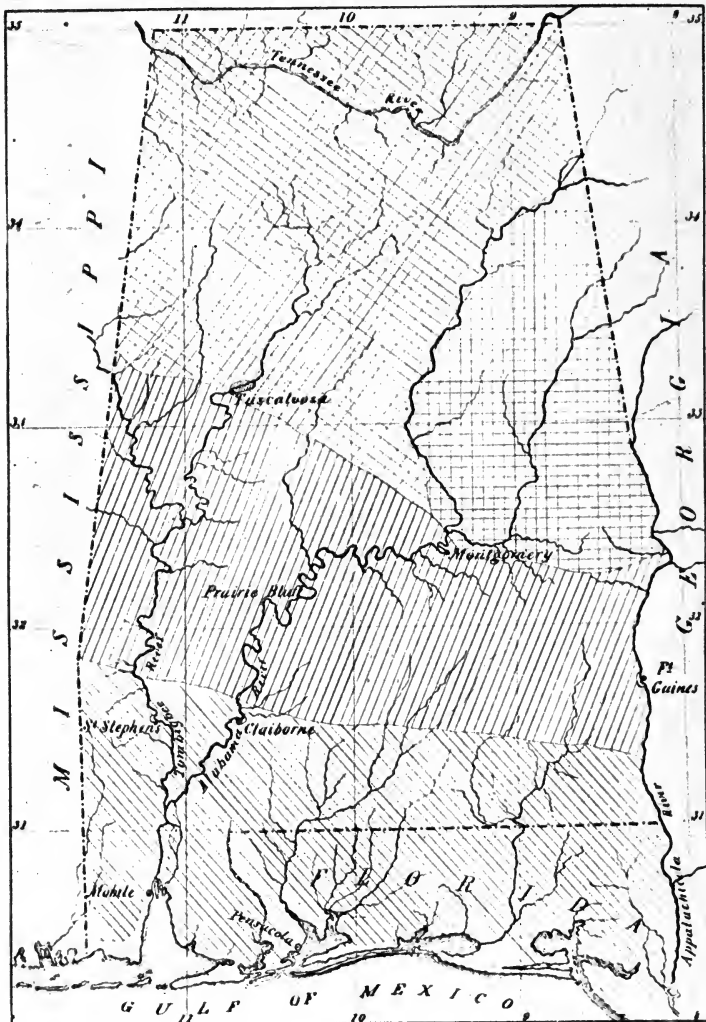
*with observations on this formation in the United States,
and a geological map of Alabama.*

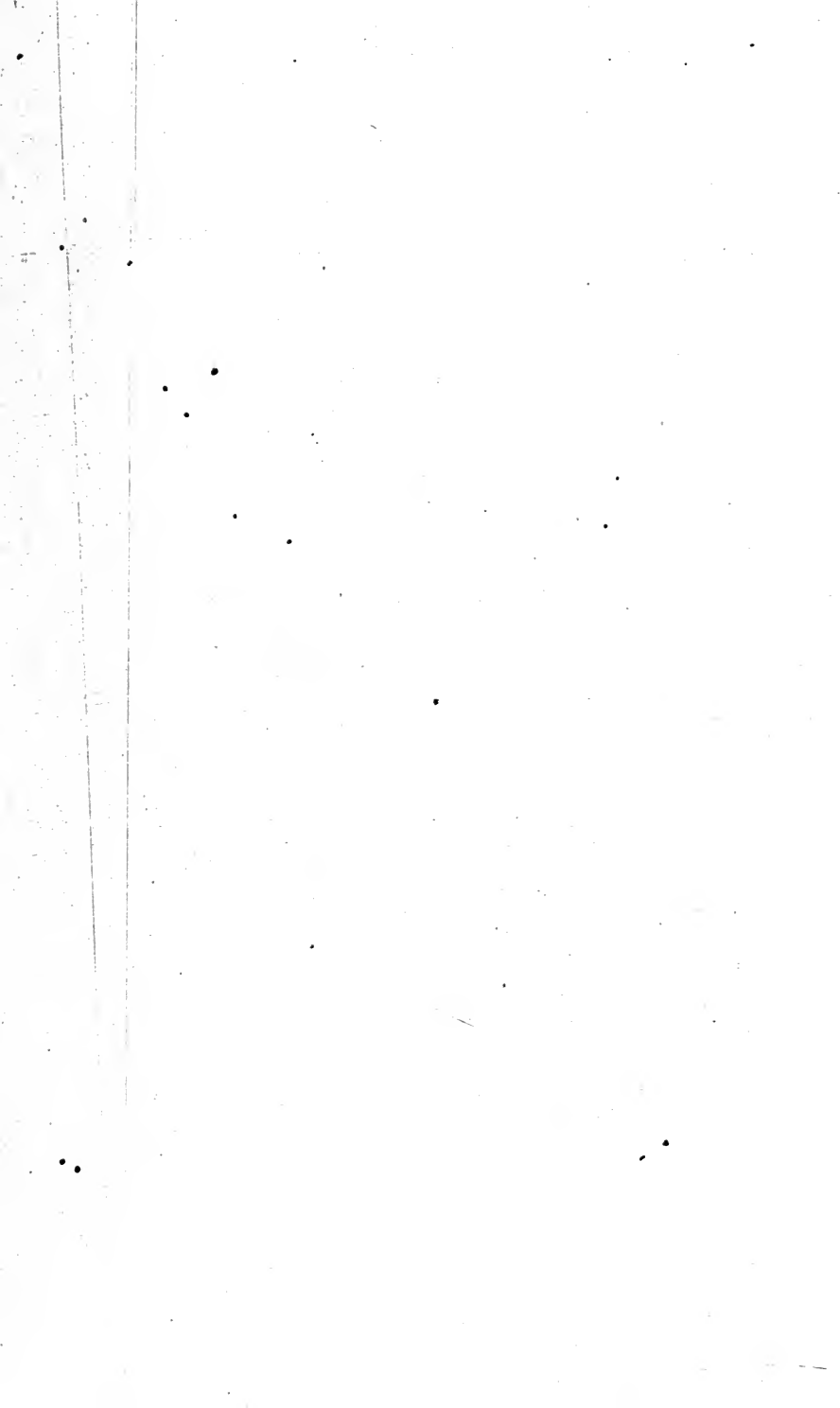
Republished with plates, March 1, 1835.



MAP OF ALABAMA.

GEOLOGY - AFTER CONRAD.





Observations on the Eocene deposits of the United States.

In a preceding No. of this work, (page 28) I alluded to a deposit of large oyster shells in South Carolina and Georgia, which Mr Finch has termed *Calcaire Ostree**, believing that it constituted a distinct formation, not referriable to any particular period in the scale of European deposits. I have since visited a portion of the southern States, and can say, from personal observation, that the continuous bed of oyster shells described by travellers and others, includes, in fact, two distinct formations, one of secondary, the other of tertiary origin, and that *two distinct species of Ostrea have been confounded with that "finger post" of the cretaceous strata, Exogyra costata, Say.†* These three shells combined constitute that anomalous species called *Ostrea gigantissima* by Mr Finch. Upon this supposed species was erected the formation termed *Calcaire Ostree*, which we have proved to be no more than the creation of Mr Finch's imagination; yet a traveller ignorant of the generic or specific character of the shells alluded to, would be likely to arrive at the same conclusion with that geologist and suppose that a continuous deposit, characterized by a single species of *Ostrea*, extended from South Carolina to the Mississippi river. Of the two species of *Ostrea* mentioned above, the *O. selæformis* characterizes a peculiar stratum of the *Eocene* at Claiborne, and is also found in the newer cretaceous strata of South Carolina. The *O. Georgiana*, (nobis) which much resembles *O. longirostris*, Lam. is characteristic of the *Eocene* strata at Shell Bluff on the Savannah river; near Milledgeville, Georgia, and at Orangeburgh, South Carolina.

The Eocene first appears at Upper Marlborough and at Piscataway, in Prince Georges county, Maryland. At the latter place I observed it in 1830, and was the first to point out its relation to the London Clay, from inspection of its fossil shells. The species are few in number, but the occurrence of the *Cardita*

*America Journal of Science and Arts, vol. VII, p. 39.

†In Dr. Goldfuss' splendid work, "Petrifacien", we observe the genus *Exogyra* is credited to Sowerby, whereas, our late and lamented naturalist, Thomas Say, Esq. instituted it, and we consider it one of his happiest efforts in the subdivision of genera, presenting us with an extremely interesting and natural group of shells peculiar to the Cretaceous strata, which were previously referred to China by European conchologists.

planicosta, a shell most characteristic of the *Eocene* period, both in France and Great Britain, first suggested the relative age of this deposit, which was confirmed by the fact that not one of the species occurs in the Miocene beds near Charlotte Hall, twenty miles distant from Piscataway. These remains are imbedded in loose incoherent earth, a mixture of sand and clay. In the bank of a contiguous stream, the matrix is hardened into a siliceous rock similar to that in Georgia and Alabama. The surface of this rock is constantly wet by springs which percolate through the superincumbent stratum.

At Fort Washington, on the Potomac, five miles from Piscataway, and on the road between the two places, I found the same formation, consisting in some places of a friable, in others, of an indurated fossiliferous marl of a dark gray color, replete with the green grains of silicate of iron which are so characteristic of the *Cretaceous* marls. It would appear that the *Eocene* strata of Maryland, which rest immediately on the marls of the *Cretaceous* epoch, have been formed in part by the debris of the latter, whilst the primary rocks have supplied the mica which is disseminated through them in minute fragments. All the *Eocene* marls effervesce strongly with acids. At Fort Washington, nearly all the shells are decomposed except the *Ostreae*, which are usually in a good state of preservation. A thick stratum of clay near the fossiliferous deposits, forming the precipitous bank of the Potomac river, contains abundance of *Selenite*, but the only trace of organic remains I discovered, was a fragment of bone, the relic of a marine animal. At the base, on the margin of the river, I picked up a valve of *Exogyra*, which led me suppose that the *Green Sand* lies immediately beneath the surface, and probably forms the bed of the river.

The *Cucullaea gigantea* and *Ostrea compressirostra* are the most abundant and characteristic fossils at Fort Washington. Some of the small shells appear to be such species as occur at Claiborne, but they are very imperfect and in most instances merely defined by casts in the coarse matrix.

The *Eocene* occurs in Virginia, forming the western boundary of the *Pliocene*, and will probably be indicated with tolerable accuracy by the line drawn by Mr Maclure for the boundary of his *Alluvium*, through Fredericksburg, Richmond, Petersburg, &c.

In South Carolina, I have traced the formation in question, as mentioned in the introduction, at Vance's Ferry on the Santee

river, in Orangeburgh county, by means of a fine series of fossils, collected by my friend Dr William Blanding, who also found in the vicinity a *Belemnite* imbedded in limestone, indicating the presence of the *Cretaceous* rock, which constitutes the prevailing, and indeed, almost the only formation between Vance's Ferry and Charleston. At the former place then, we find the *Eocene* superimposed upon the *Cretaceous* strata, and capped by a superficial deposit of *Older Pliocene* sands. The latter have been discovered also near the junction of the Congaree and Wateree rivers, a distance of seventy-five miles, in a direct line, to Bull's Bay, the nearest point on the coast.

From Vance's Ferry, the line of the *Eocene* runs a little to the south of west and passing through the town of Orangeburgh, crosses the Savannah river at Shell Bluff which is its boundary on the west. This formation appears at intervals, in a distance of forty miles, following the course of the river.* Shell Bluff, according to the observations of Mr. Vanuxem, is "seventy feet high, formed of various beds of impure carbonate of lime". The *Ostrea Georgiana* is here "in a bed nearly six feet in thickness in the upper part". A deposit of the same kind of oyster shells occurs near Milledgeville in Georgia, accompanied by the *Scutella quinquefaria*, (Say) imbedded in a white, friable limestone. Three parallel ridges of these oyster shells are said to run from the Savannah to the Altamaha river,† and to be extensively quarried by the Indigo planters, who convert them into lime.

The *Eocene* is extensively developed in Early county in the form of sandstone with silicified fossils corresponding with a rock in the vicinity of Claiborne, Alabama, the dark surface of which is paved, as it were, with beautifully translucent silicified shells. Dr. N. Jones, of Mobile, remarks, that at Fort Gaines, on the Chattahoochee, a bluff occurs more than one hundred and fifty feet in elevation, the close resemblance of which to the Claiborne escarpment is very striking; it is certainly of the same age as the latter.

