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OF

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[Division VI. – Paleontology]

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PALÆONTOLOGY

OF

NEW-YORK.

VOLUME I.

CONTAINING DESCRIPTIONS OF THE ORGANIC REMAINS OF THE LOWER DIVISION OF THE NEW-YORK SYSTEM,

(EQUIVALENT OF THE LOWER SILURIAN ROCKS OF EUROPE.)

BY JAMES HALL.

ALBANY:
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1847.

TO HIS EXCELLENCY SILAS WRIGHT,

Governor of the State of New-York.

SIR,

I HEREWITH submit that part of my Report on the Palæontology of New-York, containing descriptions of the organic remains found in the lower division of the system, which comprises the Potsdam sandstone, Calciferous sandstone, Chazy limestone, Birdseye limestone, Black-river limestone, Trenton limestone, Utica slate and Hudson-river group. All the species described will be illustrated by figures drawn and engraved from original specimens, the greater part of which have been collected by myself from these strata, and the others received from individuals whose authority for their geological position will be cited.

I have the honor to be,

With great respect,

Your obedient servant,

JAMES HALL.

ALBANY, September 1, 1846.

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PREFACE.

The present work was committed to my charge in the spring of 1843; but the unfinished state of my Report on the Geology of the Fourth District rendered it impossible to devote myself entirely to the Palæontology, during the remainder of that year. From the limited time at first allotted to the completion of the work, it became necessary to examine cursorily all the strata of the system, with a view of giving several representative species or typical forms of each group. This plan was continued until the end of the year 1844; at which time I had materials prepared for a single volume, to be illustrated by about 70 plates, giving figures of fossils from all the strata from the Potsdam sandstone to the Coal formation. I then became satisfied that such a work would afford but a very imperfect and incomplete representation of the extensive and rich fossiliferous series of New-York. In consideration of this circumstance, the time originally contemplated for completing this work was extended by the Legislature at the session of 1845; and I commenced a re-examination of the lower strata, with a view of giving a more complete representation of their organic contents. The result of these subsequent investigations has more than doubled the number of species at that time known to me, and has increased the plates from 40, the number originally contemplated for illustrating these groups, to more than 90.

In the present volume, I have, in many instances, given much detail in regard to surface and internal structure, changes of form resulting from age, nature of sediment, and other circumstances. To geologists and palæontologists, already acquainted with these facts, some portions of this may appear unnecessary; but it should be remembered, that of the 3000 copies printed, probably 2500 will go into the hands of persons unlearned in any department of natural science. The work is published expressly for the benefit of the people of the State of New-York; and I have, in this difficult subject, endeavored to point out to the apprehension of all, the differences of character, which, from being overlooked, have often led to the confounding of species from different strata under the same name; and I have also endeavored to show how important, in some instances, are very slight differences.

At the time this work was commenced, about seventy species were accurately known and described from all the strata of the lower division of the system. This number is already more than quintupled, and new forms frequently come under observation, showing that this part of the palæozoic series furnishes its full proportion of fossils. The number of species and varieties already described amounts to 381;* and among these we shall observe a proportion of the different classes and orders, not materially varying from other and younger portions of the palæozoic series.

Free from preconceived opinions regarding the geological range of species, and willing to find identical species in rocks widely separated, I have been surprised at the result of my investigations in the lower strata, which thus far have not produced a single species that can be satisfactorily established as common to succeeding formations. There are two species, concerning which some doubt may remain: these are the *Leptæna tenuistriata,* and the *Calymene senaria;* the first of which is regarded by some geologists as identical with *L. rugosa,* and the latter with *C. blumenbachii.* There are, however, some slight differences in the external characters which lead me to question the identity in either case, and to refer them to distinct species. These two instances, even if regarded as exceptions to the general rule of the entire extinction of species at the termination of any great epoch, form so small a proportion of the whole, that they offer very slender grounds for generalization.

The geological structure and order of succession among the strata of this period had already been clearly made known in the Reports of Messrs. VANUXEM, EMMONS and MATHER, who have also given many of the typical fossils. The greater number of species previously known were described by Mr. CONRAD, in his Annual Reports on the Palæontology of the State, from 1838 to 1841; and in the Journal of the Academy of Natural Sciences of Philadelphia, Vol. viii, 1842. Several other species were named and described in manuscript by Mr. CONRAD, some of which were published by Dr. EMMONS in his Report upon the Second Geological District; and I have been able to

* See Table at the end of this volume, page 330.

identify some additional ones from Mr. CONRAD's notes, and from labelled specimens in the State Collection.

In describing the species, I have preferred to follow the stratigraphical order, beginning with the lowest rock; considering the geological succession of species to be more in accordance with the design of this work, than a zoological classification. I have nevertheless endeavored, under each rock, to arrange the fossils according to their zoological affinities, beginning with the corals, which are preceded by the marine plants where any are known in the rock. This arrangement has not been so perfect as could have been desired; but the future volumes will be so planned, by a double series of numbers for the pages, as to admit of being separated, and a complete zoological arrangement of the species made. What we most need, however, for the purpose of facilitating geological research, is a true representation of the species in their order of succession, arranging always those from separate rocks or groups by themselves. In this manner only can they have their true value affixed to them, and their relative chronological importance assigned.

The increased number of species over those before known as belonging to these strata, the larger part of which appeared to be new, has made me diffident in advancing the results of my researches, and in claiming, not only a large number of new species, but also a considerable number of generic forms not before recognized. Since the descriptions of species contained in this volume were prepared, and while the early pages were passing through the press, I have had the rare opportunity of several times consulting M. DE VERNEUIL in reference to this part of the subject. His examinations have led to the same result, and he has encouraged me to publish my species as they now stand, assuring me that the greater part are new, and quite distinct from the published European forms. Subsequently I have had the pleasure of submitting some of my specimens, and the results of my examinations, to the learned M. AGASSIZ, who has honored me by expressing a favorable opinion of my labors. Although, encouraged by such friendly expressions on the part of able naturalists, I have less anxiety than I should otherwise have felt in the publication of the volume, I am nevertheless fully aware that there is much room for improvement.

Of my scientific friends, and of the scientific public generally, I must ask indulgence, while they consider the circumstances under which the work has been wrought out. Situated where I can have no recourse to scientific friends except by letter, with a scanty library of works on Palæontology, and no authentic collections for the comparison of species already described, I have been forced to depend upon my own resources in every department. I cannot therefore but suppose, that those who have devoted themselves to the study of some particular department, with greater facilities than are within my reach, will find many things, which, under better auspices, could have been made more perfect. I can only content myself with having represented in the engravings, as accurately as possible, every object described in this volume; thus affording, to those who desire to do so, the means of comparing species, and of correcting any erroneous references.

I must here acknowledge my obligations to my friend JAMES D. DANA, who has given me some valuable suggestions in regard to the corals; and had it been possible to do so, I should have submitted the whole of this class of fossils to his examination and decision.

I am indebted to many kind friends for specimens loaned or given to me for this work. I have received many fine ones from Dr. I. B. CRAWE of Watertown, Jefferson county; from Dr. BUDD and Mr. ALSON CLARKE of Turin, and from Mr. LUKE WILDER of Lowville, Lewis county.

I am under obligations to Gen. SPINNER of Mohawk, for several fine specimens from the lower strata, and for others from a higher position which do not appear in this volume. I am likewise indebted to Mr. W. H. PEASE of New-York, to Mr. LYMAN WILDER of Hoosic-falls, and to Dr. A. J. SKILTON and Prof. COOK of Troy, for numerous specimens, some of which are already cited in this volume, and others will be given in the succeeding one. Mr. JOHN GEBHARD junior, of Schoharie, has allowed me the free use of his valuable cabinet, which has furnished several fine specimens for the present volume, and will be of the most essential importance in illustrating the middle and higher groups.

I am greatly indebted to the late Mr. WADLEIGH of Middleville; and the extensive collections purchased from him have enabled me to present many new forms, as well as to illustrate in a much more perfect manner others not contained in my previous collections.

I should not omit in this place to make my acknowledgments to my colleagues Mr. VANUXEM and Dr. EMMONS, who have both furnished me with specimens not in my own or the State collection. To several other persons my obligations are also due in particular instances, which are cited in the body of the work.

Dr. T. R. Beck, with his characteristic liberality in matters of science, has allowed me free access to the collection of the Albany Institute, which contains many valuable and unique specimens. I have cited, under the descriptions, several specimens figured from this collection, and I shall be further indebted to the same for materials for the next volume.

To my friends out of the State, who have furnished me with specimens from the same formations, for comparison with those of New-York, my especial thanks are due. Among these I may mention Messrs. Joseph Clarke, J. G. Anthony and S. Carly of Cincinnati, and the Rev. Mr. Christie of Oxford, Ohio, who have liberally forwarded to me many valuable specimens, by the aid of which, in many instances, I have rendered my descriptions and illustrations more complete than I could otherwise have done with the specimens from New-York alone.

Among the species described and figured, are a few which have not yet been obtained in the State of New-York, but which may hereafter be recognized, as more careful investigations are made in the same strata. These species are so intimately associated with others which are well known and abundant in this State, that I considered it desirable to represent them in their true place.

Since this volume has been printed, the Legislature of 1847 have, with munificent liberality, passed a law for the completion of the work, and have authorised 250 plates to be engraved. This number, judging from what I already know of the succeeding strata, will be sufficient for ample illustration of the entire series.

The succeeding volume will contain the descriptions and illustrations of the fossils of the strata, from the Hudson-river group, up to the Oriskany sandstone inclusive, and will appear in the course of the ensuing year. The remainder will follow as rapidly as may be consistent with accuracy in the determination of their specific characters and geological relations. In the mean time I shall embrace every opportunity of adding to the present portion of the work, by arranging materials as they may come to hand for supplementary plates. I shall therefore feel under great obligations to any friend who may have it in his power to furnish me with species from the lower rocks, not here described, or who can aid me in obtaining specimens for the better illustration of those species but imperfectly represented in the present plates.

Many of the difficulties attending the preparation of this work thus far, are entirely or partially removed; and I confidently anticipate being enabled to bring forward the succeeding parts of it more rapidly, and, so far as regards the artistical part, in a manner more satisfactory to myself and the public. The succeeding strata are better known, and more extensive collections have been made from them; and there are also more numerous localities, and better exposures of the strata. I shall also be able to avail myself of the results of previous labors in the Fourth Geological District, where I have already carefully studied the strata and their contained fossils.

The increased number of species from the lower strata, resulting from my investigations since 1844, and the consequent expansion of the volume, has compelled me to omit the plates already prepared for illustrating the succeeding strata, which were engraved in 1843 and 1844. From the same cause, the sketch of the geology of the State, which I had proposed to precede the descriptions of the fossils, has been deferred, and will appear in a succeeding volume, accompanied by descriptions and figures of the principal genera of palæozoic fossils.

In conclusion, I wish to express my obligations to Mr. John Paterson, who has had the entire direction of the typographical arrangement of the volume, as well as the correction and revision of the proofsheets. I have also been indebted to his literary and scientific knowledge, for the general accuracy of the work.

INTRODUCTION.

The publication of the Final Reports on the Geology of the State of New-York made known, in a very satisfactory manner, the true order and sequence among the strata, from the older crystalline, or azoic rocks, to the Carboniferous system. The subdivisions then proposed had been wrought out with much care, and though in their main features based upon lithological characters, had nevertheless been studied in reference to their fossil organic contents, and each group was illustrated by a few typical species. Still it remained to ascertain more conclusively whether the divisions proposed were, in all cases, important and distinct groups, characterized by an assemblage of fossils sufficiently numerous and constant to be reliable over wide areas, and under considerable lithological variations. With this view, the study of the palæozoic features of each group has been pursued with attention; and though the entire series is yet incompletely made out, there is still enough known to prove more conclusively the propriety of retaining the subdivisions heretofore established.

In proposing the groups at that time adopted, and uniting the whole series of strata as a single system, it was not for want of means of distinguishing the limits of the more important subdivisions. The entire succession was regarded as forming a series intimately linked together by the nature of its organic contents, and showing no very important changes, till we arrive at the base of the Old Red Sandstone. It is true, we found no difficulty in recognizing, in a general manner, the subdivisions of the Silurian system, and also, in the higher part of the series, a large number of fossil species identical with Devonian forms. Still, if we are to admit among species of Silurian date, those forms from our Hamilton group, so analogous, and in several cases identical, with those of the Ludlow rocks of England, it becomes impossible to recognize, as distinct from these, any Devonian rocks. Indeed we find the species here alluded to, so mingled with others of Devonian character, that we are forced to admit the whole as belonging to the latter system. Tracing the succession downwards, also, from this latter point, we find, in the organic contents, no evidence of a change of sufficient importance to indicate the commencement of another great division of the system, till we pass below all those rocks (the Corniferous and Onondaga limestones) charged with *Favosites*, *Cyathophylli*, and other forms, of which many appear to be included in the Wenlock formation of England. Passing upward, on the other hand, to the red sandstone, containing remains of peculiar fishes so analogous to those of the British Isles, that we unhesitatingly refer the rock to the Old Red Sandstone of Europe; we find the formation separated by an unequivocal line of demarkation from the rocks below, which are charged with shells and trilobites. So abrupt and well defined is this line, that in undisturbed regions we have no difficulty in recognizing it by the sudden and entire cessation of brachiopods alone, while usually the lithological change is more distinctly marked by a coarse sandstone or conglomerate. Whatever may be said, therefore, of the identity in age, and the mingling in the same formation, of Devonian fossils, such as Brachiopoda, Acephala and Gasteropoda, with the peculiar fishes of the Old Red Sandstone in Great Britain, such a condition never happens in the United States, so far as observations have extended.*

At the present time, I am obliged to recognize the following great subdivisions as indicated by zoological characters. Commencing with the lowest rock known to contain fossils, we find the first important change in the typical forms to occur at the termination of the Hudson-river group; which is marked by a coarse sandstone or conglomerate (the Oneida conglomerate or Shawangunk grit), beyond which scarcely a single species has prolonged its existence. This point must be considered as representing that horizon, which, in Great Britain, is the termination of the Lower Silurian deposits. We never find, however, in the succeeding groups, a mingling of the fossils of the lower and higher rocks, which is regarded as taking place in England and Wales, where the strata are much disturbed.

The *Pentamerus oblongus*, so well known and extensive in its geographical range, is never found in the United States associated with the fossils of the lower division. On the other hand, it occurs in a calcareous band among shales and sandstones, far more naturally belonging to the succeeding higher strata than to the lower. Moreover, although found in

* In the State of New-York, and in other parts of the United States, the most natural and obvious arrangement would be to include in one system all the strata to the termination of the Chemung group; since, as already shown, there is no lithological change more obvious or important at the base of these higher formations, than there is at the base of the Niagara and Clinton groups. Where the Oriskany sandstone is absent, it is even scarcely possible to distinguish the line of separation between the Niagara and Corniferous limestones, though one is regarded as of Devonian and the other of Silurian age. If we consider any one class of fossils as a guide in determining the limits of systems, then perhaps the peculiar "Devonian fishes," which first appear in our Schoharie grit, or at the base of the Onondaga limestone, will be regarded as indication of the commencement of a new era. Still, however, the characters of the other classes of fossils is not materially changed, and several species of the central part of the system have prolonged their existence into the superior strata. The zoological question, therefore, is to be tested upon the ground, whether the commencement of a certain order of fishes at a certain period is more important than the subsequent change, when all the other classes of organic remains are exterminated, and the same order of fishes is continued?

a lower calcareous band, it cannot be separated by any important lithological or zoological characters from a succeeding one, in which we find fragments of *Bumastis barriensis*, and other fossils typical of the middle division of our system. Indeed, so well marked is the position of this fossil, that throughout a large part of New-York, and at intervals in a western direction, extending even beyond the Mississippi river, it holds its unequivocal place in the series; never mingling with the abundant lower forms, nor rising far above the base of the second great division of the system.*

At the same period, and associated in the same rock with the *Pentamerus*, commences the *Catenipora escharoides*, which, though sometimes regarded as of little importance in the identification of strata, has nevertheless a very limited geological range. This coral extends from the Clinton group to the top of the Niagara limestone, in which rock it becomes abundant and widely disseminated, marking unequivocally that horizon over more than a thousand miles in extent.

After leaving the first division of the system, we are able to recognize in the subordinate groups many zoological affinities, from the Clinton group, to the commencement of the Oriskany sandstone; beyond which, very few of the preceding forms continued their existence. Although the details of all these groups are not yet wrought out, we are quite confident that the result will prove the correctness of our position.†

With the Schoharie grit, commences a series of strata containing fossils as distinct from those of the preceding formations, as these are from the lower division. We here, for the first time, recognize several species that are regarded as Devonian forms; and if zoological characters are to be paramount, we are compelled to unite all the succeeding strata as of Devonian age. There is, however, no greater distinction to be observed at this horizon of change, than at the previous one; and if the two lower divisions are considered parts of one system, then the succeeding one should constitute the third term in the same.

I shall hereafter be able to show more clearly the zoological relations of these successive subdivisions, after having given as thorough a revision of the whole series, as I have been enabled to do of the groups of the lower division.

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* After examining a collection of fossils from the Lower Silurian strata of Great Britain, collected from authentic localities, I am inclined to believe that the *Pentamerus oblongus* holds the same position there as in New-York; occurring above the conglomerate or breccia, which, there as in this country, forms the true limit of Lower Silurian strata. The disturbed condition of the rocks in that country has probably so interplicated the strata, as to produce a mingling of the fossils of two periods; which has given rise to the conclusion that this fossil, with a few others of the same period, are Lower Silurian; while from a mingling of Wenlock forms with these, there is afforded no line of demarkation so clear and unmistakable as we have in the United States.

† The Delthyris shaly limestone bears many affinities, both in lithological and fossil characters, with the Niagara group. Several of the brachiopods have been considered as identical, but a careful comparison proves them quite distinct in the two groups.

That part of my work already completed in detail, shows a more perfect similarity with the Lower Silurian strata of Europe than we had heretofore supposed; and though there is not a large number of identical species, the analogy of others is quite interesting and satisfactory.

In our extreme lower formations, we have found little that can be positively identified with European deposits; still, the Potsdam sandstone, our oldest fossiliferous rock, appears to hold, in the scale of formations, a similar place with the Ungulite grit of St. Petersburgh,* which is there charged with fragments of *Obolus*, giving it the almost micaceous aspect which the *Lingula* does to its analogue in New-York. The paucity of organic forms at this period, and in the two succeeding formations, would lead us not to expect a very complete analogy between groups of this age in countries widely separated from each other. We have, nevertheless, in these extremely ancient deposits, a few forms which are peculiar, and sufficiently characteristic to identify the strata in which they occur. These forms do not appear to have been recognized elsewhere; or if known, no great importance has been attached to them. It is probable, however, that in Europe, as in many parts of the United States, the Calciferous sandstone and Chazy limestone are not well developed, and consequently their typical fossils do not exist. We find ourselves, therefore, forced to commence our comparison with European formations, from the Trenton limestone; in which, thus far, the forms of *Ophileta*,† *Scalites*, *Raphistoma* and *Maclurea*, which are typical of the preceding strata, have not been observed.

When we compare our species of the lower groups with those of Europe, as made known to us, first, by the publication of the Silurian System of Mr. Murchison, and subsequently in the work already cited, by the same Author, E. de Verneuil and Count von Keyserling, as well as from other sources, we find a very instructive and interesting analogy. The Geological Report of the Ordance Survey of Ireland, by Capt. Portlock,‡ has likewise shown us other forms identical with our own; and we are able to prove, from this author, that the zoological relations of the lower strata in Ireland are more analogous to those of New-York and the United States, than are those of the same age in England and

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* See *Geology of Russia in Europe and the Ural Mountains*, by Roderick I. Murchison, Edouard de Verneuil and Count A. von Keyserling, Vol. i, pp. 27 & 27*.

† At page 11 of this Report, I have remarked that the *Ophileta complanata*, from its usually rare occurrence and obscure characters, cannot be regarded as of much importance as a characteristic fossil. Mr. Vanuxem has since informed me, that in a late geological excursion in the vicinity of Lake Champlain, he has found this fossil in great numbers and excellent preservation, holding the same position as elsewhere in the State. It is probably, therefore, entitled to more consideration than I had before attached to it.

‡ *Geological Report on Londonderry, and Parts of Tyrone and Fermanagh*, by J. E. Portlock, F.R.S., F.G.S., &c. Dublin & London, 1843.

on the Continent. Again, Mr. LOGAN has shown, from his collections in Canada, several European species not yet detected in New-York or farther westward, which still more assimilate the eastern and western extremities of these formations so widely separated by the Atlantic.

In commencing our examinations, we find that marine plants are coeval with the earliest created animal forms; and that both appear, though obscurely, in the same rock. Throughout the entire series of the lower division, each rock or group appears to be typified by a few peculiar forms of this class, which are quite as much restricted in their geological range as are those of animal life.

Among the lower classes of animals we find an absolute identity in many of the species, and a remarkable similarity in several others. We can hardly refuse to believe that our Graptolite shales are of the same age as those of England, Ireland or Sweden, when we find so many identical species in the two formations; and though we here have many not yet recognized in those countries, some of them will doubtless be found there on further examination. The *Chætetes petropolitanus* of Russia is probably the same with our *C. lycoperdon*, which likewise occurs in the Caradoc sandstone of Britain.* Nearly all the other Corals of this period, however, are new or undescribed.

Among the CRINOIDEA, most of the forms appear to be quite new, and to present even generic characters unknown in the higher rocks. We are able to recognize, nevertheless, the occurrence of the family Cystidea, in a species of *Echino-encrinites* allied to the *E. angulosus*. Those singular forms, the *Sphæronites*, have not yet been discovered in this country; and though abundant in Sweden and Russia, have only recently been recognized in England.† We shall doubtless yet discover the same fossil in this country, though it is not probable that it will ever become characteristic of the strata. We find that animals of this order commenced their existence among the earliest forms, and as soon as calcareous matter formed any considerable portion of the deposit.

Of the BRACHIOPODA, we have several identical and many allied species in the different genera. The *Lingula quadrata* is clearly identical with the Russian species; and another species which we find in our Trenton limestone, is apparently the same as the *L. attenuata*

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* This fossil is often referred to *Favosites fibrosa*, which is regarded as having a great geological range. In our Trenton limestone species, connecting foramina are never visible; while in the similar form in the Pentamerus and Delthyris shaly limestone, there is no difficulty in distinguishing them. I have not recently examined good specimens from the Clinton and Niagara groups, but am at present inclined to express some doubt as to the identity of the species in that rock and the Trenton limestone, and the statement on page 67 may be received with some allowance.

† See Geology of Russia in Europe and the Ural Mountains, Vol. i, p. 38. The facts in relation to the discovery of Cystidea in England, there made known, had escaped my observation at the time I wrote my description of *Echino-encrinites*, and translated the passages from the second volume of the same work.

of England. The *Leptæna sericea*, *L. tenuistriata*, and probably *L. alternata*, are identical with Lower Silurian species in England, being well known and common forms both here and in Europe. The *Delthyris lynx* seems equally common in the lower strata of the United States and Russia; while *Orthis testudinaria* is every where characteristic of strata of this age. Other species of Brachiopods are closely allied, and may be regarded as representatives of European species. In this class, the *Leptæna* and *Orthis* are far more conspicuous and important than the *Atrypa*, the species of which are fewer and generally less widely distributed. Of the latter genus, however, two species, the *A. modesta* and *A. increbescens*, are abundant and widely distributed, being every where typical of the lower division of the system.

So few species of ACEPHALA from this period have been described in Europe, that no very satisfactory comparison can be drawn between them and our own. We recognize, nevertheless, several forms very analogous to those of New-York and the Western States. In this class I have established several new genera, among which are the *Modiolopsis*, *Ambonychia* and *Tellinomya*: the two former of these are well characterized in several species, while the latter now embraces some that are probably heterogeneous forms.* These may be regarded as palæozoic genera, and the species thus far indicated are important in distinguishing the older strata. The number of species of this class is far greater than could have been anticipated, being more than half as many as of the Brachiopoda, and are therefore entitled to our consideration.

Among the GASTROPODS, there is a very close resemblance in several species; while among those which appear to be identical with European forms, we are able to assert positively only one or two of which no question remains.† In this class, we have several genera peculiar to Lower Silurian strata. Among these may be included *Ophileta*, *Raphistoma*, *Scalites*, *Maclurea*, *Bucania* and *Cyrtolites*. The species in this class, although numbering several genera, are not numerous till we arrive at the base of the Trenton limestone. The generic form *Bucania*, which I have separated from forms heretofore referred to *Bellerophon*, we now know to belong to an earlier period, and is represented by two distinct species some time anterior to the appearance of the latter genus.

* The condition of these fossils is such, that often little more than the form can be ascertained; consequently it is difficult to give reliable generic characters, since form is often so variable in species of the same genus. By examining the descriptions and figures here mentioned, the reliable characters of these genera will be ascertained; and since they are the earliest forms constructed upon this type, they are worthy of consideration, inasmuch as we regard it important that the earliest forms should in all cases be regarded as typical species of the genus.

† If the figures and descriptions of *Euomphalus qualteriatus* and *Murchisonia gracilis* are correct, our species, which have been referred to these, are quite distinct.

The Cephalopods appear among the earliest organisms, two species occurring in the Calciferous sandstone. Though appearing in all the succeeding strata, they are not numerous in the Chazy and Birdseye limestones, but are the most conspicuous forms in the Black-river and Trenton, both of which may with propriety be termed "Orthoceratite limestones." The lower division of the system is pre-eminently the era of Cephalopods of the order Orthocerata; and even throughout the entire palæozoic series in the United States, no subsequent formation affords so great a development in any of the other families of this class. The several new genera of these fossils are founded on peculiar characteristics, indicating, indeed, in one instance, even more than a mere generic distinction.

We have a sufficient number of Trilobites, identical with those of the Lower Silurian rocks of Europe, to institute a comparison of the conditions of the ancient ocean in both hemispheres. That remarkable and characteristic Lower Silurian form, *Trinucleus*, is among the most common; while *Illænus* and *Isotelus*, no less characteristic, are obtained in the earliest limestone. Several new species have been added; while others, hitherto but imperfectly understood, have been more fully illustrated. It is not a little remarkable, that at this early period we have the representatives of nearly all the important genera of Trilobites known in our palæozoic strata.

Thus far, no remains of Fishes, or other animals of a higher order, have been discovered; though we find them almost at the commencement of the next division, and in all the succeeding palæozoic strata.

The results of these investigations in the lower formations, though necessarily very imperfect, have nevertheless shown a comparatively equal or proportionate development among the different classes; and though certain forms appear often to hold a predominance, it is frequently due to the development of a greater number of individuals, rather than the number of species. In other cases, the species of certain genera are more numerous, while in a succeeding rock the order may be reversed. This is true in regard to the Brachiopods, where the terebratuloid forms increase in the higher rocks, and predominate greatly over *Orthis* and *Leptæna*. The Orthoceratites diminish in number of species, and individual preponderance; while forms like *Cyrtoceras* and *Goniatites*, which are rare in lower rocks, become the predominating genera of this class in the higher strata.

Among the Corals, the *Chætetes* of the Lower Silurian strata gives place to *Favosites*, which flourishes in abundance. All the Cyathophyllidea of the lower division of the system, having turbinate forms, are destitute of transverse or horizontal septa; * and the first

* The two species, *Columnaria alveolata* and *Favistella stellata*, have transverse as well as vertical septa; but these forms, though regarded as belonging to the same family of Corals, are so different in their habit and mode of growth as to appear more nearly allied with *Favosites*.

species in which this character is developed, has the depression on one side, as in *Caninia*. Indeed, admitting the subdivisions among the groups as proposed, we shall scarcely find a well characterized species of *Cyathophyllum* in Silurian strata. Of the other families of Corals, or the Bryozoa, less is known, but there are nevertheless some important differences in character in the ascending development.

Passing over the intermediate classes, I have noticed, in the ORTHOCERATA, some peculiarities of structure which appear confined to species belonging to the lower division of the system. The first of these is in the undulating septa and angular form of *Gonioceras*; which is the first instance, within my knowledge, of undulating septa in a straight chambered shell of palæozoic date. The singular internal structure exhibited in the *Endoceras*, showing in fact the viviparous character of the animal, is still more remarkable, and exhibits a feature in the physiology of these animals before unknown. The great numbers of specimens examined leave no doubt of the true nature and object of this peculiar development of the siphuncle, which embraces the embryo sheath. I regret to say, however, that I have not been able to make investigations to such an extent as would enable me to ascertain the true characters and gradual development of the young shell as it is found in the embryo sheath, and subsequently in its free state. Thus far, I have not discovered in my collections a single species having this character, from any strata above the Hudson-river group. The peculiar character of siphon observed in *Ormoceras*, I am induced to believe, is also found in one or more species in the higher strata; but of this I cannot yet be entirely certain.

This brief introductory notice can scarcely be regarded as more than a slight and imperfect sketch of the subjects introduced. Sufficient progress has not been made, to speak with confidence of every point. So many new developments have taken place in the course of investigation, that we are ready to expect others in our future progress; and although these may not essentially modify general results, they may nevertheless tend to give greater force or importance to some minor points, or to show more clearly the untenability of others.

The plan of the work, as has already been stated, is to give a complete representation of the succession among the organic forms typical of the palæozoic strata, arranged in the chronological order of those strata. The clear and undisturbed succession which prevails throughout the entire series, has given a certainty in the direction and result of our labors; and it remains only to be hoped that the same facilities in the following portions will give that part of the work an equal value for its accuracy in this respect.

Every step in this research tends to convince us that the succession of strata, when clearly shown, furnishes conclusive proofs of the existence of a regular sequence among the earlier organisms. We are more and more able, as we advance, to observe that the Author of nature, though always working upon the same plan, and producing an infinite variety of forms almost incomprehensible to us, has never repeated the same forms in successive creations. The various organisms called into existence, have performed their parts in the economy of creation; have lived their period, and perished. This we find to be as true among the simple and less conspicuous forms of the palæozoic series, as in the more remarkable fauna of later periods. The truth of all these conclusions is now so well sustained by the results of scientific investigations, that we regard the history of the past, from the dawning of vitality till man assumed the dominion over the whole, as marked in certain and intelligible characters, incapable of misinterpretation.

PALÆONTOLOGY OF NEW-YORK.

POTSDAM SANDSTONE.

This rock, with its associated slates and conglomerates, we regard as lying at the base of the palæozoic strata; as having been produced at the dawning of the vital principle upon our planet, forming the eozoic point in our series. Nothing which bears the semblance of having been organic is yet known in strata of anterior origin. If, as has been supposed, organic forms were enveloped in the materials of the gneiss, mica and talcous slates, they have been so far obliterated by supervening changes that they cannot now be recognized. Neither has it been demonstrated, except to a very limited extent, that any of these rocks are of origin anterior to those which we term palæozoic. In the metamorphosed strata of more recent periods, we are able to trace the gradual extinction of the outlines and substance of numerous organisms as we pass from the unaltered to the metamorphic condition of the same formations. Therefore, in strata like those of the gneiss and associated slates, where the present character departs so widely from what we suppose to have been their normal type as sedimentary rocks, we are scarcely justified in expecting to meet with organic remains which might give a clue to their geological age. It can only be by a thorough study of the structural development, that we can hope to arrive at satisfactory conclusions regarding the age of a large portion of the metamorphic strata on the east of our fossiliferous masses of the Hudson River valley.*

* Some months since, Prof. H. D. Rogers informed me that he had discovered palæozoic fossils in the White Mountain range; and while this part of my report was passing through the press, I read the paper of Profs. H. D and W. B. Rogers, "*On the geological age of the White Mountains.*" It would appear, from the fossils discovered, that these apparently ancient and highly crystalline strata are of the age of the Clinton group of New-York. Nevertheless, I am, for various reasons, inclined to regard the association of fossils there mentioned, though necessarily obscured by igneous action, as indicating the occurrence of the Hudson River rocks, which we find extending to a considerable distance east of the Hudson River, charged with *Lingulæ*, *Cytherinæ*, *Agnosti*, and fragments of other Crustacea.

I have already shown (*Transactions of the Association of Geologists and Naturalists, New-Haven. May* 1845), that the Shawangunk grits do overlie the shales of the Hudson River group in Rensselaer county, N. Y., occupying some deep folds of the strata beneath. The same grits and conglomerates may be seen again farther to the north in Vermont, capping the summits of some of the elevated ridges; and, so far as we can discover, these coarse grits are conformable to the strata beneath.

We shall therefore commence our descriptions with those organic forms which are typical of the acknowledged base of the palæozoic series on the American continent, leaving for future consideration those forms which have given rise to some difference of opinion regarding the age of the rocks in which they occur. Further explorations may add to the number of forms already known in this rock; but it must be acknowledged, that, thus far, it has proved very barren in organic products.

ORGANIC REMAINS OF THE POTSDAM SANDSTONE.

PLATE I.

GENUS SCOLITHUS.

[From the Greek, σκωληξ, a worm, and λιθος, a stone.]

Skolithus. HALDEMAN, Supplement to No. I. of a Monograph of the Limniades, &c. 1840.

This name was first proposed by Professor HALDEMAN, as forming a sub-genus under FUCOIDES, and is now recognized by him as forming a distinct genus.

Character. Stem free, simple, cylindric or subcylindric, vermiform or linear, never branched.

1. 1. SCOLITHUS LINEARIS.

PLATE I. Fig. 1. *a. b. c.*

Stem simple, rectilinear; surface nearly even, cylindric or compressed, sometimes apparently striated.

Diameter $\frac{1}{8}$ to $\frac{1}{2}$ an inch; length from a few inches to several feet.

This fossil, in its usual aspect, presents the appearance of numerous linear stems, often extending to one or two feet in length. Ordinarily it appears like a series of small pins or pegs driven into the rock in a somewhat regular manner, and at uniform distances. It preserves its distinctness even when the surrounding rock is much altered, as along the western face of the Green Mountains. In such situations, and often in others, the fossil is stained by oxide of iron, and the rock cleaves more easily in that direction.

In the Second Annual Report of the Geology of Pennsylvania, Prof. ROGERS speaks of this "marine plant" as the best defined species discovered in this rock. He has also spoken of it under the name of *Tubulites;* but I believe no generic description ever appeared, previous to the one of Prof. HALDEMAN; nor am I able to find in print the name *tubulites* applied to this fossil, of anterior date.

Fig. 1. *a.* A vertical or longitudinal view of a specimen of the rock containing these bodies.
Fig. 1. *b.* A similar view of a specimen of partially altered and laminated sandstone from Pennsylvania, the tubes somewhat flattened.
Fig. 1. *c.* Weathered surface of a specimen of the altered sandstone (crystalline or granular quartz), from Adams, Mass.

Position and localities. This species is apparently confined to the Potsdam sandstone, though usually unassociated with any other fossil. It is found, though somewhat rarely, in the valley of Lake Champlain; and it also appears in the partially altered sandstone of the same age, at the base of the Green Mountains, in Adams, Mass. Rolled masses of the same rock, containing this fossil, are not unfrequent in the eastern part of New-York. It occurs in the same sandstone in several localities in New-Jersey. In the sandstone of the same age on the Susquehanna, and at other places in Pennsylvania, this fossil is of frequent occurrence; and it may be traced in the same rock, through Maryland and Virginia, to Tennessee. (*State Collection.*)

2. 1. LINGULA PRIMA.

Pl. I. Figs. 2 *a*, *b*.

Lingula prima. Conrad.

Obtusely oval or rounded, short, obtuse at both ends; sides curved; base rounded; beak scarcely rising above the margin of the shell; surface marked by faint concentric lines and sometimes a few concentric wrinkles, and fine longitudinal striæ. In some specimens, the concentric and longitudinal striæ are equally distinct, while in others the longitudinal striæ are more distinct.

In its form and general aspect, this shell bears considerable resemblance to *L. curta* of the Trenton limestone and Utica slate; but that shell is usually larger, less obtuse at the beak, with strong concentric striæ, while the longitudinal ones are indistinct or obsolete.

Position and localities. This fossil is for the most part rare even in the Potsdam sandstone, though at Keeseville in Essex county it is quite abundant, forming distinct laminæ in the rock, like films of carbonaceous matter. It extends, according to Dr. Emmons (*Geol. Rep.* p. 268), through a thickness of seventy feet of the rock at this place. It occurs also at Rosse's bridge, four miles west of Essex village, Essex county. (*State Collection.*)

3. 2. LINGULA ANTIQUA* (*n. sp.*).

Pl. I. Figs. 3 *a*, *b*, *c*, *d*, *e*.

Elongated, subspatulate, rapidly tapering towards the beak; sides usually straight, sometimes abruptly curved; front broadly rounded; surface marked by concentric lines; no visible longitudinal striæ.

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* The figure given by Prof. Emmons (*Geological Report*, p. 268) as *Lingula antiqua* of the Potsdam sandstone, is the *L. acuminata* (Conrad, *Annual Report of* 1839, p. 64) of the Calciferous sandrock, and is not known to me as a fossil of the Potsdam sandstone. The original specimen from which the figures were taken, in the collection of Mr. Vanuxem, bears a close resemblance to *L. attenuata* of Murchison's *Silurian System*, p. 641, pl. 22, fig. 13.

This shell is somewhat variable in form, as represented in the figures; but the apex is uniformly acute, and the surface of the shell marked by concentric striæ. It approaches in form to the *L. acuminata* of CONRAD; and I am unable to point out the difference, having only a drawing of that shell. In many cases, this shell, in the Potsdam sandstone, is almost wholly absorbed, a mere film remaining, showing the form of the shell. By taking extreme forms of this species, since the shell is so obscure, it would not be difficult to indicate two distinct species.

Fig. 3 *a*. The usual form of this fossil.
Fig. 3 *b*. A broader specimen, with apex wanting.
Fig. 3 *c*. A very broad somewhat rounded specimen, a view of the interior of the shell, the inner laminæ wanting, and the concentric elevated lines showing in relief.
Fig. 3 *d*. An elongated specimen, somewhat compressed laterally.
Fig. 3 *e*. An enlarged portion of 3 *c*.

Position and locality. In the grey friable variety of this rock in the town of Hammond, St. Lawrence county, and near Alexandria landing in Jefferson county. (*State Collection.*)

We look upon these minute fossils with no ordinary degree of interest, as having been, for a long period, almost the only representatives of animal life, at least upon this portion of our globe.* We find other species of the same genus in nearly every group in the New-York system, while others have flourished in every geological period, and many are still living in our present seas. In opposition to very commonly received notions, we here find, as the earliest representative of the animal race, species of a still existing genus, showing that the conditions of that primeval ocean were in many respects similar to our own. We see, so far as the evidence goes, that external conditions were then as favorable to this form of life as at present; and though subsequently immense numbers of forms were called into existence, differing from the common and numerous forms of the present day, still, since some similar forms do occur during all this time, we are justified in supposing that the conditions then existing were not very dissimilar from those at the present time, where such forms now flourish.

The form of these *Lingulæ* scarcely differs from that of some of the modern or existing species, showing that through all this time nature has worked upon the same principle in the production of her works; and the little shell of modern seas is produced, in form and appearance, and in action and habit, like the little shells which flourished in the earliest era of life upon this globe; a period so incalculably lost in the past, that we can have no conception of the time that has elapsed between.

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* Prof. H. D. ROGERS has informed me that he believes he has obtained a species of *Orbicula* from this rock, thus adding a third species, all belonging to genera which flourished in nearly every subsequent period, and of which species still exist. Mr. LYELL also remarks that he obtained at Keeseville a placunoid fossil associated with the *Lingula* (*Travels*, p. 132).

CALCIFEROUS SANDSTONE.

We find in this rock, in numerous localities, a great number of what appear to be the remains of sea plants. Many of these consist apparently of fragments of large succulent stems, even giving some evidence of having been hollow, like the stems of some of the marine plants of the present day. It is impossible in these, as in nearly all the remains of marine plants of the palæozoic rocks, to detect any structure which can be reliable in making distinctions. In the case before us, we are led to refer these vestiges to marine vegetation, not from their appearance alone, but from the fact that we find, in cavities of the same rock, small quantities of anthracite. Now although the present condition of this carbonaceous matter is that of anthracite, we nevertheless believe it to have been a fluid or semifluid bitumen, from the fact that where occurring free in a cavity of the rock, it has indurated in a globular or semi-globular form, indicating a degree of fluidity in its original condition. The very natural suggestion is, that the bituminous matter derived from this vegetation has parted with its volatile parts, and become a solid mass of non-bituminous coal. Whatever weight such an argument may have, we cannot resist the inclination to associate this production with the obscure remains which we find in the same strata.