At Claiborne, I have had the best opportunity of investigating the organic remains and superposition of the *Eocene* strata, for which I am indebted to the hospitality and assistance of my kind friend CHARLES TAIT, ESQ. whose enthusiastic love of the science would alone endear him to every student of geology. The escarpment, or bluff, facing the Alabama river at Claiborne, is, at the point where I measured it, about one hundred and sixty feet

*Vide Appendix to Cuvier's "Theory of the Earth" by Dr. Mitchell.

in height. The strata are nearly horizontal, and continue so far as the bluff extends, which is about one mile in length, and of nearly uniform height, sloping gradually at either extremity, and in front invariably precipitous, with occasional narrow and profound ravines. The alluvial land, which bounds it on the north and south, is subject to inundations during the spring freshets, and the river has been known, though rarely, to rise sixty feet above low water mark. This action of the current on the friable strata, uniting with atmospheric causes, is gradually wearing away the surface of the escarpment, and filling the channel of the river with the detritus. As fresh water shells are very abundant here, they are buried beneath this debris, and mingled indiscriminately with the fossils of marine origin, which in case of another upheave of the strata would exhibit a mixture of marine and fresh water shells.

The bluff is clothed with Magnolias, the cotton tree, walnut, chestnut, locust, &c. and exhibits two distinct terraces occasioned by strata more indurated than the others, and consequently resisting in a greater degree the action of disintegrating causes. A similar bluff of equal extent occurs on the Alabama, about three miles south of Claiborne; alluvium intervenes, and then follows a third bluff of much less elevation than the preceding. Here, in the arenaceous stratum, vast numbers of *Scutella Lyelli*, (nob.) are imbedded, and the whole mass is highly charged with oxide of iron.

At Claiborne are five very distinct strata, four of which are more strikingly defined by the peculiarity of their fossils than by their mineral character. Beneath the superficial covering of sand and gravel, we observe the strata to be arranged in the following order:

1. There is a stratum of argillaceous limestone, more or less friable, which so much resembles the newer limestone of the *cretaceous group*, occurring in the vicinity, that without reference to its organic remains, it might be considered of the same age as the latter, which is far from being the fact; it is more argillaceous and consequently of less value as a building material, for it more rapidly disintegrates on exposure to the atmosphere. Several springs flow over this rock which issue from the base of the stratum above, and the water is considered purer than that of the wells in the village. This limestone is about forty-five feet in thickness, and contains a few obscure casts of shells, referrible to species occurring in the sand beneath. The *Scutella Lyelli* is the

most frequent fossils, but it also occurs in great abundance in the sand whenever that is sufficiently coherent to preserve its form.

2. Immediately beneath is a terrace of sandstone, about three feet thick, being the upper portion of the arenaceous stratum which has furnished nearly all our *Eocene* testacea. Over this terrace, in many places, small springs of water constantly flow, falling only in drops. Beneath is the incoherent quartzose sand of a ferruginous color, which contains myriads of perfect but friable shells, of which there are about seventy genera and rather more than two hundred species. Those bivalves which have a strong ligament or cartilage, as the *Lucinae* and the larger *Crassatella*, generally have their valves in apposition and the cartilage still occasionally remains. The *Cytherea suberycinoides*, (Desh.) the most abundant fossil at Claiborne, very seldom has the valves in connexion, but if there has been any disturbance at the time of deposition, it has not been sufficient to injure the most delicate angles and striae of the shells. Occasionally specimens are found which still retain their colored markings. The surface of this stratum, where a portion of the sand has been washed away by the rains, presents the aspect of a solid bed of shells. Near the base of it, whatever point was examined, a vein of very soft lignite was observed, and what is remarkable, certain fine large univalves appear almost exclusively confined to this lignite, as if it had been formed from vegetable substance in the *Eocene* ocean to which those univalves were partial. Beneath this line the sand is somewhat coherent, and many species of shells are more abundant whilst others are more rare than above it.

In the introduction to this work, I gave the first notice of this interesting locality, and referred it to the period of the *London clay* and *Calcaire grossier*, giving it a provisional name which I gladly abandon since a better has been supplied in the *Eocene* of Professor Lyell. That it is of the same, or nearly the same age, I think the organic remains, described in the following pages, will incontestably prove. Whether any of the species does exist or not in the present ocean, I cannot pretend to decide, as our cabinets are too imperfect to admit of certainty in this point, but I am unable to refer any to such recent species as have come under my observation. None, it appears from comparison, inhabits the coast of the United States, and what is more remarkable, not one occurs in the *Pliocene* of our country. There is therefore a more marked distinction between the two tertiary formations than between the *Eocene* and *Cretaceous* strata, because four species

of fossils are common to the two latter;—facts just the reverse of those which have been published in relation to the secondary and tertiary of Europe. No vestiges of fresh water shells are observed in our *Eocene*, and I conclude, from the general character of the fossils, that the formation, unlike that of Paris, has not been of estuary but oceanic origin. M. Deshayes informs us that 137 species of *Cerithium* occur in the Paris basin, and this is said to be a genus partial to estuaries. At Claiborne only three species occur; one is rare and a doubtful member of the genus, and of the other two species I procured but one specimen of each, which tends to prove that they were not in a situation favourable to their increase. The stratum of oysters beneath may have been deposited in a lagoon, but if so, the ocean must have returned and brought back the same class of shells, which originated in the first bed of the *Eocene* sea, whilst with this convulsion the *Ostrea sellaeformis* entirely disappeared, and at the same time was deposited the debris of some rock which then first mingled with the testacea; and as this stratum of sand and shells is only about fourteen feet thick, it was probably soon formed, comparatively speaking, which will explain the cause why so few species of testacea occur in comparison with synchronous deposits in Europe.

The following species of the *Eocene* at Paris occur also in the sand at Claiborne: *Solarium patulum*, (Lam.) *S. canaliculatum*, (Lam.) *Bulimus terebellatus*, (Lam.) *Sigaretus canaliculatus*, (Sow.) *Calyptrea trochiformis*, (Lam.) *Pyrula tricarinata*, (Lam.) *Avicula trigona*, (Lam.) *Cytherea erycinoides*, (Lam.) *C. suberycinoides*, (Desh.) *Corbis lamellosa*, (Lam.) *Cardita planicosta*, (Blain.) *Fistulana elongata*. (Desh.)

3. A mass of *Ostrea sellaeformis*, about three feet in thickness, in sand cemented by carbonate of lime. As this oyster also occurs in the newer *Cretaceous* strata, at first I supposed the present to be of the same age as the latter deposit, but a subsequent examination of the inferior stratum convinced me to the contrary, as I found it characterized by *Eocene* fossils exclusively. Large specimens of the *Ostrea* generally have a water worn appearance, and occur mostly in single valves; the young which are vastly abundant are also disunited, but invariably uninjured and unworn. Fragments of this rock form a talus at the base of the escarpment.

4. A dark colored marl, seventy feet in thickness, in which the same *Ostrea* occurs, but smaller and less abundant than above. Other fossils are very rare, but I found a specimen of *Plagiostoma dumosum*, (Morton) which had attached itself while living to

an oyster shell, and this appears to be the only instance where the extinct genus *Plagiostoma* has been found in a tertiary deposit.

5. The inferior stratum is a dark colored clay, passing into marl, containing the same species of shells that occur in the arenaceous deposit, but perhaps not so great a number of them; the *Cardita planicosta* is in great abundance, but does not attain to one half the size of specimens common in the sand.

The insulated position of the *Eocene* at Claiborne, is remarkable; west of the vicinity of the village, the whole country is secondary, or of that limestone which Dr. Morton has compared to the Maestricht deposit, and termed the "*newer cretaceous strata*". As we proceed west, we traverse hills of the same limestone but find no trace of the tertiary until we arrive at St. Stephens, on the Tombeckbe, where it is still more isolated than at Claiborne, being bounded immediately from the river by the *cretaceous strata* on the west, and on the south by alluvium which intervenes between it and the secondary. On the north it also dips under the alluvium, and appears to be the rock which forms the rapid two miles north of St. Stephens, the first which is met with in ascending the river. The tide flows to the foot of this rapid, a distance of ninety miles from the head of Mobile Bay, but this happens only in the lowest stage of the water.

From some notices which have been published respecting the elevated bluff at Natchez, on the Mississippi, we infer that is of the formation in question, which, crossing the river, reappears on the banks of the Washita, near the town of Monroe, in Louisiana, where it is associated with *cretaceous strata*. This locality is of great interest to a geologist, as it will, when investigated, solve a problem of great importance, whether or not remains of the *Saurian* family exist in the tertiary. The gigantic vertebræ of the *Basilosaurus*, (Harlan) were found here enveloped in *Eocene* marl, but remains apparently of the same species, from the newest secondary limestone of Clarke county, Alabama, have been sent to this city by John G. Creagh, Esq. and by A. B. Cooper, Esq. of Claiborne. These highly interesting remains were found on the plantation of Mr Creagh, and are now in the possession of Dr. Morton, who has laboured diligently to procure whatever may advance a knowledge of American geology.

In Wilcox county, Alabama, on the plantation of my friend Judge Tait, the *Eocene* appears in the form of a dark colored sandstone, in which the shells are only traced by imperfect chalky

vestiges, but sufficiently defined to shew their relation to the fossils at Claiborne. The common grist mills of the vicinity are supplied with stones from this rock, which I have not seen *in situ*, nor do I know the extent to which it has been observed in Alabama. In the decomposed state of the fossils, it differs from other varieties of the rock, nearly the same in mineral character, that, for instance near Claiborne, where the shells are silicified.

It has been remarked of the *Eocene* deposits of Europe, that they fill depressions or basins in the chalk. The equivalent formation in Alabama, fills valleys or depressions in a white argillaceous very friable limestone, which Dr Morton has shewn to be *Cretaceous* and analogous to the Maestricht beds. This limestone, like the chalk of England, forms a rolling or undulating country and appears to have been subjected to extensive denudation, for the upper bed of the *Eocene*, in some places nearly fifty feet thick, has evidently been formed of its detritus.

The following terms are adopted for the American Tertiary formations.

- Newer Pliocene.* Near Newbern, N. C. near the mouth of Potomac river, Md. Easton, Md. Charleston, S. C.
- Older Pliocene.* St. Marys river, Md. parts of Lancaster county, Va. Yorktown, Va. James river near Smithfield, Va. Suffolk, Va.
- Miocene.* Stow creek, Cumberland co. N. J. Charlotte Hall St. Marys co. Md. Choptank river near Easton, Md. Characterized by *Perma maxillata*, Lami.
- Eocene.* Upper Marlborough, Md. Piscataway and Fort Washington, Md. Vance's Ferry on Santee river, S. C. Orangeburgh, S. C. Shell Bluff, Ga. Wilcox co. Al. Claiborne, Al. St Stephens, Al. parts of West Florida, Natchez, Mi. near Monroe on Washita river, L.
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It is necessary to observe, that all the species of Eocene fossils described in the following pages, unless where credit is given or no reference made, were published before Mr Lea's "Contributions to Geology." No. 1 was published August 25, 1833, and No. 2, November 1, 1833. They have been reprinted in order to group together the species of each genus. The "Contributions" were published some time after the appearance of No. 3, of the present work.

By reference to dates, it will be seen that Mr Lea has been guilty of a plagiarism in giving himself credit for my own observations on the tertiary formations of the United States. A laborious investigation of these, on my part, from New Jersey to the Gulf of Mexico, has resulted in identifying the Eocene, Miocene, Older and Newer Pliocene and Recent formations of the Union. Mr Lea, to my knowledge, knew nothing of our coast formations previous to my observations on that subject, and never travelled out of his closet to make original discoveries, for I have fortunately saved him the trouble.

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In a preceding No. of this work, (page 28) I alluded to a deposit of large oyster shells in South Carolina and Georgia, which Mr. Finch has termed *Calcaire Ostree**, believing that it constituted a distinct formation, not referrible to any particular period in the scale of European deposits. I have since visited a portion of the southern States, and can say, from personal observation, that the continuous bed of oyster shells described by travellers and others, includes, in fact, two distinct formations, one of secondary, the other of tertiary origin, and that *two distinct species of Ostrea have been confounded with that "finger post" of the cretaceous strata, Exogyra costata, Say.*† These three shells combined constitute that anomalous species called *Ostrea gigantissima* by Mr. Finch. Upon this supposed species was erected the formation termed *Calcaire Ostree*, which we have proved to be no more than the creation of Mr. Finch's imagination; yet a traveller ignorant of the generic or specific character of the shells alluded to, would be likely to arrive at the same conclusion with that geologist and suppose that a continuous deposit, characterized by a single species of *Ostrea*, extended from South Carolina to the Mississippi river. Of the two species of *Ostrea* mentioned above, the *O. selafiformis* characterizes a peculiar stratum of the *Eocene* at Claiborne, and is also found in the newer cretaceous strata of South Carolina. The *O. Georgiana*, (nobis) which much resembles *O. longirostris*, Lam. is characteristic of the *Eocene* strata at Shell Bluff on the Savannah river; near Milledgeville, Georgia, and at Orangeburgh, South Carolina.

The *Eocene* first appears at Upper Marlborough, in Prince George county, Maryland. The upper stratum is an indurated arenaceous marl about 4 feet thick, replete with casts of shells, most of which are identical with species common at Claiborne, Alabama. Beneath

*American Journal of Science and Arts, vol. VII. p. 39.

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this crust is a mixture of chloritic, quartzose and micaceous sand, resembling a variety of the secondary marl of New Jersey. The shells are numerous and too friable to collect, but they can be satisfactorily identified with those of Claiborne. At Piscataway and Fort Washington, in the same county, where I first ascertained the relation of these deposits to the London Clay, in 1830, the same geological features are exhibited, and the superficial crust consists of a fine bivalve, *Panopea elongata*, nob. The *Gryphæa vomer*, (Morton,) a fossil of the cretaceous strata and which closely resembles *Ostrea lateralis*, Nillson, occurs not unfrequently in these Eocene deposits. At Upper Marlborough, the *Ostrea compressirostra* is very abundant and perfect and is washed out by rains from the disintegrating superficial strata. It is remarkable that this is the only Eocene fossil, which, after a careful examination of various localities in Virginia and Maryland, I have detected in the medial tertiary strata. In New Jersey, however a species common at Claiborne is also found in a medial tertiary deposit, the *Calyptrea trochiformis*, Lam.

It would appear that the *Eocene* strata of Maryland, which rest immediately on the marls of the *Cretaceous* epoch, have been formed in part by the debris of the latter, whilst the primary rocks have supplied the mica which is disseminated through them in minute fragments. At Fort Washington, nearly all the shells are decomposed except the *Ostrea*, which are usually in a good state of preservation. A thick stratum of clay near the fossiliferous deposits, forming the precipitous bank of the Potomac river, contains abundance of *Selenite*, but the only trace of organic remains I discovered, was a fragment of bone, the relic of a marine animal. At the base, on the margin of the river, I picked up a valve of *Exogyra*, which led me to suppose that the *Green Sand* lies immediately beneath the surface, and probably forms the bed of the river, but as I afterwards found another valve near City Point in Virginia, it seems probable that the species has been transported by currents which washed the green sand of the *Cretaceous* epoch into the bed of the *Eocene* sea.

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*Vide Appendix to Cuvier's 'Theory of the Earth' by Dr. Mitchell.

the point where I measured it, about one hundred and sixty feet in height. The strata are nearly horizontal, and continue so far as the bluff extends, which is about one mile in length, and of nearly uniform height, sloping gradually at either extremity, and in front invariably precipitous, with occasional narrow and profound ravines. The alluvial land, which bounds it on the north and south, is subject to inundations during the spring freshets, and the river has been known, though rarely, to rise sixty feet above low water mark. This action of the current on the friable strata, uniting with atmospheric causes, is gradually wearing away the surface of the escarpment, and filling the channel of the river with the detritus.

The bluff exhibits two distinct terraces occasioned by strata more indurated than the others, and consequently resisting in a greater degree the action of disintegrating causes. A similar bluff of equal extent occurs on the Alabama, about three miles south of Claiborne; alluvium intervenes, and then follows a third bluff of much less elevation than the preceding. Here, the arenaceous stratum, which is highly ferruginous, contains vast numbers of *Scutella Lyelli*, (nob.)

At Claiborne are five very distinct strata, four of which are more strikingly defined by the peculiarity of their fossils than by their mineral character. Beneath the superficial covering of the sand and gravel, we observe the strata to be arranged in the following order:

1. There is a stratum of argillaceous limestone, more or less friable, which so much resembles the newer limestone of the *cretaceous group* occurring in the vicinity, that without reference to its organic remains; it might be considered of the same age as the latter, which is far from being the fact; it is of less value as a building material, for it more rapidly disintegrates on exposure to the atmosphere. Several springs flow over this rock which issue from the base of the stratum above, and the water is considered purer than that of the wells in the village. This limestone is about forty-five feet in thickness, and contains a few obscure casts of shells, referrible to species occurring in the sand beneath. The *Scutella Lyelli* is the most frequent fossil, but it also occurs in great abundance in the sand whenever that is sufficiently coherent to preserve its form.

2. Immediately beneath is a terrace of sandstone, from three to six feet thick, being the upper portion of the arenaceous stratum which has furnished nearly all our *Eocene* testacea. Over this ter-

race, in many places, small springs of water constantly flow, falling only in drops. Beneath is the incoherent quartzose sand of a ferruginous colour, which contains myriads of perfect but friable shells, of which there are about seventy genera and rather more than two hundred species. Those bivalves which have a strong ligament or cartilage, as the *Lucinæ* and the larger *Crassatellæ*, generally have their valves in apposition and the cartilage still occasionally remains. The *Cytherea suberycinoides*, (Desh.) the most abundant fossil at Claiborne, very seldom has the valves in connexion, but if there has been any disturbance at the time of deposition, it has not been sufficient to injure the most delicate angles and striæ of the shells. Occasionally specimens are found which still retain their coloured markings. The surface of this stratum, where a portion of the sand has been washed away by the rains, presents the aspect of a solid bed of shells. Near the base of it, whatever point was examined, a vein of very soft lignite was observed, and what is remarkable, certain fine large univalves appear almost exclusively confined to this lignite, as if it had been formed from vegetable substance in the *Eocene* ocean to which those univalves were partial. Beneath this line, the sand is somewhat coherent, and many species of shells are more abundant whilst others are more rare than above it.

In the introduction to this work, I gave the first notice of this interesting locality, and referred it to the period of the *London clay* and *Calcaire grossier*, giving it a provisional name which I gladly abandon since a better has been supplied in the *Eocene* of Professor Lyell. That it is of the same, or nearly the same age, I think the organic remains, described in the following pages, will incontestably prove. Whether any of the species, except *Cytherea erycinoides*, does exist or not in the present ocean, I cannot pretend to decide, as our cabinets are too imperfect to admit of certainty in this point, but I am unable to refer any to such recent species as have come under my observation. None, it appears from comparison, inhabits the coast of the United States, and what is more remarkable, but two have been found in the *Pliocene* of our country. There is therefore a more marked distinction between the two tertiary formations than between the *Eocene* and *Cretaceous* strata, because four species of fossils are common to the two latter,—facts just the reverse of those which have been published in relation to the secondary and tertiary of Europe. No vestiges of fresh water shells are observed in our *Eocene*, and I conclude, from the general character of the fossils, that the formation, unlike that of Paris, has not been of

estuary but oceanic origin. M. Deshayes informs us that 137 species of *Cerithium* occur in the Paris basin, and this is said to be a genus partial to estuaries. At Claiborne only three species occur; one is rare and a doubtful member of the genus, and of the other two species I procured but one specimen of each, which tends to prove that they were not in a situation favourable to their increase. The stratum of oysters beneath may have been deposited in a lagoon, but if so, the ocean must have returned and brought back the same class of shells, which originated in the first bed of the *Eocene* sea, whilst with this convulsion the *Ostrea sellaeformis* entirely disappeared, and at the same time was deposited the debris of some rock which then first mingled with the testacea; and as this stratum of sand and shells is only about fourteen feet thick, it was probably soon formed, comparatively speaking, which will explain the cause why so few species of testacea occur in comparison with synchronous deposits in Europe.

The following species of the *Eocene* at Paris occur also in the sand at Claiborne: *Solarium patulum*, (Lam.) *S. canaliculatum*, (Lam.) *Bulimus terebellatus*, (Lam.) *Sigaretus canaliculatus*, (Sow.) *Calyptrea trochiformis*, (Lam.) *Pyrula tricarinata*, (Lam.) *Aricula trigona*, (Lam.) *Cytherea ergyinoidea*, (Lam.) *C. suberycinoidea*, (Desh.) *Corbis lamellosa*, (Lam.) *Cardita planicosta*, (Blain.) *Fistulana elongata*. (Desh.)

3. A mass of *Ostrea sellaeformis*, about three feet in thickness, in sand cemented by carbonate of lime. As this oyster also occurs in the newer cretaceous strata, at first I supposed the present to be of the same age as the latter deposit, but a subsequent examination of the inferior stratum convinced me to the contrary, as I found it characterized by *Eocene* fossils exclusively. Large specimens of the *Ostrea* generally have a water worn appearance, and occur mostly in single valves; the young which are vastly abundant are also disunited, but invariably uninjured and unworn. Fragments of this rock form a talus at the base of the escarpment.

4. A dark coloured marl, seventy feet in thickness, in which the same *Ostrea* occurs, but smaller and less abundant than above. Other fossils are very rare, but I found a specimen of *Plagiostoma dumosum*, (Morton) which had attached itself while living to an oyster shell, and this appears to be the only instance where the extinct genus *Plagiostoma* has been found in a tertiary deposit.

5. The inferior stratum is an argillaceous, passing into calcareous marl, containing the same species of shells that occur in the arenaceous deposit, but perhaps not so great a number of them; the *Car-*

dita planicosta is in great abundance, but does not attain to one half the size of specimens common in the sand.

The insulated position of the *Eocene* at Claiborne, is remarkable; west of the vicinity of the village, the whole country is secondary, or of that limestone which Dr. Morton has compared to the Maestricht deposit, and termed the "upper division of the cretaceous group". As we proceed west, we traverse hills of the same limestone but find no trace of the tertiary until we arrive at St. Stephens, on the Tombeckbe, where it is still more isolated than at Claiborne, being bounded immediately from the river by the *cretaceous* strata on the west, and on the south by alluvium which intervenes between it and the secondary. On the north it also dips under the alluvium, and appears to be the rock which forms the rapid two miles north of St. Stephens, the first which is met with in ascending the river. The tide flows to the foot of this rapid, a distance of ninety miles from the head of Mobile Bay, but this happens only in the lowest stage of the water.

From some notices which have been published respecting the elevated bluff at Natchez, on the Mississippi, we infer that is of the formation in question, which, crossing the river, reappears on the bank of the Ouachita, near the town of Monroe, in Louisiana, where it is associated with *cretaceous* strata. This locality is of great interest to a geologist, as it will, when investigated, solve a problem of great importance, whether or not remains of animals belonging to the order *Enalio-Sauri* exist in the tertiary. The gigantic vertebrae of the *Basilosaurus*, (Harlan) were found here enveloped in *Eocene* marl, but specimens which Dr. Harlan conceives to be relics of the same species, from the newest secondary limestone of Clark county, Alabama, have been sent to this city by John G. Creagh, Esq. and A. B. Cooper, Esq. of Claiborne. These highly interesting remains were found on the plantation of Mr. Creagh, and are now in the possession of Dr. Morton, who has laboured diligently to procure whatever may advance a knowledge of American geology.

In Wilcox county, Alabama, on the plantation of my friend Judge Tait, the *Eocene* appears in the form of a dark coloured sandstone, in which the shells are only traced by imperfect chalky vestiges, but sufficiently defined to shew their relation to the fossils at Claiborne. The common grist mills of the vicinity are supplied with stones from this rock, which I have not seen *in situ*, nor do I know the extent to which it has been observed in Alabama. In the decomposed state of the fossils; it differs from other varieties nearly

the same in mineral character, that, for instance near Claiborne, where the shells are silicified.

It has been remarked of the *Eocene* deposits of Europe, that they fill depressions or basins in the chalk. The equivalent formation in Alabama, fills valleys or depressions in a white argillaceous very friable limestone, which Dr. Morton has shown to be *cretaceous* and analogous to the Maestricht beds. This limestone, like the chalk of England, forms a rolling or undulating country and appears to have been subjected to extensive denudation. The upper bed of the *Eocene*, in some places nearly fifty feet thick, has evidently been formed of its detritus.