From the nature of the rock, and from the condition of many of its fossils, we cannot doubt but many more forms, both of plants and animals, were imbedded in it, than we find at the present time. The very obscure impressions and cavities which so frequently occur, in some of which it is not difficult to detect the marks of organic structure, lead us to believe that the sea from which this deposit was thrown down contained a numerous fauna. That their remains are so obscure at the present time, has doubtles arisen from two causes : first, that during the deposition of the mass, there was a considerable intermixture of silica, which to some extent existed in a soluble condition, and, as we infer, absorbed the exuviæ and obscured the characters of these remains ; and again, the proximity of this rock, in its best defined localities, to those of hypogene origin, and the numerous faults and uplifts it presents, lead us to believe that it has undergone subsequent changes, which also may have had some effect in obliterating the organic forms.

In nearly all instances, we find the shells removed, and siliceous casts of the interior only remaining. In a few instances, the shell is replaced by siliceous matter. Many of these casts are imbedded in a mass of chert or hornstone, the material of which has doubtless been aggregated around them after their death, forming nodules or accretions as in the higher limestones and in chalk.

During the progress of this formation, and towards its close, a considerable number of forms of animal life appear to have been called into existence. We have passed from that condition of the earth unfavorable to animal development, and we perceive the gradual change, which, in the next period, presents us with swarms of animated existences. If we can, in imagination, allow ourselves to go back to the preceding epoch—to fancy the earth enveloped in one waste of ocean, save perhaps a few rocky peaks; when the natural agitation of the waters by the winds was increased by volcanic or igneous outburstings; while the rocky points were abraded, and thence fine sand and pebbles spread over the bed of the ocean, we behold life, struggling into existence in this stormy period, only manifested in the fragile yet enduring form of the little Lingula, while an apparently rootless leafless plant is the representative of the vegetable kingdom.

Look forward from this period to a gradual change—a more congenial element to the inhabitants of the ocean comes, in the form of calcareous matter, and new organisms are gradually called into existence. Still the heated waters bear their burden of silex in solution, and now they permeate every portion of this habitation of the newborn vitality, destroying the living, enveloping the dead in a siliceous paste, and preventing that development of numbers which awaits only a more congenial condition.

Such, indeed, we have every reason to believe, was the state of things at this period. Numerous hot springs, bursting out from fissures or faults of the lower strata, penetrated with their heated waters the lower beds of this rock during their deposition, and while in a condition to be so affected. The superincumbent waters doubtless partook in some degree of this condition, and became a less congenial abode for the testaceous tribes just called into being. Still this condition does not seem to have been unfitted to the development of the singular vegetable forms which appear in great numbers, and which constitute a large portion of some thin layers (the fucoidal layers) near the base of the formation.

The first metagenic interval lies between the deposition of the rock previously noticed, and the termination of this one, and may be regarded as the interval in which certain conditions were assumed by the elements, favorable to those forms of life, which continued through a long period, even indeed to the close of the palæozoic epoch.

FOSSIL PLANTS OF THE CALCIFEROUS SANDSTONE.

PLATE II.

GENUS PALÆOPHYCUS.

[Greek, παλαιος, ancient, and φυκος, a seaweed ; from the apparent habit of the plant.]

Character. Stem terete, simple or branched, cylindric or subcylindric ; surface nearly smooth, without transverse ridges, apparently hollow.

4. 1. PALÆOPHYCUS TUBULARIS (*n. sp.*).

PL. II Figs. 1, 2, 4 and 5.

Stem cylindric, gradually tapering (sometimes to an obtuse point as in fig. 1), unevenly bent or flexuous, irregularly branched and sometimes regularly bifurcating ; surface nearly smooth ; stems and branches usually compressed, and, when weathered, appearing as if hollow.

Fig. 1 is a collection of flattened flexuous stems, which were apparently broken and thrown together upon a surface of sand, and gradually covered with shaly matter. The forms are not so well defined as in some of the other specimens.

Fig. 2 is better preserved, and the cylindrical form of the stem better defined. A great number of small fragments occur on the same specimen, some of which present an appearance as if originally possessing a vesicular structure. The small branches appear to have been solid, and the larger stem hollow. The fossil is calcareous.

Fig. 4 is a portion of a single stem, presenting a small branch below, with a bifurcation above. This specimen is but partially calcareous, with a considerable intermixture of oxide of iron.

Fig. 5 is a collection of fragments of stems, aggregated in a fine sand from the lower part of the formation.

It is not improbable but a further examination will enable us to distinguish two species among those described, as the specimens present some diversity of character, which I have attributed to the nature of the matrix, and the variable proportions of siliceous and calcareous matter.

Position and locality. These fossils are more abundant towards the upper part of the mass, and in situations showing an admixture of calcareous matter. They occur in the same layers with the fossil shells in some places, while in others they hold a higher situation than some of the shells. They are found at numerous localities along the Mohawk valley, the principal of which are Amsterdam ; opposite the village of Fort-Plain ; along the railroad ; Canajoharie ; west of Palatine bridge, and at various other places.

(*State Collection.*)

5. 2. PALÆOPHYCUS IRREGULARIS (*n. sp.*).

Pl. II. Fig. 3.

Stems numerous, cylindrical, irregularly branched; branches flexuous, diverging; surface apparently smooth.

This species occurs covering the entire surface of large slabs of the sandstone. It is always much smaller than the preceding species; its condition is such that no definite structure can be ascertained, nor is it easy to give specific characters which will serve to distinguish it from others.

Position and locality. This species occurs in the fucoidal layers near the base of the rock, and lower in position than the last described. It occurs near Chazy, Clinton county, and near Keeseville in Essex county; also between Flint hill and Amsterdam, in the Mohawk valley.

The other species occurring in this rock differs essentially from those preceding, and strictly appertains to another genus, which I propose to name

BUTHOTREPHIS.

[Greek, βυθοτρεφις, produced or growing in the depths of the sea.]

Character. Stems subcylindric or compressed, branched; branches numerous, divaricating, leaflike; structure vesicular?

Some species of this plant have a habit like Potamogeton (see fig. 1, pl. 21).

6. 1. BUTHOTREPHIS ANTIQUATA (*n. sp.*).

Pl. II. Fig. 6.

Stem somewhat thickened, subcylindric; branches numerous, flattened, leaflike, tapering towards the base and apex.

This fossil has an appearance very similar to some of the modern sea plants, and is doubtless allied to the recent Fucus; but since the term *Fucoides* has been applied to marine plants of such variable forms and habit, I have thought best to adopt other names to designate some of the older palæozoic species.

In the present genus, the typical form is to be found on Plate 21, fig. 1; and other forms, referable to the same genus, appear in the higher strata. These forms present no evidence of hollow or tubular stems like the preceding, though the present species is nearly coeval with those, and the two forms are again associated in the Trenton limestone.

Position and locality. This species is found in the higher part of the Calciferous sandstone, or perhaps more properly in the base of the Chazy limestone, and in a situation somewhat higher than either of the preceding species. A single specimen only has been found at Chazy in Clinton county. (*State Collection.*)

FOSSIL SHELLS OF THE CALCIFEROUS SANDSTONE.

PLATE III.

The shells observed by myself in this rock are all univalves, though Mr. VANUXEM mentions the occurrence in it of an *Atrypa* in the Mohawk valley, and one or two species of *Lingula* have been found in the same. No specimens of the latter have come under my own observation, either in the rock itself, or in any cabinet or collection of fossils which I have examined. Mr. CONRAD gives the following species :

7. 1. LINGULA ACUMINATA.*

Lingula acuminata. CONRAD, Annual Report of 1839, p. 64.

Shell acute, acuminated at the apex, somewhat gibbous on the umbo, and compressed laterally ; basal margin rounded. Length $\frac{1}{3}$ of an inch.

Position and locality. In a boulder or loose mass of the Calciferous sandrock (See VANUXEM'S *Report*, p. 35).

8. 1. EUOMPHALUS UNIANGULATUS (*n. sp.*).

PL. III. Figs. 1, 1 *a*.

Planorbicular, discoidal ; volutions angular above, rounded below ; spire scarcely rising so high as the angular ridge upon the upper and outer edge of the last whorl ; lower side concave ; upper surface striated obliquely from within outwardly towards the edge of the whorl ; lower surface even, smooth.

This shell presents all the essential characters of species of this genus from the Mountain limestone : it is prominently marked by the single angular ridge upon the upper and outer edge of the whorls, which becomes obsolete towards the apex. The specimen is a cast ; but the striæ (which are too strong in the engraving) still remain impressed upon it on the upper side, while on the lower side it is smooth. The remains of several specimens were found in a porous sandy chert or hornstone.

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* Judging from some manuscript notes of Mr. CONRAD, in my possession, I am inclined to think he afterwards referred this shell to the *L. attenuata* of SOWERBY. Having never seen a specimen from the sandstone, I can only give this figure from a drawing of Mr. CONRAD (the original specimen being now in the possession of Mr. VANUXEM), in the hope of calling the attention of observers to the subject, and, if possible, of obtaining specimens which may be satisfactorily compared.

Lingula acuminata

Fig. 1. View of the upper side of a large specimen.
Fig. 1 *a*. The lower side of a smaller specimen, showing the broad umbilicus.

I regard this species as exceedingly interesting, and as linking by a generic type (very rare in the lower rocks of this country) the lower, middle, and upper palæozoic strata. Mr. MURCHISON records three species as occurring in the Llandeilo flags, in England and Wales; but this is the first and only individual in our lower strata, which I feel warranted in referring to the same genus.

Position and locality. The specimens were found in a loose mass of the Calciferous rock, in Saratoga county. The character of the mass, and its association, leave no doubt of the true position of the fossil. (*Cabinet of* LYMAN WILDER.)

9. 1. MACLUREA SORDIDA (*n. sp.*).

PL. III. Figs. 2, 2 *a*.

Shell discoidal; spire not elevated; mouth slightly expanded; surface apparently smooth.

The specimens of this fossil usually appear in a weathered, worn and distorted condition, in the upper part of the rock. From their condition, it is not easy to determine their specific relations.

From the circumstance that these fossils always present the oval form exhibited in the figures, Mr. VANUXEM has termed them *Ellipsolites;* but a careful examination induces me to refer them to the Genus MACLUREA, typical specimens of which occur in the succeeding rock. (*State Collection.*)

10. 2. MACLUREA MATUTINA (*n. sp.*).

PL. III. Fig. 3.

Discoidal, involute; spire not elevated; umbilicus deep; surface unknown, apparently striated.

The fossils in this specimen, as is the case with nearly all the others in this rock, are obscure, both from the character of the rock, before alluded to, and from weathering by exposure. It is therefore with some hesitation that I characterize the two species above; but as they may be of some service to the student in identifying the mass, and as the fact of their existence is also interesting, we offer them as they are usually seen. The rock in which they occur is lithologically a compact silico-magnesian limestone, which weathers with a greyish brown surface, and attains a coarse harsh structure. In the same rock are often seen a few fragments of *Orthocerata*, which, with the numerous individuals of the two species here described, render some of the thin layers highly fossiliferous.

Position and locality. These fossils are usually found in the higher portions of the rock, at Canajoharie, and other places in the Mohawk valley.

Genus OPHILETA (*Vanuxem*).

[Greek, οφις, a snake, and ειλητος, coiled; the fossil having the appearance of a snake in coil]

Planorbicular, discoidal; volutions numerous, slender.

The above characters are drawn from the descriptions of Mr. Vanuxem (*Report*, p. 36). I append the woodcut, showing the forms given by him in his report.*

11. 1. OPHILETA LEVATA.

Pl. III. Figs. 4 and 5.

Ophileta levata. Vanuxem, Geological Report, p. 36, fig. 1.

Discoidal; volutions numerous, slender; spire not elevated above the edge of the outer volution; concave beneath; volutions angular below; aperture not expanded; surface apparently smooth.

This fossil bears a close resemblance to Euomphalus, to which genus I incline to refer it, since it presents no essentially distinct characters. I have, however, in deference to the opinion of my friend, allowed it to remain under the proposed name of *Ophileta*.

Position and locality. This fossil is not uncommon in the fucoidal layers in the Mohawk valley; it therefore appertains to the higher portions of the rock. The specimens in which it occurs are often finely granular, and sometimes oolitic, containing numerous finely comminuted fragments of other fossils.

12. 2. OPHILETA COMPLANATA.

Pl. III. Fig. 6.

Ophileta complanata. Vanuxem, Geological Report, p. 36, fig. 2.

Discoidal, planorbicular; volutions numerous, very gradually increasing in size from the apex.

The specimen figured by Mr. Vanuxem (woodcut, fig. 2) preserves a more distinct outline than any one I have seen. The specimen, fig. 6, pl. 3, is from the State Collection, and labelled as above by Mr. Vanuxem. I have obtained similar obscure forms from this rock, but it is impossible to define any essential characters. Whatever may have been its original nature, it is quite unsatisfactory at present, and can scarcely be regarded as of much importance as a characteristic fossil.

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* Fig. 1. Ophileta levata. 2. O. complanata. 3. A crinoidal plate, associated with the preceding.

Position and locality. This species occurs in the higher calcareous layers of this rock, at several places on the Mohawk; at Canajoharie; and also in Lewis and Jefferson counties.

(*State Collection.*)

13. 1. TURBO DILUCULA (*n. sp.*).

PL. III. Fig. 7.

Subglobose; volutions few (about 3), ventricose, rapidly enlarging to the aperture; shell thin?; spire moderately elevated, obtuse; width and height of the shell about equal; surface?

This fossil occurs in great numbers in the siliceous portions of the rock, usually in the form of casts, or the cavities made by the shell only are preserved. The specimen figured, with portions of several others, occurs in a coarse siliceous mass, partially decomposed, and containing ramified veins of chalcedonic quartz.

Position and locality. This species is found at Middleville, at the locality of quartz crystals; and also at Littlefalls, Herkimer county. It occurs in the lower and middle parts of the mass, and usually in porous or cavernous portions.

14. 2. TURBO? OBSCURA (*n. sp.*).

PL. III. Fig. 8.

Subconical; spire ascending, obtuse; volutions few (3?), tumid, gradually increasing from the apex; height considerably exceeding the width.

This shell differs from the last in the proportionally greater height, and the more gradual enlargement of the volutions from the apex towards the aperture. The specimen figured occurs in a calcareous sandstone, with several others, more imperfect, all of which are casts, and the surfaces much eroded.

Position and locality. This shell occurs in the upper portions of the rock, at Fort-Plain.

15. 1. PLEUROTOMARIA? TURGIDA (*n. sp.*).

PL. III. Figs. 9 and 10.

Depressed-conical; whorls about 4, tumid, subangular, rapidly increasing from the apex; last whorl very large, ventricose, expanded; height and greatest breadth about equal.

This fossil is a rough cast of chert in a coarse siliceous mass of calcareous sandstone, and consequently its characters cannot be very accurately determined. The form of the aperture is very similar to that of NATICA. In fig. 10, the upper part of the spire is nearly corroded, and the whole surface very rough; in fig. 9, the surface is less eroded, though otherwise in a similar condition.

Position and locality. This species was found in a loose cherty mass of the rock in Saratoga county. (*Cabinet of* LYMAN WILDER.)

16. 1. ORTHOCERAS PRIMIGENIUM.

Pl. III. Figs. 11, 11 *a*.

Orthoceras primigenia. Vanuxem, Geological Report, p. 36, fig. 4.

Elongated, terete, gradually tapering to an obtuse point; surface smooth?; section circular; septa thin, deeply concave, closely approximated, being distant only $\frac{1}{25}$ the diameter; siphuncle?

In Mr. Vanuxem's figure, the septa are represented as about $\frac{1}{7}$ or $\frac{1}{8}$ the diameter. His specimen presents a longitudinal section nearer the apex than mine, and therefore this difference may be expected. The thin and closely approximate septa are very striking characters, and will probably serve to distinguish this species. The parts usually preserved in this rock are fragments near the apex, indicating that this portion was stronger than the rest of the shell.

Position and locality. This species is found in the higher calcareous portion of the rock, in the Mohawk valley, near Fort-Plain, and also in a brecciated mass near the same place, in great numbers.

17. 2. ORTHOCERAS LAQUEATUM (*n. sp.*).

Pl. III. Fig. 12.

Somewhat rapidly tapering (to an acute point?); surface fluted, or marked by longitudinal angular ridges, with intermediate finer ones; some faint remains of transverse striæ; section circular.

One or two only of the septa are still obscurely visible, regularly arched, but their comparative distance cannot be ascertained. This fragment, being a portion near the apex of the shell, is a part of what has been probably a much larger specimen.

Position and locality. The position of the specimen is probably at the upper termination of this rock, and just at its passage into the succeeding limestone. Its locality is uncertain.

(*State Collection.*)

In presenting these specimens as the typical fossils of this rock, it is not regarded as by any means certain that they are exclusively confined to it. Since several of them occur near its upper termination, and where the mass becomes more calcareous, it is not improbable they may appear again in the succeeding rock. The vegetable forms, however, so far as known, do not reappear, being apparently confined to the Calciferous sandstone, and flourishing to its close, but disappearing with the augmentation of calcareous matter, and giving place to the remarkable forms presented on Plates VIII. & IX.

CHAZY LIMESTONE.

The lower part of this rock, which can be seen resting upon the preceding mass, presents an aggregation of fragments of crinoidal remains, corals and shells; showing conclusively that at this early period the sea was as well fitted for the production and support of living organisms, as at any subsequent period. It is true the species are not exceedingly numerous; neither was the period of their duration very long. Still it is clearly evident that this portion of the ancient ocean, at least, swarmed with animal life in some of the lowest conditions of organization. In none of the subsequent groups do we find a more perfect crinoidal limestone, or one composed in greater proportion of the comminuted exuvia of these and other forms of zoophytic existence. Scarcely even do we find so great a number of individuals of any species, as can be obtained of the *Maclurea* upon the weathered surface of the stratum peculiar to that fossil. In vain shall we look for similar examples of so large a shell as this occurring in such incredible numbers, that several thousands may be counted in the space of a few rods; and in no subsequent rock can we find even the Brachiopoda in greater abundance than at this period, when entire strata were composed of them. In truth we are almost led to conclude that this period was more favorable to the rapid development of organization, than most of the subsequent ones; and thus at this primeval epoch, in which we have just witnessed the dawn of vitality, and might have expected a gradual ushering in of living forms, we find ourselves suddenly among myriads of extinct animals of all stages of growth and development. This epoch, like every subordinate one, has its peculiar and typical forms; forms which appear, thrive, and flourish for a time, and are never seen at subsequent periods; and although these forms may be fewer in the present than in some other cases, they are nevertheless sufficient for an example on which to base a hypothesis concerning the creation and extinction of the successive races which have existed upon the earth. We find here also some forms which appear to claim an obscure place among their associates, but which become in succeeding periods more prominent and numerous, and therefore better entitled to our consideration.

From the interest naturally attached to the forms of this early period, I have figured all that could be decided with accuracy; leaving, no doubt, others to find a place hereafter. Indeed I think there is scarcely another portion of our series that offers a better field for the palæontologist, than the lower limestones which are so well developed along the valley of Lake Champlain, the Mohawk valley, and the Black river. Few points only have been examined, and these with less attention and less time than could be desired to present any thing like a complete exhibition of their fossil contents.

CORALS AND CRINOIDEA OF THE CHAZY LIMESTONE.

PLATE IV.

18. 1. RETEPORA INCEPTA.

PL. IV. Figs. 1 *a*, *b*.

A thin expanded leaflike coral, apparently composed of branches uniting laterally and often irregularly ; fenestrules oval or sometimes slightly angular, unequal in size ; branches or reticulations even, roundish, scarcely expanded ; no pores visible.

This species presents the common appearance of others of the genus, except that the above fragment shows no axis or central point of expansion, and in this respect resembles a fragment of GORGONIA. In the irregular arrangement of the fenestrules, it differs from any of the species yet noticed.

Fig. 1 *a*. Specimen of the natural size.
Fig. 1 *b*. An enlarged portion of the same.

Position and locality. In the semi-oolitic limestone near the lower part of the mass at Chazy, and in a similar limestone near Galway, Saratoga county.

19. 2. RETEPORA GRACILIS (*n. sp.*).

PL. IV. Figs. 2, 2 *a*.

Expansion slender, diverging ; fenestrules oblong-oval ; branches or interfenestral spaces slender, flexuous, slightly striated ; no pores visible.

This species differs from the last in its more slender appearance, the greater length of the fenestrules, and the smaller interfenestral divisions. The crust or expansion is less firm and solid. The nature of the stone almost effectually prevents the discovery of any pores upon the substance of the coral. The rock in which this and the preceding species occur is a semicrystalline greyish limestone, exhibiting in some parts a tendency to an oolitic structure.

Fig. 2 *a*. Natural size of the fragment.
Fig. 2 *b*. Enlarged portion, showing the form of the fenestrules.

Position and locality. This species occurs in the lower part of the Chazy limestone, below the position of the *Maclurea gigantea*, at the village of Chazy, Clinton county.

(*State Collection.*)

20. 1. GORGONIA? ASPERA (*n. sp.*).

Pl. IV. Figs. 3 *a*, 3 *b*.

A fragment of a leaflike expansion, consisting of an open network; fenestrules angularly oval, distinct; longitudinal ribs direct, undulating, united by smaller transverse bars; surface of the ribs and bars marked by elevated dots or points, which, on the longitudinal ribs, gradually produce an elongation or elevated line, dying out just above the next lower point, thus giving a kind of interruptedly striate or echinulate appearance to the surface.

This beautiful little fragment is peculiarly well marked, and need not be confounded with any other. The surface bears some resemblance to *Retepora echinulata* (Blainville, *Man. D'Actinologie*, p. 433; Michelin, *Icon. zoophytologique*, pag. 72, pl. 14, fig. 11).

Fig. 3 *a*. Natural size of specimen.
Fig. 3 *b*. Portion enlarged, showing the rough surface of the coral, and the form of the fenestrules.

Position and locality. Near the lower part of the Chazy limestone, associated with crinoidal columns, etc., at Chazy, Clinton county.

21. 1. STICTOPORA* FENESTRATA (*n. sp.*).

Pl. IV. Figs. 4 *a*, *b*, *c*, *d*, *e*.

A stony expanded branching coral; branches flattened, obtuse at the extremities; surface on both sides covered by a celluliferous crust; cellules in perpendicular rows, separated by elevated ridges and crossbars, oval or roundish, more elongated as they become worn, alternating and apparently increasing in semicircular transverse rows; internal crust marked by concentric lines in the direction of the lines of cellules, as seen in fig. 4 *e*.

This species is perhaps identical with one found in the Birdseye limestone, but differs in essential characters from the Trenton limestone species. Specimens more or less worn present different aspects, and may be mistaken for different species; and I have been inclined to regard the specimens 4 *a b* and 4 *c d* as distinct, but further comparison and examination induces me to consider them identical.

Fig. 4 *a*. Natural size of the branches of this coral.
Fig. 4 *b*. A portion magnified.
Fig. 4 *c*. A fragment of another specimen from a different locality.
Fig. 4 *d*. Portion of the same magnified.
Fig. 4 *e*. A part of the axis of a specimen, denuded of the outer crust, and presenting a series of concentric lines, corresponding with the lines of progressive growth.

Position and locality. This fossil occurs towards the lower part of the Chazy limestone, associated with crinoidal joints, *Leptæna*, and other fossils of the rock; the preceding corals are also met with in the same association. It is found at Chazy, Clinton county, and also near Galway, Saratoga county. (*State Collection.*)

* For generic description, see description of species under Trenton limestone.

22. 2. STICTOPORA GLOMERATA (*n. sp.*).

Pl. IV. Fig. 5.

The specimen consists of a surface several inches square, covered and crowded with this coral, denuded completely of its celluliferous crust. Its appearance is very similar to the specimen fig. 4 *e*, though its mode of growth is considerably different; and principally from this circumstance, as well as from the impossibility of defining the external characters of the coral, I have referred it, with some hesitation, to a distinct species.

Position and locality. Granville (Vermont), in a limestone, associated with *Maclurea magna*, which I have elsewhere shown to be identical with that of Chazy.

Genus STREPTOPLASMA (*Fam. Cyathophyllidea*).

[Greek, στρεπτος, twisted, and πλασμα, lamellæ.]

Turbinate, gradually or abruptly expanding above; form like Cyathophyllum; terminal cup more or less deep; lamellæ vertical or longitudinal, more or less spirally twisted together when meeting in the centre.

There is some objection to the application of the term *Strombodes* of Schweigger to fossils of this character, or those formerly grouped with Cyathophyllæ, as the genus was constituted for a different coral. To indicate the prominent character, I have proposed this name as applicable to a considerable number of palæozoic species.

23. 1. STREPTOPLASMA EXPANSA (*n. sp.*).

Pl. IV. Figs. 6 *a*, *b*.

Turbinate, short, expanding above; terminal cup deep; lamellæ fine, numerous.

This species presents some variety of form and aspect, but its essential characters are a short broad turbinate form, with a deep cell. It is imbedded in the crystalline encrinital limestone, and being itself usually in a crystalline state, it appears like the pelvis of a crinoidean. From this crystalline condition, nothing satisfactory can usually be learned respecting its structure.

Position and locality. This species is apparently confined to the lower part of the Chazy limestone, not having been noticed above the position of the *Maclurea magna*. It abounds at Chazy, to the west and southwest of the village. (*State Collection.*)

24. 1. CHÆTETES ——— (*Species undetermined*).

PL. IV. Figs. 7 *a*, *b*, *c*, *d*.

Small rolled masses, in the shape of acorns or eggs, are common among the crinoidal plates in the Encrinal limestone at Chazy.

Figs. 7 *a*, *b*, *c*. The specimens considerably magnified. Fig. 7 *d*. The ends of the tubes magnified.

25. 1. ACTINOCRINUS TENUIRADIATUS (*n. sp.*).

PL. IV. Figs. 8 & 9.

Plates depressed-conical, somewhat irregularly hexagonal in form; margins deeply crenated; surface marked by elevated sharp ridges, which meet at the sutures; rays or ridges in about six fascicles, which are from three to five times divided before reaching the margin; indentations of the rays producing the crenulations; lower surface of the plates flat, presenting a deeply notched margin.

The plates of this species, which appears to be new, are very abundant in the Crinoidal limestone of Chazy: they have evidently been macerated for a long time in water before being imbedded. Associated with these plates are a great number of fragments of encrinal columns; and from the thickness and extent of the mass, which shows a large number of the plates, it is evident that, at one period, this was a favorite habitation of the crinoidea. The disturbance attending their destruction has so comminuted their remains, that no perfect specimens can be obtained.

In form of plates, and mode of sculpture, this species somewhat resembles *Cyathocrinus geometricus* of GOLDFUSS, as figured by PHILLIPS (*Palæozoic Fossils*, p. 135, pl. 60, fig. 41).

(*State Collection.*)

26. 2. ACTINOCRINUS? ——— (*Species undetermined*).

PL. IV. Fig. 10.

A single plate only (perhaps belonging to this genus) has been found. Form octagonal, somewhat irregular, smooth or granulated (from weathering?).

Position and locality. This specimen was found at the base of the limestone, and immediately at its junction with the Calciferous sandstone, about one mile west of Chazy village.

27. 1. ASTERIAS? ——— (*Species undetermined*).

PL. IV. Figs. 11 *a*, *b*.

This specimen presents precisely the form and appearance of the madreporiform tubercle on the back of an *Asterias*, scarcely differing from that of the recent species of our coast. It is entirely separated from any other organic body in the stone, though associated with large numbers of crinoidal fragments.

Fig. 11 *a*. Natural size. Fig. 11 *b*. Magnified view.

Position and locality. In the lower part of the limestone at Chazy.

SHELLS, TRILOBITES, &c. OF THE CHAZY LIMESTONE.

PLATE IV. (bis).

28. 1. LEPTÆNA PLICIFERA (*n. sp.*).

PL. IV. (bis). Figs. 1 *a*, *b*.

Semi-elliptical, much wider than long; convex valve slightly depressed along the centre, from beak to base; surface marked by about 34 or 36 equal, somewhat coarse striæ, which radiate, apparently in pairs, from the apex of the shell, intermediate ones often appearing towards the margin; striæ sharp, with rounded grooves between; visceral cavity, as shown by the cast, duplicate, separated by a sharp ridge, which extends towards the base of the shell.

Width $\frac{1}{4}$ to $\frac{3}{8}$ of an inch; length $\frac{3}{16}$ to $\frac{1}{4}$ of an inch.

The condition of nearly all the shells of this species, which I have seen, is such as to render clear and definite descriptions almost impossible. It is mostly preserved in impressions of the outer shell, or as casts. It is quite unlike any species in the Trenton limestone, but approaches in some degree a small one in the Hudson-river shales.

Fig. 1 *a*. Figure of the convex valve.

Fig. 1 *b*. Cast of convex valve, with a portion of the shell remaining: cast of visceral cavities magnified.

Position and locality. This occurs in great numbers in some thin layers of limestone near the higher part of the mass, at Chazy, Clinton county.

29. 2. LEPTÆNA INCRASSATA (*n. sp.*).

PL. IV. (bis). Figs. 2 *a*, *b*, *c*.

Shell thickened, almost semicircular; dorsal valve very convex near the beak, gradually becoming flattened on the disc, and suddenly bending upwards near the margin; ventral valve moderately concave, exhibiting a thickening near the margin; surface marked by sharp elevated radiating lines, between which are broader spaces.

The surface of this species presents a kind of thickening which partially obliterates the striæ; the ventral valve particularly exhibits this sort of incrassation. It occurs with the last described in considerable numbers, but differs in being larger, thicker and more convex, as well as in the form of the visceral markings. This species often bears some resemblance to *L. interstrialis* of the Trenton limestone, but is a much smaller shell, and differs from the young of that species in essential points.

Fig. 2 *a*, *b*. Convex valves of this species.

Fig. 2 *c*. Ventral valve.

Fig. 2 *d*. Cast of the interior of the convex valve, and the same enlarged.

Position and locality. In the thinbedded limestone, upper part of the mass, Chazy, Clinton county. (*State Collection*.)

30. 3. LEPTÆNA FASCIATA (*n. sp.*).

Pl. IV. (bis). Figs. 3 *a*, *b*, *c*.

Semi-elliptical, wider than long; surface marked by prominent sharp striæ, between which are fascicles of three or four smaller ones; striæ dichotomous, and increasing towards the margin.

This shell presents many of the essential features of *L. interstrialis* upon the external surface, but I am inclined to believe that a complete exposure of all the parts would prove it a distinct species. It differs from the young of that shell, in its more convex form and broader proportions; while the fascicles of striæ are remarkably distinct, but not crenulated, as in good specimens of *L. interstrialis*.

Fig. 3 *a*, *b*. Convex valves of two individuals.
Fig. 3 *c*. A larger specimen of the same.

Position and locality. In the thinbedded portions of the Chazy limestone, upper part of the mass, near Chazy village, Clinton county. The specimen, fig. 3 *c*, is a larger individual, apparently identical with this species, from Galway, Saratoga county, in the concretionary or brecciated portion of the rock. (*State Collection.*)

31. 1. ORTHIS COSTALIS (*n. sp.*).

Pl. IV. (bis). Figs. 4 *a*, *b*.

Dorsal valve very convex, subconical, sloping rapidly towards the margin; ventral valve flat; surface marked by about 32 distinct strong rounded radii, which are continuous, and enlarging towards the margin; dorsal area large, triangular; beak short, not incurved; cardinal line nearly equal to the width of the shell.

The strong rounded undivided costæ upon the surface of each valve distinguish this from any other species in the lower strata, though there is a larger species in the Trenton limestone which has sometimes undivided radii. The visceral impression under the beak of the dorsal valve is narrow, somewhat tripartite at the base, and margined by a sharp ridge. Cast of the dorsal valve convex, strongly marked near the margin by impressions of the radii.

This shell resembles in general form *O. testudinaria* of the Trenton limestone, but is more convex above, the striæ coarser and less numerous, and the beak is shorter and not incurved. The casts are likewise equally distinct.

Fig. 4 *a*. An imperfect shell, showing the radii towards the margin.
Fig. 4 *b*. A cast showing the visceral marking, and casts of radii near the base of the shell.
Fig. 4 *c*. An impression of the convex valve, smaller than the other specimens. Such impressions are abundant.

Position and locality. In the thinbedded upper portion of the Chazy limestone, associated with all the other brachiopods of the mass. Chazy village, Clinton county. (*State Collection.*)

32. 1. ATRYPA DUBIA (*n. sp.*).

Pl. IV. (bis). Fig. 5.

Obovate; beak of the dorsal valve extended, rounded and incurved; front scarcely depressed; surface marked by 30 or more radii.

The specimen described has nearly all the shell removed, and presents only the characters of a cast. The impressions of the radii are distinctly marked in the cast. I have observed but two or three individuals of this species.

Position and locality. In the higher semi-oolitic layers of the Chazy limestone, Chazy, Clinton county. (*State Collection.*)

33. 2. ATRYPA ACUTIROSTRA (*n. sp.*).

Pl. IV. (bis). Fig. 6.

Obovate, minute; base rounded; beak acute, acuminate; surface marked with prominent equal radii; dorsal valve convex, elevated along the middle; ventral valve convex, with a depressed line along the centre; surface marked by about 12 or 14 equal rounded diverging radii, the central one on the dorsal valve often extending only half way to the beak.

This fossil is usually very minute, and, on that account, frequently overlooked; but when once observed, its characters are sufficiently decisive. The beak is incurved, ending in a sharp point, which is often broken in detaching the specimen from the rock; the radii are strongly marked, and the obovate form is usually well preserved.

Fig. 6. The two lower figures are of the natural size; the upper one is enlarged.

Position and locality. In the higher layers of the Chazy limestone, in considerable numbers; also in the oolitic portions of the mass, Chazy village, and near Galway, Saratoga county. (*State Collection.*)

34. 3. ATRYPA PLENA (*n. sp.*).

Pl. IV. (bis). Figs. 7 *a, b, c, d, e.*

Compare *Terebratula tripartita* of the Silurian System, pl. 21, fig. 15.

Somewhat quadrangularly gibbous or rotund; front margin elevated in a moderately deep sinus; beak of the dorsal valve small, closely incurved over the beak of the ventral valve; surface marked by 16 to 20 strong radii, about four or five of which are depressed, forming the sinus of the dorsal valve, and an equal number elevated above the others on the ventral valve.

The forms 7 *a*, *b*, *c*, *d*, *e*, are varieties of the same species. The ventral valve of 7 *d* is remarkably elevated, and the whole figure rotund. In 7 *a*, *b* & *c*, the form is more quadrangular, with a strongly marked sinus and elevated ribs upon the ventral valve.

This species is exceedingly abundant at Chazy, forming almost of itself thin layers of the limestone in which scarcely another fossil appears; it is frequently crushed, and presents a great variety of accidental forms.

I have received specimens of the same fossil from Mr. LOGAN, Provincial Geologist of Canada, marked (on the authority of Mr. PHILLIPS) *Terebratula tripartita*; but our shell differs essentially in its proportions from that fossil, the length and breadth varying little, and the radii never bifurcating, though the mesial elevation is broad, dividing the surface "into three nearly equal parts."

Fig 7 *a*. View of the ventral valve, showing the beak of the dorsal valve closely incurved over the beak of the former.
Fig. 7 *b*. Lateral view of the same individual.
Fig. 7 *c*. Dorsal valve of a small specimen.
Fig. 7 *d*. Front view of a large specimen.
Fig. 7 *e*. Dorsal valve of the same.

Position and locality. In the thin layers of impure limestone near the upper part of the mass, and sometimes in the more compact portions. Chazy, Clinton county; Galway, Saratoga county; and near Montreal. (*State Collection*.)

35. 4. ATRYPA PLICIFERA (*n. sp.*).

PL. IV. (bis). Figs. 8 *a*, *b*, *c*, *d*.

Both valves depressed-convex, somewhat tetrahedral, varying to broadly oval; beak small, acute, elevated and slightly incurved over the beak of the ventral valve, which is closely appressed to the lower valve; surface marked by about 18 or 20 equal rounded radii, about 5 or 6 of which, on the dorsal valve, are slightly depressed, forming a shallow sinus, and the same number very slightly elevated upon the ventral valve.

The specimens 8 *a*, and 8 *c*, differ slightly in form, and the shell of one is more desquamated than the other, but they are specifically identical. The number of radii in this and the last described species are the same, but in this they are more rounded, the shell altogether more depressed, and the sinus very shallow, scarcely extending more than half the length of the shell.

This species occurs with the last; and when they are crushed and distorted, as most of them are, it is not easy to separate individuals of the two species.

Figs. 8 *a*, *b*. View of ventral valve, and front of same individual.
Figs. 8 *c*, *d*. Ventral valve and front view of another individual.

Position and locality. In thinbedded shaly and siliceous limestone, near the upper part of the Chazy limestone. Chazy, Clinton county. (*State Collection*.)

36. 5. ATRYPA ALTILIS (*n. sp.*).

Pl. IV. (bis). Figs 9 *a, b, c, d.*

Rotund ; valves almost equally convex, rapidly attenuating from the middle to the beaks ; beak of the dorsal valve small, acute, incurved over the other, which is closely appressed to the dorsal valve ; surface of each valve marked by about 24 equal rounded radii ; eight of the radii are slightly depressed upon the back of the dorsal valve, and much elevated in front, meeting an equal number of slightly elevated radii of the ventral valve.

This species occurs with the preceding, but is more rarely seen ; it is clearly distinct, and readily identified by the more numerous radii, evenly rounded outline, and less angular mesial elevation and depression upon the two valves. This species resembles, in many points, the rotund forms of the higher strata.

Fig. 9 *a.* View of the ventral valve, showing the beak of the dorsal valve.
Fig. 9 *b.* View of the dorsal valve.
Fig. 9 *c.* Lateral view of the same shell.
Fig. 9 *d.* Front view, showing the elevation of the mesial radii.

Position and locality. In the upper part of the Chazy limestone. Chazy, Clinton county.

37. 1. ORBICULA ? DEFORMATA (*n. sp.*).

Pl. IV. (bis). Fig. 10.

Suborbicular, depressed ; surface smooth ; apex scarcely elevated.

Position and locality. In the higher layers of the Chazy limestone. Chazy, Cinton county.

38. 1. METOPTOMA ? DUBIA (*n. sp.*).

Pl. IV. (bis). Fig. 11.

Oval ; apex elevated, incurved ; surface nearly smooth, or with fine concentric lines.

Position and locality. In the lower part of the Chazy limestone. Chazy, Clinton county.

39. 1. ILLÆNUS ARCTURUS (*n. sp.*).

Pl. IV. (bis). Fig. 12.

Buckler rounded and narrow in front, thick, expanding abruptly towards its junction with the first articulations of the abdomen ; subtrilobate, the posterior angles much extended. A single articulation of the body only is visible ; posterior edge of the buckler nearly straight ; eyes not visible, though their position is visible. The lateral lobes of the buckler are wanting, or greatly compressed and contracted.

This individual is the only specimen found, and further discoveries may make it necessary to change the description to some extent.

Position and locality. In fine semi-oolitic limestone at the base of the formation at Chazy village. (*State Collection.*

40. 2. ILLÆNUS CRASSICAUDA?

PL. IV. (bis). Fig. 13.

Entomostracites crassicauda. WAHLENBERG in Nov. Act. Reg. Soc. Upsal. 1821. Vol. viii. pag. 27. tab. ii.; pag. 294. tab. vii. fig. 5, 6.
Illænus crassicauda. DALMAN, K. Vet. Acad Handl. 1826. Pag. 65. tab. v. fig. 2 a – e.
— — HISINGER, Pet. Suecica, 1837. Tab. iii. fig. 5.

Fragment of buckler. Large, sub-hemispherical, gibbous, very thick and strong; front margin involute.

The portion remaining is essentially the central lobe of the buckler, the lateral portions having separated at the sutures. The specimen is more gibbous than common; but on comparison with the figures above quoted, and with a perfect specimen from Russia, there appears to be no reason to doubt the specific identity.

Position and locality. In subcrystalline oolitic limestone at Chazy in Clinton county, and in Galway, Saratoga county.

41. 1. ASAPHUS? OBTUSUS (*n. sp.*).

PL. IV. (bis). Fig. 14.

Caudal extremity semicircular, twice as wide as long; surface finely granulated or smooth; marginal expansion even, and not depressed as in ISOTELUS; central lobe faintly visible by a gentle depression on each side; no marks of articulations.

This fossil varies from *Isotelus*, in the extremity being destitute of the apparent articulations which are seen in species of that genus; and also in the marginal expansion being plain, and not depressed near the margin, as well as in being punctulated, and exhibiting none of those fine linings seen in the margin of ISOTELUS, ILLÆNUS and BUMASTIS.

This fossil bears some resemblance to the caudal extremity of *Asaphus palpebrosus*, but the central lobe is less distinct than in that species. The middle lobe is less distinct, and the whole shell more evenly convex and smooth than any specimens of the ISOTELUS of the Trenton limestone.

Position and locality. This species occurs in the compact limestone near the base of the formation, and where the rock is but little changed from the character of the Calciferous sandstone. It has been found only at Chazy village, Clinton county. (*State Collection.*)

42. 2. ASAPHUS MARGINALIS (*n. sp.*).

PL. IV. (bis). Fig. 15.