The following terms are adopted for the American Tertiary formations.

Upper Tertiary or Newer Pliocene. Near Newbern, N. C. near the mouth of the Potomac river, Md. Charleston, S. C. Nearly all the species inhabit the coast of the United States.

Medial Tertiary or Older Pliocene. St. Marys river, Md. parts of Lancaster county, Va. Yorktown, Va. James river near Smithfield, Va. Suffolk, Va. Stow creek, Cumberland co. N. J. Charlotte Hall, S. Marys co. Md. Choptank river near Easton, Md. Of 150 species, 40 inhabit the coast of the United States and several others live in remote seas.

Lower Tertiary or Eocene. Upper Marlborough, Md. Piscataway and Fort Washington, Md. Vance's Ferry on Santee river, S. C. Orangeburgh, S. C. Shell Bluff, Ga. Wilcox co. Al. Claiborne, Al. St. Stephens, Al. parts of West Florida, Natchez, Mi. near Monroe on Ouachita, L. No species inhabits the Atlantic coast, and of two hundred species only two have been found in the *Pliocene*.

It is necessary to observe, that all the species of Eocene fossils described in the following pages, unless where credit is given or no reference made, were published before Mr. Lea's "Contributions to Geology". No. 3 was published August, 1833, and No. 4, October, 1833.—They have been reprinted in order to group together the species of each genus.

Corrigenda.

Tab. 2, fig. 2. This was described as *P. pulvinatus*, but it is now ascertained to be very distinct, and it is proposed to name it *P. lentiformis*. Fig. 3 closely resembles *P. variabilis*, of Sowerby; but in comparing specimens of that species, given me by Richard C. Taylor, Esq., with the American analogue, I find that in the latter the marginal teeth are wider, fewer in number, and much more ornamental.

MONOCEROS ARMIGERUS. *Tab. 15, fig. 1.*

Short subfusiform, ventricose, ponderous, with two series of distant prominent thick spines, one on the shoulder, the other near the middle of the large whorl; base reflected, carinated; labrum with a short tooth and two inferior small teeth.

Syn. FUSUS TAITII, *Lea, Con. p. 152, pl. 5, fig. 159.*

Locality. Claiborne, Alab.

Resembles *Murex minax*, Brander. The spines near the labrum in some specimens are an inch long. I referred it with a mark of doubt to *Melongena* in No. 3, first edition.

MONOCEROS VETUSTUS. *Tab. 15, fig. 3.*

Obovate, ventricose, thick, with obsolete spiral lines; summit of the body whorl indented; suture impressed; groove profound, between it and the base the shell is bicarinated and has a few impressed lines; umbilicus profound; tooth very short.

Syn. M. PYRULOIDES, *Lea, Con. p. 161, pl. 5, f. 166.*

M. FUSIFORMIS, *ib. p. 162, pl. 5, f. 167.*

Locality. Claiborne, Alab.

The umbilicus varies much in size in different specimens, and is generally wanting in old shells. No. 4, first ed. p. 44.

MELONGENA ALVEATA. *Tab. 15, fig. 2.*

Subglobose, thick; spire short; whorls with a broad furrow, distinctly marked on the shoulder of the body whorl; a few distinct and numerous obscure spiral striæ; body whorl with a large obtuse oblique carina extending to the base; umbilicated; columella calous, flattened inferiorly; aperture patulous.

Locality. Claiborne, Alab.

Syn. PYRULA SMITHII, *Lea, Con. p. 155, pl. 5, f. 162.*

The genus *Melongena*, Sowerby, seems to form a natural group of shells very distinct from the true *Pyrulæ*. I first described this species in the *American Journal of Science*, vol. 23, p. 344.

CONUS SAURIDENS. *Tab. 15, fig. 7.*

Thin and fragile, smooth, with impressed spiral striæ at base; sides straight; spire short, slightly concave, with spiral striæ; suture carinated; shoulder angulated; columella folded at base.

Locality. Claiborne, Alab.

Rather rare, and remarkable for the tenuity of the shell and the fold on the columella. No. 3, first ed. p. 33.

ROSTELLARIA VELATA. *Tab. 15, fig. 4.**

Fusiform, with longitudinal curved ribs and spiral striæ, but coated more or less with a smooth polished calcareous deposit, bounded by a deep groove running on the spire and returning towards the base; labrum not expanded; margin thick and reflected; beak and spire prolonged and attenuated.

Locality. Claiborne, Alab.

Syn. R. LAMARCKII, *Lea, Con. p. 158, pl. 5, f. 164.*

This curious species is very abundant. Young shells are destitute of the tunic and the margin of the labrum is thin and not reflected. No. 3, first ed. p. 31.

ROSTELLARIA LAQUEATA. *Tab. 15, fig. 5†.*

Subfusiform, with acute longitudinal slightly curved plicæ on the superior half of each whorl; whorls slightly convex, with fine spiral striæ; labium thickened and reflected, the callus continued on the spire; labrum thick, margin acute, biangulated inferiorly; base with strong spiral striæ; truncated.

Syn. R. CUVIERI, *Lea, Con. p. 160, pl. 5, f. 165.*

Locality. Claiborne, Alab.

This species is very abundant. No. 4, first ed. p. 41.

PYRULA TRICARINATA. *Tab. 15, fig. 6.*

Subfusiform; reticulated; tricarinated; spire elevated and point-

*Misprint for "fig. 5."—G. D. H.

†Misprint for "fig. 4."—G. D. H.

ed; base produced, attenuated; labrum thickened on the submargin within.

Var. A. Not carinated.

Syn. P. PENITA, *nob*, No. 3, first ed. p. 32.

P. CANCELLATA, *Lea*, *Con.* p. 154 pl. 5, f. 160.

P. ELEGANTISSIMA, *ibid.* pl. 5, f. 161.

Locality. Claiborne, Alab.

This shell agrees so well with the *tricarinata*, Lam. as figured in Sowerby's Genera of Shells, that I here refer it to that species, a fossil of the *Calcaire grossier*. That the variety is not distinct I am assured by comparison of many specimens.

EMARGINULA ARATA. *Tab.* 15, *fig.* 8.

Ovato-oblong, with angular ribs, largest anteriorly, alternated in size and crossed by close set wrinkles; apex central, acute, much curved; fissure wide but not very profound.

Locality. Claiborne, Alab.

This elegant species is extremely rare. No. 4, first ed, p. 44.

FISSURELLA TENEBROSA. *Tab.* 15, *fig.* 9.

Oval, elevated, slightly compressed above; with numerous delicate costæ alternated in size, and crossed by very fine striæ, giving the ribs a granulated appearance; fissure narrow, inclined; inferior margin with crenulations disposed in pairs.

Syn. F. CLAIBORNENSIS, *Lea*, *Con.* p. 94, pl. 3, f. 74.

Locality. Claiborne, Alab.

Rare and seldom perfect. No. 3, first ed. p. 33.

DENTALIUM THALLOIDES. *Tab.* 15, *fig.* 10.

Elongated, slightly curved, with prominent longitudinal costæ, alternated in size, or of three different sizes.

Syn. D. ALTERNATUM, *Lea*, *Con.* p. 34, pl. 1, fig. 2.

Locality. Claiborne, Alab.

TURRITELLA MORTONI. *Tab. 15, fig. 11.*

Turritid, attenuated towards the apex, with spiral striæ; volutions concave, carinated at the base; aperture effuse.

Var. A. whorls rectilinear, spiral striæ profound.

Syn. T. CARINATA, *Lea, Con. p. 129, pl. 4, fig. 120.*

Localities. Claiborne, Alab. Piscataway, Md.

Common: I first found the species in Maryland and described it in the *Journal of the Academy of Natural Sciences*, v. 6, p. 221, pl. x, f. 2. Mr. Lea re-figures it as new three years afterward.

TURRITELLA OBRUTA. *Tab 15, fig. 12.*

Whorls 11, slightly convex, with about 7 sharp elevated striæ on each and intermediate fine close set lines; area of the suture indented; aperture subovate.

Syn. T. LINEATA, *Lea, Con. p. 130, pl 4, f. 121.*

Locality. Claiborne, Alab.

TURRITELLA VETUSTA. *Tab. 15, fig. 13.*

Turritid, with spiral raised lines alternated in size, and longitudinal much arcuated wrinkles; whorls angulated at the summit; aperture obliquely elliptical, effuse; labrum extremely thin; labium somewhat folded, and slightly reflected at base.

CERITHIUM? STRIATUM, *Lea, Con. p. 131, pl. 4, f. 122.*

Very numerous but so rarely perfect that its generic character has been hitherto mistaken. I referred to *Melania?* in No. 3, first ed. Its aperture resembles that of *T. melanoides*, Lam.

BULLA GALBA. *Tab. 15, fig. 14.*

Subcylindrical, slightly contracted near the middle; obsolete spiral lines at base; labium reflected at base; aperture very narrow above, rather suddenly expanded inferiorly.

Syn. B. ST HILLAIRII, *Lea, Con. p. 98, pl. 4, f. 78.*

In the first edition of this No. it was inadvertently named *Volvaria galba*. It may prove to be the *Bulla constricta*, Sow.

VOLUTA SAYANA. *Tab. 16, fig. 1.*

Ventricose, with numerous distinct longitudinal striæ; body volution profoundly undulated above, the ridges tuberculated by the intersection of coarse spiral lines; lines less distinct in the middle and profound near the base; columella 4-plaited, the superior one obsolete; labium striated within.

Syn. V. GRACILIS, V. DEFRANCI, V. PARVA, *Lea, Con. p. 171.*

Locality. Claiborne, Alab.

A common species, allied to *V. luctator*. The plaits vary in number; one specimen is profoundly cancellated, and has a depressed spire. The species is dedicated to Say, the lamented naturalist. No. 3, first ed. p. 29.

VOLUTA PETROSA. *Tab. 16, fig. 2.*

Subglabrous; coronated; with 8 to 10 longitudinal folds; spire turritid; base striated; columella with two plaits.

Syn. V. VANUXEMI, *Lea, Con. p. 173, pl. 6, f. 182.*

Locality. Claiborne, Alab.

Allied to *V. spinosa*, Not abundant. No. 3, first ed. p. 29.

OLIVA ALABAMENSIS. *Tab. 16, fig. 3.*

Subfusiform; spire elevated, acute; whorls contracted or indented above the suture; aperture effuse.

Syn. O. GREENOUGH, O. DUBIA, O. GRACILIS, (*young*) *Lea, Con. p. 183, pl. 6, f. 196, 197, 198.*

Locality. Claiborne, Alab.

A variable species, and remarkably abundant. A variety has the spire so elevated that the aperture is little more than half the length of the shell, which is unusually slender.

O. Phillipsii, *Lea*, may be a variety in the very young state.

OLIVA BOMBYLIS. *Tab. 16, fig. 4.*

Shell slender, subcylindrical; spire prominent, acute, the volutions with an obsolete impressed line.

Syn. *O. CONSTRICTA*, *Lea, Con. p. 182, pl. 6, p. 195.*

Locality. Claiborne, Alab.

Allied to *O. clavula*, Lam. rare.

ANCILLARIA LYMNEOIDES. *16, fig. 6.*

Shell smooth, with a prominent acute spire, and a large fold on the middle of the columella; aperture effuse.

Syn. *MONOPTYGMA ALABAMIENSIS*, *Lea, Con. p. 186 p. 6, f. 201.*

Locality. Claiborne, Alab.

This shell agrees with *Ancillaria* in every character but the fold: if this is sufficient for generic distinction, the *Conus sauridens*, nob. should be made the type of a new genus for the same reason. Lea's second species of *Monoptygma* is an *Actæon*.

No. 4, first edition, p. 44.

ANCILLARIA TENERA. *Tab. 16, fig. 5.*

Thin, ventricose; spire turrated; whorls angular and plicated at the summit; aperture large, effuse; columella much arcuated.

Locality. Claiborne, Alab. Allied to *A. scamba*, nob. rare.

MITRA PEREXILIS. *Tab. 16, fig. 7.*

Narrow-fusiform, with smooth convex whorls; spire subulate, much elevated; base with impressed lines; columella 3-plaited; aperture narrow.

Locality. Claiborne, Alab:

MITRA FUSOIDES. *Tab. 16, fig. 8.*

Short subfusiform, with longitudinal ribs, and minute spiral lines distinct at base; whorls furrowed below the suture; apex ob-

tuse; columella 4-plated; labrum minutely crenulated within.

Syn. M. FUSOIDES, *Lea, Con. p. 169, pl. 6, f. 176.*

Locality. Claiborne, Alab.

Closely allied to *M. pumila*, Sowerby,

MITRA PACTILIS. *Tab. 16, fig. 21.*

Subfusiform; spire much elevated; superior half of the whorls plain and concave above, inferiorly convex and nodulous; suture profound; apex pappillated; columella 4-plaited.

Locality. Claiborne, Alab.

Although the pappillated apex of this shell is at variance with the *Mitra*, as characterized by Lamarck, yet its other characters are decidedly those of the genus.

VOLUTA PRISCA. *Tab. 16, fig. 9.*

Obovate, ventricose, thin; spire depressed; apex obtuse; whorls plicated at the suture; base profoundly striated; columella with 4 rather oblique subequal compressed folds; aperture effuse.

Syn. VOLUTA COOPERII, *Lea, Con. p. 175, pl. 6, f. 185.*

Locality. Claiborne, Alab.

The coloured markings still remain on some specimens and exhibit revolving series of dark quadrangular spots. I described this shell as a *Turbinella*, in No. 4, first edit. but the base is not channelled and is slightly emarginate.

MITRA BOLARIS. *Tab. 16, fig. 11.*

Subfusiform, with fine close spiral lines; superior portion of the whorls slightly concave, inferior convex; spire elevated; apex obtuse; columella with 4 thick plaits; base slightly reflected and produced; subemarginate.

Syn. MITRA HUMBOLDTII, M. FLEMINGII, VOLUTA PARKINSONI, *Lea, Con. pl. 6, 177, 178, 184.*

A common species. No. 3, first edition, p. 34.

TURBINELLA PRÆTENUIS. *Tab. 17, fig. 1*

Pyriform, very thin, with revolving impressed lines, profound at base; whorls superiorly indented; spire cancellated; suture defined by a prominent line; apex papillated; columella 5 to 6-plaited; plaits compressed; base prolonged, slightly twisted, somewhat attenuated.

Locality. Claiborne, Alab.

This shell is evidently congeneric with *T. pyruloides*, which Mr Lea absurdly refers to *Voluta*, whereas its characters are just the reverse of those of the true *Volutes*, the folds *decreasing in size from above*, as in *Mitra*, and the base *canaliculate and not emarginate*.

If these two shells will not agree either with the *Turbinellæ* or *Mitræ*, they will form a new sub-genus, which might be termed CARICELLA.

 CANCELLARIA GEMMATA. *Tab. 16, fig. 10.*

Scalariform; with longitudinal acute ribs which coronate the whorls; spire much elevated; spiral lines obsolete; columella concave, 3-plaited; umbilicus effuse, carinated on the margin; labrum obtusely reflected, striate within; aperture subobovate.

Syn. C. BABYLONICA, *Lea, Con. p. 138, pl. 5, f. 134.*

Locality. Claiborne, Alab.

A beautiful species, remarkable in not being cancellated; it is not abundant but generally very perfect. No. 3, first ed. p. 35.

 CANCELLARIA ALVEATA. *Tab. 16, fig. 19.*

Subfusiform; turrated; revolving lines fine but distinct; whorls obtusely angulated; columella 3-plaited, labrum striate within.

Syn. C. MULTIPLICATA, C. SCULPTURA, C. TESSELLATA, C. ELEVATA, C. COSTATA, C. PARVA, *Lea. Con. pl. 5, f. 135, 136, 138, 139, 140, 141.*

Locality. Claiborne, Alab.

This small species is readily distinguished from the preceding: No. 4, first edition, p. 45.

MARGINELLA LARVATA, *Tab. 16, fig. 12.*

Ovate, thick, gibbous above on the labrum; spire obsolete; labrum without a varix, margin acute.

Syn. M. OVATA, M. SEMEN, (*young*) *Lea, Con. p. 178, pl. 6, f. 190, 191.* OLIVA MINIMA? *f. 200.*

Locality. Claiborne, Alab. No. 3, first ed. p. 33.

MARGINELLA CRASSILABRA. *Tab. 13, fig. 13.*

Subovate, thick; spire slightly elevated; suture indented and margined beneath by a prominent line; apex obtuse; varix on the outer lip very thick and extending upon the spire; lip with very numerous crenulations within; columella with 9 or 10 folds.

Syn. M. ANATINA, *Lea, Con. p. 176, pl. 6, f. 186.*

Locality. Claiborne, Alab.

The whorls of this species are slightly flattened above, and the deposit on the spire is also continued widely over the labium; the folds cover a great portion of the columella, and the superior ones are slightly deflected. No. 3, first ed. p. 33.

MARGINELLA HUMEROSA, *Tab. 16, fig. 14.*

Ovate, ventricose; spire very short; labrum much thickened, margin straight, minutely crenulated within; columella with 4 folds, the two inferior ones much the largest.

Syn. M. CRASSILABRA, *Lea, Con. p. 177, pl. 6, fig. 188.*

Locality. Claiborne, Alab.

MARGINELLA COLUMBA. *Tab. 16, fig. 16.*

Ovate; spire rather elevated; labrum not greatly thickened, regularly arcuated; columella rectilinear, with 5 regular folds, the 4 inferior ones subequal.

M. COLUMBA, *Lea, Con. p. 177, pl. 6, f. 187.*

Locality. Claiborne, Alab.

MARGINELLA CONSTRICTA. *Tab. 16, fig. 15.*

Narrow, somewhat elliptical; spire rather elevated, pointed; columella with 3 plaits; labrum acutely angular above.

Locality. Claiborne, Alab. Extremely rare.

CREPIDULA LIRATA. *Tab. 16, fig. 17.*

Oblique, elevated, compressed, with longitudinal irregular costæ and transverse wrinkles; beak much produced, curved forward and laterally, subspiral at the apex; cavity very profound; aperture oblong; margin of the diaphragm arcuated.

Syn. C. CORNU ARIETIS, *Lea, Con. p. 97, pl. 3, f. 77.*

Locality. Claiborne, Alab.

One of the most abundant fossils at Claiborne. It was published originally in the *Amer. Journ. Science and Arts*, v. 23, p. 344.

CREPIDULA DUMOSA. *Tab. 16, fig. 20.*

Convex, with longitudinal ribs alternated in size, the larger ribs armed with short erect spines; beak laterally curved, subspiral.

Locality. Claiborne, Alab.

In having spines, this shell resembles the recent *C. aculeata* of the West Indies, and the *Pliocene* fossil, *C. costata*, Morton.

INFUNDIBULUM TROCHIFORMIS. *Tab. 16, fig. 21*.*

Orbicular, convex or subconical, spinous; vertex subcentral, smooth; spire conspicuous.

Syn. CALYPTREA TROCHIFORMIS, *Lam. An. des Mus. v. 1, p. 385, and v. 7, pl. 15, fig. 3.* *Deshayes, Coq. Foss. v. 2, pl. 4.*

INFUNDIBULUM ECHINULATUM, I. SPINULOSUM, I. TUBERCULATUM, *Sow. v. 1, pl. 97, fig. 1, 2, 7.*

Locality. Claiborne, Alab.

In No. 3, first edition, I gave it the name of *I. urticosum*, but I no longer consider its identity with the Paris species doubtful. Mr Lea calls it *I. trochiformis*, thus giving it the name of Lamarck's shell, yet describing it as a new species!

*Misprint for "fig. 18."—G. D. II.

This interesting fossil, very characteristic of the *Eocene* of the environs of Paris, is equally so of the equivalent formation at Claiborne, where it exists in all the varieties which M. Deshayes has figured in his valuable work, "*Fossil Shells of the environs of Paris.*"

SILICUARIA VITIS. *Tab. 17, fig. 2.*

Contorted, with longitudinal ribs becoming obsolete inferiorly; wrinkled transversely; fissure inarticulate.

Syn. S. CLAIBORNENSIS, *Lea, Con. p. 33, pl. 1, f. 1.*

Locality. Claiborne, Alab.

This shell is common at Claiborne, where I have seen it twelve inches or more in length near the base of the arenaceous stratum, but it was too friable to be extracted entire. I have a pair twisted together, in the spiral portion, like two tendrils of a vine. This shell has numerous thin vaulted septa. No. 3, first ed. p. 36.

SOLARIUM ALVEATUM. *Tab. 17, fig. 3.*

Discoidal, smooth, with two impressed lines near the suture, which is profound; periphery acutely angulated; base flat with a carinated line and groove near the periphery; umbilicus with conical denticulations.

Syn. S. BILINEATUM, *Lea, Con. p. 119, pl. 4, f. 106.*

Locality. Claiborne, Alab.

The most abundant species. No. 3, first ed. p. 31.

SOLARIUM ELABORATUM. *Tab. 17, fig. 4.*

Convex, with numerous crenulated unequal striæ; periphery acute; beneath margined by a ridge and broad furrow, with nearly smooth revolving lines, except the three nearest the umbilicus, which are crenulated and profound; whorls within the umbilicus with a carinated line in the middle.

S. ELABORATUM, *American Journ. Science, vol. 23, p. 344.*

Locality. Claiborne, Alab.

A rare species, the young of which may be confounded with *S. canaliculatum*, Lam. occurring in the same locality. but differs in wanting the channel above, &c. The latter species was inadvertently omitted from the plate.

SOLARIUM EXACUUM. *Tab. 17, fig. 5.*

Discoid, with smooth, regular, revolving striæ; area of the suture broadly furrowed; periphery carinated; margin rounded above, striated; base nearly flat, with a slight submarginal furrow, obscure revolving striæ, and transverse wrinkles; margin of the umbilicus carinated.

Syn. DELPHINULA PLANA, *Lea, Con. p. 117, pl. 4, f. 104.*

Locality. Claiborne, Alab.

This elegant species resembles a *Valvata* with a depressed spire. Rare. No. 4, first ed. p. 44.

SOLARIUM STALAGMIUM, *Tab. 17, fig. 6.*

Discoidal, with two prominent crenulated striæ, and one or two intermediate obscure lines; area of the suture broadly furrowed; periphery rounded, with regular revolving lines; base convex, with obsolete revolving lines, and distinct lines diverging from margin of the umbilicus; whorls within the umbilicus bicarinate, transversely striated; aperture nearly orbicular.

Syn. S. ELEGANS, *Lea, Con. p. 121, pl. 4, f. 109.*

Locality. Claiborne, Alab.

This is a common species, and the most beautiful fossil at Claiborne. No. 4, first ed. p. 44.

SOLARIUM FUNGINUM. *Tab. 17, fig. 7.*

Discoidal; slightly convex; whorls minutely plicated at the suture, which is profound; periphery with a crenulated carina; base flat, slightly grooved near the margin; short impressed lines radiating from the umbilicus, interrupted by an impressed submarginal line.

Syn. SOLARIUM HENRICI, *Lea, Contrib, p. 119, pl. 4, f. 107.*

Locality. Claiborne, Alab. No. 4, first ed. p. 44.

SOLARIUM AMCENUM. *Tab. 17, fig. 8.*

Discoidal; whorls carinated immediately above the suture, crenulated below the suture, and with a very minute impressed revolving line; periphery carinated, margined on either side by a groove and carinated line; base nearly flat, slightly convex, with lines radiating from the margin of the umbilicus, interrupted by two impressed submarginal lines.

Locality. Claiborne, Alab.

SOLARIUM PATULUM. *Tab. 17, fig. 9.*

Convex; whorls flattened or slightly concave, carinated and crenulated on the margin; base with a submarginal furrow; umbilicus patulous.

S. Patulum, Lam. Deshayes, Coq. Foss.

Locality, Claiborne, Alab.

I published this species by the name of *S. scrobiculatum*, but it appears to be identical with the *patulum*, Lam. a fossil of the *Calcaire grossier* at Grignon.

SOLARIUM CANCELLATUM. *Tab. 17, fig. 11.*

Subconical, cancellated; volutions with 3 prominent revolving carinæ, and channelled at the suture; base cancellated; umbilical margin carinated; whorls cancellated within the umbilicus; aperture suborbicular.