Caudal extremity semi-elliptical, distinctly three-lobed, marked by 7 or 8 distinct pseudo-articulations, which are duplicate on the lateral lobes; articulations not reaching the margin, but terminating in a crustaceous marginal expansion, which is depressed or channelled near the edge as in ISOTELUS; surface granulated.

This is a very distinctly marked fragment of an undescribed trilobite ; the distinctness of the false articulations, and deeply trilobate character of the caudal extremity, distinguish it from known species of *Isotelus*, which it resembles in the marginal expansion and general form.

Position and locality. This fossil is found in the crystalline and highly fossiliferous mass of the Chazy limestone, below the portion containing *Maclurea magna*, at Chazy village. (*State Collection.*)

43. 1. ISOTELUS GIGAS?

Pl. IV. (bis). Fig. 16.

Asaphus platycephalus. Stokes, Trans. Geol. Soc. London, 1822, Second series, Vol. i. p. 208, pl. 27.
Isotelus gigas. Dekay, Annals N. York Lyceum, 1824. Vol. i. p. 171, plates 12 & 13.

This fragment approaches so nearly in character to the caudal shields of the young of *Isotelus gigas*, that I have not thought it worth while to separate it from that species.

44. 2. ISOTELUS CANALIS.

Pl. IV. (bis). Figs. 17, 18, 19.

Isotelus canalis. Conrad in MS.

Margin of caudal extremity broadly and deeply depressed, forming a channel ; surface punctured. Judging from this fragment, the original was at least six inches in length.

Figs. 18 & 19. Labrum or epistoma of an *Isotelus*, perhaps of *I. canalis.*

The structure and general aspect of these portions of the trilobite evidently ally it generically with the Isotelus ; and from the discovery of these, I am disposed to admit the species which the fragment before mentioned did not justify. The form of these plates is more elongated, and totally different from the corresponding parts of *I. gigas.*

Position and locality. These fragments of a large species of Isotelus occur near the upper part of the mass, a little west of Chazy village. (*State Collection.*)

45. 1. CERAURUS?—(*Species undetermined*).

Pl. IV. (bis). Fig. 20.

A single fragment, being the posterior prolongation of the buckler of a species of Ceraurus, very analogous to *C. pleurexanthemus* of the Trenton limestone.

Position and locality. In the oolitic limestone of Chazy. (*State Collection.*)

Remains of other trilobites, too indistinct to be described, have been noticed in this rock ; but the materials are so comminuted, that it is impossible to recognize fossils, of which fragments of many species have been observed.

UNIVALVES (GASTEROPODA) OF THE CHAZY LIMESTONE.

Plates V., V. (bis), & VI.

46. 3. MACLUREA MAGNA.

Pl. V. Figs. 1 *a, b, c, d;* and Pl. V. (bis). Figs. 1 *a, b, c.*

Maclurites magna. Leseuer, Jour. Acad. Nat. Sci. Philad., Vol. i. pag. 312, pl. 13, figs. 1, 2, 3.
Maclurea. Emmons, Geol. Report, pag. 276, fig. 1.

Sinistrorsal, discoidal, depressed-turbinate; breadth more than twice as great as the height; spire flat, a slightly depressed line at the sutures; whorls about six, gradually increasing from the apex, ventricose, flattened above, obtusely angular on the outer edge; surface marked by fine striæ, which, upon close examination, are found to be produced by the imbricating edges of lamellæ; striæ undulating, bending backwards from the suture, and forwards in passing over the edge of the shell; aperture obtusely trigonal, depressed above, slightly expanded beyond the dimensions of the whorl just behind it; axis hollow; umbilicus broad and deep, extending to the top of the spire.

Plate V.

Fig. 1. The upper surface partially denuded of the shell, showing the striæ with the smooth cast beneath. This is a perfect representation of the shell, except that the minute terminal volution is not shown.

Fig. 1 *a.* Side view of a cast of the shell, showing the depressed turbinate form and flat spire.

Fig. 1 *b.* View of the lower surface, somewhat worn, showing the large umbilicus, which is partially filled with stony matter.

Fig. 1 *c.* A vertical section of the shell, near, but not directly through the centre of the spire, showing several volutions and the deep umbilicus. Such sections of the shell are not unusual in the rock, and they are generally vertical to the lines of deposition.

Fig. 1 *d.* A view of the shell worn down from the lower side, as it very commonly appears upon the weathered surfaces of the rock at Chazy.

Plate V. (bis).

Fig. 1 *a.* An obliquely vertical section of the fossil, passing nearly through the centre of the spire above, but more on one side below, so as to escape the umbilicus.

Fig. 1 *b.* A vertical section of the outer volution. A common appearance upon the weathered surface of the rock at Chazy.

Fig. 1 *c.* An unusually large specimen of the same species; the surface worn so as to obliterate the striæ, and obscure the first volutions.

This shell is exceedingly abundant in the limestone at Chazy and some other places. Sections of the shell in every possible position are seen, covering the weathered surfaces and forming a large part of several strata, and less abundant in some others. In the black marble of Ile la Motte and other localities it is quite abundant, and the polished slabs often present beautiful sections of this shell. This marble, being used for hearthstones, doorsteps, doorsills, etc., is extensively distributed by commerce, and meets one at great distances from its locality, always recognizable by this fossil. Indeed, some of the doorsills of the Astor House in New-York, and of many of our public buildings, present good examples of the fossil.* Its geographical range is known to be very great, extending from Northeastern New-York to Virginia, and even into Kentucky and Tennessee, and northwesterly nearly to Lake Superior.

Localities. Chazy, Clinton county; Watertown, Jefferson county; Ile la Motte; Winchester, Virginia; St. Joseph's Island, in St. Mary's River. (*State Collection.*)

47. 1. SCALITES ANGULATUS.

PL. VI. Figs. 1 *a*, *b*.

Scalites angulatus. CONRAD in MS. EMMONS, Geol. Report, pag. 312, fig. 1.

Subfusiform, ventricose in the middle; spire conical, consisting of about four angulated volutions, which, when entire, form about half the length of the shell; suture canaliculated; aperture triangular, straight above, and terminating apparently in a short canal anteriorly; canal directed forward; columella plain; outer lip extending from the body of the shell, nearly rectangular to the longitudinal axis, and turning at an abrupt angle forwards, slightly depressed at the angle and thickened in the centre; upper side of the whorls marked by striæ directed obliquely backward, and which, on passing over the angle, are directed somewhat spirally forwards.

This remarkable shell is confined to a small extent in thickness, but is not rare in certain layers at Chazy. Its peculiar form at once distinguishes it, not only from any fossil in the lower strata, but from any in the whole range of the palæozoic rocks yet known to me. The lower part of the shell, only, bears some remote analogy with *Buccinum fusiforme* (MURCHISON, *Silurian System*, pag. 642, pl. 20, fig. 19).

Position and locality. In the grey lower portion of the limestone at Chazy, Clinton county. (*State Collection.*)

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* It may be well to call the attention of the geological student to this fact. The surface of the stone presents hundreds of specimens worn down in this manner, some from the upper and some from the under side, which, if no regard be had to the circumstance, may be considered as distinct species, the one a sinistrorsal and the other a dextral shell. In the present instance, if the fossil be supposed to be worn down from above, the aperture is on the right side, differing from fig. 1 *d*. Both the horizontal and vertical sections of the shell show conclusively that it is unilocular, though it has been erroneously regarded as multilocular.

From the wide geographical distribution and limited geological range of this shell, I regard it as of great importance in the identification of strata. In the contorted and partially altered limestones of Eastern New-York and Vermont, where nearly all other remains are obliterated, I have found the various sections of this shell, often compressed or distorted, but frequently and almost always sufficiently clear to identify the mass.

Genus RAPHISTOMA.

[Greek, ραφε, a seam or suture, and στομα, mouth; from the suture or seam-like appearance in the upper side of the aperture.]

Character. Shell depressed-turbinate; discoidal spire, with three to five volutions; suture close; umbilicus moderately large; aperture subtrigonal; upper side of the volutions marked by a kind of seam or suture, produced by the sudden tendency backwards of the striæ, which leaves a slight notch in the edge of the aperture.

This genus approaches to Euomphalus in some of its characters, while it possesses others in common with Pleurotomaria. The slight notch in the upper edge of the aperture, which is marked in the progressive growth of the shell by a simple seam or bending in the striæ, is somewhat similar to the notch and band of Pleurotomaria; but the outer angle of the volution presents no band, but a simple bending of the striæ. It is probable also that the generic characters here given may be so extended as to include the *Scalites* figured above, as I have some evidence of the existence of the characteristic markings upon that shell.

The species now described have heretofore been referred to Maclurea, but the characters are different from the typical species of that genus.

48. 1. RAPHISTOMA STRIATA.

Pl. VI. Figs. 2 *a*, *b*.

Maclurea striatus. Emmons, Geol. Report, 1842, pag. 312, fig. 3.
Maclurea labiata? (A cast). Ibid. fig. 2.
Euomphalus qualteriatus? Goldfuss, 1834; and 1844, Vol. 3, pag. 81, pl. 189, fig. 3.
Compare *Euomphalus qualteriatus.* Verneuil, Palæontology of Russia and the Ural Mountains, 1845, pag. 333, pl. 23, fig. 1 *a*, *b*.
And *Euomphalus pseudo-qualteriatus.* Hisinger, Lethæa Suecica, 1837, pag. 36, pl. 11, fig. 5.
Not *Pleurotomaria lenticularis.* Emmons, Geol. Report, 1842, pag. 393, fig. 2.

Depressed, discoidal; breadth twice as great as the height; spire nearly flat, slightly elevated towards the apex from the inner side of the last volution; volutions about four or five, somewhat rapidly diminishing towards the apex, ventricose below; outer margin obtusely angular; aperture subtriangular, nearly straight above and rounded below; umbilicus moderately large.

The specimen figured is somewhat imperfect; a portion of the surface only being covered by striæ, which are round and rather coarse. Though apparently not identical with the figures of Goldfuss referred to, or with the original *Helicites qualteriatus* of Schlotheim (*Nachträgen*, Pl. xi. fig. 3), it is nevertheless to be regarded as a representative species; and being found in the Lower Silurian strata (*Strata calcarea antiquiora*, Hisinger) of Europe, it becomes interesting to inquire whether it may belong to some representative mass of the Chazy limestone, as our fossil is unknown in any higher position.

The striæ on the side of the shell, near the mouth, bend backwards more than is represented in the figure.

Fig. 2 *a.* An obliquely lateral view of the specimen, showing the spire, with the striæ upon the surface of the shell.
Fig. 2 *b.* View of the spire denuded of the shell.

Position and locality. This species occurs in the lower fine-grained limestone, at Chazy, Clinton county, where it is associated with the following species, but never with the preceding one. (*State Collection.*)

49. 2. RAPHISTOMA STAMINEA (*n. sp.*).

PL. VI. Figs. 4, 5, 5 *a.*

Maclurea labiata? EMMONS, Geol. Report, 1842, as above.

Compare with the last described species.

Discoidal, depressed towards the margin, with the central portion of the spire rising somewhat above the outer volution; volutions about four or five, sharply angulated on the outer side, nearly flat above and subventricose beneath; surface marked by strong elevated rounded striæ, which, bending in a curve backwards from the suture, are interrupted along the centre of the upper part of the whorl by a concentric elevated line (fig. 5), passing the sharp angle of the volution; the striæ bend abruptly forwards, and, curving gently around, pass into the umbilicus; cast of the inner volutions rounded above.

Breadth about once and a half the height.

This species is clearly indicated by the strong concentric line or imbrication which interrupts the striæ upon the upper surface of the volutions. I have, however, seen something of the kind obscurely indicated upon the last described species. No such concentric line or interrupted striæ (indicating the generic character) are mentioned or indicated in the descriptions and figures referred to, and it is therefore proper to regard this as a distinct species.

The specimen fig. 4 differs so little from the type of the species, that, for the present, it is united with the same. Numerous imperfect specimens have been found in this rock, indicating several distinct species; but I have not yet been able to define their characters with sufficient precision to describe them.

Fig. 5. View of the spire, the inner volutions partially denuded of the shell.
Fig. 5 *a.* A lateral view, showing the aperture, which is distorted by crushing from above. The denuded spire is shown to rise considerably above the outer volution. The striæ upon the side do not bend forward as much as in the original.

Position and locality. In the lower granular portion of the limestone, at Chazy village, Clinton county.

50. 3. RAPHISTOMA PLANISTRIA (*n. sp.*).

PL. VI. Figs. 3 *a*, *b*.

Turbinate; length and breadth nearly equal; spire depressed; apex a little elevated; volutions about four, angular; outer one quite flat or a little concave above, scarcely ventricose below; surface marked by flat broad apparently imbricating striæ, which are bent backwards, and interrupted along a line near the middle of the upper part of the whorls; aperture narrow, trigonal; umbilicus small.

This shell differs from the last, in the greater proportional height, the narrow trigonal aperture and small umbilicus, as well as in the flat plain striæ.

In general appearance, this species differs little from a small TROCHUS in the Trenton limestone, and, on hasty examination, might be mistaken by unpractised observers. The spire in this shell, however, is more nearly flat, and the shell more extended below; the aperture also is longitudinal, while in that shell it is transverse.

Fig. 3 *a*. View of the spire; the striæ flat and broad. The figure does not show the interruption.
Fig. 3 *b*. View from beneath, showing the umbilicus. The height of the shell is not shown here.*

Position and locality. In the fine-grained subcrystalline and oolitic limestone, at Chazy village, Clinton county. (*State Collection.*)

51. 4. RAPHISTOMA PLANISTRIA, *var.* PARVA.

PL. VI. Figs. 3 *c*, *d*, *e*.

Depressed-turbinate; spire elevated in the centre; volutions about five, outer one sharply angular; surface marked by fine scarcely distinct striæ, which bend backwards above and forwards below the angle of the volution; aperture longitudinal, narrow, trigonal.

Length and height about equal.

I have seen but two perfect specimens of this minute shell, though it is quite abundant at Chazy, upon the worn surfaces of strata, often presenting vertical and horizontal sections. From the great numbers of specimens of this size, and from the perfection of one or two separate specimens, I am, for the present, inclined to separate it from the last, which it resembles in form, but wants the distinct imbricating striæ.

Fig. 3 *c*. View of the spire. Fig. 3 *d*. Lateral view. Fig. 3 *e*. View of the aperture.

Position and locality. In the grey fine-grained subcrystalline limestone, at Chazy village, Clinton county. *State Collection.*


2 1

* Fig. 1 of this illustration shows the top of the spire, with the interrupted striæ along the middle of the upper side of the volution, which is omitted in the plate. Fig. 2 shows the height of the shell.

52. 2. PLEUROTOMARIA BIANGULATA.

Pl. VI. Fig. 6.

Subdepressed-spiral; length and breadth about equal; volutions few, ventricose, bi-angulated above and somewhat rounded below; suture canaliculated; aperture somewhat quadrangular; cast smooth, rounded.

The specimen is imperfect, but presents very clearly the above characters: it is the only one of the species seen in this rock.

Position and locality. Chazy, Clinton county, in the lower grey limestone.

(*State Collection.*)

53. 3. PLEUROTOMARIA (*Species undetermined*).

Pl. VI. Fig. 8.

One or two fragments of the under side of a species, apparently referable to this genus, have been seen, but nothing from which a description can be satisfactorily made out. The surface is strongly striated.

Position and locality. In the fine-grained grey limestone of Chazy, Clinton county.

(*State Collection.*)

54. 4. PLEUROTOMARIA ANTIQUATA (*n. sp.*).

Pl. VII. Fig. 1.

Trochiform, subconical; volutions about three or four, depressed laterally.

The specimen is a cast, two and a half inches in diameter, and nearly two inches high; the last volutions wanting. The surface markings are entirely wanting, and no portion of the shell remains to indicate its external characters. Since this is the only large species observed in this rock, it will readily be recognized.

Position and locality. In the dark-colored limestone, associated with *Maclurea magna*. Chazy, Clinton county.

55. 1. CAPULUS AURIFORMIS.

Pl. VI. Figs. 6 *a*, *b*.

Depressed-spiral; apex scarcely elevated; whorls about three, the last one embracing nearly the whole shell, flattened-ventricose, marked by a few undulations; no striæ visible; aperture large, semilunar; shell thick.

A single specimen only of this shell has been observed: it is much depressed, with a large aperture; the outer whorl rapidly attenuating to the apex. The shell is evidently waterworn; and any striæ, if they existed, are obliterated.

Position and locality. Galway, Saratoga county, in the Chazy limestone.

(*State Collection.*)

56. 1. MURCHISONIA ABBREVIATA.

Pl. VI. Fig. 7.

Terete-conical; length about twice the breadth; whorls few, appressed, angulated; marked by advancing and retreating striæ.

A single specimen of this shell was found at Chazy, but it was unfortunately lost after the drawing was made. It seems appropriately referred to the Genus Murchisonia, which includes the elongated Pleurotomaria-like shells, of which there are several species in the lower strata.

Position and locality. In the lower fine-grained limestone. Chazy, Clinton county.

Genus BUCANIA.

[Greek, βυκανη, a trumpet; from the form of the shell.]

Character. Convolute; spire equally concave on either side; volutions in the same plane, all visible, outer one ventricose, inner ones usually angulated on the edge, concave on the ventral side; aperture rounded-oval, somewhat compressed on the inner side by contact with the next volution, laterally and dorsally abruptly expanded.

This genus is proposed to include several species of shells of a peculiar form, usually referred to Bellerophon, but from which they differ in having all the volutions visible, and gradually increasing in size. The *Bellerophon cornuarietes* of Sowerby (*Min. Conch.* Tab. 469, fig. 2), will fall under this genus. At least six species are already known to me, and these are confined to the lower term of the system, none as yet having been observed in the higher strata, though the one quoted above from Sowerby is said to occur in the Mountain limestone.

This genus differs from Porcellia, in being symmetrical, the volutions in the same axis, being equally expanded on either side, both sides presenting the same aspect, and the aperture corresponding to the axis of the shell.

57. 1. BUCANIA SULCATINA.

Pl. VI. Figs. 10, 10 *a*.

Bellerophon sulcatinus. Emmons, Geol. Report, pag. 312, fig. 4.

Convolute; depth and width nearly equal, length a little greater; whorls closely appressed against each other, and angulated on the sides; surface marked by longitudinal ridges, which are interrupted by obliquely transverse lines, the latter making a retral angle on the depressed dorsal line. These ridges are often subdivided into two or more undulating lines, and which, from being interrupted by the transverse lines, give the shell a beautiful ornamented appearance as represented in fig. 10. The aperture is transversely oval, or somewhat rounded, and compressed upon the ventral side. The shell is readily distinguished by its beautifully ornamented surface, absence of dorsal carina, and the acutely angular edges of the inner whorls.

Fig. 10. Dorsal view, looking into the aperture, which is filled with stony matter, so that the form can not well be shown. The shell is denuded from a large portion of the last volution, but is well preserved on the part exhibited in the figure

Fig. 10 *a*. Lateral view of the fossil denuded of the shell; the cast smooth.

Position and locality. This species occurs in the lower fine-grained limestone of Chazy, and I have seen fragments with similar markings from other localities. Chazy, Clinton county. (*State Collection.*)

58. 2. BUCANIA ROTUNDATA.

PL. VI. Figs. 11 *a*, *b*, *c*.

Convolute, suborbicular or spheroidal; outer whorl ventricose, angular, expanding towards the aperture; inner ones appressed, angular at the sides; surface marked by transverse striæ or lines of growth; aperture suboval, compressed on the ventral side by the contiguous whorl.

This shell is more rotund than the last; the inner volutions are less angular, and the external surface is marked only by faint transverse striæ or lines of growth, with a few stronger wavelike lines. There is no indication of a carina, or of a depressed line along the back of the shell. The whorls are not involute, but closely pressed against each other; the dorsal side of the inner is pressed to the ventral side of the outer, forming a broad groove or depression.

Fig. 11 *a*. Dorsal view, looking into the aperture, which is partially filled with stony matter, and broken at the sides. In this view, it presents the aspect of a BELLEROPHON.

Fig. 11 *b*. Side view; the volutions not all visible, from the umbilicus being filled with stony matter.

Fig. 11 *c*. Longitudinal section, showing the form and relation of the volutions to each other: the dotted line is the margin of the outer volution near the aperture.

Several individuals of this species have been seen in the Chazy limestone; and, so far as known, it is confined to this rock.

Position and locality. In the fine-grained and partially oolitic limestone of Chazy, Clinton county.

ORTHOCERATA OF THE CHAZY LIMESTONE.

Plate VII.

Fragments of several species of Orthocerata have been observed in the Chazy limestone, though but few of them are sufficiently perfect to be identified from description. In general aspect, some of these appear to be identical with those of the Black-river limestone ; but there are others apparently peculiar to the Chazy limestone.

59. 3. ORTHOCERAS RECTIANNULATUM (*n. sp.*).

Pl. VII. Figs. 2, 2 *a.*

Cylindrical ; surface annulated by obtusely angular ridges, with broad curving depressions between ; annulations distant a little more than one-third the diameter of the fossil ; siphuncle small, distinct, excentric ; septa moderately convex.

The septa are only visible on the extremity of the specimen, and being almost denuded of the shell, the character of the surface is unknown.

Fig. 2. A portion of the fossil, nearly two inches long, exhibiting eight annulations.
Fig. 2 *a.* Transverse section, showing the position of the siphon.

Position and locality. In the grey crystalline central portions of the limestone at Chazy, Clinton county. (*State Collection.*)

60. 4. ORTHOCERAS SUBARCUATUM (*n. sp.*).

Pl. VII. Fig. 3.

Cylindrical, gradually tapering, slightly arcuated, marked by angular ridges which are equidistant and alternating with the septa ; surface of shell smooth? ; septa distant from $\frac{1}{4}$ to $\frac{1}{5}$ the diameter ; siphuncle not visible.

This fossil resembles the last, but tapers more rapidly, and the annulations are more acute. Another difference also is the slightly arcuate figure of the latter, which, if it be found constant, may characterize the species.

Position and locality. In the central dark-colored limestone, associated with *Maclurea magna*, at Chazy, Clinton county. (*State Collection.*)

61. 5. ORTHOCERAS TENUISEPTUM.

PL. VI. Fig. 6.

Cylindrical, gradually tapering, straight; surface smooth; section cylindrical; septa very thin, gently arched, approximate, about $\frac{1}{25}$ the diameter; siphuncle small?

Only fragments of this shell have been found in this limestone, and therefore all its characters cannot be ascertained. It corresponds in many respects with *O. primigenium* of VANUXEM (Pl. iii. fig. 11); but the specimens of that fossil attain only a small size, while this one is very large. Another difference will be observed in the concavity of the septa, which are less arched in the specimen under consideration.

Position and locality. Chazy, Clinton county, in the dark limestone, associated with *Maclurea magna.* The specimens appear on the surface of the strata, and are all more or less weathered. (*State Collection.*)

62. 6. ORTHOCERAS BILINEATUM.

PL. VII. Figs. 4, 4 *a*.

For description, see ORTHOCERATA of Trenton limestone.

An examination of this specimen, since the plate was engraved, convinces me that it is identical with *O. bilineatum* of the Trenton limestone. The specimen was given me by Dr. EMMONS, as coming from the Calciferous sandstone, at a locality two miles east of the city of Albany. An examination of the spot has convinced me that the rock in question is the Trenton limestone, thrust up through the Hudson-river slates. The association of fossils, as well as all other circumstances, prohibit its reference to the Calciferous sandrock.

63. 7. ORTHOCERAS MONILIFORME.

PL. VII. Fig. 5.

Elongated, cylindrical, gradually tapering; surface smooth, or with only fine striæ; septa very slightly arched, distant about $\frac{1}{4}$ the diameter; siphuncle moniliform, contracted at the point of contact with the septa.

The siphuncle is but little expanded between the septa, which latter, being distant, give an elongated moniliform appearance. The apparent contraction towards the base is owing to the wearing, in an oblique direction, of the surface of the stone in which it is imbedded.

In describing many of this family of fossils in the older rocks, it will be necessary to rely upon the internal arrangement of the parts, as these are often presented in natural sections, while the external surface is obscure or inaccessible.

Position and locality. Chazy, Clinton county, in limestone, with *Maclurea magna.*

Scarcely one of the fossils here described is known to ascend into any of the subsequent depositions. Of the peculiar forms presented, and which began and terminated their existence with this mass, we may mention the Maclurea, Scalites and Raphistoma, of which generic analogues are scarcely known in a higher position. We may cite also two species of Bucania, which are remarkable and well-characterized shells, neither of which appear in a higher position. There are at least two species of Orthoceras unknown elsewhere, besides a considerable number of less prominent species figured on Plates IV. and IV. (bis).

We therefore feel warranted in uniting the several strata, as seen at Chazy, Galway, Ile la Motte and other places, as a group, marked by a peculiar assemblage of fossils, and as much entitled to this consideration as any other. In the Mohawk valley, as before shown, we do not find a full development of these strata; the Calciferous sandstone is often succeeded directly by the Birdseye limestone, or there are a few calcareous layers between them. In some localities along this valley, these interposed calcareous layers assume a more definite character, approaching to the oolitic portions of the Chazy limestone. In such localities they contain fossils, one or two of which are apparently identical with those of the Chazy limestone at Chazy, and others which have not been observed at the latter locality. The small fossil shells, Ophileta, figured on Plate III., hold this position, and may probably be referred to the period of the Chazy limestone, though, in the locality where they occur, it is impossible to separate the layers containing them from the Calciferous sandstone.

The thinning out of the materials constituting this rock or group of strata, in the Mohawk valley, leaves the Calciferous sandstone and the succeeding Birdseye limestone in contact; bringing into direct succession, in numerous places, the fossils figured on Plates I. and III. with those of Plates VIII. and IX., those of the intermediate plates rarely or never appearing along the Mohawk valley. These remarks will enable the student to understand the absence of many peculiar fossils from a large extent of country in Central and Southern New-York, as well as in localities farther southwest.

BIRDSEYE LIMESTONE.

FOSSIL PLANTS? OF THE BIRDSEYE LIMESTONE.

PLATES VIII. & IX.

The Birdseye limestone is well developed along the valley of the Mohawk river; and in many places, owing to the absence of the Chazy limestone just mentioned, it succeeds directly to the Calciferous sandstone. It is distinguished by its thick layers, evenly bedded structure, and well marked vertical joints, which give the rock, when quarried, the appearance of a wall. It is usually of a bluish grey or light dove color, weathering to a light ashen grey : in its western extension it loses its bluish shade, becoming lighter in color. The rock is fine-grained or compact, breaking with a conchoidal fracture, the surface presenting numerous crystalline points or spots.

The organic remains of this rock are not numerous in species; but their existence, though often very obscure, has given it a lithological character, by which it is known over a wide extent of country, and from which its name has been derived. The peculiar forms described in the succeeding pages (Plates VIII. & IX.) enter largely into the rock, and in many places constitute no small portion of the whole mass. They are frequently partially obliterated by crystallization; but in far the greater number of instances, a weathered surface exhibits them in greater or less perfection; and although the species are so few, there is no rock better characterized than this one by its palæozoic features. The form and mode of growth are such as to distinguish these fossils from all preceding or succeeding forms; and though a single stem may resemble other marine vegetation, yet, when taken in combination, they present features totally distinct and unique. In the most prominent species, the stems are vertical to the strata; and they are, as it were, tied together at intervals throughout their whole extent, by diverging branches which unite with the contiguous stems on all sides. In this respect, they present a feature unknown in either the corals or marine plants of the Fucus family. Their internal structure also presents some similar anomalies; for while we find in some parts a structure like the cellular tissue of ordinary plants, we find, in others, cells or tubes bearing some analogy to the zoophytes. The substance also appears to have been partially calcareous or corticiferous, at least the external coat. In order, therefore, to give some expression to this apparent combination of structure, if such it prove to be, I have proposed a distinct generic name, to include at least two well-marked species.

Genus PHYTOPSIS.

[Greek, φυτον, a plant, and οψις, resemblance.]

Stems cylindrical or subcylindrical, straight or flexuous, erect or procumbent, branched; branches diverging and anastomosing; structure cellular, consisting of thin laminæ with transverse divisions; other portions presenting a reticulated structure.

64. 1. PHYTOPSIS TUBULOSUM (*n. sp.*).

Pl. VIII. Figs. 1, *a*, *b*, c, *d*, *e*.

Fucoides demissus. Emmons, Geol. Report, pp. 109, 110, 383 & 384.*

Stems subcylindrical, sometimes obtusely angular or compressed, branched; branches inosculating obliquely, or in an ascending direction; external covering thin, calcareous?; centre usually filled with softer materials, or crystallized.

This very remarkable fossil forms one of the most prominent features of the Birdseye limestone along the Mohawk valley. In vertical sections of the strata, it presents the appearance represented in figs. 1 and 1 *a*. Where the rock is not too crystalline, the internal substance of the fossil is argillaceous, and presents a contrast in color to the surrounding rock. The general direction of the stems is vertical; but the anastomosing branches diverge at all angles, uniting with the contiguous stems, thus forming a connection throughout the mass for many feet in extent.

Sometimes these tubes are filled with crystalline calcareous matter, and the surface of the rock presents numerous crystalline points or round spots, and, in a vertical section, lines of this crystalline matter, the structure of the fossil having been obliterated. This is true in many parts of the Mohawk valley, and in the Black river valley, where the other species prevails. In Kentucky and Tennessee, this rock is marked by numerous crystalline points and lines indicating the existence of this fossil, but I have never been able to detect its structure in any specimens from these places. The species is known to us in its greatest perfection along the Mohawk valley.

The figures on Plate VIII. present the usual aspect under which this fossil appears.

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* This fossil has usually been referred to the *Fucoides demissus* of Conrad; but I regard it as by no means certain that Mr. C. intended to apply this name to the fossil under consideration. In his report of 1838, he enumerated no less than six new species of Fucoides in the lower strata, and it is therefore safer to describe under a new name, than risk confounding with other species.

Dr. Emmons has given illustrations of this fossil in his Report above quoted. Those on page 109 correspond with a very common appearance of this fossil and the succeeding species (Pl. ix.). I have not been able to discover specimens showing the anastomosing of the connecting branches, as represented on page 110 of that report. The specimen figured on page 384, fig. 3 (Emmons, *Geol. Report*), showing the structure of a coralline, doubtless arises from a *Favosites* or *Chætetes*, which has fixed its residence upon one of these stems; for it is unlike any structure I have been able to detect, in the examination of several hundred specimens of the fossil in all stages of decay and exposure.

Fig. 1. A fragment of rock, showing several stems of this fossil with their anastomosing branches.

Fig. 1 *a*. A similar vertical section where the stems have been divided, showing that they were originally hollow.

Fig. 1 *b*. A bulb of stony matter, embraced by the stems or rootlets of this fossil. The stems apparently proceed from such a bulb or root, as the radicles converge below, and diverge above, as represented in the figure.

Fig. 1 *c*. A horizontal section, presenting the ends of several stems, most of which are less than the ordinary size. The rock is discolored for some distance around these stems, as if deprived of its coloring matter by the carbonaceous character of the fossil.

Fig. 1 *d*. A horizontal section of stems larger than the usual size. These stems are cellular, with apparent longitudinal dissepiments in two of the four presented in the figure.

Fig. 1 *e*. A horizontal or transverse section of the stems, showing a concretionary arrangement of the calcareous matter around them, which, on weathering, presents the appearance here represented. This concretionary arrangement evidently took place during the deposition of the calcareous matter and the growth of the plant, and appears to have constantly formed a little eminence around the stem during the progress of the deposition.

Position and locality. Throughout the Birdseye limestone, in various localities along the Mohawk valley; near Amsterdam; Fort-Plain; St. Johnsville; Canajoharie, &c.

(*State Collection.*)

65. 2. PHYTOPSIS CELLULOSUM (*n. sp.*).

Pl. IX. Figs. 1, 1 *a*, *b*, *c*, *d*.

Stems subcylindrical or compressed, diverging from a centre or root, procumbent or ascending, branching; branches irregularly anastomosing, forming a close strong network; crust or covering thin; substance cellular; cells oblong, quadrangular or stellate.

The difference in the structure presented in these figures, appears to be due, in a great measure, to the direction of the section. A longitudinal section of a stem presents a simple fibrous structure, with more or less distant interlacing transverse fibres, forming oblong or quadrangular cells, as in part of 1 *a*, 1 *b* and 1 *c*. In oblique sections of the stem, square or rhombohedral cells are presented, as in part of 1 *a*; while in others, these cells present a cruciform or stellate appearance, as in 1 *d*. Almost innumerable varieties of structure are presented by the surfaces of weathered specimens, where sections of stems in every possible direction, as well as in all stages of preservation, are presented. The form of mineralization, varying from calcareous through all stages to perfectly siliceous, produces also some variety of appearance in the fossil. The base of an individual, as fig. 1, is rarely seen, and only where the matter of the rock is argillaceous. The portion represented is a small part only of an individual; for the branching and diverging stems extend at least several feet, and we know not how much farther.

While the first species appears to be the prevailing form in the Mohawk valley and some other parts of the State, the latter species prevails almost exclusively in the valley of the Black river and in Canada. The two are usually confounded, but their mode of growth and their internal structure are sufficient to distinguish them. When crystallized, however, and the rock is compact, we have no certain means of determining them. The latter species is crystallized more frequently than the former, the stem of which is tubular and usually filled with argillaceous matter.

Fig. 1. Base or root of one of these fossils, with its diverging and slightly ascending branches. The surface, not being worn, presents no marks of structure.

Fig. 1 *a*. A part of the specimen presents the longitudinal fibres, with very distant transverse fibres.

Fig. 1 *b*. A longitudinal section, passing nearly through the centre of the stem, showing the longitudinal and transverse fibres.

Fig. 1 *c*. Portion of two stems with the cuticle removed, showing the structure.

Fig. 1 *d*. Oblique sections near the termination of branches (the fructiferous portions?), presenting stellate or cruciform cells.

Fig. 1 *a* (in part), presents quadrangular cells, arranged diagonally to the direction of the stems. These forms may arise from weathering, or solution of cellular partitions in forms like 1 *d*.

Position and locality. In the Birdseye limestone at Watertown and other places on the Black river, and in the Champlain valley. Specimens like figs. 1 *a* and 1 *b* are not uncommon in some parts of the same rock in the Mohawk valley. (*State Collection*.)

FOSSIL SHELLS OF THE BIRDSEYE LIMESTONE.

Plate X.

In some localities of the Birdseye limestone, where the rock is of a nature to admit of their development, shells are very numerous, but it rarely happens that they are sufficiently distinct to admit of precise description. Several species appear to be identical with those of the Trenton limestone; but there are others, which, so far as we know at present, are confined to this rock alone.

I have presented the following forms, as indicating those which have more frequently fallen under my own observation, though I doubt not that a more numerous collection could be made by farther investigations. The rock usually adheres so closely to the shell, that the latter separates with it, and thus the external sculpture is obliterated. We are compelled, therefore, to depend mainly on the form of the shells in distinguishing species. Their position is almost entirely confined to the higher portions of the rock, which is irregularly stratified, and much intermingled with shaly matter and fragments of the Phytopsis.

66. 1. MODIOLA? OBTUSA (*n. sp.*).

Pl. X. Fig. 1.

Single valve oblong, suboval, gradually narrowing towards the beak, convex; anterior extremity very obtuse. Some faint lines of growth, or striæ, are perceptible.

The specimen is a cast, nearly smooth, narrowing gradually towards the beak, and slightly contracted before reaching the anterior extremity.

Position and locality. In the upper part of the rock at Watertown, Jefferson county, associated with Phytopsis. (*State Collection*.)

67. 2. MURCHISONIA? ANGUSTATA (*n. sp.*).

Pl. X. Figs. 2 *a*, *b*.

Subulate, elongated, narrow; spire long, sharp; volutions about nine or ten, rounded; suture simple; aperture nearly circular; surface? Length $\frac{1}{2}$ to $\frac{7}{8}$ of an inch.

The form of this shell is well preserved in several specimens, but the surface is too much eroded to define its markings. There is, in some specimens, obscure evidence of a carination on the outside of a few of the lower whorls.

Position and locality. In the higher part of the Birdseye limestone, associated with *Phytopsis cellulosum*.

68. 3. MURCHISONIA VENTRICOSA (*n. sp.*).

Pl. X. Fig. 3.

Conical, abruptly tapering; breadth about half the length; volutions about five, ventricose, subangulated above, rapidly enlarging towards the aperture; surface covered with longitudinal arched threadlike striæ, which, tending backwards from the suture, bend forward after passing over the angle of the whorl.

In the specimen under examination, the striæ are only partially visible, except on the upper part of the volutions: they are precisely like those on the species of Loxonema known to me; but the angular elevation along the upper part of the volution indicates that this may be a species of Murchisonia, the Loxonema being destitute of such a carina. In the cast, there is no evidence of the band marking the carina as in Murchisonia, but the striæ bend forward in the same manner on the lower part of the volutions.

Position and locality. In the higher part of the rock, where it passes into the Trenton limestone. Tribe's-hill, Mohawk valley. (*State Collection.*)

69. 4. MURCHISONIA PERANGULATA (*n. sp.*).

Pl. X. Fig. 4.

Fusiform; spire long, acute; volutions rapidly diminishing in size, angular on the middle, appressed above and below, except the last one, which is somewhat ventricose.

There are some obscure traces of striæ, and of the spiral band, which enables us to refer the shell to the Genus Murchisonia, but it has been so much macerated as nearly to obliterate these markings. The shell is readily recognized by the strongly angulated whorls, which, above the lower one, are not ventricose.

Position and locality. It occurs in a siliceous cherty mass of the Birdseye limestone, associated with fragments of shells, corals, etc., near the upper termination of the rock. Watertown, Jefferson county. (*State Collection.*)

70. 5. MURCHISONIA? VARICOSA (*n. sp.*).

Pl. X. Figs. 7 *a*, *b*.

Turreted, or ovoidly conical; volutions rapidly diminishing, angular, ventricose; surface marked with longitudinal ribs or strong striæ, which are crossed by transverse ridges, giving it a varicose appearance.

The specimens which I have seen are obscure from the adhesion of stony matter, but the species seems well characterized and easily recognized, and it is therefore given in its imperfect condition. The lower volutions bear about two or three prominent ridges or angular elevations upon the upper side, while they are more regularly rounded below.

Fig. 7 *a*. A specimen having the surface much worn and weathered: the markings are but partially visible.

Fig. 7 *b*. Longitudinal section of a specimen of the same shell.

Position and locality. This species occurs in the upper part of the Birdseye limestone, associated with Phytopsis and the preceding species of shells. It also occurs in the Black-river limestone, near its upper termination. Watertown, Jefferson county.

71. 1. NATICA? ——— (*Species undetermined*).

Pl. X. Fig. 5.

Volutions about four, rapidly enlarging from the apex, last one very ventricose; surface smooth?; suture apparently channelled; spire but little elevated.

This small shell is of rare occurrence in this rock, and I am by no means satisfied that it is distinct from a species of the Trenton limestone. It will be readily recognized from the figure.

Position and locality. In the upper part of the Birdseye limestone, associated with *Pleurotomaria*, *Phytopsis*, and other fossils. Watertown, Jefferson county.

72. 5. PLEUROTOMARIA? NUCLEOLATA (*n. sp.*).

Pl. X. Fig. 6.

Trochiform; spire short, rapidly tapering to an obtuse termination; volutions few, angular, flat above, the last one ventricose below; suture canaliculate.

The last volution composes nearly the entire shell, the upper ones being very small, and somewhat depressed. This is a small distinct species, which I have observed in no other position.

Fig. 6 *a*. Natural size of specimen.

Fig. 6 *b*. Enlarged view of the same.

Position and locality. In the upper part of the Birdseye limestone, with the last species. Watertown, Jefferson county.

73. 6. PLEUROTOMARIA QUADRICARINATA (*n. sp.*).

PL. X. Fig. 8.

Trochiform; spire obliterated; last whorl with four distinct carinæ; surface marked with zigzag striæ, which advance and retreat in passing over the angles of the whorl; aperture nearly circular; umbilicus large.

It is impossible to characterize the whole of the shell, since all the specimens yet seen are more or less imperfect. The angles upon the last volution, with the zigzag striæ, seem sufficiently characteristic of the shell to denote its specific distinction.

Position and locality. In the higher shaly part of the Birdseye limestone, associated with *Phytopsis* and the shells which follow.

74. 7. PLEUROTOMARIA UMBILICATA (*n. sp.*).

PL. X. Figs. 9 *a, b, c, d, e, g, h.*

Depressed, nearly discoidal; spire gradually ascending; width about equal to twice the height; spire short; volutions about four, angular and compressed above, ventricose below; suture canaliculated; aperture subrhomboidal, angulated anteriorly; umbilicus large and deep; surface marked with undulating striæ.

The last whorl is distinctly marked by three spiral ridges or carinations: one near the suture, one at the upper outer edge, and one at the lower outer edge, leaving the side of the volution plain and vertical; the upper side is angulated by the first carina, and the lower side rounded, scarcely ventricose; the lower angle of the last volution is covered by the spire, the two upper ones continuing. This fossil is readily distinguished, even in fragments, by the distinctly canaliculated suture, elevated upper carina, and the curvilinear depression between this and the next angle.

This species is very common, appearing in the Birdseye limestone, and continuing into the Trenton limestone, where it is numerous and widely distributed. It assumes various forms, which are partly due to compression, but retains its essential characters here given.

Fig. 9 *a.* Lateral view of a cast of this species, the spire partially obliterated.
Fig. 9 *b.* View of a larger specimen, showing but a single angle upon the cast, the upper one having been obliterated.
Fig. 9 *c.* View of the upper side of a smaller specimen.
Fig. 9 *d.* Lateral view of a specimen much compressed.
Fig. 9 *e.* Lower surface of the same, showing the umbilicus and the striæ upon the shell, which is partially preserved.
Fig. 9 *g.* View of the upper side of a crushed specimen.
Fig. 9 *h.* Lower side of a small specimen.

When imbedded in the rock, and often much distorted, the different phases of this fossil might be regarded as indicating distinct species, but a careful examination will decide them to be identical.

For further illustrations of this species, see Trenton limestone, Plate XXXVI.

Position and locality. In the higher shaly and irregularly stratified portions of the Birdseye limestone, at Watertown, Jefferson county. (*State Collection.*)

75. 8. PLEUROTOMARIA? NODULOSA (*n. sp.*).

Pl. X. Fig. 10.

Turbinate, spiral; spire ascending, short, obtuse; volutions few, angular, ventricose, rapidly increasing towards the aperture; umbilicus large; surface marked by nodulose spiral ridges, which are crossed by longitudinal lines, giving the shell a varicose appearance.

The surface of this shell, the characters of which are partially obliterated, somewhat resembles *Murchisonia varicosa;* but the spire is much shorter, and the last whorl larger and more ventricose. The large deep umbilicus is also a distinguishing feature of this fossil.

Position and locality. In the upper part of the Birdseye limestone, associated with *Orthoceras multicameratum* and *Phytopsis.* (*State Collection.*)

76. 9. PLEUROTOMARIA? OBSOLETA (*n. sp.*).

Pl. X. Fig. 11.

Suborbicular, depressed-spiral; volutions rounded, ventricose; aperture round, with a posterior depression which apparently communicates with the umbilicus; umbilicus small; surface marked by longitudinal fine striæ radiating from the umbilicus.

Little more than a single volution of this specimen can be seen, the upper part of the shell being enclosed in the rock. The margin of the aperture does not present the notch characteristic of the Pleurotomaria, and it is therefore referred with some doubt to that genus.

Position and locality. In the upper part of the Birdseye limestone, associated with the preceding fossils. Watertown, Jefferson county. (*State Collection.*)

77. 1. CYTHERINA ——— (*Species undetermined*).

Pl. X. Fig. 12.

Broken and separated valves of this little crustacean are of common occurrence in the higher portions of the Birdseye limestone, though usually too imperfect for description. It is probably identical with a species in the Trenton limestone, which will be described in the proper place.

Locality. Watertown, Jefferson county. (*State Collection.*)

ORTHOCERATA OF THE BIRDSEYE LIMESTONE.

PLATE XI.

78. 8. ORTHOCERAS MULTICAMERATUM.

PL. XI. Figs. 1 *a*, *b*, *c*.

Orthoceras multicameratum, CONRAD in MS. EMMONS, Geol. Report, 1842, p. 382.

Extremely elongated, slender, very gradually tapering to an acute point; surface apparently smooth, or girt with slight undulations; septa thin, gently arched, distant from $\frac{1}{4}$ to $\frac{1}{12}$ the diameter; siphuncle a cylindrical ventral tube; outer chamber very deep.

The difference in the apparent concavity of the septa is owing to the wearing of the fossil to different depths from the surface. The septa are very variable in their distance from each other, being from $\frac{1}{3}$ to $\frac{1}{12}$ the diameter, and presenting even greater variations than this, so that a single measurement would be no guide to the specific character. There will be found in this species, and probably in others, a proportion between the distance of the septa and the diameter of the shell: where the diameter is greatest, the septa are proportionally nearer; and where smallest, comparatively more distant. This proportion, however, is not always uniform; for when similar diameters in different specimens are measured, one presents a greater number of septa than the other.

This species resembles the *O. tenuiseptum* of the Chazy limestone, but I have not sufficient evidence of their identity to unite the two. It occurs in great perfection in the Birdseye limestone, and is almost the only well marked species found in this rock. Fragments of several other species have been found, but none sufficiently characterized to merit description.

Fig. 1. A fragment twelve inches long, showing a large part of the deep outer chamber, which is partially filled with fragments of the PHYTOPSIS (See Plate IX).

Fig. 1 *a*. Another fragment, showing the continuation of the fossil to the apex. These two were not found in connexion, but are apparently fragments of two individuals.

Fig. 1 *b*. A fragment, showing some irregularity in the septa.

Fig. 1 *c*. A worn specimen, showing the septa and siphuncle which is near the margin (ventral?). The siphon, in one part, shows something like an enlargement between the septa as in ORMOCERAS; but it is too indistinct to warrant the reference.

Position and locality. This fossil occurs principally in the higher and more shaly portions of the Birdseye limestone, often surrounded and enveloped in fragments of the *Phytopsis*. Watertown, Jefferson county; Mohawk valley.

(*State Collection; Collection of the Albany Institute, &c.*)

79. 9. ORTHOCERAS RECTICAMERATUM.

Pl. XI. Fig. 1 *d*.

Elongated, cylindrical, gradually tapering; septa not curved, but passing obliquely in a line from the inside of the shell to the siphuncle, or *vice versa;* siphuncle a cylindrical tube, somewhat excentric; septa distant $\frac{1}{4}$ to $\frac{1}{10}$ the diameter.

This species bears considerable analogy to the last in some respects; but it differs in the direction of the septa, which are not curved; in tapering more rapidly, and in the siphuncle being less excentric. The specimens obtained give only partial opportunities of seeing the exact position of the siphuncle, which differs essentially from the last.

Position and locality. It occurs in the same association as the last, and all the specimens contain great numbers of fragments of *Phytopsis.* Watertown, Jefferson county; Mohawk valley.

BLACK-RIVER LIMESTONE.

Succeeding the Birdseye limestone, we have a well-defined mass of greyish blue limestone, very compact and sometimes subcrystalline in texture. This has already been fully described, and is known as the Black-river limestone. It probably rarely or never exceeds ten feet in thickness; but from being characterized by a large number of peculiar fossils, though mainly belonging to a single family, it is regarded as worthy of a separate notice.

The principal and most prominent organic bodies in this rock are Orthocerata, some of which attain the astonishing length of more than ten feet, and have a diameter of one foot or more. Associated with these are several species of Cephalopoda belonging to other genera, and some species of the Gasteropoda which subsequently appear in the succeeding limestone.

The Orthocerata and other Cephalopoda of this rock, so far as I have been able to ascertain, differ from any in the Trenton limestone; and it would therefore appear that nearly every species perished at the close of this period. Several species, one of *Pleurotomaria*, and a few others, are identical with those of the Trenton limestone, and it is by these only that it is linked with the succeeding rock. Its organic affinities, however, are very close; for in both this limestone and the Trenton, great numbers of Orthocerata occur, though of different species.

CORALS OF THE BIRDSEYE AND BLACK-RIVER LIMESTONES.

Plate XII.

80. 1. COLUMNARIA ALVEOLATA.

Pl. XII. Figs. 1 *a*, *b*, *c*.

Columnaria alveolata. Goldfuss, Petrefacta, pag. 72, tab. xxiv. fig. 7 a, b, c.
— — Eaton, Geol. Text-Book, pag. 131, pl. 4.
Columnaria. Emmons, Geol. Report, pag. 276, fig. 2.

A hemispherical or irregularly massive coral, consisting of radiating, parallel or diverging tubes; tubes hexagonal (or varying from 5- to 7-sided), striated longitudinally, crossed by transverse dissepiments with vertical radiating lamellæ; no communicating pores.

The vertical lamellæ converge from the sides of the cell towards the centre, but I have not yet seen a specimen in which they meet at the centre. These lamellæ are unequal in number, varying apparently from twenty to thirty, and never meeting in the centre in our specimens: they are often partially obliterated, and leave the inside of the tube marked only by sharp ridges, corresponding to the striæ upon the outside; when the transverse dissepiments are also obliterated, these ridges are denticulated, marking the point of junction. The vertical lamellæ are only visible in weathered specimens, as fig. 1 *b*, where the ends of the tubes are exposed. In a large number of specimens, the radiating lamellæ are entirely obliterated, and the dissepiments only preserved, as in fig. 1 *a*. These are common at Watertown, Jefferson county. In the Mohawk valley and elsewhere, when preserved in compact limestone, the tubes are solid, separable from each other, and preserving very perfectly their deeply striated surfaces, as in fig. 1.

The coral occurs in hemispherical masses, varying in diameter from three inches to several feet.*

Fig. 1. A vertical section of a compact specimen, showing the striated walls of the cells.
Fig. 1 *a*. A vertical section, showing the transverse dissepiments, with the vertical lamellæ obliterated.
Fig. 1 *b*. A transverse section (weathered surface), showing the radiating lamellæ.
Fig. 1 *c*. The same enlarged.

Position and locality. Glensfalls; Chazy; Watertown; Lowville, Lewis county; Amsterdam and numerous other places in the Mohawk valley, always confined to the Black-river limestone, and is never known to rise above it in any locality. In many situations, it forms a large portion of a single thick stratum near the termination of the rock.

* There is a specimen (a portion only of an entire mass) in the State Collection, weighing about 1500 pounds: the whole mass probably weighed 2000 or 3000 pounds. This specimen is from the Mohawk valley, and was blasted from the rock in quarrying stone for the enlarged Erie Canal; and I am indebted to the Engineer, Mr. M'Alpin, for being able to place it in the Collection. Certainly, when we find at so early a period such masses of coral, there is no reason why extensive coral reefs may not have margined our early shoals or islands of granite, as those of modern origin do the islands and shoals of our present seas.

Genus STROMATOCERIUM.

In the black marble of Ile la Motte, and in the same rock at Chazy, but more particularly in the dark limestone containing the Columnaria, we find numerous specimens of obscure corals having a structure represented in figs. 2, 2 *a* and *b*. They are completely silicified, so that the more minute structure cannot be decided; but since they are abundant, and require notice, I have proposed the provisional name of *Stromatocerium*, from στρωμα, -ατος, a layer or lamina, and κηριον, honeycomb.

81. 1. STROMATOCERIUM RUGOSUM.

Pl. XII. Figs. 2, 2 *a*, *b*.

Coral hemispherical; growth in concentric laminæ or strata; laminæ numerous, wrinkled; some faint indications of vertical tubes or cells.

This coral usually appears as a rough shapeless excrescence upon the weathered surface of the limestone; but a little examination shows it to be composed of concentric layers, which are evidently the skeleton of some coral.

Fig. 2. A specimen, natural size, showing the concentric lamination of the coral. The masses are often several times as large as this one.

Fig. 2 *a*. A fragment magnified, showing less contortion of the laminæ, with some indistinct indication of vertical tubes or cells.

Fig. 2 *b*. A small portion of a specimen of the natural size, showing the rugose or contorted direction of the laminæ.

Position and locality. This coral, so far as known, is confined to the Black-river limestone, and to the dark layers alternating with the Birdseye limestone. It occurs in the dark marble quarried on the east side of Ile la Motte; but this mass lies much above the *Maclurea magna*, if not higher than the Birdseye limestone. It occurs at Chazy village, Watertown, and other places.

82. 2. CHÆTETES LYCOPERDON?

Pl. XII. Figs. 3, 5.

See Plates xxiii. and xxiv. Trenton limestone corals.

A cylindrical branched coral; branches somewhat clavate; tubes fine, angular; no connecting pores visible.

There is no apparent difference between this species and the one so common in the Trenton limestone. It is extremely rare in the Birdseye, though I have been led to suspect its existence in many instances where the structure is wholly obliterated by crystallization, as is the case with many other fossils of this rock. The same fossil, apparently, occurs in worn ovoid fragments in the Chazy limestone, and its upward limit I have not yet ascertained. It has, however, evidently a wide geological range; coming into existence at almost the earliest period of organic life, and is among those rare forms that escaped destruction, or again came into existence after the final deposition of the Hudson-river group.

Fig. 3. Specimen natural size.

Fig. 4. Probably the same species, very minute, occurring in some thin shaly layers at the upper part of the Birdseye limestone, or at its junction with the Black-river limestone.

Position and locality. Upper part of the Birdseye, and in the Black-river limestone, at Watertown, Jefferson county.

83. 2. STREPTOPLASMA PROFUNDA (*n. sp.*).

PL. XII. Figs. 4 *a, b, c, d.*

Obliquely turbinate, often slightly curved near the base, expanding above more or less abruptly; cell profoundly deep, extending nearly to the base of the coral; margin of the cup reflexed; surface scarcely marked by transverse rugæ; lamellæ from 36 to 60, strong, nearly equal on the margin, but distinctly alternating in length within; no transverse dissepiments or celluliferous structure.

Specimens of this fossil occur in considerable numbers in the upper part of the Birdseye limestone, and in the Black-river limestone. One specimen in the State Collection presents the remains of more than sixty individuals upon a surface six inches square.

This fossil never presents any evidences of budding from its centres, as in many of the CYATHOPHYLLÆ; for among all yet seen, the individuals are single and distinct. When worn down longitudinally or obliquely upon the surface of strata, as in figs. 4 *d*, *e*, and similar forms, they have been regarded as the jaws and teeth of fishes, and this has given rise to the report of remains of fishes in these lower strata. The interior of the cup presents a serrated appearance, which is owing to oblique sections that are shown in the figures just referred to.

Fig. 4. Lateral view of a specimen where the edge of the cup is worn down, shortening the entire length about one-third.

Fig. 4 *a.* Section of a specimen near the base, showing the contortion of the lamellæ at the centre: the section is slightly oblique.

Fig. 4 *b.* Transverse section above the base, showing the alternation of larger and smaller lamellæ, which do not reach the centre.

Fig. 4 *c.* Transverse section near the termination of the cup.

I have some doubt whether the section here presented is of the same species, the lamellæ being much stronger and less in number than in the other individuals, which all occur in one specimen of the stone.

Fig. 4 *d.* A longitudinal section, slightly oblique to the axis, and coming out on one side of the centre below, showing some of the lamellæ vertically and others obliquely—giving the serrated appearance before alluded to.

Fig. 4 *e.* An oblique section, being nearly transverse to the lower part of the fossil on one side.

Various other appearances are given by these natural sections on the weathered surfaces of the limestone, which are exceedingly instructive as illustrating the generic and specific characters of the coral.

Position and locality. Watertown, in the "7-foot tier;" Chazy; Ile la Motte; also in great numbers at Manheim, East-Canada creek, in the Birdseye limestone.

84. 3. STICTOPORA LABYRINTHICA (*n. sp.*).

Pl. XII. Figs. 8 *a*, *b*.

Coral composed of broad, flattened, flexuous, branching stems, diverging and ascending from a base; branches uniting laterally, and forming broad foliaceous expansions; transverse sections of a group presenting an irregularly reticulate structure; branches celluliferous on both sides of the flattened central axis; cellules oval, arranged in quincunx order.

This coral occurs in the most compact portions of the Birdseye limestone, the edges of the branches appearing in dark lines upon the exposed surfaces of the stone, as fig. 8 *a*. In some localities large surfaces of the rock are covered in this manner, and it is nearly impossible to trace their commencement or termination. In a few instances, the flat surfaces of the branches are exposed sufficiently to show the generic relations of the coral. The branches are broader than in the next described species, but the arrangement of cells is similar.* The edges of the branches have much the appearance of Graptolites, except that they are rarely straight.

Fig. 8. The weathered surface of a fragment of the limestone, showing the transverse sections of this coral of the natural size.

Figs. 8 *a*, *b*. Enlarged portions as seen upon the specimen above, showing sections of two rows of cells rising obliquely from the axis.

Position and locality. This fossil, as shown in fig. 8 and the magnified portions, is found only in the Birdseye limestone. It is abundant at Chazy village, Clinton county, and at Watertown, Jefferson county. (*State Collection.*)

* The accompanying illustration on wood may enable the student to comprehend more clearly the characters of this somewhat obscure fossil. The drawing is an exact representation of a small portion of the surface of the limestone, where this coral abounds. In many instances the branches are partially turned on one side, and present two or three rows of cells; but where fully exposed, the number of rows is above twelve.

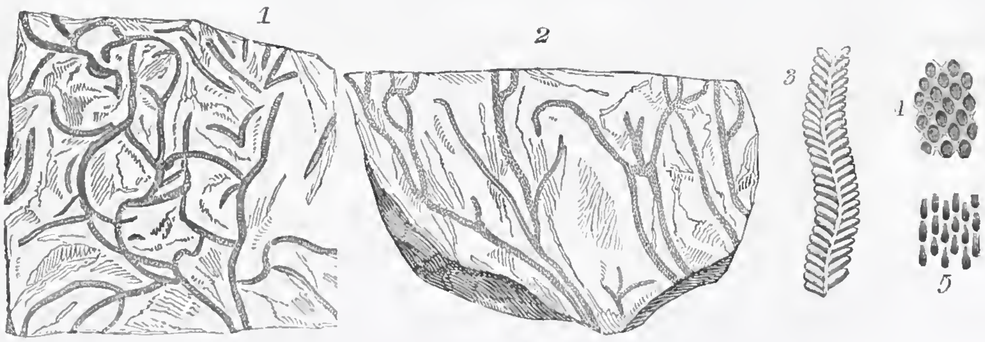

Fig. 1. A small fragment of limestone, showing the natural size of the coral upon the weathered surface.
Fig. 2. Vertical section of the same fragment of limestone, showing the ascending and anastomosing branches
Fig. 3. Enlarged portion of the worn edge of a branch of the coral from fig. 1.
Fig. 4. Surface apparently unworn, presenting elevated oblique ridges between the rows of cells.
Fig. 5. Surface of a branch somewhat worn.

85. 4. STICTOPORA RAMOSA (*n. sp.*).

Pl. XII. Figs. 6, 7 & 7 *a*.

A branching, erect, somewhat stony coral, covered on both sides by a celluliferous crust; branches flattened; cells oval, in quincunx order, arranged in regular oblique lines, alternating with each other in the direction of the axis, opening obliquely upward and outward; mouths of the cells in perfect specimens elevated, more perfectly rounded at the upper side; intercellular spaces striated?

This fossil occurs in various conditions, generally more or less worn, and broken into fragments: when perfect, the mouths of the cells are clearly elevated; when a little worn, they are even with the crust; when more worn, the whole frond has a retepore-like aspect, and the intercellular spaces are proportionally much less.

Fig. 6. A small fragment of limestone, the surface covered with pieces of the coral.
Fig. 7. A small portion showing the base of the cells when separated from the internal axis.
Fig. 7 *a*. The same magnified.

Position and locality. Great numbers of fragments of this species occur in some thin shaly layers at the termination of the Birdseye limestone; during the deposition of which, the species seems to have flourished in much greater numbers than at any other period.*

(*State Collection*.)

CRINOIDAL COLUMNS.

Pl. XII. Fig. 9.

Fragments of columns of this kind, differing in no respect from the species of the Trenton limestone, are found in the Black-river limestone at Watertown (See plate and description of the same).

* The accompanying illustration may render the character of this fossil more clear.

Fig. 1 is a fragment of stone, showing the fossil of its natural size.
Fig. 1 *a*. A magnified portion, showing the ranges of cells and their regular alternation.
Fig. 2. A small fragment of the coral, showing the bases of some of the cells.
Fig. 2 *. The same enlarged. *a*, the external celluliferous crust. *b*, the axis denuded of the crust, showing marks of the cells. *c*, bases of the cells, the margin well defined, distinctly oval; the longest diameter in the direction of the axis.

CEPHALOPODA OF THE BLACK-RIVER LIMESTONE.

Plates XIII. to XX.

The Cephalopoda of this period present a remarkable development in numbers of individuals, though not a large number of species. The forms are all peculiar to the rock,* none of them having been found in the higher limestone, though other species of the same family are so largely developed during the Trenton limestone period. Some of the Orthocerata attain the enormous length of eight or ten feet, and are not less than one foot in diameter. This period, though so well defined by its fossils, must have been one of short duration, during which the bottom of the ocean seems to have swarmed with myriads of these cephalopods. The deposition of calcareous matter which imbedded them, and, so far as known, destroyed the entire race, has not a thickness of above ten feet in New-York. Still the same deposit, containing the same species of fossils, is recognized on Lake Huron, and in Kentucky and Tennessee; and even in Sweden, we have reason to believe that the same distinction may be made as here, and that in other parts of Europe the mass will be found marked by identical or representative species.

86. 1. LITUITES UNDATUS.

Pl. XIII. Figs. 1, 1 *a*, *b*, & 3; and Pl. XIII. (bis). Fig. 1.

Inachus undatus, Conrad in MS. Emmons, Geol. Report, pag. 394, fig. 1.

Convolute, suborbicular; spire equally depressed on either side; volutions about four, contiguous, gradually increasing towards the aperture, which is subquadrate and scarcely expanded; volutions rounded upon the sides and flattened upon the back, ventral side compressed from contact with the next volution; surface undulated by strong oblique ridges and depressions, which rise from the inner side of the volutions, bend backwards, and become very strong upon the periphery; entire surface covered with fine sub-imbricating striæ, which are more distinct towards the aperture; striæ curving downwards, forming an arch upon the back of the shell.

This rare and remarkable shell is readily distinguished by its flattened orbicular form, and strong retral ridges, which are very prominent on the outer edge of the volution, though usually scarcely indicated upon the plain flattened back of the last whorl, which is only marked by curved striæ.

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* I have received a single species from Lewis county, as occurring in the Trenton limestone, which is identical with a species in this rock, and also the same from Herkimer county; but I am not quite satisfied of the position in these instances.

PLATE XIII.

Fig. 1. Lateral view of a specimen. A part of the last volution, near the aperture, is broken off.

Fig. 1 *a*. Lateral view of the cast of a smaller specimen.

Fig. 1 *b*. Dorsal view of the same specimen.

Fig. 3. A section apparently of the same fossil, though the surface markings are not preserved. The septa are distinctly shown in a portion of the shell, and the dorsal siphon at two points *a*, *a*. I have not been able to ascertain positively the position of the siphon in the other specimens bearing the shell, figs. 1 and 1 *a*.

PLATE XIII. (bis).

Fig. 1. A large specimen, showing a part of the fossil denuded of the shell, the direction and distance of the septa, and a portion of the deep outer chamber, the extremity being broken off.

I am indebted to Dr. CRAWE for the use of this fine specimen, as well as for that on Plate XIII. fig. 1.

Position and locality. This fossil is known to me only as occurring at Watertown, Jefferson county, in the Black-river (or "*seven-foot tier*" of) limestone, being unknown in any higher position. (*State Collection*.)

87. 2. LITUITES CONVOLVANS?

PL. XIII. Figs. 2, 2 *a*.

Compare *Lituites convolvans*. HISINGER, Pet. Suecica, 1837, pag. 27, pl. 8, fig. 6; Anteckn V. tab. v. fig. 1, 2.
Lituites imperfectus. WAHLENBERG, Nov. Act. Reg. Soc. Sci. Upsal, 1821.

Convolute, discoidal, gradually enlarging; volutions about two or three, scarcely contiguous, outer one separating and continued in a direct line towards the aperture; surface smooth?; section circular; septa plain, moderately concave, direction oblique from the inner side of the volution outward and upwards; siphuncle dorsal?

Two or three specimens of this species have been discovered, where exposed upon the weathered surface of the limestone, which is too compact to allow of separating perfect specimens. So far as can be determined, the surface is smooth and the section circular. It is evidently closely allied to the *L. convolvans* ut supra, and probably identical with that fossil, which is found in the older limestone of Sweden.

Fig. 2. A portion of a cast, showing the septa and part of the outer chamber.

Fig. 2 *a*. A vertical section of another individual as seen on the weathered surface of the limestone, showing the septa, which are removed from the smaller extremity by weathering. The cast is worn down below the siphuncle, which has not been observed in any specimen yet seen.

Position and locality. In the Black-river limestone, associated with large numbers of ORTHOCERATA. Watertown, Jefferson county.

Genus GONIOCERAS (*Fam. Orthocerata*).

[Greek, γονιος, an angle, and κερας, a horn.]

Character. General form and structure of the Orthoceras; the tube flattened, with extremely salient angles; septa sinuous; section an extended ellipse, with projecting angles; siphuncle ventral.

This genus is constructed to include a very peculiar form of the Orthocerata figured on Plate XIV., and which differs so essentially from all the other forms examined as to require separation.

88. 1. GONIOCERAS ANCEPS.

Pl. XIV. Figs. 1, 1 *a*, *b*, *c*, *d*.

General form elongated, somewhat rapidly tapering from the base, extremely compressed; section an excentric ellipse, compressed laterally towards the extremities, and extended into very acute angles; diameters as 1 to 4 or 1 to 5; septa composed of double laminæ, deeply concave in the centre, numerous, thin, approximate, sinuous on the longest diameter; siphuncle moniliform, ventral, consisting of a round tube, which is exceedingly expanded between the septa, like the siphuncle of Ormoceras.

This remarkable fossil, usually appearing upon the weathered surfaces of rocks, with the ventral or dorsal side exposed, and presenting a broad surface with extended septa and central siphon, has received the appellation of "*petrified fish's backbones.*" I had been disposed to regard this structure (as represented in the plate) as due, in part at least, to pressure; but the examination of numerous specimens in the rock, and of a portion of one nearly perfect, compels me to decide that their apparent disproportions are natural, and not the result of accident. In a portion of a nearly perfect individual, the siphuncle is so near the outer shell as to produce a longitudinal ventral ridge. In this instance, the relative diameters confirm previous measurements.

The shell is apparently smooth or very finely striated, and extremely thin, as also are the septa. There is very little evidence of compression, and the original form seems to have been very nearly what it now is.

In the longest diameter of the ellipse, the septa bend rapidly forward from the siphuncle, till a little more than half way to the external shell, where they make a gentle curve more directly towards the exterior, and, before reaching it, curve a little backwards. In the opposite direction, the septa have but a simple curve. In this character, the septa bear some resemblance to those of Goniatites.

Fig. 1. Natural longitudinal section of a GONIOCERAS, showing a portion of the siphuncle, which is greatly expanded laterally between the septa, and contracted at their junction with it. In this specimen, the sides are worn down below the angles of the shell, so that the septa do not appear to turn backwards or towards the apex, as shown in 1 *a*, where the section is more directly through the angles.

Fig. 1 *a*. A longitudinal section, showing a small portion of the siphuncle at one extremity, and a more perfect exhibition of the curving septa towards the exterior of the fossil.

Fig. 1 *b*. A transverse section, showing the position of the siphuncle. The specimen on the upper side of the figure has been slightly worn, so as to present a straight line. The siphuncle is nearer to the upper edge than is represented in the figure.

Fig. 1 *c*. A transverse section near the smaller extremity of the shell, showing the position of the siphuncle.

Fig. 1 *d*. A small portion of the exterior denuded of the shell, showing only the central portion of the septa.

Position and locality. In the Black-river limestone, and limited entirely to that mass. Watertown, Jefferson county.

(*State Collection; Cabinets of the Albany Institute, of* J. B. CRAWE, *and* J. HALL.)

89. 1. ORMOCERAS TENUIFILUM.

PL. XV. Figs. 1 *a, b, c*; PL. XVI. Figs. 1 *a, b, c, d, e*; and PL. XVII. Figs. 1 *a, b*.

Compare *Orthoceratites crassiventris*. WAHLENBERG, 1821, Petrefacta Telluris Suecanæ, in Nov. Act. Reg. Soc. Sci. Upsal, Vol. viii. p. 90.
— — HISINGER, 1819, Anteckn V. Tab. iv. fig. 9.
— — ID. 1837, Petref. Suec. Tab. x. fig. 3.
Ormoceras Backii. STOKES, 1837, Geol. Trans. 2d series, vol. v. p. 709, referring to fig. 1, pl. 30 of vol. 1 of the same work and same series.
Conotubularia Cuvierii. TROOST, 1838, Mémoires de la Société Géologique de France, Tome iii. pag. 88, pl. 9, fig. 1; also fig. 7, pl. 10 of the same memoir.
Actinoceras. BRONN, as figured by STOKES, Geol. Trans. ut supra.

Elongated, subcylindric, somewhat gradually tapering to a very elongated conical form; siphuncle ventral, annulated or expanded into bladder-like rings at the junction of the septa; septa moderately concave; surface marked by longitudinal undulated fine thread-like lines.

The greatest expansion of the swelled portion of the siphuncle is just within the concavity of the septum, and the constricted portion is just above the convexity of the septum. The outer shell is thin, but it is connected with an interior one which often closely joins it by infiltration of mineral matter, when it presents a thickened appearance. The septa are likewise composed of double plates or laminæ, which separate and expand at the siphuncle, folding round and forming the outer shell of this annulated tube. In cases where these laminæ separate a little nearer to the outer shell than in others, the rings, instead of being obtuse or rounded at their edges, are angular.

This species of ORMOCERAS occurs in immense numbers in the Black-river limestone.

The rock is very compact, and the fossil cannot be easily obtained except in weathered portions of the mass. Most of those figured, and nearly all the specimens usually seen, are found upon the weathered surfaces of the rock, where it presents such a variety of appearances as to lead one to believe there are several species. In examples like those on Plate XVI. they are commonly regarded by the inhabitants of the neighborhood as the vertebræ of fishes, to which they bear some remote resemblance.

I have little doubt of the identity of this fossil with those cited above; though since there is not absolute certainty, I have adopted another name until this can be determined. The specimens of Mr. Stokes are from a locality where the existence of other well known fossils induces us to refer the rock to the lower stages of our system, and probably to a position precisely corresponding to the thin mass containing these fossils upon the Black river. The specimens of Mr. Troost, though said by that gentleman to be associated with many from the younger silurian strata and some carboniferous fossils, I am well aware are from a position quite as low in the series as the Trenton limestone of New-York. It is true, Mr. Hisinger has referred his *Orthoceratites crassiventris* to the more recent transition strata of Sweden, which would be a strong indication of its being a different species, if there be no error in regard to position.*

Plate XV.

Fig. 1. A fragment of this species, partially covered with the delicate thin outer shell, presenting in the lower part of the figure some obscure markings of the septa; and above, showing the moderate convexity of a septum.

Fig. 1 *a*. Transverse section of the same specimen, broken through the annulations of the siphon.

Fig. 1 *b*. A portion of the outer shell magnified, showing the fine undulating threadlike lines upon the surface. (*Specimen from the Cabinet of the Albany Institute.*)

Fig. 1 *c*. A longitudinal section of a portion of a large individual, showing the septa, which are composed of double plates reaching only to the inner lamina of the exterior shell. The distance between the laminæ is unusually great in the upper part of this specimen, the spaces between them being nearly as great as between the septa.

Plate XVI.

Fig. 1. A transverse section, showing the edge of an annulation of the siphon, and the proportionate size of this part of the fossil. (By a mistake of the artist, the upper edge of this ring is far too nearly central to be true.)

Fig. 1 *a*. An artificial longitudinal section of a portion of fig. 1, pl. 15, showing the siphon and septa.

Fig. 1 *b*. A longitudinal section, in a direction from the ventral to the dorsal side, showing very clearly the position of the siphuncle. The specimen appears contracted at both extremities, which is due to its having been slightly bent, so that in wearing down, the two extremities are worn beyond the centre, while the middle portion is central, showing the siphuncle almost in

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* The structure of siphuncle here represented, though common in the lower, is rare in the higher strata; and although we have something approaching to the same form, yet I have not hitherto been able to detect precisely the same in any of the Orthocerata of more recent periods than the Hudson-river group.

contact with the external shell. Fragments like this one are of frequent occurrence, inducing a belief that it is a distinct species; and the figure is given here for the purpose of explaining the manner in which such a section is produced, which may be either by a previous bending of the shell, or from wearing down unevenly upon the surface.

Fig. 1 *c*. A longitudinal section, similar to the last, but the shell not bent; the direction of the section is nearly in the ventral and dorsal lines. Septa and outer shell showing double laminæ.

Fig. 1 *d*. A longitudinal section, showing the siphuncle apparently central, which is due to a wearing down from the ventral side, and consequently leaving the siphon equidistant from the two lateral margins of the shell.

Fig. 1 *e*. A similar section to the last, both of which exhibit more or less distinctly the double laminæ of the outer shell and septa.

In figs. 1 *b*, *c*, *e*, the double laminæ of the outer shell and septa are not so clearly distinguishable, the interspaces in the fossil being filled up by calcareous matter, so that both shell and septa appear thickened. In 1 *a* and 1 *d*, particularly the latter, the double laminæ of the septa are quite distinctly preserved, the interspaces being empty. This structure will be more fully illustrated when treating of the generic character of the ORTHOCERATA.

PLATE XVII.

Fig. 1. A fragment of the same species, showing the siphon directly in contact with the ventral side of the shell, a portion of which remains on the lower part of the specimen. There is also a slight irregularity in the size of the annulations, which is a common occurrence.

Fig. 1 *a*. Transverse section of the last, showing the wrinkled inner surface of the siphon at the points of contraction.*

Fig. 1 *b*. A longitudinal section, passing through the siphuncle: the interior is here filled with stony matter; but in other specimens, the inner surface of the tube presents the same wrinkled appearance along the contracted portions as is represented above, fig. 1 *a*.

In presenting so many figures of this species, the object has been to prevent misapprehension, and to present to the student in the science the most obvious features, and those apparent variations which he might seize upon to form distinct species. Doubtless they will be presented under other aspects; but it is believed that a careful study and comparison of these figures may enable one to detect the important characteristics, and decide their identity with these forms.

In the *Transactions of the Geological Society of London*, Second series, Vol. i. pl. 30, are to be found some analogous forms; and if there be no fallacy in these, which I somewhat suspect, there are several species indicated. From the geographical position of these fossils, it may be inferred that their geological position is identical with those of New-York.

Position and locality. In the Black-river limestone, associated with *Gonioceras*, *Lituites*, *Columnaria*, &c. &c. Watertown and Henderson Bay, Jefferson county; Copenhagen and Lowville, Lewis county; rarely in the Mohawk Valley, Lake Huron, &c. (*State Collection*.)

* See figures of ACTINOCERAS in *Trans. Geol. Soc. London*, 2d series, Vol. v. pl. 19.

90. 2. ORMOCERAS TENUIFILUM? *var.* DISTANS.

PL. XVII. Fig. 2.

Form as previously described ; septa a little more distant ; form of siphuncle, as appears near the base, somewhat different, and resembling very nearly *Ormoceras Bayfieldii* (STOKES, *Geol. Transactions*, 2d series, Vol. i. pl. 9, fig. 1). A partial longitudinal section on the opposite side displays the same structure as figs. 1 *c*, *d*, *e*, on the previous plate, and I have regarded this as a variety of the last species.

The specimen before us is worn down to the siphuncle only towards the lower part of the figure ; and the peculiar form there presented is probably owing to weathering, or some accident, as I have seen the same in another specimen since this was figured.

Position and locality. With the preceding.

91. 3. ORMOCERAS? GRACILE (*n. sp.*).

PL. XVII. Fig. 3.

Slender, elongated, very gradually tapering ; septa distant about $\frac{1}{3}$ of the diameter ; siphuncle ? surface ?

This species is distinguished by its more slender form and distant septa. The siphuncle is not distinctly visible ; but from some other evidences, it is presumed to belong to the Genus ORMOCERAS.

Position and locality. Watertown, in the Black-river limestone.

(*Cabinet of the Albany Institute.*)

GENUS ENDOCERAS.

[Greek, ενδον, within, and κερας, a horn.]

I propose this term, at least provisionally, to include those species of the ORTHOCERATA which have a large siphuncle, mostly lateral or excentric, marked or ridged on the outer surface by the septa, which, from their oblique direction, give it the appearance of a tube with spiral lines. Within this siphuncle are one or more very elongated conical tubes, often one within another to the number of four or five.

This latter character is one of the essential features of the *Actinoceras* of BRONN ; but the foundation of this name implies an impossibility, and requires a structure incompatible with the economy of the ORTHOCERATA ; and, therefore, for our specimens at least, we must substitute another.*

* I shall be able to show, under the ORTHOCERATA of the Trenton limestone, that such a structure as that of rays in verticillations from the internal tube to the walls of the siphon could never exist in an animal constituted like the *Orthoceras*. These tubes, being developed one within the other, and remaining within the siphuncle only temporarily, and capable of separation without injury to either the young tube or the parent shell, could never have been provided with verticillating rays to sustain themselves in that position. We have also such numbers of them separated from the parent shell, that had there been any such structure, some indications of it would have been preserved.

92. 1. ENDOCERAS SUBCENTRALE (*n. sp.*).

Pl. XVII. Fig. 4.

External form unknown, much elongated; septa rather distant; siphuncle a large straight subcentral tube, with external imbricating elevations at the attachment of the septa. The septa, on approaching the side of the siphuncle, turn suddenly upwards, or towards the apex, before joining the tube. A small portion only of the internal tube is visible, but enough remains to show its character. The marking is too faint to be traced, but it probably differs from any other species in this rock.

Position and locality. This fossil occurs, associated with the Ormoceras, in the limestone of Black river, at Watertown, Jefferson county. (*State Collection.*)

93. 2. ENDOCERAS LONGISSIMUM (*n. sp.*).

Pl. XVIII. Figs. 1, 1 *a*.

Extremely elongated, cylindrical. In the specimen before us, the internal embryo tubes of the siphuncle, only, are preserved: these are cylindrical, elongated, very gradually tapering, each one fitting within the other nearly close at the aperture, but receding from each other towards the smaller extremity; markings of the surface not visible.

The section 1 *a* shows at least three distinct tubes, one within the other, which extend the whole length of the specimen. The portion figured is eighteen inches in length, and this is probably much less than half the whole length of the original. Fragments of this species are very abundant at Watertown, and they are often found embraced within portions of the original shell, which was at least six inches in diameter and several feet in length.

The two figures connected by a dotted line are parts of the same specimen, joining as indicated. The section 1 *a* shows the different tubes, one within the other.

Position and locality. In the Black-river limestone, associated with Ormoceras. Watertown, Jefferson county. (*Cabinet of the Albany Institute.*)

94. 3. ENDOCERAS MULTITUBULATUM (*n. sp.*).

Pl. XVIII. Figs. 2 *a*, *b*.

Teretely conical, tapering somewhat rapidly; embryo sheaths numerous (five), one within the other; sheaths thin; smooth externally; interspaces equal, narrow.

This species differs from the last, in tapering more rapidly towards the apex, and in the consequently different form, as well as in the greater number of sheaths, which latter, however, would not be regarded as important.

Position and locality. In the Black-river limestone at Watertown, Jefferson county, associated with those forms previously figured.

95. 4. ENDOCERAS GEMELLIPARUM (*n. sp.*).

PL. XIX. Figs. 1 *a*, *b*.

Teretely conical, somewhat rapidly tapering; siphuncle lateral; septa moderately convex, distant; surface?

This fragment is of large size, being four and a half inches in diameter. It is remarkable for presenting, enclosed within the siphuncle, two embryo tubes, which in themselves show some lines of septa indicating their tendency to perfection.

The apices of both these tubes, as in all cases of single embryo tubes, are directed towards the apex of the parent shell. One of them is slightly bent on one side, and covered with stony matter.

Fig. 1 *a*. External view of the fragment.

Fig. 1 *b*. Transverse section of the smaller extremity, showing the siphuncle tube which joins the external margin; within which are shown sections of the two embryo tubes.

Fig. 1 *c*. Longitudinal section of the specimen, *d* and *e* being the two enclosed tubes, one of them partially covered with stony matter.

Position and locality. In the Black-river limestone at Henderson's Bay, Jefferson county.

96. 10. ORTHOCERAS FUSIFORME (*n. sp.*).

PL. XX. Fig. 1.

Elongated, gradually tapering; outer chamber deep, gradually contracting towards the mouth, giving a fusiform aspect to the specimen; septa approximate; siphuncle excentric.

This species presents the peculiar character of contracting towards the aperture, at about the same rate that it diminishes from the last septum in the opposite direction. The siphuncle is a large apparently even cylindrical tube. Two specimens only have been observed, both of which are from the base of the Black-river limestone, near its junction with the Birdseye. This species possesses a character which I have observed in some others, namely, that of having several of the last septa, and the final one especially, more closely arranged than the others.

Locality. Watertown, Jefferson county; Valley of the Mohawk, Herkimer county.

TRENTON LIMESTONE.