S. cancellatum, nob. American Journal of Science, v. 23, p. 344; Lea, Con. p. 121, pl. 4, f. 110.

Locality. Claiborne, Alab.

In Silliman's Journal, I inadvertently named Suffolk in Virginia as the locality of this shell which occurs only at Claiborne. Mr Lea claims not only the species but the name I had given it!

SOLARIUM TRICOSTATUM. *Tab. 17, fig. 10.*

Subconical, with angular whorls and 3 or 4 prominent crenulated revolving carinæ; suture channelled; base with revolving lines; umbilicus small, carinated within near the margin.

Syn. S. GRANULATUM, *Lea, Con. p. 122, pl. 4, fig. 111.*

Locality. Claiborne, Alab.

This species is rare. The name *granulatum* being used by Lamarck, I am obliged to substitute another.

SOLARIUM LINEATUM. *Tab. 17, fig. 12.*

Subconical; whorls convex, with smooth regular prominent revolving lines; area of the suture furrowed; apex prominent; base convex, lineated; margin of the umbilicus not crenulated; aperture orbicular.

Syn. TURBO LINEATUS, *Lea, Con. p. 126, pl. 4, f. 116.*

Locality. Claiborne, Alab. Rare. No. 4, first ed. p. 44.

PLEUROTOMA ALTERNATA. *Tab. 17, fig. 13.*

Fusiform, with revolving close unequal wrinkled lines; whorls angular, carinated in the middle; carina on the superior whorls crenulated; beak produced.

Syn. P. LESUERII, *Lea, Con, p. 137, pl. 4, f. 133.*

Locality. Claiborne, Alab. No. 4, first edition, p. 46.

PLEUROTOMA TABULATA. *Tab. 17, fig. 14.*

Turritid, longitudinally undulated; angle of the whorls carinated; revolving striae minute, cancellated by the lines of growth; umbilicated.

Syn. P. CÆLATA, *Lea, Con. p. 132, pl. 4, fig. 123.*

Locality. Claiborne, Alab.

This species most resembles the *P. dentata*, Lam. but is very distinct. No. 4, first ed. p. 46.

PLEUROTOMA PRORUTA. *Tab. 17, fig. 15.*

Fusiform, smooth; whorls convex, with a submarginal impressed line; body whorl ventricose; submargin of the labrum with a slight oblique varix; labrum emarginate near the base.

Locality. Claiborne, Alab.

Allied to *P. prisca*, Sow. I formerly referred it to *Fusus*, but having examined more perfect specimens, I find it possesses the emarginate labrum.

PEUROTOMA NUPERA. *Tab. 17, fig. 16.*

Fusiform; whorls angular, obliquely crenulated on the angle, and with fine revolving wrinkled lines; suture margined beneath by an obtuse obsolete carina; beak somewhat produced.

Syn. *P. DESNOYERSII*, *P. HENINGHAUSII*, *P. RUGOSA*, *Lea, Con. p. 135, 136, pl. 4, f. 128, 129, 130.*

Locality. Claiborne, Alab.

PLEUROTOMA CONOIDES. *Tab. 17, fig. 17.*

Fusiform; spire conical acute; apex obtuse; whorls convex, with a few revolving lines, distinct near the suture, obsolete on the wider part of the body whorl and distinct at base; aperture contracted; beak short, straight, slightly grooved longitudinally.

Locality. Claiborne, Alab.

PLEUROTOMA SUBEQUALIS. *Tab. 17, f. 18.*

Fusiform; whorls angular, tuberculated on the angle, and with minute revolving striæ; body whorl ventricose; beak rather longer than the spire.

Locality. Claiborne, Alab.

PLEUROTOMA ELABORATA. *Tab. 17, f. 19.*

Subulate, profoundly cancellated, or with numerous oblique elliptical nodules caused by the intersection of the striæ; beak short, truncated.

Locality. Claiborne, Alab. No. 4, first ed. p. 46.

PLEUROTOMA DEPYGIS. *Tab. 17, fig. 20.*

Subulate; whorls angulated in the middle, with obscure oblique nodules on the angle; revolving lines minute, more distinct in the middle of the body whorl, which is slightly ventricose; beak short, straight, truncated.

Syn. P. LONSDALII, *Lea, Con. p. 132, pl. 4, f. 124.*

Locality. Claiborne, Alab.

Differs from *P. nupera* in having a much shorter beak and more elevated spire. No. 4, first ed. p. 46.

PLEUROTOMA ACUTIROSTRA. *Tab. 17, fig. 21.*

Narrow-fusiform, with angular whorls, crenulated on the angle; suture defined by a prominent line; 3 distant revolving prominent lines on the body whorl and intermediate fine lines; beak produced, attenuated.

Locality. Claiborne, Alab.

PLEUROTOMA GEMMATA. *Tab. 17, fig. 22.*

Fusiform; whorls slightly concave above, with prominent tubercles on the angle; an obsolete tuberculated carina beneath the suture; beak produced, rather shorter than the spire.

Locality. Claiborne, Alab.

Some other small species of *Pleurotoma* occur at Claiborne, but they are obscure in their specific characters. One very small species, however, omitted from the plate, is well characterized, and may be named *P. CALLIFERA*—Fusiform, with distant obtuse costæ; whorls plain above; suture defined by a prominent line; labium callous above; beak very short, truncated.

FUSUS TRABEATUS. *Tab. 18, fig. 1.*

Subfusiform, thin, ventricose, with elevated revolving striæ at base and more obscure ones above; body whorl with two distinct rows of compressed tubercles; humeral one continued on the spire; whorls angular; beak produced, flexuous; aperture patulous.

Syn. F. BICARINATUS, *Lea, Contrib. p. 146, pl. 5, f. 147.*

Locality. Claiborne, Alab.

No. 3, first ed, p. 29.

FUSUS INAURATUS. *Tab. 18, fig. 2.*

Subfusiform, ventricose, smooth; suture profound, margined beneath by a prominent line; spire short, pointed, with a crenulated line on the whorls near the apex; beak flexuous.

Syn. F. FITTONII, *Lea, Con. p. 150, pl. 5, fig. 156.*

Locality. Claiborne, Alab.

Allied to *F. ficulneus*, Lam. but differs in having a less elevated spire, a marginal carina and crenulations on the whorls, &c.

No. 3, first ed. p. 29.

FUSUS PAPILLATUS. *Tab. 18, fig. 3.*

Fusiform; shoulder with thick spines; a corresponding approximate series of obsolete tubercles beneath; spire short, volutions concave, apex papillated; beak long, subcylindrical.

Locality. Claiborne, Alab. Extremely rare.

FUSUS LIMULUS. *Tab. 18, fig. 4.*

Fusiform, with revolving lines alternated in size; angle of the whorls with thick slightly oblique tubercles; spire elevated, pointed; beak short, somewhat reflected.

Syn. F. ORNATUS, F. ACUTUS, *Lea, Con. p. 148, pl. 5, f. 152, 153.*

Locality. Claiborne, Alab. No. 4, first ed. p. 43.

FUSUS PERLATUS. *Tab. 18, fig. 5.*

Short-fusiform, ventricose, with revolving raised lines and narrow longitudinal costæ; whorls angulated; beak short, reflected.

Locality. Claiborne, Alab.

FUSUS THORACICUS. *Tab. 18, fig. 6.*

Fusiform, with 7 or 8 revolving elevated costæ on the body whorl, and longitudinal prominent striæ; suture deeply channelled; costæ two on each whorl of the spire.

Syn. F. DECUSSATUS, *Lea, Con. p. 145, pl. 5, f. 146.*

Locality. Claiborne, Alab. No. 3, first edition, p. 29.

FUSUS PROTEXTUS. *Tab. 18, fig. 7.*

Fusiform; revolving lines prominent, distinct; whorls of the spire, except near the summit, with longitudinal undulations; apex obtuse or papillated; body whorl obscurely biangulated, abruptly contracted inferiorly; beak straight, much elongated.

Locality. Claiborne, Alab.

FUSUS RAPHAÑOIDES. *Tab. 18, fig. 8.*

Fusiform, entire; whorls slightly contracted above; suture profound; margined by an obsolete raised line; body whorl abruptly rounded inferiorly; aperture suddenly contracted above and beneath.

F. raphanoides, nob. Journ. Acad. Nat. Scien. vol. 7, p. 144.

Locality. Claiborne, Alab.

Allied to *F. longærus*, Lam.

FUSUS IRRASUS. *Tab. 18, fig. 10.*

Short-fusiform, ventricose, with longitudinal undulations on the body whorl and costæ on the spire; revolving striæ very prominent; summit of the whorls flattened, broadly but not profoundly

EXPLANATION OF PLATES 15, 16, 17, 18.

PLATE 15.

- Fig. 1. *Monoceros armigerus*
 3. ———— *vestustus*
 2. *Melongena alveata*
 4. *Rostellaria laqueata*
 5. ———— *velata*
 6. *Pyrula tricarinata*
 7. *Conus sauridens*

- Fig. 8. *Emarginula arata*
 9. *Fissurella tenebrosa*
 10. *Dentalium thalloides*
 11. *Turritella Mortoni*
 12. *Turritella obruta*
 13. *Turritella vetusta*
 14. *Bulla galba*

PLATE 16.

- Fig. 1. *Voluta Sayana*
 2. *Voluta petrosa*
 3. *Oliva Alabamensis*
 4. *Oliva bombylis*
 5. *Ancillaria tenera*
 6. *Ancillaria lymneoides*
 7. *Mitra perexilis*
 8. ———— *fusoides*
 9. *Voluta prisca*
 10. *Cancellaria gemmata*
 11. *Mitra bolaris*.

12. *Marginella larvata*
 13. ———— *crassilabra*
 14. ———— *humerosa*
 15. ———— *constricta*
 16. ———— *columba*
 17. *Crepidula lirata*.
 18. *Infundibulum thochiformis*
 19. *Cancellaria alveata*
 20. *Crepidula dumosa*
 21. *Mitra paxillis*

PLATE 17.

- Fig. 1. *Turbinella praetenuis*
 2. *Siliquaria vitis*
 3. *Solarium alveatum*
 4. ———— *elaboratum*
 5. ———— *exacuum*
 6. ———— *stalagmium*.
 7. ———— *funginum*
 8. ———— *amœnum*
 9. ———— *patulum*
 10. ———— *tricostatum*
 11. ———— *cancellatum*

- Fig. 12. *Solarium lineatum*
 13. *Pleurotoma alternata*
 14. ———— *tabulata*
 15. ———— *proruta*
 16. ———— *nupera*
 17. ———— *conoides*
 18. ———— *subequalis*
 19. ———— *elaborata*
 20. ———— *depygis*
 21. ———— *acutirostra*
 22. ———— *gemma*

PLATE 18.

- Fig. 1. *Fusus trabeatus*
 2. ———— *inauratus*
 3. ———— *papillatus*
 4. ———— *limulus*
 5. ———— *perlatus*
 6. ———— *thoracicus*
 7. ———— *protextus*
 8. ———— *raphanoides*

- Fig. 9. *Ranella Maclurii*
 10. *Fusus irrasus*
 11. ———— *bellus*
 12. ———— *thalloides*
 13. ———— *salebrosus*
 14. ———— *stamineus*
 15. ———— *Cooperi*
 16. ———— *altilis*

channelled ; suture not impressed ; beak tapering, nearly straight.

F. irrasus, nob. *Journ. Acad. Nat. Sciences*, vol. 7, p. 145.

Locality. Claiborne, Alab.

FUSUS BELLUS. *Tab.* 18, *fig.* 11.

Fusiform, with revolving prominent very regular striæ, and longitudinal rather narrow regular costæ ; spire elevated, pointed ; beak short, slightly reflected ; submargin of the labrum thickened and with short elevated lines within ; margin waved.

Locality. Claiborne, Alab.

The regularity of the ribs and striæ give this shell a beautiful appearance which is heightened by the symmetry of its form.

No. 4, first ed. p. 43.

FUSUS THALLOIDES. *Tab.* 18, *fig.* 12.

Narrow-fusiform, with rather distant spiral elevated striæ ; spire subulate, elongated, superior whorls with obscure longitudinal undulations ; aperture small, elliptical ; labium reflected ; beak straight, channel contracted.

Locality. Claiborne, Alab. No. 4, first ed. p. 43.