This limestone is more important than either of the preceding, in geographical extent, thickness, and number of fossils. It usually succeeds the Black-river limestone, or, in its absence, the Birdseye limestone, in thin shaly layers, or in compact strata separated by shaly laminæ. In a few instances the rock is concretionary in its lower portions, a large proportion of shaly matter being intermingled. The rock is for the most part thinbedded, of a dark blue or black color. Towards the higher part of the mass we usually find some thickbedded grey subcrystalline strata, bearing quite a different aspect from the rock below.

Tracing the rock upwards from this point, we find a gradual increase of shaly matter, until finally the whole mass becomes a shaly limestone, thence passing into the succeeding black shale by imperceptible gradations.

The rock is highly fossiliferous throughout, some localities furnishing more than others, and offering better facilities for procuring them. The number of species figured show how prolific it has proved, even under a very imperfect investigation. Perhaps none of the higher groups furnish a greater number of species in the same extent of thickness and surface exposed, than does this rock.

In describing the rocks of New-York in the Geological Reports, it was found convenient to separate the Trenton limestone from the Utica slate, and the succeeding shales and sandstones of the Hudson-river group. The same distinction has been kept up in the present Report, though a more thorough investigation of the palæozoic features of these different rocks has proved that many of the fossils are common to the Trenton limestone and the Hudson-river group, while a few species of the limestone appear in the Utica slate. Among the trilobites, we may mention the *Calymene Blumenbachii*, which abounds in the Trenton limestone, is rare in the Utica slate, and more frequent in the Hudson-river group. The *Trinucleus* is common in the Trenton, abundant in the Hudson-river group, though rarely seen in the Utica slate. The *Triarthrus Beckii* abounds in the Utica slate, and is rare both above and below, though occurring in both situations.

Nearly all the species of the Brachiopoda of the Trenton limestone reäppear in the Hudson-river group, though rarely seen in the intervening slate. There are, at the same time, species in the Hudson-river which are unknown in the Trenton limestone, and *vice versa*, though their palæozoic relations are very intimate throughout.

From all these facts, I am disposed to unite the whole as one group, still retaining the subdivisions for convenience of reference. This seems the more desirable, since at the west, particularly in Ohio and Indiana, the augmentation of calcareous matter has made it impossible to draw any line of demarcation which shall correspond with the three divisions so obviously marked by their lithological characters in New-York.

FOSSIL PLANTS OF THE TRENTON LIMESTONE.

PLATES XXI. & XXII.

In the soft shaly portions of this limestone, there are considerable numbers of the fucoid-like vegetable, fig. 1, pl. 22. They often appear as if attached by roots, but are never branched. More rarely species like fig. 1, pl. 21, appear upon the shaly surfaces of the limestone.

Great numbers of obscure vegetable markings, or fragments of fucoid-like bodies, are frequently found in the shaly strata of the Trenton limestone, in nearly all localities where the surfaces are exposed. These bodies are coëxtensive with the rock, and even much more numerous in some western localities, and in Canada, than within the State of New-York.

97. 2. BUTHOTREPHIS GRACILIS (*n. sp.*).

PL. XXI. Fig. 1.

Stem slender, flattened, branched; branches compressed, leaflike, subdichotomous, diverging, opposite and alternate; no visible structure.

This is a beautiful species, very similar to some of the linear-leaved Potamogetons. A carbonaceous film is all that remains of the fossil. It was probably a succulent marine plant, not unlike FUCUS, but of a very slender form and habit. It occurs where the crystalline limestone is separated by thin shaly layers, upon which, and upon a shaly carbonaceous film on the limestone, this fossil is found.

Position and locality. Jacksonburgh and Middleville, Herkimer county, in the central and lower portions of the Trenton limestone. (*State Collection.*)

98. 3. BUTHOTREPHIS SUCCULENS (*n. sp.*).

PL. XXII. Figs. 2 *a*, *b*.

Fossil composed of thick succulent stems; stems branching; branches divergent, bifurcating; structure apparently cellulous, indistinct.

This fossil resembles, in its thick succulent stems, the SALICORNIA. It is one of the most prominent and remarkable species in the rock.

This is the *Lithodendron dichotomum* of EATON.

Fig. 2 *a*. A portion of a large specimen, the branches scarcely compressed.
Fig. 2 *b*. A single stem with branches, from another plant.

Position and locality. In the Trenton limestone, Glen's Falls. (*Cabinet of the Troy Lyceum.*)

99. 3. PALÆOPHYCUS RUGOSUS (*n. sp.*).

PL. XXI. Fig. 2.

Compare with *P. tubularis*, Pl. iii. figs. 1, 2, 4, 5.

Stem subcylindrical, rough, branched; branches cylindrical, diverging at nearly right angles from the main stem. The surface of the stem is very rugose, or irregularly pitted and ridged; the branches flexuous, and nearly rectangular to the stem.

This species is commonly obtained in fragments, and presents a great variety of appearance.

Position and locality. Middleville; West-Canada Creek, and below Prospect Hill, in the Trenton limestone. (*State Collection.*)

100. 4. PALÆOPHYCUS SIMPLEX (*n. sp.*).

PL. XXII. Figs. 1 *a, b, c, d.*

Stems simple, cylindrical (or flattened and angular from compression), flexuous, gradually tapering to an obtuse point; surface smooth, or with indistinct interrupted ridges or striæ; one side often with a longitudinal groove.

The stems are apparently hollow tubes, as the interior is filled with fragments of shells, crinoidal columns, etc. The crust, or substance of the stems, appears to have been of moderate thickness (one-half to one line), and flexuous or elastic, as they are frequently bent and compressed.

These fossils usually occur in short fragments, but they are not unfrequently met with in larger portions of six inches in length, and of the diameter of half an inch or more. From their tubular structure, flexuous form, and apparent attachment by roots, they have evidently been organic bodies.

This species is perhaps more numerous than any other in the limestone, as I have obtained several hundred fragments of various lengths and dimensions. It appears to have grown only during the shaly deposition, and is imbedded in this portion of the mass; consequently it is absent or obscure where such material is wanting as a component part of the rock.

Fig. 1 *a.* A portion of a large stem, and section.
Fig. 1 *b.* A fragment compressed and bent.
Fig. 1 *c.* Section of the same.
Fig. 1 *d.* A small fragment, showing the groove along the side of the stem.

Position and locality. In the lower shaly portions of the Trenton limestone, at Middleville, Herkimer county. (*State Collection.*)

CORALS OF THE TRENTON LIMESTONE.

PLATES XXIII. TO XXVI.

The corals of the Trenton limestone are limited to a moderate number of species, and a few only of these are abundant; but one species, the CHÆTETES, in some of its varied forms, abounds in nearly all localities of the rock. These species, of which there about eighteen, are referable to no less than twelve distinct genera. The *Chætetes Lycoperdon*, in hemispheric forms, often abounds in certain layers, to the almost entire exclusion of any other fossil; while the slender and branched varieties of the same species are found in other situations, covering the entire surface of strata for many yards in extent. These corals rarely attain to massive dimensions, though we sometimes meet with irregular forms weighing ten or twelve pounds. This species is far more abundant than any other, and, in some of its protean forms, is every where met with in the Trenton limestone, being much more numerous than all the other species together.

During the entire deposition of this rock, the condition of the ocean does not appear to have been favorable to the continued growth of corals, since no massive species are found in it. This is probably owing to the constant intermingling of shaly matter during the time, which interfered with the growth of these animals; for there seems no other sufficient reason, since such large masses of the COLUMNARIA are found in the thin layer of Black-river limestone below this rock. The western extension of this formation shows, during the same period, the existence of immense numbers of corals, none of which attain to large dimensions, though in their present condition they form a considerable proportion of some of the strata.

101. 2. CHÆTETES LYCOPERDON.

PL. XXIII. Figs. 1, 1 *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, & 2, 2 *a*, 3; and PL. XXIV. Figs. 1 *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *k*, *m*, *n*, *o*.

Favosites Lycoperdon. SAY.
Favosites lycopodites. VANUXEM, Geol. Report, pag. 46, fig. 3. EMMONS, Geol. Report, pag. 389, fig. 3.
Calamopora fibrosa [?] GOLDFUSS, 1826, Petrefacta, pp. 82, 215, tab. xxviii. figs. 3 & 4; tab. xxiv. fig. 9.
Favosites fibrosa? GOLDFUSS, 1833, Petref. corrigenda, p. 215.
Compare *Chætetes petropolitanus*, LONSDALE; *Favosites petropolitana*, PANDER. MURCHISON & VERNEUIL, Geology of Russia and the Ural Mountains, pag. 596, pl. A. fig. 10.

Coral polymorphous, composed of closely aggregated tubes or columns, which diverge gradually from a broad base forming hemispherical masses, or from an imaginary axis producing conical or ramose forms; tubes minute, fibre-like, traversed by diaphragms; no connecting pores; increase of the coral by subdivisions of the parent tube, or by the successive addition of lateral or marginal tubes; exterior envelope submembranous.

This abundant coral appears in hemispherical, conical, nearly globular and ramose forms. Its most usual form is the hemispheric or puffball-shape, from which it received its name of *Favosites Lycoperdon*.* Some of the hemispherical masses show a great divergence of the tubes, as if radiating from an axis; while others are nearly vertical. Specimens approaching a conical or ramose form exhibit a tendency to radiation of the tubes from a central axis.

A comparison of all these forms shows no essential difference of structure, farther than might be expected from the different conditions under which the fossil was developed; and I am at present disposed to regard all the forms referred to this species as varieties of the same, although there may be some links wanting to show the perfect gradation from the hemispheric to the ramose forms. It is not intended to be understood that the hemispheric and globular masses always develop the ramose varieties, like fig. 2, pl. 23; these doubtless having this form from their commencement. Still the specimens 1 g, pl. 23, and 1, pl. 24, show that the massive varieties do sometimes become ramose to some extent; and there are other specimens, which could not be represented in figures, that prove more clearly the development of the ramose, from the massive forms. In addition to these more regular forms, this coral sometimes presents itself in irregular massive forms, as if, while a group had been growing, they were disturbed, a part of the polyps being destroyed, and the others growing onward and increasing, finally producing shapeless masses.

These remarks are made for the purpose of calling the attention of the student to these circumstances, particularly as the hemispheric masses alone have been referred to SAY's species. These observations will be better understood by a comparison with the following figures, drawn from different specimens.

Fig. 1. Portion of a vertical section of a hemispherical form of large size, showing the radiating structure from increase of tubes by subdivision, and also the increase by development of marginal tubes. The tubes are filled, and have become solid columns, which are easily separable by a slight blow of the hammer.

Fig. 1 *a*. A portion magnified, showing only the enlarged columns; the diaphragms not visible.

Fig. 1 *b*. Transverse section of a small conical or hemispheric form, showing the radiating arrangement of the tubes.

Fig. 1 *c*. A portion of the same enlarged, showing the diaphragms at regular intervals in some of the tubes which are divided longitudinally.

Figs. 1 *d*, *e*, *f*. Different external forms of the coral: 1 *d* and *f*, with more depressed forms, being the more usual; while 1 *e* shows a tendency to branching, which, if continued, would produce a coral with a massive centre and numerous branches.

Fig. 1 *g*. A large irregular mass with numerous diverging branches, some of which are broken off, showing the radiating arrangement of the tubes from a central axis. This specimen exhibits the same tendency as in 1 *e*, carried forward to a greater extent, showing how the same form may produce the ramose varieties. The tubes or solid columns, where the branches are broken off, present precisely the same structure as in the smaller hemispheric masses.

Fig. 1 *h*. A fragment from a larger mass, where the tubes are not filled with calcareous matter, showing the regularity of the diaphragms, which are distant a little less than the width of the tubes.

Fig. 1 *i*. The same enlarged. The mass is light and spongy like recent coral, and appears to be composed of numerous smaller ones which were drifted together, and afterwards recommenced their growth, forming a very irregular mass.

* From its resemblance to *Lycoperdon bovista*.

Fig. 2, var. *ramosus*. A fragment of limestone, with numerous worn fragments of a coral upon its surface. The structure of this coral is apparently identical with those just noticed, though it has assumed a perfectly ramose form. Large surfaces of limestone, covered with such fragments, are found in many situations where the hemispheric form does not occur, as well as where that is found.

Fig. 2 *a*. A fragment enlarged, showing the columnar structure upon the worn surface. The tubes terminate at unequal heights, from having been worn and broken off in this manner.

Fig. 3. A cylindrical specimen having the bases of three branches above, which appear to have been suddenly contracted and discontinued; as also the central shaft, which has been broken off, and partially healed before the death of the animal. The form of the openings of the tube is not correctly given in this figure. It is not unusual, in the branching forms, to find specimens in which the branches have been broken off, and the polyps adjoining the fracture, by the addition of lateral tubes, commence covering up the part and terminate it abruptly, as the branches of this specimen and the upper branches of 1 *g*.

Numerous figures might be given, illustrating the varieties of form assumed by this coral. The following have been added on Plate XXIV.:

Fig. 1 *a*. Section of a small hemispherical mass, showing the tubes nearly vertical to the base.

Fig. 1 *b*. A portion of the same magnified.

Fig. 1 *c*. The base of one of the hemispherical forms, where the polyps have just commenced their operations; the tubes, though distinctly formed, have scarcely a perceptible elevation. The polyps here commenced their operations by attaching themselves to a valve of the *Orthis testudinaria*, and thence extended laterally on all sides. This is the common mode of commencing their growth; and an examination of the base usually reveals the fragment of some shell, trilobite, or other organic body in the centre. The tubes do not attach directly to this foreign body, but a kind of membranaceous envelope is first spread over it, and from this the tubes take their origin, the envelope continuing to extend laterally as the growth of the coral advances.

Fig. 1 *d*. A small membranous envelope of this coral, from which, in some parts, the tubes have just commenced rising: this substance is thin, and concentrically wrinkled on both sides. These bodies are often found of an inch or more in diameter when the tubes have scarcely commenced their growth; and in many cases we find them not more than half a line in height, and are thence able to trace them through all their stages of growth.

Fig. 1 *e*. A portion of an irregular massive specimen, showing a tendency to branching more distinctly than the specimens represented on Plate XXIII.

Fig. 1 *f*. A few tubes of the same enlarged, showing the structure before exhibited in the hemispheric masses.

Fig. 1 *g*. A cylindrical branched specimen.

Fig. 1 *h*. A portion enlarged, showing the radiated tubes.

Fig. 1 *i*. Enlarged ends of the tubes on the surface of fig. 1 *g*.

Figs. 1 *m* & 1 *k*. Smaller branched and cylindrical specimens. In these the direction of the tubes is more nearly in the direction of the axis of the coral, as shown in fig. 1 *o*: they are, otherwise, similar to the previously noticed forms. The opening of the tubes upon the surface being likewise more oblique to the axis, they present a different form as represented in fig. 1 *n*. It is possible that these small forms may be found constant enough to receive a distinct designation; but at present I perceive so insensible a gradation from these forms to figs. 1 *g* and 1 *e*, that I am unable to define any limits to either variety.

I have devoted a considerable space to the illustration of this species, and my only apology must be, that since the work will be mainly distributed among learners, I desire to make it readily understood by them. If therefore the author's own labors can in any manner be offered as a substitute, the student may find his task easier than to be left in such cases with a single illustration, while many hours of labor might be required to convince himself that all these forms were identical.

Position and locality. This species occurs in infinite numbers in the Trenton limestone, and in nearly every part of the rock. In some localities the hemispheric, and in others the cylindrical and ramose forms prevail, and not unfrequently both occur together.

This species commences its existence soon after the final deposition of the Calciferous sandstone, where it is somewhat rare. In the Trenton limestone it presents its maximum development, but is still quite common in the Hudson-river group. At the west it is equally abundant and protean in its forms in both these groups, acquiring its maximum development at a higher point, geologically, than in New-York. The same species apparently reäppears after the deposition of the Oneida conglomerate, and is found in the Niagara group, as well as in the Pentamerus and subsequent limestones. A similar, if not identical species, occurs in the Hamilton and Chemung groups.

Its geographical range is equally extensive with its geological range. It occurs in nearly every part of New-York, in many places in Pennsylvania, in Virginia, Kentucky, Tennessee, Ohio, Indiana, Michigan and Wisconsin, as well as Canada.

Its principal localities in the Trenton limestone, are Trenton Falls, Middleville, Jacksonburgh, Watertown, Lowville, Turin, Plattsburgh, Chazy, Glen's Falls, and numerous other localities in the Mohawk, Champlain and Black River valleys. (*State Collection.*)

102. 3. CHÆTETES? RUGOSUS (*n. sp.*).

PL. XXIV. Figs. 2 *a*, *b*.

A polymorphous or ramose coral; branches somewhat compressed; tubes radiating almost vertically from a central axis; diaphragms numerous, regular; interior walls of the tubes rugose, or transversely wrinkled.

The tubes are larger, the interior distinctly rugose, and otherwise presenting a somewhat different aspect from the preceding, to which, however, it is closely allied. The specimen figured shows a ramose form, the branches diverging in three directions, but they have been broken off before the coral was imbedded.

Fig. 2 *a*. The specimen of the natural size.
Fig. 2 *b*. An enlarged portion, showing the form of the tubes and the rugose interior.

Position and locality. In the lower part of the Trenton limestone, at Middleville, Herkimer county.

103. 4. CHÆTETES COLUMNARIS (*n. sp.*)

PL. XXIII. Figs. 4, 4 *a*.

Coral massive, hemispherical or subglobose, consisting of a series of parallel or diverging polygonal tubes; tubes four- or five-sided, simple, without visible transverse dissepiments or connecting pores; interior of the cells apparently rugose or denticulate.

The rugose structure within the cell probably indicates the existence of diaphragms which have disappeared. The fossil, in its general form and structure, has the appearance of a FAVOSITES, from which a cursory examination would not induce us to separate it. A closer examination proves that the tubes are usually four-sided, and that there are no connecting pores in the walls of the cells. These characters had decided me to separate it from the Genus FAVOSITES, before knowing fully the characters on which the Genus CHÆTETES is founded. It appears referrible to the latter genus from its general similarity to some of the species, the character of quadrangular cells probably being unimportant and not constant. The apparent absence of diaphragms, or transverse dissepiments, is perhaps due to their subsequent destruction, or solution and removal.

This species occurs in large massive forms of a foot or more in diameter, and I have seen it only in such masses, and in fragments of similar ones. The substance of the coral is usually replaced by chert or hornstone.

Fig. 4. A fragment, of the natural size.
Fig. 4 *a*. An enlarged portion, showing the general form of the tubes.

Position and locality. Lower part of the Trenton limestone, Sugar River, Lewis county.

104. 1. RECEPTACULITES NEPTUNII?

PL. XXIV. Figs. 3 *a*, *b*, *c*, *d*.

Receptaculites Neptunii. DE FRANCE, Dict. des Sci. Nat., Tom. 45, p. 5.
— — BLAINVILLE, Man. D'Actinologie, pag. 572; atlas, pl. C. fig. 1 *a*, *b*, *c*, *d*.

Suborbicular or hemispherical, depressed in the centre; surface presenting a series of quadrangular cells, within each of which is a vertical cylindric tube opening upwards; openings of the tubes not entirely circular.

This fossil, which is apparently identical with the one described by DE FRANCE, and figured in BLAINVILLE'S *Manuel d'Actinologie*, occurs in oval or suborbicular forms somewhat depressed in the centre. The upper surface presents a series of quadrangular openings made by the intersection of vertical lamellæ, which cross each other in the direction of curved lines, like the peripheries of a series of circles of different diameters having distant centres. An examination, by grinding down the surface of these quadrangular openings, shows that the centre is occupied by a circular tube. These tubes radiate from the base, and gradually assume a vertical position in ascending. They present no marks of vertical lamellæ or diaphragms, but are constricted near the upper surface of the specimen, and again at a point some distance below.

Fig. 3 *a.* The upper surface of the specimen, showing the quadrangular or rhomboidal openings upon the outside.

Fig. 3 *b.* A portion of the same enlarged, with a few of the openings, showing the aperture of the cylindrical tube within. The opening above is not entirely circular.

Fig. 3 *c.* Vertical section of the cylindrical tubes through the centre of the mass, as they appear on a weathered surface. As these converge towards the base, the ends only are seen, as shown in the figure.

Fig. 3 *d.* Three of these tubes enlarged, showing a contraction or stricture near their upper termination, and the same below.

Position and locality. In the Trenton limestone, Carlisle, Pennsylvania.*

105. 3. STREPTOPLASMA CORNICULUM (*n. sp.*).

PL. XXV. Figs. 1 *a, b, c, d, e.*

Turbinate, curved near the base, which terminates in an acute point, somewhat rapidly expanding above; cup profound; lamellæ about sixty; surface marked by strong longitudinal lines indicating the lamellæ, which are crossed by fine concentric wrinkled lines.

Length varying from three-fourths to one and a half inches.

This species has usually been referred to *Cyathophyllum ceratites* of GOLDFUSS; but an examination of its structure proves that it does not belong to the Genus CYATHOPHYLLUM.

Fig. 1 *a.* A small nearly perfect individual.

Fig. 1 *b.* A larger specimen.

Fig. 1 *c.* A short and less curved specimen, with the surface distinctly marked.

Fig. 1 *d.* A portion of the surface of the last enlarged.

Fig. 1 *e.* Vertical section on one side of the centre.

Position and locality. This species occurs principally in the thin shaly layers intervening between the calcareous beds in the lower part of the rock. It is found at Trenton Falls, Middleville, Turin, Watertown, and at numerous other localities. (*State Collection.*)

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* The species described by DEFRANCE is from a very ancient rock, according to the remarks of DE BLAINVILLE, and, we may presume, from the same formation as our own, rendering it the more probable that the two are identical species. The only observed difference between the two is in the apertures of the tubes, which, in our species, are not circular as represented in the figure of DE BLAINVILLE. The figure of *Coscinopora sulcata* (GOLDFUSS, Plate ix. fig. 19 *b*) resembles very closely the upper or inner surface of our coral; but the species from the lead-bearing limestone of the West, usually referred to *Coscinopora sulcata*, is totally different from our species, and probably distinct from that of GOLDFUSS, since that species is referred by him to the Jura limestone.

106. 4. STREPTOPLASMA CRASSA (*n. sp.*).

Pl. XXV. Figs. 2 *a*, *b*, *c*.

Obliquely turbinate, slightly curved, gradually expanding upwards from an obtuse point; lamellæ about fifty, coarse and strong; surface marked by longitudinal lines coincident with the lamellæ; transverse lines obsolete.

The whole aspect of this specimen is strong and coarse, differing essentially from the last, which presents a neat symmetrical outline and surface. The interior presents some apparent irregularity in the lamellæ, showing a depression toward the more expanded side of the coral, somewhat like Caninia. The structure otherwise, however, is unlike Caninia, and, as in Streptoplasma, consists of simple vertical lamellæ.

This species resembles in some degree the one so common in the Black-river and Birdseye limestones, but the lamellæ are coarser and stronger, and equal in thickness to twice the space between them.

Fig. 2 *a*. Lateral view of a specimen, the edges somewhat broken.
Fig. 2 *b*. Longitudinal section, showing the internal arrangement of the lamellæ.
Fig. 2 *c*. View of the cup, showing imperfectly the meeting of the lamellæ in the centre.

Position and locality. Trenton limestone, near Middleville. Rare.

107. 5. STREPTOPLASMA MULTILAMELLOSA (*n. sp.*).

Pl. XXV. Figs. 3 *a*, *b*, *c*.

Obliquely turbinate, somewhat curved, rapidly enlarging above; cup moderately deep; lamellæ about 120, thin, edges apparently slightly crenulated; exterior covering thickened, smooth.

This species somewhat resembles the *S. corniculum* in form; but it is more robust, the lamellæ more numerous, and the cup more shallow. The outer edges of the lamellæ, where denuded of their covering, appear to be crenulated or wrinkled, and the spaces between them are twice their thickness: this last character alone is probably sufficient to distinguish the species from the two preceding.

Fig. 3 *a*. Lateral view of a specimen, somewhat shortened from wearing off of the smaller extremity.
Fig. 3 *b*. Transverse section, showing the thin lamellæ.
Fig. 3 *c*. An enlarged portion of the denuded outer surface.

Position and locality. In the grey crystalline part of the Trenton limestone, Watertown, Jefferson county; and near Trenton, Oneida county. (*State Collection.*)

108. 6. STREPTOPLASMA PARVULA (*n. sp.*).

Pl. XXV. Figs. 4 *a*, *b*, *c*.

Turbinate, curved, somewhat gradually expanding above ; cup deep, occupying about one half the length of the specimen ; lamellæ few (about 30), strong ; surface smooth ; edge of the cup not recurved.

This species is much smaller than either of the preceding, and, presenting a nearly smooth surface, differs externally from the young specimens of *S. corniculum*. The lamellæ are also fewer than in that species, and are comparatively thinner and weaker than in *S. crassa*. In many instances the margin is broken off to the depth of the cup, showing the lamellæ in the centre as high as on the outer margin, but this is always due to accident.

It is much more numerous than either of the preceding species, and is rarely associated with them in the rock.

Fig. 4 *a*. The lower part of a specimen of ordinary size, with the margin of the cup broken off, showing the lamellæ within.

Fig. 4 *b*. Transverse section of the same, showing the simple radiating lamellæ.

Fig. 4 *c*. A group of the same. Three of the specimens lie upon the surface of the stone, with their bases nearly in contact.

Position and locality. In the thin shaly layers just above the Birdseye limestone, at Middleville, Herkimer county. (*State Collection.*)

109. 1. PORITES? VETUSTA (*n. sp.*).

Pl. XXV. Figs. 5 *a*, *b*.

A sub-hemispheric coral, composed of irregular concentric laminæ ; cells vertical to the laminæ ; openings upon the surface, nearly circular, with internal vertical lamellæ which reach half way to the centre.

To some extent, this specimen presents the character of Porites, in a great degree of perfection. The surface of the specimen being weathered, the radiating lamellæ are often obliterated. The centre of the cells are also destitute (perhaps from weathering) of the fine elevated points characteristic of some recent species of the Porites.

This is the only species known to me in the lower term of our system, which presents, in any degree of perfection, the characters of the recent Porites.

Fig. 5 *a*. Surface of the specimen, a part only showing the cells.

Fig. 5 *b*. A portion magnified. The figure on the right hand is one of the cells more distinctly enlarged.

Position and locality. In the lower part of the Trenton limestone, near its junction with the Black-river limestone. Watertown, Jefferson county.

110. 1. ——— CYATHIFORMIS (*n. sp.—Genus undetermined*).

PL. XXV. Figs. 6 *a, b, c*.

Depressed cyathiform, concave in the centre; edges thick, rounded, reflexed; upper surface reteporoid or irregularly reticulated; spaces somewhat elongated, rhomboidal.

The outer surface is scarcely visible, but, as far as seen over the edge of the cup, it is reticulated. The upper and inner surface has a reticulated structure, with almost uninterrupted concentric rugose lines and fainter transverse lines. From the state of the specimen, its structure cannot be fully made out, but it may belong to the Retepore family.

Fig. 6 *a*. View of specimen, looking upon the upper or inner surface.
Fig. 6 *b*. Lateral view of specimen.
Fig. 6 *c*. Enlarged portion of the inner surface, showing the structure and arrangement of the cells.

The form of this fossil is very similar to that of some species of TRAGOS or SCYPHIA, figured by GOLDFUSS.

Position and locality. In the Trenton limestone, Carlisle, Pennsylvania.

(*Cabinet of* Mr. CONRAD.)

GENUS ESCHAROPORA.

[Greek, εσχαρ, a scar, and πορα, pore or cell.]

Character. Coral consisting of a solid cylindrical or subcylindrical stem, gradually tapering above, expanded and attached by rootlike ramifications below; surface entirely celluliferous; mouths of cellules oval, scarcely contracted, enclosed in a rhomboidal space formed by elevated oblique lines which cross the coral in two directions; cellules consisting of oval tubes of nearly equal dimensions throughout, which radiate in an ascending direction from an imaginary axis.

This genus is proposed to include the peculiar fossils figured on Plate XXVI. figs. 1 *a, b, c, d, e*, and fig. 2, which can scarcely fall under any genus already constituted. The coral consists of a cylindrical stem, which is never branched in any specimens yet seen. The opening of the cells upon the surface is very similar to ESCHARA, but more like those of the proposed Genus STICTOPORA. In unworn specimens the surface presents the rhomboidal divisions, within which are the oval cellules as in the last named genus; but it differs from that genus in having no internal axis separable from the outer celluliferous crust, and in the entire surface being covered with cellules, while the edges of the STICTOPORA are usually free from them, being sharp, and often striated.

111. 1. ESCHAROPORA RECTA.

Pl. XXVI. Figs. 1 *a, b, c, d, e, f, g*.

Coral straight, rigid, unbranched, cylindrical or slightly compressed.

The essential characters are expressed in the remarks under the generic description.

Fig. 1 *a*. Specimen natural size; the lower extremity expanding to form the rootlike processes, and terminating abruptly above.

Fig. 1 *b*. An enlarged portion, showing the arrangement of cells, which are apparently in ascending spiral lines around the axis.

Fig. 1 *c*. A small specimen, entirely cylindrical, tapering above to an acute point.

Fig. 1 *d*. An enlarged portion, showing the oblique elevated lines crossing the surface, in the spaces between which are the openings of the cellules. These lines are partially obliterated in worn specimens.

Fig. 1 *e*. The root or attaching part of this coral : the branches embrace a portion of stony matter. Upon the base of the broken shaft of the coral, a portion of the surface is marked as the specimen 1 *a*.

Fig. 1 *f*. Transverse section of the axis of this specimen.

Fig. 1 *g*. A longitudinal section of one of these corals, a little on one side of the centre, showing a few ranges of the apertures of the cells, and the diverging and ascending tubes on either side.

Position and locality. In the Trenton limestone, both in its lower and central portions. Middleville, Jacksonburgh, &c. Herkimer county. (*State Collection*.)

112. 2. ESCHAROPORA RECTA, *var*. NODOSA.

Pl. XXVI. Fig. 2.

This coral consists of a fragment somewhat bent. The surface presents the same arrangement of cellules as in the figs. 1, differing only in the nodulose elevations on the elevated ridge along the centre of the shaft.

Genus STICTOPORA.

[Greek, στικτος, spotted or punctured, and πορα, pore.]

Character. A foliaceous, somewhat calcareous, branching coral, attached below by a smooth rootlike expansion; stems and branches bifurcating, and sometimes coalescing, celluliferous on both sides, with a thin central axis; cellules consisting of oval tubes, not urceolate or utricular; apertures distinctly oval, with a raised border nearly as large as the cell within.

Remark. Although it is impossible to define precisely what was the orginal form of the mouths of these cellules, yet, from finding large numbers of them unworn and apparently perfectly preserved, we are able to decide that they differ from ESCHARA and FLUSTRA, with which they seem to be closely allied, as well as with CERIOPORA in some instances.* We are able to characterize several species, depending for their distinction partly on their mode of growth, and partially upon the arrangement of the cellules upon the surface.

113. 5. STICTOPORA? ACUTA.

PL. XXVI. Figs. 3 *a*, *b*.

Compare *Eschara? scalpellum.* LONSDALE in Silurian System, pag. 679, pl. 15, fig. 25, 25 *a*.

Branches numerous, bifurcating, celluliferous on both sides; cells oval, nearly opposite on the two sides; outer rows of cells sometimes smaller and less distinct; margins of the coral solid, smooth and sharp on the edges.

The branches are marked by from seven to nine rows of oval cells, which, when perfect, are surrounded by an elevated border. The coral is usually so much worn that the edges of the apertures do not rise above the surface of the branches.

In general form and appearance, this species resembles the *S. ramosa* of the Black-river limestone; but on a careful examination, it proves clearly distinct. The number of rows of cells is fewer, and the cells larger; the edges of the branches are solid, smooth and sharp, while in that species the cells extend entirely to the margin. The most essential difference, however, is the apparent absence of an axis in this species; while the *S. ramosa*, as the other species of the genus, is separable into a thin celluliferous crust from each side, between which is a thin flat axis.

This species is placed provisionally under the Genus STICTOPORA, from its general analogy of form and mode of growth; but a further examination may make it necessary to remove it to the Genus ESCHAROPORA, from the structure of the axis, which appears to be inseparable from the celluliferous crust.

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* Mr. DANA, to whom I have submitted the examination of some of these species, suggests that *S. ramosa* is rather nearer CELLEPORA than FLUSTRA. He thinks that the open cell is owing (as in MEMBRANIPORA) to the exterior not having been calcareous (*Letter to the Author, Aug.* 19, 1846). The broad foliaceous expansions of *S. labyrinthica* bear some resemblance to MEMBRANIPORA, but the cells are not narrowed below.

The Genus CERIOPORA of GOLDFUSS includes some forms (pag. 217, pl. 65, figs. 11, 12 & 13), which are very analogous to our corals; but this genus is composed of heterogeneous materials, as is clearly proved by a reference to his figures and descriptions. A large number of the species given by GOLDFUSS under this genus are distributed by other authors under ALVEOLITES, CHRYSAORE, HETEROPORA, PUSTULIPORA and SPINIPORA; leaving, among others under CERIOPORA, several species very analogous, in the form and arrangement of cellules, to those I have placed under the proposed genus STICTOPORA. These, however, depart so widely from the type of the genus, according to the description of the author, that it appears preferable to arrange them under another term, by which, at least among the palæozoic fossils of the United States, it is believed that they can be readily recognized.

The essential difference between this genus and ESCHAROPORA, and which induces me to separate the two, lies in the existence of a thin foliaceous axis separating the bases of the cells in STICTOPORA, as shown on Plate iv. fig. 4, and Plate xxvi. fig. 4 *d* & *f*, and which does not exist in the typical species of ESCHAROPORA; the cells, as in ramose forms of FAVOSITES and other similar corals, radiating from an imaginary axis.

Fig. 3 *a.* A small fragment of limestone, with several branches of the coral upon its surface.
Fig. 3 *b.* An enlarged portion of one of the branches.
Fig. 3 *c.* Transverse section of two branches of the coral, just above the bifurcation.

Position and locality. This species is of frequent occurrence in both the lower and central portions of the Trenton limestone. The finest specimens have been obtained from the lower thin shaly layers, the surfaces of which it sometimes nearly covers. The beautiful specimen in the State Collection is from near Herkimer village. It also occurs at Trenton Falls, Middleville, Boonville, Sugar River, Watertown, Plattsburgh, Glen's Falls, &c.

114. 6. STICTOPORA ELEGANTULA.

PL. XXVI. Figs. 4 *a, b, c, d, e, f, g.*

Branches compressed, rigidly bifurcating, and usually more or less curved, celluliferous on both sides of a striated axis ; cellules roundish oval, margins distinctly elevated, closely arranged in alternating lines ; margins of the branches solid, beautifully striated, sharp on the edges.

This species is readily distinguished from the last, by the usually shorter and broader branches, by the greater number of rows of cells, and their more rounded form, as well as the beautifully striated margins of the branches. The celluliferous crust frequently separates from the central axis, which presents a striated surface, with marks of the bases of the cellules arranged between elevated concentric lines. A similar character will be observed in the species of this genus figured on Plate IV., and may be regarded as characteristic of the genus.

Fig. 4 *a.* A small fragment of the natural size, showing the form of branches and arrangement of cells.
Fig. 4 *b.* A small part of the same enlarged. The form of the cells is more rounded than appears in this figure.
Fig. 4 *c.* The entire specimen fig. 4 *a* enlarged, to show more distinctly the arragement of the cells, the striated margin, etc.
Fig. 4 *d.* A small specimen, bifurcating above, with the celluliferous crust nearly removed, a few of the cells only remaining near the base. The longitudinal and concentrically transverse striæ are clearly shown.
Fig. 4 *e.* A small portion of the same enlarged.
Fig. 4 *f.* A more elongated specimen ; the branches narrow, and bifurcating more nearly like the last species. The celluliferous crust is removed, leaving the central striated axis.
Fig. 4 *g.* A small portion of the last enlarged.

The specimen 4 *f* is referred to this species, though with some hesitation, from the narrow and more extended branches, and fewer rows of cells, the exact form of which cannot be ascertained.

Position and locality. In the central portions of the Trenton limestone, associated with *Orthocerata, Conularia, Orthis testudinaria, Trilobites,* &c. Middleville, Trenton Falls, Jacksonburgh, and other localities in the Mohawk valley. (*State Collection.*)

115. 2. GORGONIA PERANTIQUA.

PL. XXVI. Figs. 5 *a*, *b*.

Coral consisting of numerous small branches proceeding from a central point; branches bifurcating, smooth, or very finely striated; cellules arranged on two sides of the axis, opening laterally.

The specimen consists of a number of lax branches, apparently diverging from a centre or point of attachment: these branches are several times subdivided, but present no evidence of connecting bars.

The species is exceedingly rare, a single one being all that has fallen under my notice.

Fig. 5 *a*. The specimen, natural size.
Fig. 5 *b*. A portion of a branch enlarged, showing the openings upon the two sides of the axis.

Position and locality. In the soft shaly layers of the lower part of the Trenton limestone, near Middleville, Herkimer county.

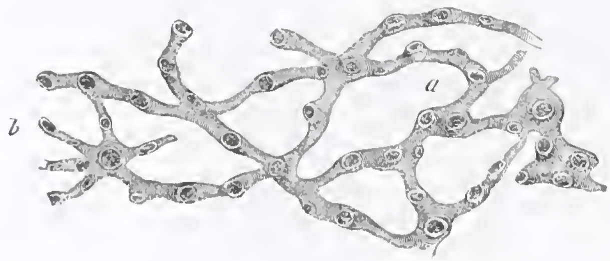
116. 1. AULOPORA ARACHNOIDEA.

PL. XXVI. Figs. 6 *a*, *b*, *c*.

Coral consisting of a fine weblike expansion, diffusely branching and anastomosing, attached to the surface of other bodies; tubes narrow, slender, short, subclavate or straight, single; mouth slightly elevated, opening obliquely upwards, smaller than the cell below.

This very delicate species, in some portions of its extent, bears considerable resemblance to *Alecto dichotoma* of the Jura limestone (LAMOUROUX, *Exp.*, p. 84, t. 81, f. 12 – 14; BLAINVILLE, *Man. d'Act.*, p. 464, t. 65, f. 1; *Aulopora dichotoma*, GOLDFUSS, *Petrefaeta*, pag. 218, pl. 65, fig. 2); but other portions develop a structure scarcely compatible with this genus, and I have therefore placed it under the Genus AULOPORA. The illustration below presents a magnified view of a distinct part from that shown on the plate, and exhibits the essential characters of AULOPORA.* It is the only species of the genus known

* A magnified portion of this fossil, a part of which (*a*) shows the character of AULOPORA, while other portions (*b*) more nearly resemble ALECTO.



to me in the lower term of our system, and on this account is more interesting, as showing the early commencement of this peculiar form of coral, which is known only in a fossil state. The lowest position in which it has been known previously, is the Wenlock limestone, and the upper limestone of the Caradoc (*Silurian System*, p. 676); others occur in the Eifel (Devonian), and other species are known in the Oolite and Jura limestones.

This is not a common fossil in the Trenton limestone, though it has been seen in several localities widely separated, thus proving its great geographical range.

Fig. 6 *a*. The dorsal valve of ***Delthyris lynx***, having the inner side of the shell spread over with a fine web of this little coral.

Fig. 6 *b*. A magnified portion, showing the form of the cells, openings, etc.

Fig. 6 *c*. Two of the cells still farther magnified. The openings and structure, in these portions, are more like ALECTO than AULOPORA.

Position and locality. In the blue shaly limestone of Ohio and Kentucky, equivalent to the Trenton limestone of New-York.

117. 1. ALECTO INFLATA.

PL. XXVI. Figs. 7 *a*, *b*.

Coral attached, arachnoid ; tubes short, much expanded above, contracting at the aperture, and narrowing rapidly below ; mouths large, opening obliquely upwards.

This coral resembles the last in its mode of growth and general appearance ; but the tubes are more expanded or vesicular above, and the little mouths are proportionally more distinct. It is clearly referrible to the Genus ALECTO, in its mode of growth, form, and arrangement of cells, which proceed one from the other, each base being a little below the aperture of the previous one.

Fig. 7 *a*. Dorsal valve of *Leptæna alternata*, on the outer surface of which this coral is affixed.

Fig. 7 *b*. Two of the tubes magnified, to show their form.

Position and locality. This coral occurs in the central part of the Trenton limestone, associated with the *Trilobites*, *Brachiopoda* and *Orthocerata* of the rock. Trenton Falls, Oneida county.

118. 1. INTRICARIA? RETICULATA.

PL. XXVI. Figs. 8 *a*, *b*, *c*.

Coral composed of a great number of filiform cylindrical branches, which anastomose irregularly, and spread over a considerable surface, apparently attached to some other body ; cells in a single row on the upper side of the branches ; mouths of the cells circular or slightly oval.

This coral presents the essential characters given by DE BLAINVILLE for the INTRICARIA, a genus established by DEFRANCE for a fossil coral. Our species is composed of fine filiform branches, which diverge and anastomose, sometimes with a considerable degree of regularity, leaving oblong hexagonal spaces between. At other times they are irregular in their mode of branching and uniting. The worn branches are smooth, showing that the cells do not penetrate beyond the outer crust of the coral. The cells are in a single row, except just below the bifurcation of the branches, where there is a double row.

This beautiful little coral is exceedingly obscure, and has been observed only on the weathered surfaces of the rock, though it is believed to have a somewhat extended geographical range. It is found associated with species of STICTOPORA, and small ramose forms of the *Chætetes lycoperdon*.

Fig. 8 *a.* A small fragment of the rock covered by this coral, and fragments of one or two other species (natural size).
Fig. 8 *b.* A portion magnified, showing the apertures of the cells, and the mode of branching and anastomosing. A small fragment of another coral lies across the specimen.
Fig. 8 *c.* A small portion of a branch still more enlarged, showing the apertures of the cells.

Position and locality. In the lower concretionary portion of the Trenton limestone at Watertown, Jefferson county; also in the regularly stratified portions of the same rock near Ticonderoga, on the shore of Lake Champlain. (*State Collection.*)

119. 3. RETEPORA? FOLIACEA.

PL. XXVI. Figs. 9 *a, b.*

The specimen is a small fragment, apparently of the non-poriferous surface of RETEPORA. It is a thin expanded coral, presenting a tessellated surface as represented in the figure; the small sharp elevated ridges not crossing each other directly, but appearing as if knotted at their junction.

This single specimen is all that has been seen, and farther observation is required to decide satisfactorily the generic relations of the coral. It is presented here, in the hope of calling the attention of observers to the existence of such a form in the Trenton limestone; and, also, that if it prove to be a RETEPORA, it is the lowest position, geologically, in which the genus is known.

Fig. 9 *a.* The specimen (natural size), upon the surface of limestone, with other corals.
Fig. 9 *b.* The surface of the same enlarged.

Position and locality. In the shelly part of the Trenton limestone, nearly half way from the base to the top. Lowville, Lewis county.

GENUS STELLIPORA.

[Greek, στέλλα, a star, and πορα, pore.]

Character. Coral consisting of a thick expanding crust, apparently attached to some other marine body; surface with numerous star-shaped prominent elevations; stars composed of 4 to 9 strong elevated rays, the upper edges of which present numerous elevated points or pores.

This peculiar coral approaches nearer to the ANTHELIA, than to any other genus represented in works within my reach. The stars have not the distinct circular centre represented in the figure of M. DE BLAINVILLE, but in other respects they correspond very nearly.

120. 1. STELLIPORA ANTHELOIDEA.

PL. XXVI. Figs. 10 *a, b, c.*

The specimen, which is a fragment only of a larger thick crustaceous expansion, presents upon its surface about ten perfect star-shaped elevations, with remains of several others upon the fractured edges of the specimen. These stellated elevations are irregularly disposed, and not of uniform size or number of rays; the smaller having the fewer rays, and appearing to be near the margin of the coral. The intermediate space is almost smooth, or finely granulated.

For this unique and very interesting specimen, I am indebted to LUKE WILDER, Esq. of Lowville, Lewis county, whose zeal and discrimination have enabled him to collect a very fine cabinet of the fossils of the Trenton limestone. This coral is associated with fragments of two or three species of *Trilobites*, *Orthis testudinaria*, *Chætetes*, *Stictopora*, and the last noticed species of *Retepora ?*

Fig. 10 *a*, represents the fragment, with the prominent star-form cells of the natural size.
Fig. 10 *b*. Three of these stars enlarged, showing points or pores upon their upper surface. One of these stars has a slightly irregular form in the centre, as if composed of parts of two: this is true of several others.

Position and locality. In the central part of the Trenton limestone. Lowville, Lewis county.

121. 1. GRAPTOLITES AMPLEXICAULE.

PL. XXVI. Figs. 11 *a, b.*

Compare *Graptolites foliaceus*. PORTLOCK, Geol. Report of Londonderry, Tyrone, &c., pag. 320, pl. 19, fig. 9 *a, b, c.*

Stipes slender, linear, elongated, surrounded by small sheathing folioles or scales, giving it a serrated appearance; folioles small, acute.

This species, although compressed, has still considerable thickness of substance, unlike those in the slate, which are compressed to extreme tenuity. The substance appears to have been partially calcareous, or at least corticiferous, and, being imbedded in compact limestone, has retained more nearly its original character than those imbedded in the soft shales, where any calcareous matter would have been removed. The central stipe is clearly surrounded by small triangular scales, which sheath at the base, and taper abruptly to an acute point above. This structure, where the whole is flattened, gives a serrated character to the stipes.

This fossil is not uncommon in the Trenton limestone, though it never occurs so abundantly as other species do in the slates above.

Fig. 11 *a.* A group of these fossils; all the stipes, except one, having been broken off by a fracture of the stone.

Fig. 11 *b.* An enlarged portion, showing the edges of the sheathing scales.

Position and locality. In the central part of the Trenton limestone. Trenton Falls, Middleville, &c.

CRINOIDEA OF THE TRENTON LIMESTONE.

PLATES XXVII., XXVIII. & XXIX.

Notwithstanding the fact that some portions of the Trenton limestone are composed in a great degree of the broken and comminuted remains of the CRINOIDEA, still it is very rare to meet with specimens approaching to perfection. Much difficulty has been encountered in consequence of this circumstance, since the numerous fragments of columns, apparently belonging to different species, rendered it necessary to make some disposition of them. One or two fortunate discoveries, among this family of fossils, has enabled me to decide satisfactorily as to the reference of the columns which are most numerous, leaving but few undetermined fragments.

In addition to the CRINOIDEA of this ancient period, we have, in the Family ECHINODERMATA, the Genus ASTERIAS, which appears in this rock in unequivocal form and condition.*

The CRINOIDEA of this period are not only specifically distinct from those in the succeeding geological eras, but, together with those of the Hudson-river rocks, present the characters of a group or family quite distinct from any similar group in the higher strata.

* The small tubercle, from the Chazy limestone, figured on Plate iv., though perhaps not entirely satisfactory as proof of the existence of ASTERIAS at that period, offers a presumption which is strengthened by the occurrence of an unequivocal species in the Trenton limestone, several individuals of which have been found.

GENUS SCHIZOCRINUS.

[Greek, σχιζω, to cleave; in allusion to the cleft or double interscapular plates.]

Character. Pelvis composed of five pentagonal plates; first costals five, joining at their lateral edges; second costals five, separated by a hexagonal intercostal plate, which rests upon the upper lateral edges of the lower costals; scapular and arm-plates five, hexagonal, the lower side curved and fitting the concave upper edge of the plates below; hand-joint double or bipartite, as also the interscapular or interbrachial plates; hands and fingers regularly bifurcating.

This genus, in its general features, bears a close resemblance to some species of the CYATHOCRINUS; but the greater number of series of plates, and the duplicate character of the interscapular plates, is sufficient to separate it from that genus. It bears considerable resemblance in its characters to the *Dimerocrinites* of PHILLIPS, presenting nearly the same deviations from *Cyathocrinus* which that genus does from *Actinocrinites*.

122. 1. SCHIZOCRINUS NODOSUS (*n. sp.*).

PL. XXVII. Figs. 1 *a* – *p*.

Body cupshaped, obtusely pentagonal, spreading somewhat abruptly from the column; arms short; fingers in ten pairs, fimbriated; column round, composed of joints of unequal thickness and diameter, the larger ones furnished with side-arms; surface of the joints deeply striated in radii, which give a serrated appearance to the edges of the plates.

This species is perhaps the most abundant of any in the Trenton limestone, though usually seen only in fragments of columns. The column, as in many other species, varies considerably in appearance at different distances from the body; which characters require to be considered, in order to recognize the same when found in small fragments. The thin upper plates of the column are about equal in thickness and diameter; and for some distance below this the column is composed of alternating larger and smaller plates, the larger ones being thicker, and gradually becoming nodulose on their margins. In tracing the column downward, there is a gradual increase in number of the smaller plates between the larger ones; the second stage being two, the third three, and the fourth four; and, in the mean time, the larger plates become furnished with side-arms. When the number of intermediate plates between the arm-plates reaches the number of five, the central one shows a tendency to thickening and enlargement, and does, at least in a great number of instances, assume the character of the thicker armed plates, which finally become equally developed with the others. This change in the character of the column at different distances from the body presents a great variety of aspect, and, when examined in fragments, is liable to lead the student astray, by inducing him to refer fragments of the same species to different ones.

In weathered specimens of this column, the edges present a beautiful serrated appearance, from the elevated striæ upon the plates of the column joining together, the elevations of one filling the depression in the other. The side-arms of the larger joints are rarely seen of any considerable length, the bases being all that usually remain of them.

Fig. 1 *a*. A nearly perfect individual of this species, with portions of the fingers and several inches of the column attached. The column, in its different parts, shows the structure which the other fragments of columns present.

The body is composed of plates arranged as follows :

Fig. 1 *b*. E. Pelvis, composed of five small pentagonal plates.

$\frac{F}{a}$. First costal plates five, heptagonal, resting upon the upper and inner edges of the pelvic plates.

$\frac{F}{b}$. Second costal plates five, hexagonal, resting upon the upper edges of the costal plates.

H. Scapulars five, hexagonal, and resting directly upon the last.

G. Intercostal plate.

I. Double interscapular plates.

The intercostal plate supports upon its upper lateral edges a pair of interscapular plates, which are in turn succeeded by two other pairs of similar plates; the last pair truncated on their upper angles, and more deeply excavated between, supporting on the upper and inner lateral edges a small quadrangular plate, and upon the truncated upper edges a pair of larger quadrangular plates.

K. Brachial plates. Each of the scapulars is surmounted by a hexagonal brachial or arm-plate, which supports a double cuneiform arm-joint $\frac{L}{K}$, from which proceed the hands and fingers M, N.

Fig. 1 *c*. Part of one of the tentaculated fingers of this species. The tentacula are long, and not jointed; the joints of the fingers are cuneiform, the tentacula being attached to the broader side of each joint.

Fig. 1 *d*. A part of one of the fingers magnified, showing the tentacula attached to the broader side of the plate.

Fig. 1 *e*. A fragment of a small column. *f*. The same enlarged, showing characters precisely similar to the fragments of larger columns.

Fig. 1 *g*. A column of large size; the upper part showing the larger thick plates, which are nodulose on their margins, alternating with three thinner plates : lower down the number of intermediate plates becomes four, and below this five, when the central one becomes thicker and broader, the edges projecting beyond the others.

Fig. 1 *h*. A fragment of a small column; the surface worn nearly smooth, and presenting only the points of attachment of the side-arms on the thicker joints.

Fig. 1 *i*. A small column; the larger joints unusually projecting, and their edges elevated.

Fig. 1 *k*, *l*, *m*. Fragments of columns from different parts, showing the alternation of larger and smaller plates, points of attachment for side-arms, and the weathered surface exhibiting the serrated appearance of the edges of the plates.

Fig. 1 *n*, *o*. Specimens showing the character and aspect of fragments of different parts of the column. In some portions there are six, seven, and eight intermediate plates, the central ones usually extending a little beyond the others, and showing a nodulose margin.

Fig. 1 *p*. Ends of the plates of the columns, showing a striated surface.

This column, though so variable, is still so different from the columns of other species, that there will be no difficulty in recognizing the species even from small fragments.

Position and locality. This species occurs in nearly every part of the Trenton limestone, being more abundant in the lower strata than in any other position in the rock. The columns are found in great abundance at Middleville, Herkimer county; also at Trenton Falls and Jacksonburgh. The specimen fig. 1 *a* is from Glen's Falls, where it is found in the shaly portions of the limestone. It is found also at Plattsburgh, Watertown, and numerous localities in the Mohawk, Champlain and Black River valleys.

123. 1. POTERIOCRINUS ALTERNATUS (*n. sp.*).

Pl. XXVIII. Figs. 1 *a*, *b*, *c*, *d*, *e*, *f*.

Body obconical, gradually expanding above, and furnished with fimbriated tentacula. The pelvis is composed of five narrow pentangular plates, which gradually enlarge above, and support on their oblique upper edges five hexagonal costal plates, which are surmounted by the heptagonal brachial or arm-plates.

This species presents all the essential generic characters of *Poteriocrinites* of Miller, except that I have not been able to observe the interscapular plate. Each of the arm-plates supports a tentaculated finger, which is subdivided above. The column, as far as known, is comparatively slender, composed of thickened plates with rounded edges, which alternate in size, continuing uniform in this character for several inches.

Fig. 1 *a*. A specimen upon the weathered surface of the limestone, showing imperfectly the structure and arrangement of the plates, with the tentacula and a portion of the column below.

Fig. 1 *b*. Shows the arrangement of the plates around the column, and the attachment of the fingers to the upper part of the brachial plate.

Fig. 1 *c*. A brachial plate separated.

Fig. 1 *d*. A costal plate separated.

Fig. 1 *e*. A pelvic plate.

Fig. 1 *f*. A portion of the column of this species, showing the alternating width and rounded edges of the plates.

The figures here given are from parts of several individuals, and will enable the student to detect the specific character of the fossil with little difficulty. The column, however, appears more characteristic than any other part of the animal, for the shape of the plates resembles the next species.

Position and locality. This fossil is found in the grey crystalline portion of the Trenton limestone, in Turin, Lowville, &c. in Lewis county, and also in the lower portions of the same rock at Middleville, Herkimer county. Fragments of the column are found in numerous localities, and, being so unlike any other species of this rock, are readily referred to their proper place. (*State Collection.*)

124. 2. POTERIOCRINUS GRACILIS.

PL. XXVIII. Figs. 2 *a, b, c, d, e, f.*

Body small, obconical, gradually expanding above, surmounted by long slender bifurcating tentacula, which are not fimbriated.

The pelvic and costal plates are precisely in form like those of the last species, but the brachial plate is much shorter, and but five-sided; the attachment of the fingers upon the upper side is by a broad plate. The surface of the plates is finely granulated, appearing nearly smooth to the naked eye. The fingers are thrice bifurcated above the hand-joints, and, towards their termination, appear to be covered by a muscular integument. The column is proportionally much larger than in the last species, and is composed of thin even plates, which are closely adhering at the margins, and sometimes appear striated longitudinally, the whole presenting an appearance as if covered by an integument. A few of the upper joints of the column, only, have been seen in a single specimen; the last joint adheres closely to the base of the pelvis. This species differs, likewise, in the much greater length of the tentacula, which are somewhat unequally bifurcated above, and composed of long smooth joints, while in the previous species the fingers are tentaculated and shorter.

The irregular intercostal (interscapular of MILLER) plate is distinguishable in this species, showing that it is clearly referable to this genus.

Fig. 2 *a.* A specimen of the natural size, which is broken off just below the last joint of the column, which adheres closely to the pelvis. The tentacula are broken off above, before reaching their termination.

Fig. 2 *b.* The same enlarged, showing more clearly the arragement of the plates, and the situation of the intercostal plate.

E. Pelvis.
F. Costal plates.
J. Irregular intercostal plate.
H. Scapular plate.

Fig. 2 *c.* The body of another specimen, with a few of the last joints of the column attached.

Fig. 2 *d.* The same enlarged, showing the intercostal plate and the structure of the column.

Position and locality. This species has been found only in the soft shaly layers near the base of the Trenton limestone, at Middleville, Herkimer county.

(*From the Collections of* Mr. WADLEIGH *and* Dr. EMMONS.)

Genus SCYPHOCRINUS.

[Greek, σκυφος, a little cup, and κρινος, a lily.]

Character. Pelvis composed of five pentagonal plates; costal plates five, four of them heptagonal, and one irregular and octagonal; a second row of costal plates, or perhaps more properly a double row of scapular plates, which are similar, uniform and quadrangular, except over the irregular costal plate; scapulæ supporting a cuneiform arm-joint, interscapular and interbrachial plates.

It appears necessary to designate this crinoidean by a new term, since those with which I am acquainted differ from it in some essential points. Disregarding any thing more than general analogy and habit, we should readily refer this species to Cyathocrinus; but taking into account the details of structure, we are compelled to remove it from that genus.

It may be found that the general characters here given can be extended so as to include several others which do not fall under any constituted genus.

125. 1. SCYPHOCRINUS HETEROCOSTALIS (*n. sp.*).

Pl. XXVIII. Figs 3 *a, b, c, d, e, f.*

Body cupshaped, expanding above with five double arms; pelvis saucer-shaped, composed of five pentagonal plates, which are closely adhering among themselves, and to the last joint of the column; costal plates somewhat heptagonal, one of them somewhat irregularly eight-sided; scapulars and second scapulars subquadrangular, supporting above a cuneiform arm-joint, which again sustains upon its oblique upper edges two ranges of plates, which, continued, form the fingers; interscapular plate sub-cuneiform below and quadrangular above, with oblique sides which support two interbrachial plates, against which the edges of the cuneiform arm-joint rest.

The structure is fully explained by the figure 1 *b*, where the dotted lines connect the sides of the plates as they are arranged in the fossil.

The column is round, moderately large, and composed of joints which alternate in this manner: the last joint, adhering to the pelvis, is a thin plate with crenulated edges, which is succeeded by a thicker joint with a rounded smooth edge; again a thin one with a crenulated or fimbriated edge, and so on alternately. The entire surface of the fossil is rugose or sculptured in lines and points, the edges of the plates joining by slight sutures.

No perfect specimens have been seen, and we are ignorant of the entire length of the fingers and tentacula, which were probably as long as in the last species.

Fig. 3 *a*. A specimen (natural size), with the fingers and column broken off; the form otherwise well preserved.

Fig. 3 *b*. The structure and arrangement of the plates, the letters indicating the parts as explained in the previous figures. The plates are slightly enlarged beyond their natural size.

Fig. 3 *c*. The base of the specimen magnified, to show the fimbriated plate adhering to the base of the pelvis.

Fig. 3 *d*. Lateral view of a smaller specimen of the same species, with portions of the fingers remaining.

Fig. 3 *e*. The same, showing the base, with a fragment of the column broken off and lying at the side.

Fig. 3 *f*. A portion of this column magnified, to show the character of the plates.

Position and locality. In the soft shaly layers interstratified with the calcareous beds in the lower part of the Trenton limestone, at Middleville, Herkimer county.

126. 2. SCHIZOCRINUS?

Pl. XXIX. Fig. 1.

A fragment composed mainly of the fingers and tentacula of an encrinite, closely resembling, and probably identical with, that figured on Plate XXVII. The joints of the fingers are cuneate ; the tentacula attached to the thicker edge ; the latter plain, and not jointed. The fingers are much longer than those of the specimen just referred to, but the individual was also larger : the number is the same in both specimens.

Position and locality. In the compact limestone, associated with numerous shells of this rock, at Sugar River, Lewis county. (*State Collection.*)

BASES OF ATTACHMENT OF CRINOIDEA.

Pl. XXIX. Figs. 2 *a*, *b*.

The base or rootlike attachment of the columns of some species of Crinoidea are sometimes found in this rock, attached to other fossil bodies. The specimens figured are both attached to a worn specimen of the *Chætetes lycoperdon*. It is uncertain to what species they belong.

Locality. Trenton Falls. (*State Collection.*)

COLUMNS OF CRINOIDEA.

Pl. XXIX. Figs. 3 *a*, *b*, *c*.

Pentagonal columns, and fragments of other columns of which the body has not been seen in the Trenton limestone, are sometimes found in the central and higher portions of that formation. For description and illustration of the one figured above, see Crinoidea of the Hudson-river group.

Locality. Middleville, in grey crystalline Trenton limestone.

The specimen fig. 3 *c* is a fragment of an unknown crinoidal column, which presents the peculiarity of being deeply striated longitudinally, and having distant enlarged plates, which project, with rounded edges, beyond the general circumference. It may perhaps belong to the Poteriocrinus or Scyphocrinus, small fragments only of the columns of these having been seen.

Position and locality. Middleville, in the lower part of the Trenton limestone.

Genus ECHINO-ENCRINITES.

Echino-encrinites, Herman Von Meyer, 1826. Karstner, Archiv. fur die Naturlehre, Vol. vii. p. 155 – 192, pl. 2, fig. 1 – 5; Vol. viii. p. 232 – 237.
Echinosphærites, Pander, 1830, *Sp.* Bronn, 1835, *Sp.*
Goniocrinites, Eichwald, 1840.
Echino-encrinus, Volborth, 1842.
Sycocystites, Von Buch, 1844.

This genus is one among the few which Von Buch has included in his family Cystidea, a group intermediate between the Echinidea and the true Crinoidea, and which pass into the latter by the genus Caryocrinus, which combines in some degree the characters of both groups.

The discovery of a species of this genus among the fossils of our older strata furnishes another interesting link, connecting in their palæozoic characters the rocks of the European continent with those of America, and showing that at so early a period, when the peculiar forms of Echinodermata, the Crinoidea, flourished in considerable numbers, a genus also existed which indicated a structure intermediate between that then numerous family, and the future Echinidea, a portion of this great group being at the same geological period represented by a true Asterias.

The following extract, translated from the observations upon this genus in the second volume of the *Geology of Russia and the Ural Mountains*, will convey a more definite idea than my own language; since, thus far, I have had no opportunity of examining any other than very imperfect specimens.

This easily characterized genus belongs, as well as the Echinosphærites, to the Crinoidea with closed summits and destitute of arms, or the Cystidea of M. de Buch; but it is distinguished from the first, by the small number of its plates, their form and their regular arrangement. We find in them, indeed, only four basal plates, ten intermediate plates forming two ranges of five each, and five superior plates which unite at the summit. Of the four basal plates, three are quadrangular, and the fourth becomes pentagonal by the truncation of its salient angle. This last is exactly opposite to the two poriferous rhombic plates, of which we shall speak immediately; and upon its truncated side is placed one of the plates which extends to the great lateral circular aperture, and which helps to form its contour. This opening is free, without enclosing plates; and as this is the only one, except the mouth, which we discover on the surface of these bodies, it is very probable that it served both as the *anus* and as an *ovarian aperture.* M. Volborth supposes that it was divided in the interior, to serve this double function. It is certain that we see on none of our specimens the convex and pentagonal star, which is always remarked on the Echinosphærites.

Another very important character of the Echino-encrinites, is their being provided with a thick, round, *creuse*, elastic and contractile stem, which, by its thickness, contrasts with the small, and still so little known stem, of the other genera of the group Cystidea. This stem is not articulated like those of the Encrinites, and appears to be composed of tubes resting one within the other, and graduated like the compartments of a spyglass: it is besides covered with longitudinal striæ, and appears to us, as also to M. Volborth, very analogous to, if not identical with, the *Cornulites serpularius* of authors.*

* See fig. 3, p. 89.

The surface of the Echino-encrinites is irregular, unequal, and embossed. The plates of the shell are convex, sub-pyramidal, and ornamented with thick and reticulated striæ. These striæ, *always perpendicular to the sides of the plate*, as in the Echinosphærites, form, by their combination in successive *chevrons*, five or six rhombs radiating from the centre of these. The union of these rhombs forms triangles inscribed one within the other where the plates are regular, or in part having a common base, when, by the reduction of the sides of a plate, one of the rhombs become rudimentary. The smallest of these triangles, comprised between three faces of the pyramid, corresponds with the angles of the plates of the shell.

The Echino-encrinites is further distinguished by the presence of pores, not disseminated over the entire surface as in the Echinosphærites, but occupying a determinate place, and bordering three small rhomboidal areas. These pores were only imperfectly defined by SCHLOTHEIM in his *Echinosphærites granatum* and by M. HERMAN VON MEYER in his *Echino-encrinites senkenbergii* : it is to M. VOLBORTH that we are indebted for having exactly marked their place (See *Bull. de Saint-Petersbourg*, Vol. x., no. 19, pl. 1, fig. 4, 5, 6). Two of these poriferous rhombs are situated near the base, and have their great diagonals united upon one of the angles of the opening where the stem is inserted; while the third is found on the opposite side, between the mouth and the great lateral opening, and directly above the pentagonal basal plate : the two first are mounted upon the plates of the two inferior ranges, and the last upon those of the two superior ranges.

What was the design of these pores, or elongated grooves, which bound the three rhomboidal areas? It would, doubtless, be difficult to affirm any thing on this subject : it is sufficient to remark that these pores are disposed according to the same law as in the Echinosphærites, or the Hemicosmites; that is to say, that they part from the centre of the plates, and unite at their angles. The middle of the rhomboidal areas are usually striated; but the striæ are less distinct than upon the rest of the crust, and appear sometimes a little worn. The crust is in general solid, and crystallized in rhombohedrons as in all the crinoidea.

The genus *Echino-encrinites* has been established by M. HERMAN VON MEYER, in the *Archives* of KARSTNER, upon a specimen now unfortunately lost. The description and the figure which he gives of it are nevertheless exact enough to enable us to recognize, without hesitation, the fossil bodies of Saint-Petersburgh, confounded by MM. PANDER and BRONN with the Echinosphærites, and named by M. EICHWALD *Gonocrinites*. M. DE BUCH, struck with the impropriety of the name of M. HERMAN VON MEYER, has proposed, in his *Memoire* of this year, to change it for that of *Sycocystites*. Although this name, it must be allowed, may be better than that which we have adopted, we prefer to follow the rule which we have imposed upon ourselves, to preserve always the most ancient names.

The Echino-encrinites belong, as well as the Echinosphærites, to the Lower Silurian system of Russia. M. VOLBORTH, to whom we owe a notice upon those of the environs of Saint-Petersburgh, distinguishes three species of them in this country : the *E. striatus*, *angulosus*, and *granatum*. We possess only the two first of these, and we do not believe that the third species is identical with the *Echinosphærites granatum* (WAHL.), to which this author compares it. Indeed, according to M. DE BUCH, this last species, of which he makes the type of his genus *Caryocystites*, should have a very different number of plates, and the striæ not reticulated. The *Echino-encrinites senkenbergii* (H. VON MEYER) constitutes probably a fourth species. M. BRONN, in his *Lethæa Geognostica*, had reunited it to the *Echinosphærites granatum* (SCHLOT.); but in the additions and corrections of the same work, p. 1284, he says that M. HERMAN VON MEYER has shown that this reunion has no foundation.

The Echino-encrinites appear exclusively to belong to Russia; at least we do not know of their occurrence elsewhere. If the *Cornulites serpularius* is only a part of their stem, there is reason to believe, nevertheless, that they will be found in Gothland and in England, where this singular body has been discovered.

(*Geology of Russia and the Ural Mountains*, Vol. ii. pp. 27, 28 & 29.)

127. 1. ECHINO-ENCRINITES ANATIFORMIS (*n. sp.*).

PL. XXIX. Figs. 4 *a*, *b*, *c*, *d*, *e*, *f*.

Body composed of four series or ranges of plates; basal or pelvic plates four, three of them pentagonal, and one with the upper angle truncated; second series hexagonal; the third series indistinct, those forming the summit not visible. Column short; lower extremity very slender, and composed of joints which are twice or thrice as long as broad; in ascending, the diameter increases, and the joints are shorter, finally becoming flat rings with prominent sharp edges, being nearly one half the diameter of the cup above.

The summit of the specimen presents an appearance as if the original had been provided with arms or tentacula, but there are no remains of them observable.

Our species approaches very closely to those figured and described by H. VON MEYER and VOLBORTH, as quoted by VON BUCH in his paper on the CYSTIDEA*; and also those

* Journal of the Geological Society of London, No. 5, 1846.

The accompanying illustration, fig. 1, is from this paper of M. VON BUCH, and will convey a more definite idea of the form of these bodies than the imperfect specimens thus far seen in our rocks.

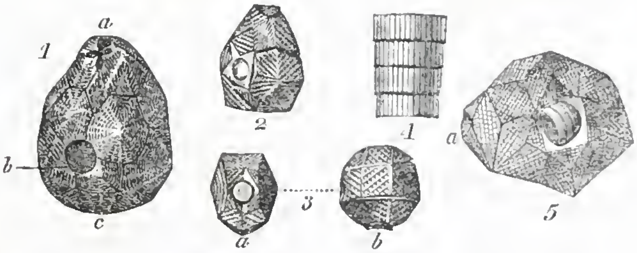


Fig. 1 *a*, the summit, with the mouth; *b*, the ovarian aperture; *c*, the base.

Fig. 2. Lateral view of a specimen, showing the ovarian aperture.

Fig. 3 *a*, the base of the specimen; 3 *b*, lateral view of the same.

Fig. 4. A portion of the column of the same species.

Fig. 5, as above, is the *Echino-encrinites striatus* of PANDER. A small portion of the column is still adhering to the body, and the side on which is situated the ovarian aperture *a* is much extended.

(*Palæontology of Russia and the Ural Mountains*, pag. 29 & 30, pl. 1 & 27.)

M. VOLBORTH has recently discovered the very delicate tentacula of the *Echino-encrinites* (*Bulletin de la Classe Phys. Math. de S.-Petersbourg*, Vol. iii. no. 6). They are placed on the border of the buccal aperture, and do not pierce the plates as in ordinary Crinoideans. These tentacula are not fimbriated; and since, according to M. v. BUCH, the animal was provided with an ovarian aperture, they were not required for protecting the eggs, as in the true crinoideans. The views of VON BUCH, however, do not entirely coincide with those of M. VOLBORTH, who regards this aperture as the anus.*

* See note on page xiv. of M. DE VERNEUIL's General View of the Palæozoic Fauna of Russia.

in the *Palæontology of Russia and the Ural Mountains*, as cited above, which are the only authorities within my reach.

The specimens examined are very imperfect, consisting first of a column and a few scattered plates, which were collected by myself in 1835; and subsequently, since the first pages of this report had passed through the press, of some more perfect specimens, collected by Dr. Budd, in Lewis county, who has kindly forwarded them for my examination.

There are some slight differences observable between the European species and this one, the most obvious of which is the greater elongation and breadth of the cup near the top in the latter. This feature, however, may be due to compression; as the condition of our specimens, which are imbedded in a shaly calcareous mass and usually crushed, does not admit of minute comparison.

The occurrence of this fossil, so nearly allied to, if not identical with, the Russian species, is an exceedingly interesting circumstance, since all the specimens before known are from a single locality (Pulcowa) in Russia. The position also corresponds precisely; for, in that country, these peculiar fossils occur only in the lower part of the Silurian system. So true is it that certain organic forms are reliable in the determination of the age of certain formations, that M. de Verneuil, on seeing my specimens, pronounced the rock, without hesitation, the Trenton limestone, which rock is unquestionably identical with the great Orthoceratite limestone of Russia and Sweden.

The illustrations which I have been able to give, are the following:

Fig. 4 *a*. The column, with a single detached plate near its upper termination. The long narrow joints of the column, which gradually become shorter and broader until they form broad thin rings in the upper part, are clearly shown. The plate belongs to the second range, and is hexagonal, with three prominent ridges upon its surface. A curved depression on one side shows that it formed a part of the lateral aperture.

Fig. 4 *b*. Part of a similar column, with the plates of a crushed cup lying at its upper termination. There are, at the summit of this specimen, one or two free nearly circular discs, and one apparently attached, as if forming the base of the tentacula at one point.

Fig. 4 *c*. One of these plates enlarged. The surface is worn smooth, with the exception of the ridges upon the plate, but this is doubtless due to maceration and abrasion.

Fig. 4 *d*. A larger and more perfect specimen; the plates near the base showing the strong striæ upon their surface, which are at right angles to the edges.

Fig. 4 *e*. The structure, as far as can be ascertained from our specimens.

Fig. 4 *f*. The surface of one of the plates, magnified, to show the striæ.

Position and locality. The specimens first obtained are from the midst of the fossiliferous portions of the Trenton limestone, associated with *Chætetes*, *Orthis testudinaria*, *&c*. The last are from a stratum upon which a layer of shaly matter has been deposited, imbedding the fossils. The rock contains no other fossils. Turin, Lewis county.

128. 2. ASTERIAS MATUTINA (*n. sp.*).

Pl. XXIX. Figs. 5 *a*, *b*.

Body small, with five radiating arms; arms elongated (length twice and a half the width of the body), terete, acute, composed of three rows of plates, which join above by their lateral margins. Beneath each upper lateral row of plates there is an inferior lateral range visible, leaving the sulcus beneath the middle row, which is often depressed. The dorsal plates are somewhat hexagonal; those of the arms quadrangular: surface punctate or granulate, perhaps from the removal of the spines covering the surface.

The specimen is considerably crushed, and two of the arms broken off at the base; the madreporiform tubercle upon the back is not visible in our specimen. From its condition, the structure cannot be entirely made out, but it is sufficiently clear to enable any one to recognize the species.

Three specimens of this highly interesting species are known to me, two of which occur in the Trenton limestone of New-York. It bears some resemblance to the one found at Cincinnati; but it would appear, from the figure and description of Prof. Locke (*Proceedings Acad. Nat. Sci.*, Vol. iii. p. 33), that it is a distinct species, being at least twice as large, with the centre proportionally larger, and the plates composing the arms smaller than in our species.

The name (*Asterias antiqua*) given by Prof. Locke, is already appropriated by Troost for a very distinct species, judging from his figure (*Trans. Geol. Soc. Penn.*, Vol. i. p. 232, pl. 10, fig. 9), and probably holding a higher geological position. Prof. Troost also mentions (page 235 of the work just cited) having "found five other species of free Asterites: one of them occurring in a lower stratum than that in which the *A. antiqua* is imbedded, and the four others in a higher situation; all, nevertheless, below the Coal." It is therefore quite certain that the Genus Asterias existed during the deposition of the older Silurian rocks in localities widely separated from each other, and also that the genus is represented by more than a single species.

Fig. 5 *a*. The specimen, natural size.
Fig. 5 *b*. A portion enlarged, showing the form of the plates and the punctate surface.

Position and locality. The specimen figured is from the thin shelly layers at Trenton falls, about midway of the rock. Another specimen has been found near Canajoharie, probably from a lower position in the Trenton limestone. An imperfect specimen, apparently of the same species, has been found in the shales of the Hudson-river group, by Gen. Spinner, of Mohawk. (*Collection of* W. H. Pease.)

129. 1. TENTACULITES? FLEXUOSA (*n. sp.*).

Pl. XXIX. Figs. 6 *a, b, c, d.*

Tubes single or aggregate, adhering, more or less curved at the tip or along the whole length; surface marked by strong annulations, which are crossed by fine longitudinal striæ; annulations somewhat irregular; interior distinctly septate; septa with the concave sides upwards.

The mode of growth and the interior structure here developed give us more information regarding the habits of this hitherto doubtful fossil, than we have before possessed. If the species in question be a true Tentaculites, of which perhaps we may have some doubt, it appears to have been developed like many of the Corals, viz. a simple tube affixed at the base, occupied by an animal which secretes calcareous matter, building up the walls of the cell, and extending across it transverse septa as the tube became elongated. The structure of the tube, however, allies it more nearly with Crinoideans than with Corals; and it is probable that it was inhabited by a simply constructed animal of the same order.

The specimen fig. 1 *a* first attracted my attention by its curved tip, showing that it must have been attached to some other body. A further careful search among a large number of specimens from Lowville enabled me to discover the attached group, which shows that an exudation of calcareous matter attaches them firmly to the shell, while a group of the cells of *Chætetes lycoperdon* have commenced their growth on the same.

I have referred this, with some hesitation, to the Genus Tentaculites, both on account of its general form and mode of adhering to other bodies, as well as from its internal structure, which, however, has not heretofore been shown in the true Tentaculites. All the other species known in our strata are straight, rigid, and gradually tapering to a point, always separate, and never known as adhering to other bodies.

Fig. 6 *a*. A single specimen of this species, with a portion of the same magnified, showing the transverse septa.

Fig. 6 *b*. A group of the same species, adhering by their smaller extremities to the dorsal valve of *Orthis testudinaria*. At *c*, there is the base of several cells of the *Chætetes lycoperdon*, adhering to the same shell.

Fig. 6 *d*. A single tube, magnified, showing more distinctly the striæ upon the surface, and, also, in some degree, the irregularity of the annulations.

Position and locality. This fossil is only known to me as occurring in the thinbedded portions of the Trenton limestone, from sixty to one hundred feet above its base. Lowville, Lewis county.

BRACHIOPODA OF THE TRENTON LIMESTONE.

Plates XXX., XXXI., XXXII. & XXXIII.

The Brachiopoda of this period are among the most numerous and prominent fossils of the rock. Several species are so abundant as to constitute of themselves entire strata, and others cover extensive surfaces of the thin layers. Those which occur in the greatest profusion in New-York, are the *Orthis testudinaria* (identical with the species of the same name in Europe), and *Leptæna sericea;* while other forms of Leptæna are scarcely less abundant in some localities. In the western extension of the same rock, the *Delthyris lynx* and *Atrypa protea* are equally abundant; but these species are comparatively rare in New-York, and are never prominent species in any localities east of Ohio.

The species of this order are comparatively constant and reliable throughout extensive areas, and the typical species of this rock in New-York are equally characteristic of strata of the same age in Ohio and Indiana. It is true, that both in this State and in all the western localities, many of these species are equally characteristic of the upper part of this great group, viz. the Hudson-river rocks. In New-York, some of the same species which mark the Trenton limestone are equally abundant in the shaly sandstones of the Hudson-river group; while in the latter, we do not know of more than two species, at the present time, distinct from those in the limestone below, and these may yet be found in a lower position.

It is from the occurrence of these species of Brachiopoda in the Hudson-river group, together with species of other genera, that I am induced to unite the whole, as before stated, in one great series, though the lithological characters are so different in the two extremities. Among others, the Lingulæ hold a prominent place; this limestone containing half as many as we know, at present, in all the other palæozoic rocks of America. This is the more interesting, since this genus, containing species of the same type, exists in the waters of our present seas, together with the Orbicula, another prominent fossil of this period; while the other genera are unknown as existing forms.

Although the number of species of this order is nearly as great as of any other group of equal thickness, still it is probable, from what we already know, that the number will be increased at least one half, and perhaps doubled, when the Brachiopoda of the same period in the West shall be fully known. It is probable that we shall yet discover species in New-York which may swell the present number considerably, though we can scarcely anticipate that we shall ever discover all those species which flourished in the more favorable conditions of the western ocean of that period.

130. 4. LINGULA ATTENUATA?

Pl. XXX. Figs. 1 *a*, *b*.

Compare *Lingula attenuata*. Sowerby in Sil. Researches, pag. 641, pl. 22, fig. 13.
Also *Lingula acuminata*, page 9 of this Report.

General form ovate-acute, attenuated towards the apex; sides nearly straight; front rounded; surface depressed, marked by concentric lines which are crossed by obscure radiating striæ.

This description corresponds essentially with that of Sowerby, except that our shell is never smooth. The concentric lines are more or less strongly visible in all our specimens. The sides are straighter, and the shell more attenuated towards the apex, than in any other species which we have in this rock: it varies in form, however, to a considerable degree, as will be seen on comparing different specimens of the same species.

Fig. 1 *a*, is the largest individual of this species yet seen.
Fig. 1 *b*. A specimen of the ordinary size.

It should be observed by the student, that the proportional strength of the concentric and radiating lines on the Lingula are influenced by the exfoliation of the shell which takes place in many of them. In some cases the concentric lines are partially or entirely obliterated by this process.

In figs. 1 *a* and *b*, the radiating striæ are visible, from a partial exfoliation of the shell.

Position and locality. This species occurs in greater numbers about midway from the base to the top of the Trenton limestone, and is often met with in other parts of the rock. At Middleville, which is the best locality for all the species of the genus, this one is found about fifty or sixty feet above the Birdseye limestone. It is also found at Trenton Falls, Jacksonburgh, Lowville, Watertown, and other places. The usual associates of the *Lingula* are the *Conularia*, *Leptæna alternata*, and sometimes the small corals, as *Stictopora*, *&c*.

The species found in the Calciferous sandstone is far more attenuated than any which we find in the Trenton limestone, and is perhaps quite distinct from the *L. attenuata* of the Llandeilo flags, as it is, apparently, from the present species. That figured by Murchison is intermediate in form between the two, being less attenuated than the one in the Calciferous sandstone, and more attenuated than the one under consideration. If the Lingulæ, like other genera of the Brachiopoda, were influenced in form by the nature of the sediment deposited, or the ocean bed on which they lived, then the same species may present the extremes of form here noticed.

131. 5. LINGULA RICINIFORMIS.

Pl. XXX. Figs. 2 *a*, *b*, *c*.

Oval, convex, slightly attenuated towards the beak, which is obtuse; surface nearly smooth, or with fine nearly obsolete concentric lines. Fine radiating striæ are sometimes visible; and the surface is sometimes slightly ridged, as if from elevated lines beneath the outer lamina of the shell.

The general oval form and equal convexity of the shell are almost its only distinguishing characters. It is less attenuated towards the beak than the last, and the surface is not so distinctly striated.