FUSUS SALEBROSUS. *Tab.* 18, *fig.* 13.

Fusiform, elongated ; whorls concave above, and with obtuse nodes inferiorly ; revolving lines fine and raised ; body whorl suddenly contracted at base ; apex obtuse ; beak slightly flexuous, rather longer than the spire.

F. salebrosus, nob. *Journ. Acad. Nat. Sciences*, vol. 7, p. 145.

Locality. Claiborne, Alab.

Allied to *F. protectus*, but may be distinguished by the undulations on the body whorl.

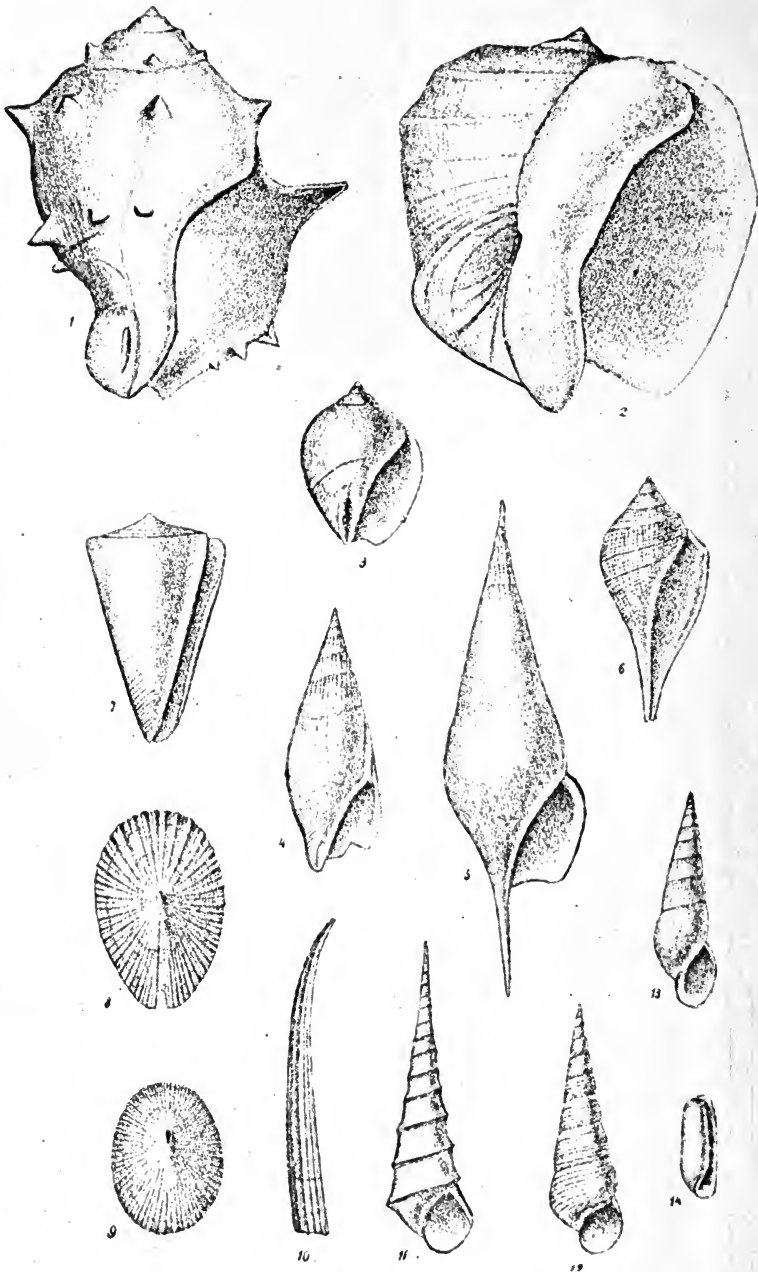
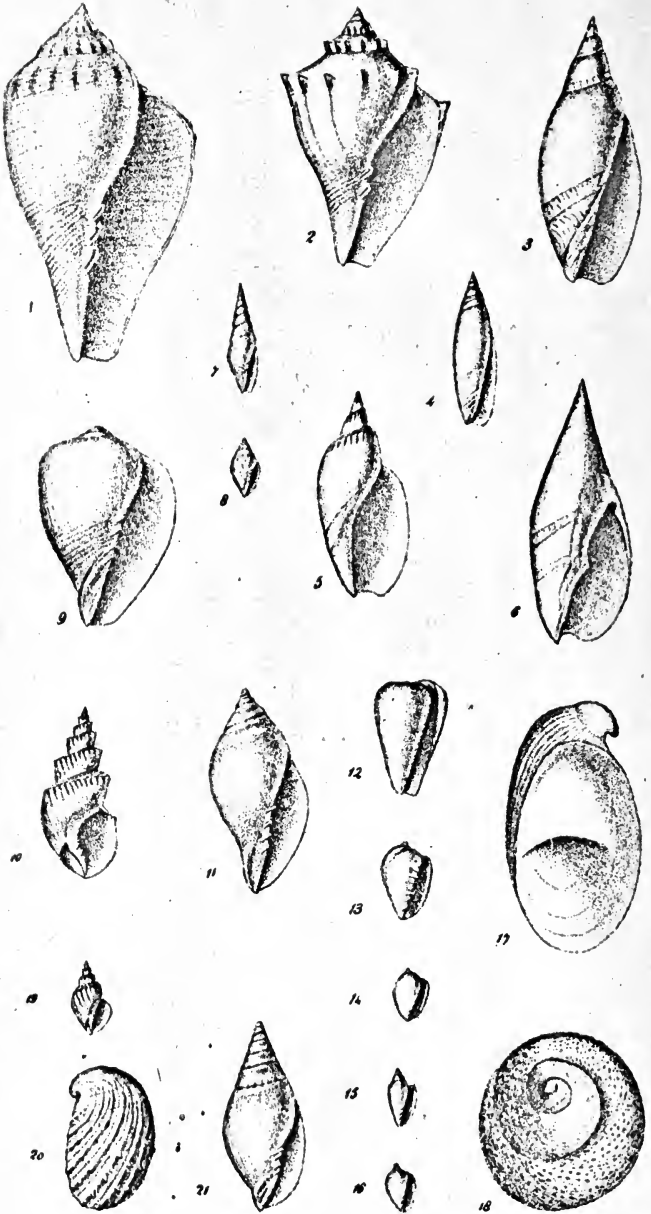
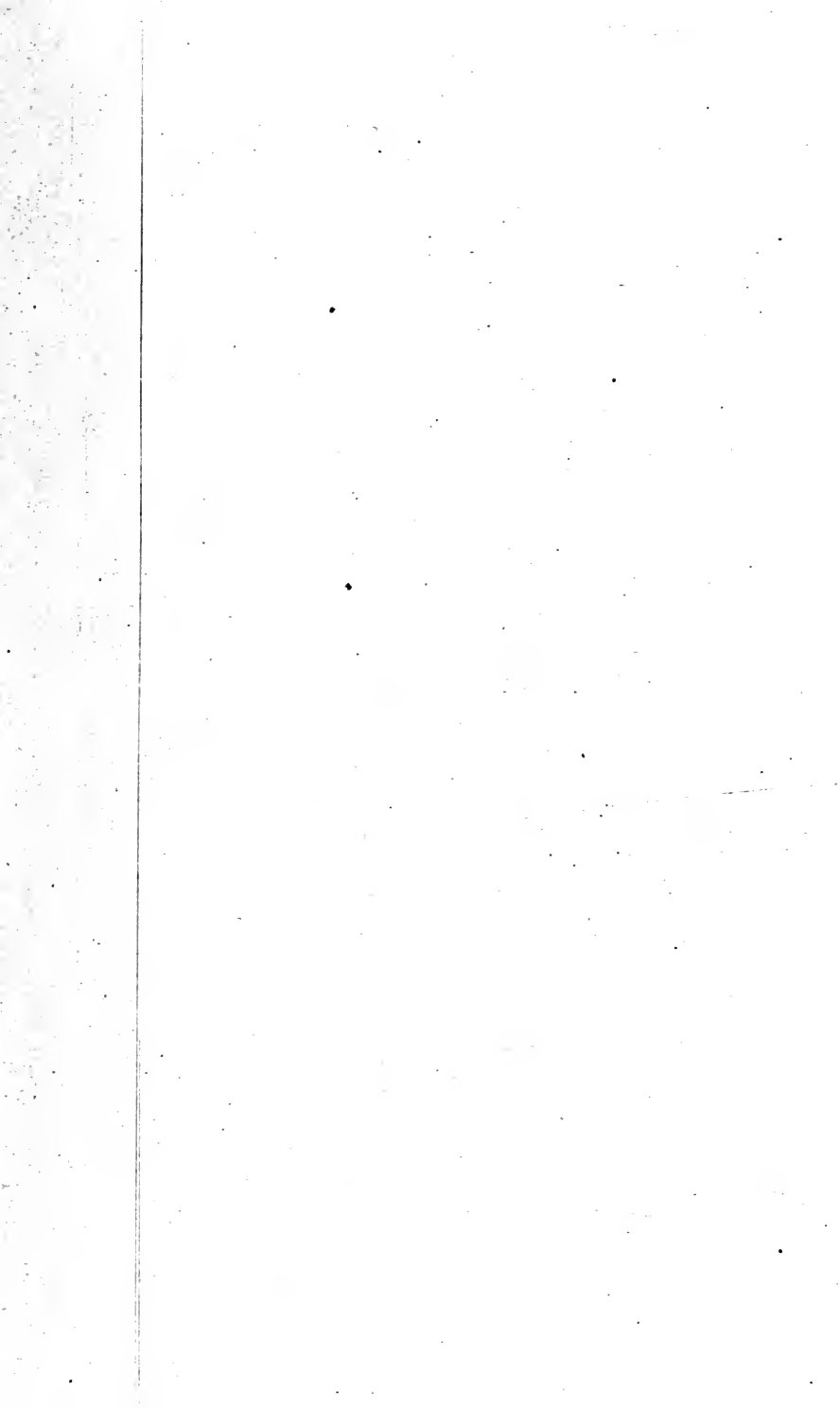
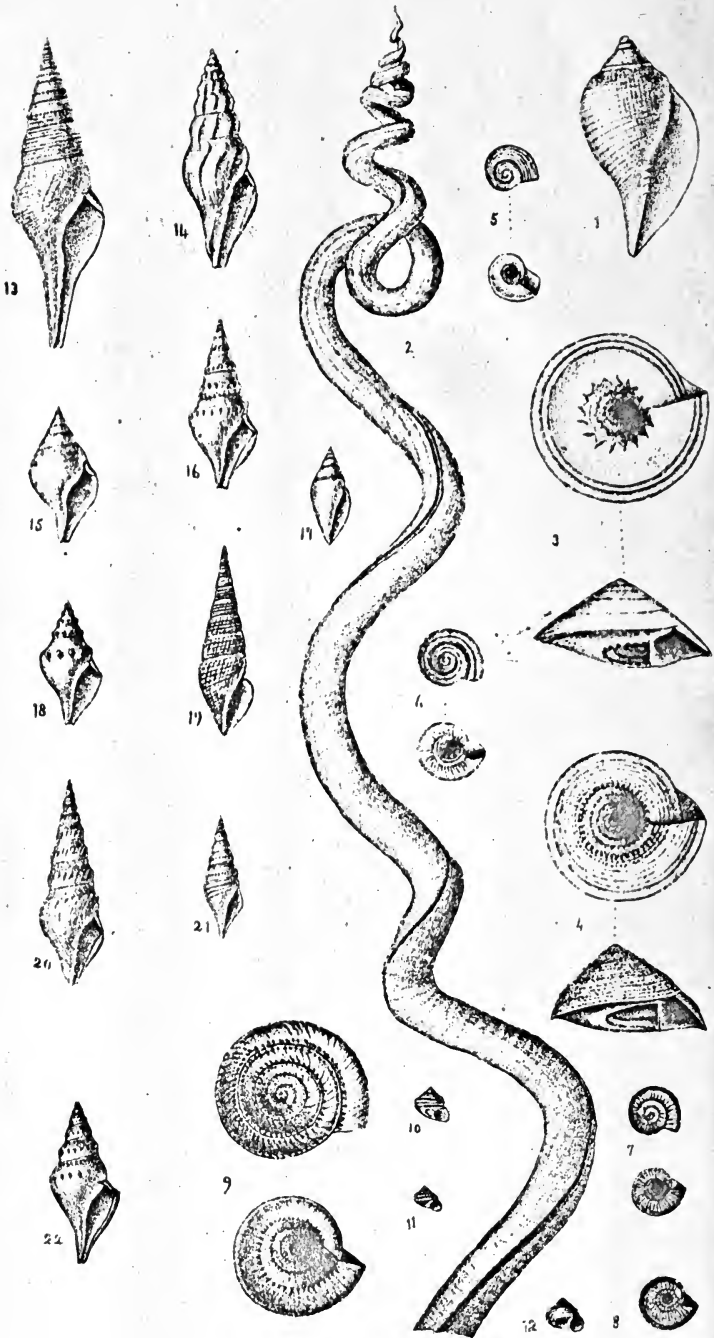