The length of this species does not exceed $\frac{5}{16}$ of an inch, with a width of little more than $\frac{3}{16}$. Compared with figs. 1 *a*, *b*, it is less attenuated towards the beak, and not depressed towards the front, which latter feature appears to be constant in the *L. attenuata*. That species also becomes more spatulate or expanded towards the base as it increases in size, which is shown in 1 *b*.

The figures 2 *a*, *b*, *c*, are from three specimens, varying in size, but all presenting the same form.

Position and locality. This species occurs with the last in compact dark limestone near Middleville, Herkimer county. (*State Collection.*)

132. 6. LINGULA ÆQUALIS (*a variety of the last species?*).

Pl. XXX. Figs. 3 *a*, *b*.

Broadly oval, very obtuse, somewhat attenuated near the beaks, regularly convex, rounded in front; surface marked by fine radiating striæ and less conspicuous concentric lines.

This shell differs from the last, in its greater proportional width, and almost equally obtuse extremities. Length and breadth about as 5 to 6.

In addition to the very fine radiating striæ upon the surface of the shell, there are some undulating ridges or wrinkles which are not very distinct. The radiating striæ are often obsolete or inconspicuous, and, to the naked eye, the surface appears entirely smooth. The shell is usually less convex than the last species, which it closely resembles.

Position and locality. In the compact limestone, near the centre of the mass, at Middleville, Trenton Falls, &c.

133. 7. LINGULA QUADRATA.

PL. XXX. Figs. 4 *a*, *b*, *c*.

Crania quadrata. EICHWALD, 1829, Zool. specialis, Vol. i. pag. 273, pl. 4, fig. 2.
Lingula quadrata. EICHW. 1840, Sil. Syst. in Esthland, p. 164.
— — ID. 1840, Urwelt Russlands, heft 1, p. 15.
— — ID. 1842, Ibid. heft 11, p. 58.
— — MURCHISON and VERNEUIL, Geol. Russia and the Ural Mountains, Vol. ii. pag. 292, pl. 1, fig. 10.

Equivalve, equilateral, broadly oval, depressed-convex; sides nearly straight and parallel, or slightly curved; extremities nearly equal in width, the first broadly rounded, cardinal extremity slightly narrower and somewhat angularly sloped; beak marginal, not prominent; exterior surface of the shell marked by strong concentric striæ, and along the middle by distinct longitudinal striæ, which are equally visible when the outer shell is exfoliated. A longitudinal depressed line marks the shell from the beak nearly half way to the base.

This species is perhaps the largest fossil LINGULA known: it is distinguished by its general elliptical form and nearly parallel sides. In its dimensions it is near the *Lingula Lewisii* (SOWERBY); but it is more regularly rounded at the base, and does not present the square outline which that shell has. Our largest specimen is one inch and a half in length, with a width of almost an inch.

The usual length of this shell is one inch, and its great size alone is commonly sufficient to distinguish it from any other species in our strata. The longitudinal striæ mark only the central part of the shell, and are equally distinct when the shell is exfoliated: this character may be useful in detecting the species.

Our shell is evidently identical with that of Russia, as cited above, both from the figure and description, and from the opinion of M. DE VERNEUIL, who has seen the Trenton species.

Fig. 4 *a*. A specimen of the ordinary size; the shell partially exfoliated, and presenting the strong radiating striæ along the centre.

Fig. 4 *b*. View of the edge of the shell, with the two valves closed. It appears slightly inequivalve from compression.

Fig. 4 *c*. A specimen of larger dimensions, from which the shell is partially exfoliated.

Position and locality. This species occurs in the central and higher part of the Trenton limestone, usually in the compact dark layers, unassociated with other fossils. In some instances, it occurs in the higher gray rock. Trenton Falls, Middleville, Turin, Lowville, and other localities in New-York. It has a wide geographical range, being known in Ohio and Wisconsin, where its geological position is similar to that in New-York. Its occurrence in several localities in Russia proves its distribution over an immense area in the palæozoic seas.

134. 8. LINGULA ELONGATA (*n. sp.*).

PL. XXX. Fig. 5.

Oblong oval, gradually narrowing towards the beak ; sides nearly straight ; shell much elevated along the centre, which continues to the beak, and is slightly depressed in front ; a narrow depressed line extends along the length of the shell, from the beak, more than half way to the base ; surface marked by fine concentric striæ, without visible longitudinal ones.

Length of the shell, $\frac{11}{16}$; width, $\frac{6}{16}$ of an inch.

I have seen but a single specimen of this shell, but its great elongation, and entire freedom from radiating striæ, either upon the outer surface or where exfoliated, seem to me sufficient marks of distinction. Our shell corresponds in many respects with *Lingula parallela* of PHILLIPS (*Geol. Yorkshire*, Vol. ii., pl. 11, fig. 17 – 19), as described by PORTLOCK (*Geol. Report*, pag. 444, pl. 32, figs. 6, 8 & 9), but his specimens are much smaller ; the original shell, moreover, occurs in a much higher position, which alone would be a fair presumption against it being identical with the one of the Trenton limestone.

Position and locality. In the compact dark limestone in the central part of the rock. Lewis county. (*Cabinet of* MR. VANUXEM.)

135. 9. LINGULA CURTA.

PL. XXX. Figs. 6 *a*, *b*.

Lingula curta. CONRAD, Jour. Acad. Nat. Science, Vol. viii. pag. 266, pl. 15, fig. 12.

Obtusely ovate, flat or depressed convex ; beak small, often scarcely prominent ; surface marked by concentric elevated lines or wrinkles ; apex obtuse ; base broadly rounded.

The length and breadth of this shell are nearly equal, and the beak often scarcely projects beyond the outline of the shell. In the Utica slate, it is quite flat from compression, while in the limestone it is depressed convex.

Fig. 6 *a*, is from the Utica slate, the same specimen figured by Mr. CONRAD.
Fig. 6 *b*, is from the Trenton limestone.

When the shell is exfoliated, fine radiating striæ are visible.

Position and locality. Middleville and East-Canada creek, in the compact dark limestone, nearly in the central part of the rock. It occurs also in a higher position, and in the Utica slate ; also at Carlisle (Pa.), in Utica slate.

136. 10. LINGULA OBTUSA (*n. sp.*).

PL. XXX. Figs. 7 *a*, *b*, *c*.

Broad-ovate, obtuse at the apex and regularly rounded below, depressed in front, but very prominently convex on the umbones ; beaks obtuse, prominent, not terminal ; margin of the shell a little produced beyond the beaks ; surface apparently smooth, but, under a magnifier, exhibiting fine concentric and radiating striæ.

This shell is easily distinguished by its ovate form, with very obtuse apex ; the beak is prominent and elevated, with a narrow space between it and the margin of the shell. The outline from beak to base is much more arched than in any other species.

Fig. 7 *a*. A very perfect specimen of large size, giving the exact form of the shell : radiating striæ scarcely visible.

Fig. 7 *b*. Another specimen, the form not quite as perfect as in the last, but the radiating striæ more distinctly visible.

Fig. 7 *c*. A smaller individual of the same species.

Position and locality. In the more shelly central part of the Trenton limestone at Middleville, Herkimer county. (*State Collection.*)

137. 11. LINGULA CRASSA (*n. sp.*).

PL. XXX. Figs. 8 *a*, *b*, *c*, *d*, *e*.

Broadly ovate, with a subacute beak ; one valve more convex than the other, and somewhat arched ; shell thick, marked by strong concentric elevated lines, without radiating striæ.

This shell is broad and regularly rounded in front, sloping abruptly to the beak. The thick shell and prominent concentric lines are characteristic. The shell is black, and less brilliant than the LINGULÆ usually are. I have seen but one perfect specimen. Single valves and fragments are abundant in the limestone at Basin Harbor (Vermont). It is also apparently the same species, in fragments and smaller individuals, which sometimes abound in the silico-argillaceous limestone intercalated among the slates east of the Hudson river near Troy, showing its geological range to be from the Trenton limestone through the Hudson-river group.

Fig. 8 *a*, *b*. View of both valves of this species.

Fig. 8 *c*. View of the edge of both valves, closed ; one being more convex than the other, and slightly arched.

Fig. 8 *d*. A larger specimen, apparently of the same species, somewhat crushed.

Fig. 8 *e*. A smaller specimen, apparently of the same species.

Position and locality. This species occurs at Middleville, in the central part of the Trenton limestone ; also in the same rock at Basin Harbor and Crown Point on Lake Champlain. A species, similar or identical, in limestone among the shales of the Hudson-river group, near Troy.

138. 2. ORBICULA? FILOSA (*n. sp.*).

Pl. XXX. Figs. 9 *a*, *b*, *c*, *d*.

Orbicular; one valve more or less convex; apex marginal; surface radiated with numerous fine elevated threadlike striæ, which are more or less prominent, depending on exfoliation of the shell; intermediate striæ coming in between the others as they recede from the beak, but the striæ are not bifurcate.

It is with some hesitation that I refer this shell to the Genus Orbicula, since it presents some variation from the usual type. The young specimens are very convex, almost conical, but gradually become depressed and expanded as they increase in age and size.

A single specimen, which is partially exfoliated, presents the marks of three visceral or muscular impressions, arranged somewhat like those of the Crania; but since the shell differs as widely from types of that genus, as it does from Orbicula, I should scarcely feel authorised to place it under that genus, in the present state of our knowledge regarding it. The strongly striated surface presents a deviation from the general character of shells belonging to Lingula or Orbicula; but it is otherwise of the same texture — black and glossy, as those shells. It likewise occurs associated with them, proving that its habit was similar, deviating no more from these genera than they do from each other.

As the shell exfoliates, the surface becomes smoother, and the striæ are nearly lost, except upon the margins.

Fig. 9 *a*. A young shell, very convex or obtusely conical in form.

Fig. 9 *b*. A larger shell, less convex than the last: when exfoliated near the beak, the marks of the muscular impressions are visible, similar to those of Crania. This portion is magnified.

Figs. 9 *c* & *d*. Two apparently full grown shells of this species; the form is much depressed, nearly flat, and the surface completely covered by fine striæ.

These specimens bear a close resemblance externally to the Orthis; but it is easy to discover, on examination, that they do not belong to that genus.

Position and locality. These specimens occur in fine-grained dark limestone, near the upper termination of the Trenton mass. They are associated with *Orbicula*, *Lingula*, and some of the *Conularia*. Middleville. (*State Collection.*)

139. 3. ORBICULA LAMELLOSA (*n. sp.*).

Pl. XXX. Figs. 10 *a*, *b*.

Orbicular, depressed; apex small, but little elevated, situated about one-third the breadth of the shell from the margin; surface marked by elevated lamelliform concentric lines or ridges.

Fig. 10 *a*. Ventral view. *b*. Lateral view.

This shell is nearly flat, with the exception of the small apex. The concentric lines appear to be made up of thin shelly laminæ; but in the single specimen we have, their edges are much broken. In some of its characters it approaches the *O. rugata* (*Silurian Researches*, pag. 610, pl. 5, fig. 11), a species, or an analogue of which, we find in great abundance in the Hamilton group; the latter differs, however, in the concentric ridges being proportionally finer and less elevated, and the shell is much larger. The one under consideration is readily distinguished from any other in the Trenton limestone, by its slight elevation and subcentral apex.

Position and locality. Middleville, in the shelly layers, lower part of the Trenton limestone. A rare species.

140. 4. ORBICULA TERMINALIS.

Pl. XXX. Figs. 11 *a, b, c, d.*

Orbicula terminalis. Conrad in MS. Emmons, Geol. Report, pag. 395, fig. 4.

Shell very obtusely subovate or orbicular; ventral valve depressed convex, with a terminal or marginal apex; dorsal valve very convex or subconical, with a central apex, a broad depression and narrow slit on one side, extending to the margin of the shell opposite the beak of the ventral valve; surface usually smooth, from exfoliation? Fine longitudinal or radiating striæ are also visible when the shell is exfoliated; these striæ are sometimes punctate.

A single specimen, apparently in a perfect condition, is marked by strong concentric elevated lamellæ, giving a rough aspect to the surface.

This fossil is easily recognized by its low convex suborbicular ventral valve, with a marginal apex. The opposite valve is less often seen, but it is as readily distinguished by the broad depression on one side of the apex, with the narrow slit in the bottom for the protrusion of the peduncle. This character is a very remarkable one, and serves to distinguish this from all other known species of Orbicula in our strata.

M. de Verneuil, in his *Palæontology of Russia and the Ural Mountains*, has described and figured a species of Orbicula (the *O. reversa*, pl. xix.), which possesses the same remarkable feature of having the convex valve perforated for the protrusion of the ligament. This rare character is possessed by few species of the Orbicula; the *Orbicula lodensis* of the Geological Reports of the Third and Fourth Districts of New-York, being the only one previously known to me; and in this one, the perforated valve is far less convex than in the one under consideration.

The Russian species occurs in an ancient silurian sandstone in the vicinity of St. Petersburgh, which is perhaps of the same age as our Potsdam sandstone. Associated with it is another species of Orbicula, and an Obolus, a genus allied to Lingula, and which in this instance occurs in great numbers, giving the Russian sandstone a micaceous appearance, as the small LINGULA does our Potsdam sandstone in the vicinity of Keeseville and other places.

Fig. 11 *a*. Dorsal valve, showing the central apex and lateral depression, which extends to the margin.
Fig. 11 *b*. Ventral valve with marginal apex.
Fig. 11 *c*. Lateral view of a perfect specimen.
Fig. 11 *d*. Ventral valve, marked with strong concentric lamellæ; apex marginal.

Position and locality. This species is not uncommon at Middleville, Herkimer county, and perfect specimens are found at Lowville. It occurs also at Watertown, Turin and Trenton Falls. (*State Collection*.)

Of the forms of LINGULA above presented, 1, 2, 3 and 6, are more nearly allied to each other, while all the others are clearly distinguishable. If the upper part of *L. riciniformis* were extended, and the shell a little depressed, it would correspond with *L. attenuata*; while if the proportions were altered in the opposite direction, or the beak depressed and sides expanded, it would correspond with *L. æqualis*, and the transition from this to *L. curta* is scarcely perceptible. On comparison, however, of a considerable number of specimens, I am induced to believe that it is desirable to separate them; calling attention to these differences, and thus inducing a comparison of a larger number of specimens. We may thus, hereafter, be able to point to some more decided characters, or show the gradations of the same species through all these forms.

Presenting, as the LINGULÆ for the most part do, but few prominent features, and being seen but rarely, it is not easy to distinguish them, or to point out characters which mark specific distinctions, as many of those relied upon may be only indicative of different ages of the shells, or of different periods of their growth, and may even be dependent on other circumstances unknown to us.

The other forms, beyond those noticed, are clearly distinct species, and easily recognized by the characters given.

The ORBICULÆ are usually associated with the LINGULÆ, in the fine-grained compact limestone; the CONULARIA is also an almost constant associate of these shells, and rarely found in other situations. These shells, so unlike in structure and habit, appear to have flourished under similar circumstances, and to have required the same kind of ocean bed or sediment.

141. 4. LEPTÆNA ALTERNATA.*

PL. XXXI. Figs. 1 *a – n*; and PL. XXXI. A. Figs. 1 *a – h*.

Leptæna alternata. CONRAD, Ann. Geol. Rep. New-York, 1838, p. 115.
Strophomena alternata. ID. Ib. 1839, p. 63, table of organic remains.
— — ID. Ib. 1840, p. 201 : regarded in this place as identical with *Orthis alternata* of SOWERBY.
— — ID. Ib. 1841, p. 37.
— — EMMONS, Geol. Report, 1842, pag. 375, fig. 3.
Leptæna alternata. VERNEUIL, Pal. of Russia and the Ural Mountains, 1845, pag. 225, pl. 14, fig. 6 *a*, *b*.
— *deltoidea.* ID. Ib. pag. 222, pl. 14, fig. 5 *a*, *b*.
Compare *Orthis alternata*, SOWERBY, Sil. Researches, pag. 638, pl. 19, fig. 6.
Also *Strophomena nasuta*, CONRAD, Jour. Acad. Nat. Sciences, Vol. viii. p. 260.
— — EMMONS, Geol. Report, pag. 403, fig. 3.

Broadly semioval; length and breadth about as 12 to 15; hinge line, in perfect specimens, a little longer than the width of the shell, slightly reflected at the extremities, which sometimes become short acute ears; cardinal area narrow, the callosity of the ventral valve nearly filling the triangular foramen of the dorsal valve; beak uniformly perforated with a minute circular opening; dorsal valve depressed convex, sometimes more convex in the middle, suddenly deflected near the margin and flattened towards the cardinal line; ventral valve concave, gradually or sometimes suddenly inflected towards the basal margin; surface marked by fine rounded radiating striæ, which alternate at unequal intervals with coarser ones; striæ increasing in number towards the margin of the shell, crossed by fine elevated concentric lines and a few imbricating lines of growth.

In this species the striæ are usually of two sizes, the coarser and more elevated ones having from four to six finer ones between; the latter increase in number as they recede from the apex, and one of them, in the centre of the fascicle, becomes enlarged, and rises above the others. Some of the specimens figured are strongly marked individuals, where these characters are very distinctly preserved; but there are many variations from the type of the species, and some others where it is difficult to decide their true relations when we have not a series showing their gradations.

The characteristic developments of the shell depend on the circumstances of its existence and the nature of the sediment. There are other differences which are due to causes beyond our knowledge; for, in the same locality, and where great numbers of them must have lived under precisely similar circumstances, we find considerable variation in character. In

* This species was proposed by Mr. CONRAD, under the name of *Leptæna alternata*, in 1838; and the name was known and continued in use in New-York till the publication of the final Reports (the generic term *Strophomena* being substituted for *Leptæna*). When Mr. MURCHISON's *Silurian Researches* was received in this country, we found that Mr. SOWERBY had proposed the name of *Orthis alternata* for a lower silurian species, which is doubtless a true LEPTÆNA; and not knowing certainly that it was an identical species, Mr. CONRAD subsequently proposed for our species the name of *trentonensis* in his manuscript notes. M. DE VERNEUIL has adopted the name *Leptæna alternata* in his *Palæontology of Russia and the Ural Mountains*, and I have continued the same in the present work. If, hereafter, it should be found to conflict with the species of SOWERBY, the specific term *trentonensis* may be adopted. The present name has precedence over all others applied in this country to the same species.

the compact limestones of New-York, where, in splitting the rock, a portion of the shell often exfoliates, we find a great deviation from the type of the species. The age of the shell also exerts considerable influence upon its external form. The young ones, or those of medium size, are usually symmetrical shells, moderately convex, and gently curving towards the base. The striæ in such individuals are distinctly in fascicles of four to six, separated by stronger and more elevated single ones on either side; as the shell increases, this uniformity in the arrangement often disappears, and the striæ appear of uniform size, or alternate irregularly. The concave or ventral valve, particularly in old specimens, has the striæ nearly uniform in size.

Plate XXXI.

Fig. 1 *a*. A specimen of medium size, with the elevated striæ very distinctly marked, and the gradual enlarging of one of the intermediate smaller striæ is shown as they recede from the apex.

Fig. 1 *b*. A smaller specimen, presenting the characters of the species in a very perfect manner.

Fig. 1 *c*. The inside of the dorsal valve of this species, showing, imperfectly, the visceral impression near the beak, and the papillose surface of the shell. The alternation of larger striæ with fascicles of smaller ones is quite distinct.

Fig. 1 *d*. An individual of larger size, having the essential features of the species well preserved. This specimen is much more convex in the centre, and more abruptly curved in front, than either of the preceding.

In the four figures above, the width considerably exceeds the height of the shell; but this character is not constant.

Fig. 1 *e*. The dorsal valve of another species; the length and breadth are about equal, and in this respect only does it differ from the preceding ones. The larger and more elevated striæ alternate precisely in the same manner with four to six smaller ones, the whole being crossed by fine concentric slightly undulating lines.

Fig. 1 *f*. A specimen having almost precisely the same form as 1 *e*; but the larger striæ are not so prominent, and the intermediate smaller ones not as regular as in the last species. This character, taken in connexion with the deviation in form, has been regarded as indicating a distinct species; but it is clearly identical with those previously noticed, showing no greater difference in regard to the striæ than is observed in others of the same form as 1 *a*, *b*, which will be shown on the succeeding plate.

The foregoing figures represent the principal forms found in the Trenton limestone in the State of New-York. In western localities of rocks of the same age, this species assumes a greater variety of form, and has received several distinct names.

Fig. 1 *g*. The dorsal valve of this species, from the shaly blue limestone of Ohio. The surface is well preserved, and the striæ very strongly marked: a few imbricating lines of growth are visible near where the curvature of the shell becomes abrupt.

Fig. 1 *h*. Ventral valve of another specimen; the radiating striæ are nearly equal, the larger elevated ones, dividing the fascicles of small rays, being scarcely distinct, while on the dorsal valve they present the same distinction as in the last figure. The hinge view of the same shell shows the deltoid foramen nearly closed, with the small perforation in the beak, which is enlarged in the upper figure.

Fig. 1 *i.* This shell is a representative of that known as *L. ponderosa* in Ohio. In form it resembles the two preceding, except that it is more deflected on the margin, with more distinct imbricating and squamose lines of growth; the space between the two valves is also much greater, and the shell more massive. The striæ upon both valves resemble the preceding; but it often happens that those on the convex valve are more or less worn, so as to appear nearly equal. The character of the hinge, with the perforation in the beak, is the same in both varieties.

This variety of form evidently consists of old shells, which often show marks of injuries that have been partially healed; they also bear evidence of wearing, and are frequently covered with corals, from which the lighter and younger shell is comparatively free. The view of the ventral valve and hinge line is precisely similar to the last; the lower figure is a lateral view, showing the great elevation of the dorsal valve and the abrupt curvature in front, with the strong imbricating lines of growth.

Fig. 1 *k.* An elongated form of this species; the dorsal valve showing the margin abruptly curved upwards from a little below the hinge line. The alternating striæ are very perfectly represented, and the cardinal line presents the same characters as the previous ones; the foramen in this one being scarcely closed, while the minute perforation in the beak is very conspicuous.

This form corresponds precisely with 1 *f*, while there is a little deviation in the alternation of the striæ in that specimen.

Fig. 1 *m.* The interior of the ventral valve, showing the visceral impression, and the two prominent toothlike processes between which the ligament of attachment passed out through the foramen: these processes approach each other above, and produce the callosity, which, in most specimens, fills, partially or entirely, the foramen in the opposite valve. The entire inner surface is papillose, and more strongly so on the visceral impression.

Specimens of this kind, revealing the internal structure of the species, are of rare occurrence in the Trenton limestone in New-York, though not unfrequently found farther west.

Fig. 1 *n.* The convex valve of this species, with the shell partially exfoliated. The stronger radiating striæ are very prominent, but the intermediate ones are obsolete except towards the hinge; the concentric elevated lines are, at the same time, very prominent. The shell is partially removed, so as to reveal somewhat of the internal structure.

Although presenting some slight deviations in the striæ from the type of the *L. alternata*, I cannot find sufficient to characterize it as a distinct species.

Plate XXXI. A.

The elongated forms, figs. 1 *f* and *k* on the last plate, gradually assume a nasute shape, in which state they have been characterized as *Strophomena nasuta* by Mr. Conrad. The following illustrations will show sufficiently well how the species under consideration assumes this form.

Fig. 1 *a.* A specimen which is contracted just below the ears and bent abruptly upwards, having towards the front several folds, and a more prominent one directly in front.

Fig. 1 *b.* A lateral view of the same specimen, showing the abrupt and extreme deflection of the shell.

Fig. 1 *c.* A specimen having the same general form as the last, but contracted and folded in front so as to present precisely the same form as the *L. nasuta* of Conrad.

The surfaces of both these specimens present the essential characters of the *L. alternata*, and the beak is always perforated. This is shown in the enlarged view of the hinge in fig. 1 *a*, which at the same time shows the foramen not quite closed.

This nasute feature is often connected with a single elevated ridge, or more prominent stria, much longer than the others, and extending from the base to the beak of the shell. This appears very distinctly in the two preceding specimens; but to show that this character is common to the species, the specimen fig. 1 *d* is represented, showing a prominent line down the centre, while the shell is totally destitute of the other characters of *S. nasuta*, being scarcely convex and very regularly semioval.

Figs. 1 *e*, *f*, *g* & *h*. These figures represent a series of the younger shells of this species, as they occur in the compact limestone of Middleville, Little Falls, Trenton Falls, and other places. The striæ often alternate irregularly, and sometimes they are of nearly equal size. This variation often arises in part from exfoliation of the shell; but if a number of specimens are examined, there will be found a gradation in the striæ, and some of them exhibit the typical characters of the species.

These figures present also a gradation in form from the perfectly semioval to the elongated or nasute front, showing very conclusively that this character cannot be relied upon in the distinction of species.*

Position and locality. This is one of the species, which, commencing its existence prior to, or at the epoch of the Trenton limestone, continues in great numbers throughout that rock, and, though not appearing in the Utica slate, reappears in the Hudson-river group in immense numbers, several thin strata in the upper part of this group being composed almost entirely of the shells of this species.

The forms 1 *e*, *f*, *g* & *h*, of Plate XXXI. A., are the most common and abundant in the Trenton limestone, and some of these are met with in almost every locality : the other forms are more rare.

It is abundant at Middleville, Little Falls, Jacksonburgh, Herkimer, Trenton Falls, Sugar River, Turin, Lowville, Watertown, Plattsburgh, Glen's Falls, &c.

The same species, in forms like 1 *g*, *h*, *i*, *k*, Plate XXXI., and others, are abundant at Maysville (Ky.), Cincinnati and Oxford (Ohio), Madison (Indiana), and in Tennessee.

(*State Collection.*)

* I have been induced to dwell so long upon this species, from the fact of its variable form, and other characters which have been the source of much annoyance to amateurs, and no little trouble to myself, since I have it from different persons and localities, under at least six or eight different names.

142. 5. LEPTÆNA CAMERATA.

PL. XXXI. A. Figs. 2 *a*, *b*.

Strophomena camerata. CONRAD, Jour. Acad. Nat. Sciences, pag. 254, pl. 14, fig. 5.
Compare *Leptæna deltoidea*, CONRAD, and the figures of that species in this work.

Suborbicular; dorsal valve very ventricose in the middle, abruptly elevated in front; disk and umbo nearly flat, or depressed convex; surface marked by numerous crowded unequal radiating striæ; extremities of the hinge line slightly salient, and constricted below; apex scarcely projecting beyond the hinge margin.

The shell is removed from this specimen, except on the disk of the dorsal valve. Near the extremity of the hinge line, and on the disk, there are some obscure wrinkles, which induce me to believe that this shell is only a variety of *L. deltoidea* of CONRAD. The specimen figured, however, I believe to be the original one from which Mr. CONRAD has drawn his description, otherwise I should not have ventured a separation from *L. deltoidea.*

Fig. 2 *a*. Lateral view of the specimen, showing the extreme convexity of the shell in the centre, and the nearly flat disc.

Fig. 2 *b*. Front view, showing the great deflection; the surface is puncto-striate, from being denuded of the shell.

Position and locality. In the Trenton limestone at Trenton Falls. (*State Collection.*)

143. 6. LEPTÆNA DELTOIDEA.

PL. XXXI. A. Figs. 3 *a*, *b*, *c*, *d*, *e*.

Leptæna deltoidea. CONRAD, Ann. Geol. Report, 1838, p. 115:
Strophomena deltoidea. ID. Ib. 1839, p. 64; 1841, p. 37.
— — VANUXEM, Geol. Report, 1842, pag. 46, fig. 2.
— — EMMONS, Geol. Report, pag. 389, fig. 2.

Shell semioval or deltoid; hinge line extending beyond the width of the shell; dorsal valve convex, abruptly deflected at the margin, except a small portion in the centre, which is often produced in front; surface of the disc marked by numerous irregularly concentric undulations or wrinkles, which are crossed by fine equal radiating striæ (one or two of these striæ, in the middle of the shell, more prominent than the others); sides of the shell marked only by the finer striæ; sometimes, in well marked specimens, the striæ are distinctly alternating; disc elevated in the middle; beak scarcely projecting beyond the cardinal line.

This shell differs from the preceding species, in the usually more convex area or disc of the dorsal valve, and the linguiform extension in front, which, though existing in the nasute forms of the *L. alternata*, is not accompanied by the concentric wrinkles. This feature characterizes nearly all the specimens I have seen from Trenton Falls.

The following figures present some variety of form, which this species assumes, under different circumstances and in distant localities :

Fig. 3 *a*. A specimen showing but a slight difference from the last described species. It is marked by distinct concentric wrinkles upon the disc; is finely striated, with more prominent elevated ones alternating with every four, five or six of the smaller ones. In this respect it partakes of the characters of the specimen fig. 1 *i*, which appears to me clearly referable to *L. alternata*.

Fig. 3 *b*. This specimen presents the same form as the last, except that it is more produced in front. The concentric wrinkles on the front are perhaps more distinct, and the shell is contracted more abruptly just below the extremity of the cardinal line, producing small acute ears.

Fig. 3 *c*. Lateral view, showing the elevation of the shell.

Fig. 3 *d*. A specimen of this shell, of nearly the same form as the last. The concentric wrinkles are more distinct, and the radiating striæ are equal, except on the central part of the shell, where they are stronger. The shell is not entirely developed to the margin, and therefore does not appear so much elevated as the last.

Fig. 3 *e*. A larger specimen, with the disc distinctly wrinkled and marked by nearly equal radiating striæ; scarcely produced in front. The striæ on the centre are more distinct than at the sides.

Fig. 3 *f*. A very perfect specimen in form and markings. This drawing is by Mr. Conrad, from a specimen now in my possession. The striæ are a little stronger on the middle of the shell, and in some parts alternate with smaller ones.

It is certainly often very difficult to draw the line of distinction between this species and the *L. alternata*, and more particularly so between this and *L. camerata*. Again, on the other hand, it approaches very close, in some of its forms, to the succeeding species (*L. tenuistriata*); but these two, when well preserved, are clearly and decidedly distinct.

The figures of this species, given by Mr. Vanuxem and Dr. Emmons, scarcely show any concentric wrinkles, and approach more nearly to the nasute form of *L. alternata* (fig. 1 *h*, pl. 31 A).

Position and locality. This species is often abundant in the Trenton limestone, though in many localities it is quite rare, or never seen. It abounds at Trenton Falls, and at Sugar River in Lewis county. It is more rarely seen in the neighborhood of Little Falls, while towards the north it is rarely found, and is scarcely known to me as occurring in the Champlain valley. (*State Collection.*)

144. 7. LEPTÆNA TENUISTRIATA.

PL. XXXI. A. Figs. 4 *a, b, c, d, e, f.*

Ref. *Leptæna tenuistriata.* SOWERBY in Sil. Researches, pag. 636, pl. 22, fig. 2 a.
Compare *Leptæna deltoidea* of CONRAD ut supra.

Semicircular, measuring the disc of the dorsal valve; hinge line extending beyond the width of the shell, the extremities forming small acute ears; dorsal valve with the disc flat, abruptly deflected from the middle; surface marked by about 9 or 10 (12, Sow.) concentric wrinkles, which are crossed by numerous equal crowded striæ; cardinal area narrow linear; foramen nearly closed; beak, in many instances, perforated.

Fig. 4 *a.* A small specimen of this shell, the dorsal valve having about four or five strong undulations upon the surface; the cardinal extremities are strongly deflected.

Fig. 4 *b.* Cardinal line, showing imperfectly the deltoid foramen.

Fig. 4 *c.* A small specimen, having about six distinct undulations on the disc, and three less distinct ones towards the beak; the shell bends abruptly upwards, nearly at right angles to the disc; surface evenly marked by the radiating striæ; the extremities of the hinge line are acute and abruptly deflected, forming small ears.

Fig. 4 *d.* A small shell of this species, exhibiting very indistinct undulations upon the surface, being very abruptly deflected near the margin, and extremely extended on the cardinal line.

Fig. 4 *e.* A larger specimen, showing about four or five distinct undulations on the dorsal valve, and the same number on the ventral valve. The cardinal line is more extended than is usual in this species.

Fig. 4 *f.* Ventral valve and cardinal line of the same species, showing the narrow almost linear area; the latter enlarged, showing the perforation in the beak, which, however, may be due, in part, to injury.

Fig. 4 *g.* Lateral view of the same specimen, showing the abrupt deflection and elevation in front.

This species of Mr. SOWERBY, to which form ours bears a close analogy, is generally regarded as identical with the *Leptæna depressa;* but I am by no means satisfied that it is not really different. In all the specimens which I have seen, the shell has a different aspect, is not so rounded, and is less regularly wrinkled. I have not been able to see the internal structure, which will eventually decide the difference in the two shells.

Should this prove to be the *Leptæna rugosa*, it establishes the existence of that species at a much earlier period than we have been accustomed to suppose, and also that it is one of those rare forms (and at present the only shell known to me) which reappeared after the final deposition of the Hudson-river group.

Position and locality. This species, though very rare in most localities where the other forms of this genus are found, is sometimes seen in other associations near the higher part of the limestone. It is unknown to me in the Hudson-river group, though at the west it is found in a similar position. It occurs at Adams (Jefferson county), near Turin (Lewis county), and at Middleville. Among its western localities, Cincinnati and Oxford (Ohio), Maysville (Kentucky), and Madison (Indiana), are the most important.

145. S. LEPTÆNA ALTERNISTRIATA (*n. sp.*).

Pl. XXXI. B. Figs. 1 *a, b, c.*

Shell semioval, wider than long; cardinal line frequently extended beyond the width of the shell; dorsal valve moderately convex in the middle, and gradually curving upwards; surface marked by radiating striæ of unequal size, a large and small one often alternating; ventral valve with nearly equal radiating striæ; entire surface marked by fine concentric elevated lines; cardinal area narrow, almost linear; callosity of the ventral valve nearly filling the foramen of the other; beak perforated by a minute nearly microscopic circular opening.

It will be observed that this shell possesses several characters in common with *L. alternata;* but it appears to me somewhat different, and I am not able to find a gradation in the characters which would lead me to unite it with that species. It is usually more extended on the cardinal line than that species, and has in consequence a different form, as in 1 *c.* The shell is always lighter and apparently thinner, less abruptly curved and thickened on the margin, though often reaching the size of the largest varieties of *L. alternata.* The striæ on the ventral valve are always of uniform size, while, on the dorsal valve, they alternate in size, often very regularly. This form of shell is usually sufficiently distinct to enable me to separate it readily from among the various forms of the *L. alternata*, and, on this account, I have proposed a distinct name.

Fig. 1 *a.* The dorsal valve of a large specimen, showing a very regular alternation in the size of the striæ.

Fig. 1 *b.* Ventral valve of the same species, the striæ being regular and uniform in size.

Fig. 1 *c.* A smaller specimen, presenting a greater extension of the cardinal extremities, and an irregular alternation of the striæ upon the surface.*

Position and locality. I have not been able to discover this species well characterized among the shells of the Trenton limestone in New-York, though it is not rare in the Blue limestone of the West, at Cincinnati (O.), Maysville (Ky.), Madison (Ia.), and other places, where it is associated with several other species. (*State Collection.*)

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* The characters here given are pretty constant in a large number of specimens; but I have found, since the engravings were finished, a variation in some individuals. A single specimen presents characters like fig. 1 *n*, pl. 30, in the distance of the striæ and the prominent concentric lines. The distance of the prominent striæ is also much greater in this one, and yet there is still but a single intermediate stria. The species, if distinct, suffers many changes and variations analogous to the *L. alternata*, and it may yet prove a variety of that very variable species.

146. 9. LEPTÆNA SERICEA.*

PL. XXXI. B. Figs. 2 *a, b, c, d, e, f, g, h.*

Leptæna sericea. SOWERBY in Sil. Researches, 1839, pag. 636, pl. 19, fig. 1.
Leptæna semiovalis. CONRAD, Ann. Geol. Report, 1838, p. 115.
Strophomena sericea. ID. Ib. 1840, p. 201; 1841, p. 37.
— — EMMONS, Geol. Report, 1842, pag. 394, ill. 105, fig. 1.

Semioval; length usually somewhat more than half the width on the cardinal line; cardinal line extended a little beyond the sides of the shell; dorsal valve convex in the centre, deflected at the edge; ventral valve concave (nearly flat, Sow.); surface marked by fine striæ, which are even and uniform, or alternating with stronger ones; striæ increasing in number towards the margin, granulate or papillose, crossed by a few lines of growth; surface shining.

This beautiful and abundant little shell is readily distinguished by its almost perfectly semioval form, with fine papillose striæ alternating with larger ones; the latter are often obsolete, and the surface appears uniformly striated.

Fig. 2 *a*, *b*. The form and surface of the shell are perfectly preserved in this specimen, both valves of which have distinct larger striæ alternating with several smaller ones.

Fig. 2 *c*, *d*. The opposite valves of another specimen, showing equal striæ and a few concentric lines of growth.

Fig. 2 *e*. The interior of the ventral valve, showing two winglike papillose callosities for the visceral attachment; these are separated by a deep groove in the centre, and margined on that side by a sharp elevated ridge. This marking presents some slight variations of form, sometimes apparently from having been worn, and in others there appears to have been some original difference.

Fig. 2 *f*, shows a variation from the preceding internal structure.

Fig. 2 *g*. Interior of the convex valve, showing the visceral impression, margined by a sharp elevated ridge, which converges to the deltoid opening in the area.

Fig. 2 *h*. View of the cardinal area of the convex valve, showing the deltoid aperture which is partially closed.

From the great numbers of the separated valves of this species, the internal structure can be well examined. A large part of the interior surface is marked by elevated points, as if for the attachment of muscles. The exterior is also papillose, and, where partially exfoliated, the surface is shining and strongly punctate.

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* I have adopted, in this case, Mr. SOWERBY's name, though apparently in opposition to the rule by which I intended to be governed; but notwithstanding Mr. CONRAD's name has precedence in point of time, it was not accompanied by any description or figure, while that of Mr. S. has both. I have, in all cases where possible to ascertain what shells were intended by Mr. CONRAD, applied his names, or given them as synonyms, in order to show what species were indicated by him in his Annual Reports. This is but justice to Mr. C.; and any error or failure must be chargeable only to my inability to identify the species, since there are few labelled specimens in the Collection of the State at this time.

Position and locality. The thin layers in the lower part of the Trenton limestone are often entirely covered with the perfect shells or separated valves of this species. In a higher position, it forms a large proportion of some thin beds, which, when split open, the surfaces present the pearly lustre of recent shells. In some western localities, as at Cincinnati and Oxford (Ohio), it is equally abundant, covering large surfaces of the strata. It occurs in all localities of the Trenton limestone. It also reappears in the Hudson-river group, being in some localities very abundant.

147. 10. LEPTÆNA FILITEXTA (*n. sp.*).

Pl. XXXI. B. Figs. 3 *a, b, c, d, e, f.*

Resupinate, broadly semioval; hinge line a little extended beyond the width of the shell, and deflected at the extremities; dorsal valve concave, elevated towards the beak; sides and front gently inflected; ventral valve uniformly convex on the disc, regularly curving downwards towards the margin; surface marked by crowded equal striæ, which are crossed by fine elevated concentric lines; triangular foramen, in the concave valve, partially filled by the callosity of the opposite valve; area moderately broad.

This shell is characterized by its great proportional width upon the cardinal line, and its equal, regularly rounded striæ, which are crossed by fine elevated lines, giving the surface a textile or woven appearance, which is remarkably characteristic in well preserved specimens, and differs from any other species in this rock.

Fig. 3 *a.* Ventral valve of a specimen of large size. The equal rugose striæ are very distinctly preserved, and also a few subimbricating lines of growth near the margin.

Fig. 3 *b.* View of the cardinal area, showing the deflection at the extremities, and the convexity of the shell.

Fig. 3 *c.* Interior of the dorsal valve, showing the distinct and peculiar form of the visceral impression, and the partially closed foramen. The entire interior surface of the shell is papillose.

Fig. 3 *d.* Dorsal valve of a smaller specimen, which is more abruptly inflected near the margin.

Fig. 3 *e.* Cardinal view of the same, showing the deflection at the extremities of the shell, and the convexity of the ventral valve.

Fig. 3 *f.* An enlarged portion of the surface, showing the textile character.

Position and locality. This species is comparatively rare in the Trenton limestone, though several fine specimens have been found at Middleville, in the lower part of that rock. I have seen small specimens of the same species, from Mineral Point (Wisconsin), and from Ohio, holding a similar geological position. (*State Collection.*)

148. 11. LEPTÆNA PLANUMBONA (*n. sp.*).

Pl. XXXI. B. Figs. 4 *a, b, c, d, e*.

Shell resupinate, robust, length and breadth as 9 to 11; cardinal line straight, suddenly deflected at the extremities, equal to or greater than the width of the shell; sides a little contracted just below the cardinal extremities, leaving slightly salient angles; ventral valve flat or slightly depressed near the beak, elevated and very convex in the middle, somewhat abruptly and concentrically deflected towards the margin; dorsal valve flat on the disc, slightly elevated towards the beak, and deflected to correspond with the other valve; surface marked by radiating striæ, every third, fourth or fifth of which is alternated by a stronger one; entire surface (in perfect specimens) marked by fine concentric elevated lines, and a few imbricating lines of growth.