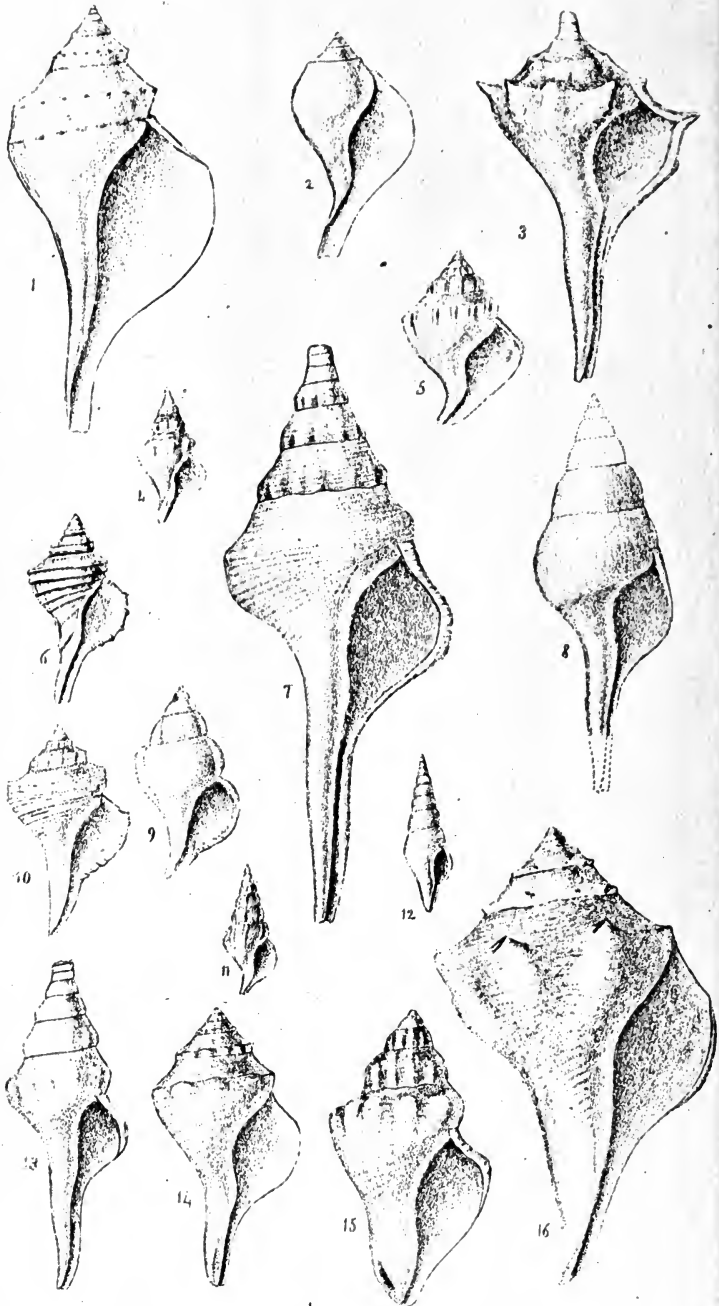
Plate 16.













EXPLANATION OF PLATE 19.

(See page 8.)

Fig.	Name of Species.	Where Described.
1.	<i>Cytherea nuttalli</i> * Con.	Jr. Phila. Ac. Nat. Sc., 1st ser., vol. 7, 1834, p. 149.
2.	<i>Astarte tellenoides</i> Con.	Am. Jr. Sc., 1st ser., vol. 23, 1833, p. 342
3.	<i>Corbula oniscus</i> Con.	" " " " 341
4.	<i>Corbula nasuta</i> Con.	Fos. Sh. Ter. Form., 1833, p. 38, p. [60]
5.	<i>Corbis lamellosa</i> Lam.	An. sans Vert., vol. 5, p. 537.
6.	<i>Corbis undata</i> † Con.	Fos. Sh. Ter. Form., 1833, p. 41, p. [67]
7.	<i>Lutraria papyria</i> Con.	" " " " "
8.	<i>Mactra parilis</i> Con.	" " " 42 [68]
9.	<i>Mactra prætenuis</i> Con.	" " " " "
10.	<i>Erycina rectilinearis</i> Con.	" " " " "
11.	<i>Erycina æquorea</i> Con.	" " " " "
12.	<i>Amphidesma tellinula</i> Con.	Mentioned in App. to Mort's Syn. Org. Rem., 1834, p. 8. Described Am. Jr. Sc., 2d ser., vol. 1, 1846, p. 397, pl. 4, fig. 5.
13.	<i>Amphidesma linosa</i> Con.	Foss. Sh. Ter. Form., 1833, p. 42, p. [68]
14.	<i>Amphidesma profunda</i> Con.	Merely mentioned on p. 8, App. Mort. Syn. Org. Rem., 1834.

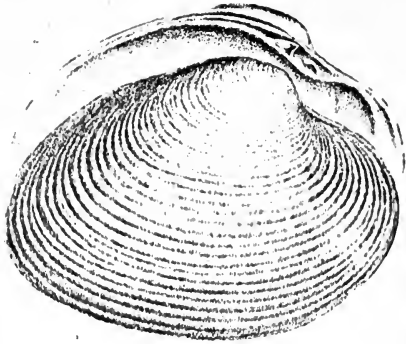
*Not named on the original plate.
†Written "undulata" on the plate.

EXPLANATION OF PLATE 20.

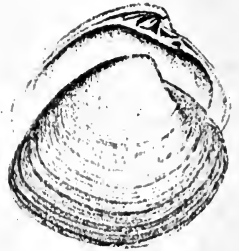
(See page 8.)

Fig.	Name of Species.	Where Described.
1.	<i>Cytherea mortoni</i> Con.	Jr. Phila. Ac. Nat. Sc., 1st ser., vol. 7, 1834, p. 150.
2.	<i>Cytherea discoidalis</i> Con.	Foss. Sh. Ter. Form., 1833, p. 37, p. [59]
3.	<i>Gratelupia hydana</i> Con.	" " " p. 36, p. [58]
		(Described as a <i>Cytherea</i>)
4.	<i>Cytherea perovata</i> Con.	Foss. Sh. Ter. Form., 1833, p. 37, p. [59]
5.	<i>Cytherea atquorea</i> Con.	" " " 36, p. [58]
6.	<i>Cytherea subcrassa</i> Lea.	Cont. to Geol., 1833, p. 67, pl. 2, fig. 43.
7.	<i>Cytherea poulsoni</i> Con.	Foss. Sh. Ter. Form., 1833, p. 36, p. [58]

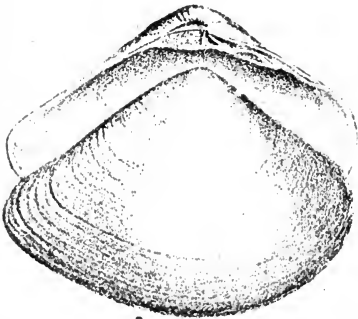
Plate 20.



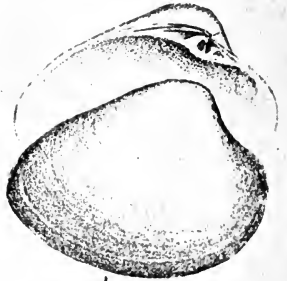
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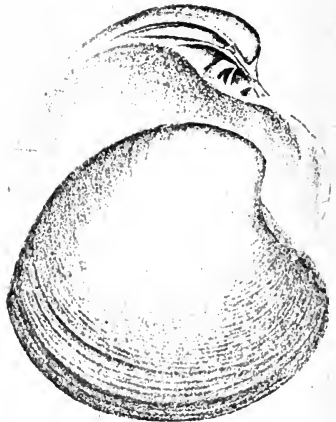
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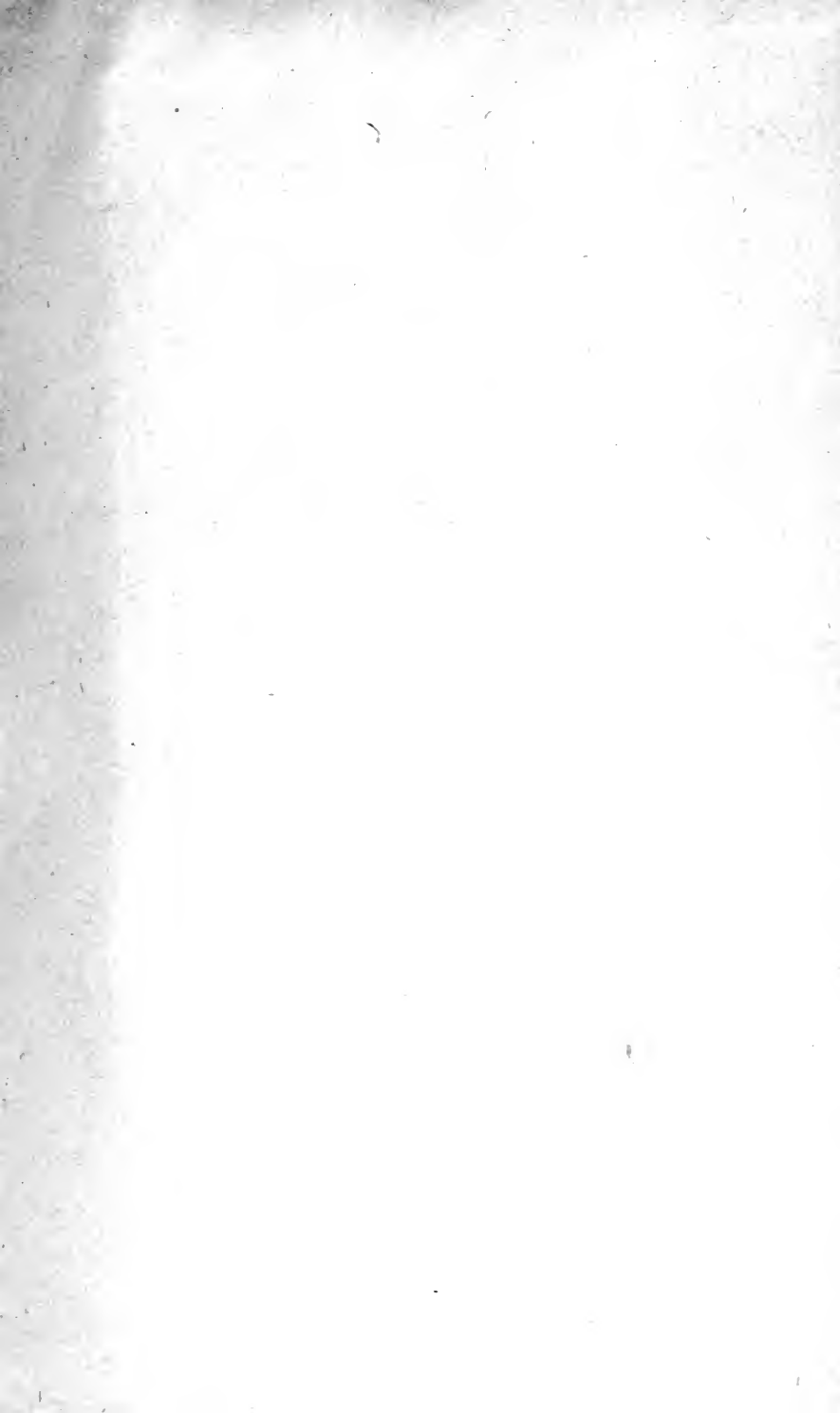
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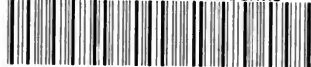
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