This is a very neat symmetrical species, presenting very little variation of form. The concentric lines are often obliterated, and the surface shows only the radiating striæ. The remarkable flatness, which often amounts almost to a depression of the convex valve near the beak, is a distinguishing character in all the specimens I have examined. The sides of the shell are suddenly constricted just below the extremities of the hinge line, producing small salient ears; the ventral valve is very convex just forward of the middle, and the opposite valve equally concave.

Fig. 4 *a* & *b*. Views of the two valves; the ventral or convex one *b* showing some strong imbricating lines of growth, while the other valve has but a single one. The beak of the dorsal valve projects beyond the cardinal line of the other valve, as shown in 4 *b*.

Fig. 4 *c*. Cardinal view, showing the nearly linear area and closed foramen. There is sometimes a small space for the protrusion of the ligament.

Fig. 4 *d*. Interior of the concave valve, showing the visceral impression, which is nearly circular, depressed in the centre, and longitudinally marked by strong elevated ridges; it is margined by an elevated border, which proceeds from the two extremities of the foramen, and, curving around, leaves a narrow slit in front. There is an elevated line extending from the beak of the shell, through this slit, to the centre of the valve. The margin is marked by strong ribs, which reach from the edge to the point of curvature of the shell; these ribs are produced by the elevated striæ on the outside, which leave a depression upon the inner margin.

Fig. 4 *e*. Lateral view of the shell, showing its convexity in the middle, and flattening towards the beak.

Position and locality. This shell has not been very clearly recognized in New-York, but it is abundant at the West, in the Blue limestone, holding a position equivalent to that of the Trenton limestone, and associated with the preceding species of Leptæna. Among the western localities, I may mention Cincinnati and Oxford (Ohio), Madison (Indiana), and Maysville (Kentucky). (*State Collection.*)

149. 12. LEPTÆNA DEFLECTA.

Pl. XXXI. B. Figs. 5 *a*, *b*.

Strophomena deflecta. Conrad, Proc. Acad. Nat. Sci. Philadelphia, 1843, Vol. i. p. 332.

Resupinate, semioval; dorsal valve slightly concave and elevated towards the beak, deflected at the angles; ventral valve moderately convex; cardinal extremities reflected; cardinal area wide, partially common to both valves; foramen partially closed; surface marked by fine equal striæ which are crossed by fine elevated concentric lines, giving the striæ a crenulated appearance.

This is a robust, very symmetrical shell, bearing a close analogy to the *L. filitexta* (fig. 3), from which, however, it is apparently distinct. The striæ are more distinctly crenulated, sharper, and more elevated than in that species; though for want of a sufficient number of specimens, and a knowledge of the internal structure of the shell, I still feel some hesitation in regard to its distinctive character. A single specimen, only, has been examined, the prominent characters of which are the nearly flat dorsal valve, with elevated beak and sharply crenulated striæ.

Fig. 5 *a*. Dorsal valve of the specimen.
Fig. 5 *b*. Cardinal area of the same.

Position and locality. This species occurs at Mineral Point (Wisconsin), associated with numerous other well known Trenton species, leaving no doubt of its true geological position.*

150. 13. LEPTÆNA RECTA.

Pl. XXXI. B. Figs. 6 *a*, *b*.

Strophomena recta. Conrad, Proc. Acad. Nat. Sci. Philadelphia, 1843, Vol. i. p. 332.

Semioval, nearly semicircular, compressed; cardinal line very straight, extending beyond the width of the shell, and angulated at the extremities; area narrow, equally common to both valves; ventral valve scarcely convex, with a slight mesial depression; dorsal valve flat, elevated towards the beak; surface marked by strong bifurcating crenulated striæ.

The specimen under examination has perhaps suffered some distortion, but it is remarkable for the nearly equal areas, and the almost entire flatness of both valves. In its angulated and extended cardinal extremities it resembles the succeeding species; but that shell is much longer in proportion to its width, and the striæ are less sharply crenulated.

* Mr. Conrad has kindly placed this and some other western specimens at my disposal, for the purpose of instituting a comparison between the eastern and western species of our lower formations.

Fig. 6 *a*. View of ventral valve.
Fig. 6 *b*. Cardinal view of the same shell.

Position and locality. Associated with the last species, and others, in the lower shaly limestone at Mineral Point (Wisconsin).

151. 14. LEPTÆNA PLANOCONVEXA (*n. sp.*).

Pl. XXXI. B. Figs. 7 *a*, *b*, *c*, *d*.

Shell resupinate, sub-planoconvex, often distinctly inequilateral and oblique; ventral valve moderately convex; dorsal valve nearly flat or slightly concave; cardinal line extended considerably beyond the width of the shell, and often produced into small acute ears; surface marked by rather coarse radiating striæ, which bifurcate towards the margin of the shell; apex usually, and perhaps always, perforated; foramen closed; cardinal area narrow.

The most obvious characters of this shell are its resupinate form, the nearly flat dorsal valve, and frequent inequality of the two sides, or the greater extension of the cardinal line on one side. In these features alone it is dissimilar to all the other species of the genus in the lower strata. In its nearly flat valve, it approaches to the Orthis; while the extension of the cardinal line, and closed foramen, are characters belonging to Leptæna, as well, also, as its general habit, which is different from the true Orthis.

In some of its varieties, and particularly in the ventral valve being flat near the beak, it resembles the last species, but differs essentially from it in the coarser nearly equal striæ and absence of concentric elevated lines, as well as other important characters.

Fig. 7 *a*. View of the dorsal valve, with one of the cardinal extremities produced beyond the other; this feature is not due to wearing, but is the natural form of the shell.
Fig. 7 *b*. View of a smaller specimen, more nearly equilateral.
Fig. 7 *c*. Profile view of the shell.
Fig. 7 *d*. Cardinal view of the first specimen.

Position and locality. This species occurs associated with the two last, having a very extensive geographical range. It is known in numerous localities in Ohio, Indiana, Kentucky and Wisconsin. (*State Collection.*)

152. 15. LEPTÆNA TENUILINEATA.

PL. XXXI. B. Fig. 8.

Strophomena tenuilineata. CONRAD, Jour. Acad. Nat. Sci. Philadelphia, 1842, Vol. VIII. p. 259

"Semioblong-oval, with minute crowded radiating lines; cardinal extremities slightly salient and angulated; one valve slightly convex, the other flat.

"Distinguishable from its congeners of the Trenton limestone by the slight convexity of the inferior valve, and the extreme fineness of the radiating lines. The outline is also different, being wider at the base than any other Trenton species. It resembles *Orthis compressa* (SOWERBY), except in outline being much longer in proportion to the width.

"Occurs in Trenton limestone."

The above is quoted from Mr. CONRAD'S description and remarks, not having seen the shell myself. The drawing is given from his figure, marked with this name, and is doubtless correct. It is evidently a rare species, as I have never met with a single individual. The *Orthis compressa* of SOWERBY, to which Mr. CONRAD compares this species, is a Lower Silurian fossil, corresponding very nearly in position to this one.

153. 16. LEPTÆNA SUBTENTA.

PL. XXXI. B. Figs. 9 *a*, *b*.

Strophomena subtenta. CONRAD, MS. and figure.

Resupinate, semioval; ventral valve convex in the middle; cardinal extremities deflected, somewhat abruptly curving towards the margin, and flattened on the umbo; surface marked by fine equally bifurcating striæ, which are crenulated by concentric lines, obliquely wrinkled on the cardinal margin; interior of the hinge showing two projecting toothlike processes, with a narrow space between them for the passage of a ligament; lateral teeth spreading widely.

I find, among the drawings of Mr. CONRAD, the figure of a Trenton species, with this name attached. I have not seen the same in New-York, but the specimen figured is from a western locality. It bears all the essential marks of the species cited, and I have therefore introduced it under that name. It will, doubtless, be found again in New-York. The cardinal margin bears some resemblance to CHÆTETES, but a careful examination does not show any spires. The strong oblique wrinkles form a distinguishing feature.

Fig. 9 *a*. View of the dorsal valve.
Fig. 9 *b*. Interior of the hinge margin.

Position and locality. In the Blue limestone of Ohio, associated with *Leptæna alternata*, *L. sericea* and *Orthis testudinaria*. Oxford (Ohio). Trenton Falls, on the authority of Mr. CONRAD.

154. 17. LEPTÆNA ——— (*Species undetermined*).

PL. XXXI. B. Figs. 10 *a*, *b*, *c*.

Semioval; greatest width $\frac{10}{16}$, height $\frac{7}{16}$ of an inch; cardinal line scarcely equalling the greatest width of the shell below; surface marked by fine radiating striæ, which are crossed by fine concentric lines; striæ upon the ventral valve equal and uniform in size; those on the dorsal valve consisting of larger striæ with one or two finer ones between, a single one, larger than the others, extending from the beak to the base of the shell; beak imperforate; foramen not closed.

This species presents many characters in common with *L. alternata*, and is perhaps only the young of that shell. The character of the surface markings is very analogous, differing no more than might be expected between the young and old individual. The callosity of the ventral valve, which, in most of the LEPTÆNA, nearly fills the triangular foramen, presents in this case a narrow channel or groove, leaving a passage for the extension of the tendinous peduncle. The imperforate beak shows a distinct small point, projecting beyond the cardinal line. The open foramen is probably due to the youth of the individual, as it often happens that this passage becomes closed with age. Whether the perforation in the beak may become developed as the shell advances in age, I am unable to determine.

The specimens under consideration are apparently young shells, though I have not been able to trace their gradation to the larger forms of *L. alternata*, or any other species. The careful examination of six well preserved specimens shows a uniform development of the characters above given.

Fig. 10 *a*. Ventral valve of this species, showing the equal radiating striæ.
Fig. 10 *b*. Dorsal valve, with unequal striæ.
Fig. 10 *c*. Cardinal area, and the same enlarged, showing the open foramen and imperforate beak.

Position and locality. This shell occurs in the same situation and association with *L. alternata*, *L. sericea*, and other species of the genus.

There are, in addition to the foregoing, one or two undetermined or obscure species, which require further investigation before they can be regarded as established.

155. 2. ORTHIS TESTUDINARIA.

PL. XXXII. Figs. 1 *a* – *l*.

Orthis testudinaria. DALMAN, Vet. Acad. Hand. Stockholm, 1827, p. 115, t. 2, f. 4 *a, b, c, d, e.*
Trigonotretta testudinaria. BRONN, Leth. Geognostica, pag. 82, tab. 3, fig. 2.
Orthis testudinaria. HISINGER, Pet. Suecica, 1837, pag. 71, tab. 20, fig. 11 *a, b, c.*
— — ? SOWERBY in Sil. System, 1839, pag. 640, pl. 20, fig. 9.
— — CONRAD, Ann. Geol. Report of 1839, p. 63; 1840, p. 201; 1841, p. 37.
Orthis striatula, CONRAD in MS. EMMONS, Geol. Report, 1842, pag. 394, ill. 105, fig. 3.
Orthis testudinaria? EMMONS, Ib. pag. 404, fig. 4.

Suborbicular, plano-convex; cardinal line straight, shorter than the width of the shell; dorsal valve convex, much elevated towards the beak, often with an elevated ridge down the centre; beak small, slightly incurved; ventral valve flat, or with a longitudinal depression along the centre, which often produces an emargination in front; cardinal area small; foramen small, triangular; surface covered with fine striæ, which bifurcate towards the margin, and are crossed by elevated threadlike lines, giving them a crenulated appearance.

This species is variable in some respects. Nearly all the specimens from New-York have a regularly depressed-convex dorsal valve, with a flat or sometimes slightly convex ventral valve; while those from Ohio, which are specifically identical, have very frequently an elevated longitudinal ridge on the dorsal valve, and a depression along the flat or ventral valve. These characters do sometimes occur in the Trenton specimens, but not often. In the western specimens the striæ are usually more prominent than in those of New-York, and the shells likewise attain a larger size.

This species is exceedingly abundant in the Trenton limestone, being, with the *Leptæna sericea*, the two most abundant fossils in the rock. It often covers entire surfaces of the thin strata, both as perfect specimens and as separated valves. It appears to be in equal abundance in nearly all the western localities of the same rock.

A comparison of a Swedish specimen of *Orthis testudinaria* with those of New-York, shows no essential difference; the former being a little more elongated, and the ventral valve more convex than in the prevailing forms of the Trenton limestone.

Fig. 1 *a*. Ventral valve, showing the beak of the dorsal valve and the foramen.
Fig. 1 *b*. Profile view of the same shell, showing the convexity of the dorsal valve: the same is shown in the cardinal view, 1 *d*.
Fig. 1 *c*. View of the dorsal valve, showing the small projecting beak.
Fig. 1 *e*. A smaller specimen of the same species.
Fig. 1 *f*. The interior of the dorsal valve, showing the toothlike processes margining the foramen, and projecting forwards into the shell.
Fig. 1 *g*. The interior of the ventral valve, showing the visceral impression, and the two lateral toothlike processes which unite with the processes of the other valve.
Fig. 1 *h*. Cast of the dorsal valve, showing the two visceral impressions, one on either side of a central elevated ridge.
Figs. 1 *i*, *k*, *l*. The same species, from the Blue limestone of Ohio.

Position and locality. This species occurs in every part of the Trenton limestone, appearing near its base, and continuing throughout : it also appears in the Hudson-river group, in almost equal numbers. (*State Collection.*)

156. 3. ORTHIS SUBÆQUATA.

Pl. XXXII. Figs. 2 *a*, *b*, *c*, *d*, *e*, *f*.

Orthis subæquata. Conrad, Proc. Acad. Nat. Sci. Philadelphia, 1843, Vol. i. p. 333.
Compare *Orthis parva*, var. *avellana.* Verneuil, Pal. Russia & Ural Mountains, 1845, p. 188, t. 13, f. 3 & 4.

Semioval or subglobose ; length and breadth about equal ; valves ventricose, subequal, regularly rounded in front ; cardinal line about equal the width of the shell ; area rather large ; dorsal valve very convex, with a prominent elevated centre ; beak extended, scarcely incurved ; ventral valve regularly convex, with scarcely a depression in the centre ; surface covered with crowded, radiating, nearly equal striæ.

Length $\frac{9}{16}$ of an inch ; breadth a little greater.

This shell bears some resemblance to the *O. testudinaria*, but differs in the nearly equal convexity of the valves, the larger area, and more crowded striæ, which do not exhibit the fine concentric lines of the latter species. Well defined specimens have not been found in New-York : the one figured is from the Collection of Mr. Conrad. From its general resemblance to *O. testudinaria*, it would be easily overlooked ; and since it occurs in the same association at the West, it is not improbable but it will be found in New-York.

Fig. 2 *a*. Ventral valve, showing the projecting beak of the dorsal valve, and a portion of the cardinal area and foramen, which is a narrow slit extending to the beak.
Fig. 2 *b*. View of the dorsal valve of the same specimen.
Fig. 2 *c*. Profile view of the same, showing the nearly equal convexity of the valves.
Fig. 2 *d*. Cardinal view of the same, showing a slight depression in the centre of the ventral valve.
Figs. 2 *e*, *f*. Figures of a smaller specimen ; the ventral valve being less convex than in the older specimen.

Position and locality. This species occurs at Mineral Point (Wisconsin), in the Blue limestone, associated with *Leptæna sericea*, *Orthis testudinaria*, *Delthyris lynx*, and other Trenton limestone fossils.

157. 4. ORTHIS BELLA-RUGOSA.

Pl. XXXII. Figs. 3 *a*, *b*, *c*.

Orthis bella-rugosa. Conrad, Proc. Acad. Nat. Sci. Philadelphia, 1843, Vol. i. p. 33.

Semioval ; length and breadth about as 7 to 8 ; valves almost equally convex ; ventral valve with a narrow depression along the centre, which becomes indistinct towards the margin ; beak of the dorsal valve considerably extended beyond the cardinal line, scarcely incurved; surface marked by fine, close, radiating striæ which are unequally bifurcated towards the margin, and transversely marked by prominent imbricating squamose lamellæ, which alternately advance and retreat in passing over the striæ and the spaces between them. Width half an inch; length less than half an inch.

This species is, in form, much like *O. subæquata;* but the valves are less convex, and it is readily distinguished by the squamose striæ, which give the surface a rugose appearance, differing from all the other species of Orthis in this rock.

Fig. 3 *a.* Ventral valve.
Fig. 3 *b.* Dorsal valve.
Fig. 3 *c.* Profile view, showing the nearly straight projecting beak of the dorsal valve.
Fig. 3 *d.* Cardinal view, showing the large triangular foramen.
Fig. 3 *e.* An enlarged portion of the surface, showing the imbricating squamose lamellæ.

Position and locality. This unique and beautiful species occurs with the preceding, and others which are common to the Trenton limestone of New-York, though it has not yet been noticed within this State.

158. 5. ORTHIS DISPARILIS.

Pl. XXXII. Figs. 4 *a, b, c.*

Orthis disparilis. Conrad, Proc. Acad. Nat. Sciences, 1843, Vol. i. p. 333.

Semicircular, with about 28 regular rounded striæ, more than half of which reach the beak, the intermediate ones commencing on the umbo; striæ crossed by finer concentric elevated lines; ventral valve flat or slightly concave, depressed along the centre, which produces a slight curvature in the edge of the shell; margin of the shell regularly rounded from the extremities of the cardinal line; area large; foramen a narrow nearly linear slit, reaching to the apex.

This peculiar shell is readily identified by its greatly elevated or subconical dorsal valve, and quite flat or slightly concave ventral valve. The striæ are stronger than in the preceding species, and uniformly crossed by concentric lines as in *O. testudinaria.* The dorsal area is proportionally larger than in any other species except *O. tricenaria,* which is a larger and more elongated shell.

Fig. 4 *a.* Ventral valve.
Fig. 4 *b.* Dorsal valve.
Fig. 4 *c.* Profile view, showing the great disproportion in the size of the valves.
Fig. 4 *d.* View of the cardinal area and foramen.

Position and locality. This species occurs at Mineral Point (Wisconsin), associated with the preceding species. I have also seen it from Cincinnati, associated with numerous species of Brachiopoda typical of the Trenton limestone.

159. 6. ORTHIS PERVETA.

PL. XXXII. Figs. 5 *a*, *b*, *c*.

Orthis perveta. CONRAD, Proc. Acad. Nat. Sci. Philadelphia, 1843, Vol. i. p. 333.

Transversely suboval, somewhat wider below than the length of the hinge line; valves slightly ventricose, nearly equal; surface marked by numerous fine radiating striæ, which bifurcate on the umbo; ventral valve with a slight almost imperceptible depression along the middle; dorsal valve with a broad elevation in front, producing a sinuous margin; cardinal area partially common to both valves, as likewise the deltoid foramen.

Length about one third of an inch; breadth nearly half an inch.

Fig. 5 *a*. View of the ventral valve, and area of the dorsal valve.
Fig. 5 *b*. Cardinal view of the same specimen.
Fig. 5 *c*. Profile view, showing the width of the area, and the projecting beaks on both valves.
Fig. 5 *d*. Cardinal view magnified, showing that the area and foramen are partially common to both valves.

I have adopted this species, with the three preceding ones, from Mr. CONRAD, as they occur associated with several well known Trenton species at Mineral Point (Wisconsin). The associated species more particularly are the *Orthis tricenaria*, *O. pectinella*, *O. testudinaria*, *Leptæna sericea*, *Delthyris lynx*, &c.

160. 7. ORTHIS ÆQUIVALVIS (*n. sp.*).

PL. XXXII. Figs. 6 *a*, *b*, *c*.

Subrotund; valves almost equally convex; length nearly equal to the breadth; sides contracted just below the cardinal line, which is less than the greatest width of the shell; area narrow; foramen small; dorsal valve differing from the ventral, in the beak being slightly extended, and scarcely curved over the foramen; surface marked by about twenty rather sharp radii, with deep intermediate spaces; radii strongly marked entirely to the beak, and becoming bifid or trifid towards the middle of the shell.

This species is easily recognized, from the almost perfectly equal valves, the beak of the dorsal valve being only a little more extended than that of the ventral valve. The strong radiating striæ or costæ, which are usually bifid or trifid, are marked as if by the bases of short spires, or of squamose projections of the shell, which, in perfect specimens, indicate a character much like *Atrypa aspera*.

Fig. 6 *a*. View of the ventral valve, showing the beak of the dorsal valve, a small portion of the area, and triangular foramen.
Fig. 6 *b*. View of the dorsal valve.
Fig. 6 *c*. Cardinal view of the same, showing the equality of the valves.

Position and locality. In Trenton limestone, Middleville? Cincinnati.

161. 8. ORTHIS FISSICOSTA (*n. sp.*).

Pl. XXXII. Figs. 7 *a*, *b*.

Compare *Orthis calligramma*. Dalman, Hisinger, de Verneuil.
Orthis actoniæ. Sowerby in Murchison's Sil. System, pag. 639, pl. 20, fig. 16.

Semioval, with the cardinal line somewhat less than the width of the shell ; area narrow ; foramen narrow, triangular, reaching to the apex ; dorsal valve moderately convex, with the beak extending and slightly incurved ; ventral valve moderately convex in the middle, and depressed at the sides ; surface marked by angular costæ, which become bifid and trifid on the centre or towards the margin of the shell ; number of costæ about 19 or 20.

This shell, in its general form, resembles the *O. calligramma ;* but it is clearly a distinct species, judging from a single European specimen in my possession. The bifid, trifid, and even quadrifid costæ are an obvious difference, though such a change may take place in the costæ of *O. calligramma*. The costæ are fewer on this species, and more elevated ; the ventral valve is convex, while in that species it is flat and slightly depressed in the centre ; the dorsal valve is less convex in our species, though the specimen is somewhat crushed.

In the divided character of the costæ, this shell resembles the *Orthis actoniæ* cited above ; but our specimen is smaller than the one figured by Sowerby, and has a greater number of costæ (19 on the dorsal and 20 on the ventral valve, while that one has 14). A comparison with a single specimen of *O. actoniæ* shows the costæ to be more distant in that species than in ours.

Fig. 7 *a*. View of the ventral valve, showing a portion of the area and beak of the dorsal valve.
Fig. 7 *b*. Profile view of the same, showing the projecting beak of the dorsal valve. The dorsal valve has been crushed, so that the profile view does not give a correct idea of its convexity.

Position and locality. This species occurs with the preceding ones in the Blue limestone of the West, but it is unknown to me in New-York. I obtained but a single specimen near Cincinnati, showing that the shell is comparatively rare.

162. 9. ORTHIS TRICENARIA.

Pl. XXXII. Figs. 8 *a*, *b*, *c*, *d*, *e*.

Orthis tricenaria. Conrad, Proc. Acad. Nat. Sciences, 1843, Vol. i. p. 333.

Semioval ; length and breadth nearly equal ; cardinal line straight, equal to, or greater than the width of the shell ; area very broad ; foramen long, sublinear ; dorsal valve subconical, with the apex much elevated and produced, though scarcely incurved ; cardinal margins sloping very obliquely from the beak ; ventral valve flat, regularly rounded from the extremities of the hinge line ; surface marked with from 16 to 32 rounded simple radii, with spaces between equal to the radii.

The most striking character of this shell, and one which will serve to distinguish it from any other Orthis known to me in New-York, is the great elevation of the dorsal valve, and remarkably broad cardinal area ; the ribs are always simple, continuing distinct quite to the apex of each valve, and gradually enlarging towards the base ; the foramen is somewhat linear in perfect specimens, and continues quite to the beak.

Fig. 8 *a*. View of the ventral valve and area; the specimen imperfect.
Fig. 8 *b*. Interior of the dorsal valve, showing the cardinal area.
Fig. 8 *c*. Exterior of the dorsal valve.
Fig. 8 *d*. Interior of the ventral valve, showing the toothlike processes and visceral impression.
Fig. 8 *e*. Profile view of a perfect specimen.

This is a rare shell in New-York, and I have been able to obtain but few specimens, and these for the most part imperfect. Its associates in the strata are *Orthis testudinaria*, *Leptæna sericea*, *Atrypa triplex*, *Ceraurus pleurexanthemus*, *&c.*

Position and locality. In New-York, it occurs in the lower part of the Trenton limestone, associated as above, at Middleville. It is found at Mineral Point (Wisconsin), apparently in the higher part of the same rock. (*State Collection.*)

163. 10. ORTHIS PLICATELLA (*n. sp.*).

Pl. XXXII. Figs. 9 *a*, *b*, *c*, *d*, *e*, *f*, *g*.

Compare *Orthis radians*. J. Sowerby in Sil. System, pag. 639, pl. 22, f. 11.

Broadly semioval, nearly equivalve, length and breadth about as 3 to 4; surface marked by strong radiating plicæ, which are usually simple, about 20 to 28 on each valve, crossed by simple elevated concentric lines, which are more distinct in the depressions between the costæ, and often obscure or obsolete upon their exposed surfaces; valves nearly equally convex, without sensible depression or elevation on either one, meeting at the edges in a straight line; cardinal line not extending beyond the width of the shell; area narrow; dorsal foramen extending to the beak.

This species bears some resemblance to *Orthis radians* of Sowerby, but it proves clearly distinct on comparison with his description; the plications are never so few as 15, and the shell is never concave in front. The equal convexity of the valves, and uniform, strong, somewhat sharp plications, are distinguishing characters. The proportionate greater extension of the hinge line, and less distance from beak to base, distinguish this shell from any variety of *O. pectinella*, even when the surface only can be seen.

Fig. 9 *a*. Ventral valve of medium size.
Fig. 9 *b*. Ventral valve of a small individual.
Fig. 9 *c*. Ventral valve, showing the apex and part of the dorsal area.
Fig. 9 *d*. Profile view of the same.
Fig. 9 *e*. Cardinal view, showing the dimensions of the area and foramen.
Fig. 9 *f*. Ventral valve of a large specimen; the plications trifid towards the base.
Fig. 9 *g*. Profile view of the same.

Position and locality. A single well marked specimen only, has fallen under my observation within the State (at Middleville), where it occurs in the lower part of the Trenton limestone. It is quite frequent at Cincinnati (Ohio), Maysville (Ky.), Madison (Indiana), associated with the *Leptæna alternata*, *L. sericea*, *Orthis testudinaria*, and other fossils typical of the Trenton limestone. (*State Collection.*)

164. 11. ORTHIS PECTINELLA.

Pl. XXXII. Figs. 10 *a*, *b*, *c*, *d*, *e*.

Orthis callactis & *Orthis flabellulum*. Conrad, Ann. Geol. Report of 1840, p. 201; of 1841, p. 27.
Orthis pectinella. Conrad in MS. Emmons, Geol. Report, 1843, pag. 394, ill. 105, fig. 2.
Compare *Orthis callactis*, Dalman, Vet. Acad. Handl. 1827, pag. 112, pl. 2, fig. 2.
— — Hisinger, Pet. Suecica, 1837, pag. 70, tab. 20, fig. 9.
— — Sowerby in Murchison's Sil. System, 1839, pag. 613, pl. 19, fig. 5.
Orthis flabellulum. J. Sowerby in ib. fig. 8; and pl. 21, fig. 8.
Orthis calligramma, and synonymy. Murchison and Verneuil, Pal. of Russia and the Ural Mountains, pag. 207, pl. 13, fig. 7 *a*, *b*, *c*, *d*, *e*, *f*; var. *orthambonites*, fig. 8; var. *ovata*, fig. 9.*

Suborbicular or obtusely semioval, wider than long in the proportion of about 9 to 12; cardinal line extended, equal to or less than the greatest width of the shell, slightly deflected at the extremities; area moderately large and well defined; shell resupinate, or the area and foramen being principally on the flatter valve, or partially common to both; dorsal valve subconvex near the beak, with flat sides and a broad depression along the centre, which is distinct in front; ventral valve regularly convex, most prominent in the centre; beak extending only to the cardinal line; surface marked with from 22 to 30 prominent rounded radii, which are equal to the spaces between; radii simple, or bifid and trifid towards the margin, crossed by small elevated concentric lines.

This shell usually presents a regular suborbicular outline, with well defined dorsal area, and strong diverging ribs, which are well marked to the beaks of the shell. A prominent distinguishing trait is its resupinate character, placing the area and foramen essentially on the dorsal valve, which is nearly flat, while the ventral one is convex. The radii, in some specimens, are of uniform size and undivided, while in others they are bifid and trifid from the middle downwards. The number of ribs is greater than in the *O. callactis* of Dalman; and in this respect, as well as their subdivision, it resembles the *O. flabellulum* of J. Sowerby, as cited above.

Fig. 10. A small individual, having the radii simple on both valves.
Fig. 10 *a*. The ventral or convex valve, with the radii simple or nearly so.
Fig. 10 *b*. Dorsal valve of the same specimen, having the radii bifid and trifid towards the margin.
Fig. 10 *c*. Cardinal view of another specimen.
Fig. 10 *d*. Ventral valve, with the radii nearly simple.
Fig. 10 *e*. Interior of the ventral valve.

Position and locality. This species, though not usually abundant, occurs nevertheless in nearly every part of the Trenton limestone, though unknown to me in the Hudson-river group. Its principal localities are Middleville, Trenton Falls, Sugar River, Turin, Watertown, showing that the species is widely distributed. (*State Collection.*)

* M. de Verneuil regards the *Orthis calligramma*, *O. callactis?* *O. flabellulum*, and others, as being the single species first named by Dalman, the other names having been applied to varieties of the same species. The species referred by me to *Orthis flabellulum* (Report, 1843, pag. 105, fig. 5), is apparently distinct from the one under consideration, and occurs in a higher position.

165. 12. ORTHIS PECTINELLA, *var.* SEMIOVALIS.

PL. XXXII. Figs. 11 *a*, *b*, *c*.

Broadly semioval, resupinate, length and breadth as 7 to 10; cardinal line distinct, equal to the width of the shell, a little inflected at the extremities; area moderately broad; dorsal valve depressed-convex near the beak, flat towards the margin, and a little concave at the cardinal extremities; ventral valve regularly convex, with the beak incurved and scarcely projecting beyond the margin of the shell; surface marked by about 28 to 36 simple subangular ribs, with equal intermediate spaces.

The plications are remarkably simple, showing no tendency to bifurcation, and are always clearly defined. It differs from the *O. pectinella* in its greater proportionate width and finer plications, though not sufficiently to make it a distinct species. It approaches somewhat in shape to the *O. plicatella*, but is usually longer in proportion to its breadth, and the sides are more regularly curved. The resupinate character is a strong mark of distinction, when the area can be seen.*

Fig. 11. A large specimen, somewhat imperfect on one side. The plications in this shell are 36.
Fig. 11 *a*, *b*. Dorsal and ventral valve of a smaller individual, the latter somewhat worn on the surface.

Position and locality. In the higher part of the Trenton limestone at Turin, Watertown, and Middleville. (*State Collection.*)

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* I have given below two figures of *Orthis calligramma*, from an authentic European specimen, for the purpose of comparison with *O. pectinella*, which has been regarded as identical with it. The difference in the profile views will be at once perceived, as well as in the figure of the ventral valve compared with the figures 10 *a* and *b*. The convex dorsal valve, with the beak curving over the ventral valve, in the European specimen, is readily contrasted with the short beak of the convex valve in *O. pectinella*; while the dorsal valve, nearly flat on the centre, is elevated at the beak, producing the area.

The species known in Ohio as *O. callactis* (*O. plicatella*, p. 122), is quite distinct from the European species of that name, as will be readily seen on comparison of figs. 9 *a* – *h*, Plate xxxii.

Fig. *a*. View of the ventral valve of *Orthis calligramma*,
Fig. *b*. Profile view of the same.
Fig. *c*. Profile view of *Orthis pectinella*.

166. 13. ORTHIS INSCULPTA (*n. sp.*).

Pl. XXXII. Figs. 12 *a*, *b c*.

Shell resupinate; dorsal valve depressed-convex; beak elevated, not incurved; cardinal line less than the width of the shell; area short; surface marked by fine elevated radii, which are bifid on the umbo, and again regularly bifid or trifid towards the margin of the shell; transversely marked by strong elevated concentric lines, which are particularly prominent between the radii, giving an indented or sculptured appearance to the surface; interior of the dorsal valve showing marks of the visceral impression, which is peculiarly sculptured.

This species, of which a single valve only has been seen, is so peculiarly marked as not to be mistaken among all the other species of Orthis in the lower rocks. The cavity under the foramen is large and deep, marked on its lower and outer extremities by two pointed sacs, and margined by a thickening of the shell around: the visceral impression on the outside of this cavity is of a double auricular form, and sculptured by curved elevated lines. The inner margin of the shell is impressed by the outer radii.

This very peculiar form is usually associated with the following forms in the Blue limestone of Ohio. Its very beautiful sculpture, both internally and externally, is sufficient to distinguish it from all other species in the rock.

Fig. 12 *a*. Dorsal valve, the beak imperfect. *b*. Interior of the dorsal valve. *c*. Dorsal area.

Position and locality. Same as the preceding and following species.

167. 14. ORTHIS DICHOTOMA (*n. sp.*).

Pl. XXXII. Figs. 13 *a*, *b*.

Suborbicular; valves almost equally convex; cardinal line less than the width of the shell; dorsal area rather large, compared with the size of the shell; beak extended, not incurved; greatest elevation of the dorsal valve below the beak, and opposite the cardinal line; ventral valve uniformly convex; surface marked by about 26 well defined rounded radii on each valve, which uniformly bifurcate about half way from the beak to the base of each valve; radii indistinctly crenulated by obscure concentric lines, which are more distinct on the intermediate spaces.

This is a neat symmetrical shell, which, although not very conspicuous, is nevertheless clearly distinct from any other species. The radii are well defined and regularly dichotomous, which, with the moderate and nearly equal convexity of the two valves, are characters not observed in any other species. It approaches in some respects to *O. æquivalvis*, but is less convex, and the beaks more unequal. It likewise approaches in some respects to *O. fissicosta*, but the radii are more numerous, and the beak not incurved: the entire shell is also less robust in habit.

Fig. 13 *a*. Ventral valve, showing the projecting dorsal beak. *b*. Profile view of the same.

Position and locality. This species occurs at Cincinnati (Ohio), associated with many of the preceding and succeeding species.

168. 15. ORTHIS SUBQUADRATA (*n. sp.*).

PL. XXXII. A. Figs. 1 *a* – *o*.

Subquadrate, the cardinal line forming one side, the sides and base being nearly straight, with the angles rounded; cardinal line less than the width of the shell, extremities curved; area small, partially common to both valves; foramen moderate, triangular, partially common to both valves; dorsal valve nearly flat or slightly depressed near the margin, elevated towards the beak, which is small and well defined; ventral valve regularly convex, with a shallow sinus along the centre, producing a slight elevation of the dorsal valve in front; surface marked by uniform subangular radii, which bifurcate near the beak, and again towards the margin, those near the cardinal line curving upwards; radii crossed by fine elevated concentric lines, which are very distinct in the depressions between the rays.

This species and the three succeeding ones are often confounded; but if the following points are observed, there will be little difficulty in distinguishing the one under consideration by the external characters, the internal markings being quite distinct.

The form of a perfect specimen is subquadrate, as shown in the figures; the surface is evenly marked by radii which bifurcate twice, very rarely three times, before reaching the margin: the upper lateral ones curve upwards, so as often to run out upon the cardinal line, or the rounded slope near its extremity. This character is never observed in either of the following species. The visceral impression in the dorsal valve is subquadrangular, and broad below, the base being nearly on a straight line. The foramen of the ventral or convex valve is partially filled by a thick medial tooth, which projects above the plane of the area, and is deeply striated on the two sloping upper and outer sides.

By comparing the parts indicated with either of the two following species, there will be no difficulty in deciding as to which the individual belongs.

Fig. 1 *a, b, c.* Three views of the dorsal valve, showing gradation in the size of the shell.
Fig. 1 *d, e.* Profile views, showing the nearly equal elevation of the beaks.
Fig. 1 *f, g.* Front views, showing the slight elevation produced by the sinus in the ventral valve.
Fig. 1 *h, i.* Ventral valves, showing the slight depression along the centre of the shell.
Fig. 1 *k.* Cardinal view, showing the area, foramen, etc.
Fig 1 *l.* Exterior of a large dorsal valve somewhat flattened from compression.
Fig. 1 *m.* Interior of the same, showing the form of the visceral impression and the marks of the external radii, which terminate near the margin.
Fig. 1 *n.* Dorsal area and foramen.
Fig. 1 *o.* Interior of the ventral valve, showing the narrow area and foramen, with the projecting medial tooth, which is enlarged in the upper figure. The impressions of the external radii are visible but a short distance from the margin on the inside of the shell.

Position and locality. This is a common species in nearly all the western localities, being known at Maysville (Kentucky), Cincinnati and Oxford (Ohio), Madison (Indiana), and other places, associated with other species of the genus, and with LEPTÆNA.

169. 16. ORTHIS OCCIDENTALIS (*n. sp.*).

Pl. XXXII. A. Figs. 2 *a – m*; and Pl. XXXII. B. Figs. 1 *a – i*.

Resupinate, transversely somewhat oval, or longitudinally semioval; length and breadth about as 5 to 7; cardinal line equal to the greatest width of the shell; area large, triangular, partially common to both valves; foramen narrow, triangular, reaching to the apex of the dorsal valve; dorsal valve convex towards the beak, and usually flattened or slightly convex towards the margin (in old shells a broad depression in front); beak much elevated, straight, not incurved; ventral valve regularly convex, with a slight depression along the centre; beak slightly projecting beyond the cardinal line, and incurved; surface marked by subangular radii, which bifurcate at one-half or two-thirds the distance from beak to base; radii crossed by fine sharp elevated concentric lines, which are usually well preserved in the spaces between the radii.

This species, in some of its phases, approaches in general aspect to the last, but differs in essential particulars. The length from beak to base is proportionally less than in the last; the depth of the two valves together, when not compressed, is greater; the beak of the dorsal valve is more elevated, the area larger and foramen longer; the beak of the ventral valve is likewise a little more incurved; the radii are stronger, and do not bifurcate near the beak; the concentric elevated lines are sharper and finer; the striæ are straight and direct, the last ones not bending upwards as in the *O. subquadrata*. As the shell becomes advanced, the dorsal valve presents an increasing depression towards the margin, which finally becomes a broad, not distinctly defined sinus. At the same time the slight depression in the centre of the ventral valve, similar to that in the last species, does not reach the margin, and finally becomes obsolete. The slight elevation in front, shown in the last, is exactly reversed in this species.

These characters, when once observed, will not fail in enabling the student to identify the species, and to distinguish it from any others in the same geological position.

The internal structure is not as well known as in the last, the interior of the dorsal valve not having been seen. The interior of the ventral valve corresponds in general character to the last; the small medial ventral tooth does not, however, reach as high as the plane of the area, and it is thin and sharp, while the last is thick. The interior surface is marked nearly to the beak with the impressions of the external radii; while in the last, these markings reach only a short distance from the margin.

Plate XXXII. A.

Figs. 2 *a – f*, are illustrations of a series of this species, beginning with the smallest recognized specimens, and passing through the several grades, till the increasing rotundity of the ventral valve towards the umbo, rises above the beak of the dorsal valve.

Figs. 2 *g*, *h*. Profile views of several specimens as above. The strong, nearly straight, and greatly elevated beak of the dorsal valve is well shown, as is also the slightly incurved beak of the ventral valve; the latter becoming more gibbous as the shell advances in age.

Figs. 2 *i, k, l, m.* Front views, showing the increasing sinus of the dorsal valve as the shell becomes older.

Plate XXXII. B.

Figs. 1 *a, b.* Cardinal views of a young and old specimen of *Orthis occidentalis.*

Fig. 1 *c.* Ventral valve of an imperfect specimen, partially showing the interior of the dorsal valve, which is strongly marked by the external radii.

Fig. 1 *d.* Profile view of a large specimen.

Figs. 1 *e, f, g.* Views of ventral valves.

Figs. 1 *h, i.* Interior of ventral valves of the same species, showing the medial tooth and the marks of the external radii.

Position and locality. This species is associated with the preceding, in considerable numbers, in the Blue limestone of the West; being found at Maysville (Ky.), Cincinnati and Oxford (Ohio), Madison (Indiana), and other places. (*State Collection.*)

170. 17. ORTHIS SINUATA (*n. sp.*).

Pl. XXXII. B. Figs. 2 *a – s.*

Semioval, with a sinus in front; cardinal line scarcely equal to the width of the shell; dorsal area large, triangular; foramen triangular, reaching to the beak, the upper margins sloping rather abruptly from the beak; ventral area narrow linear, foramen broad triangular, with a distinct medial tooth, which reaches as high as the area; dorsal valve convex, its greatest elevation at the point of the beak, which is acute; a depression along the centre, which becomes a sinus in older shells; ventral valve regularly convex in young specimens, gibbous, somewhat emarginate and elevated in front in older specimens; surface marked by strong, regular, rounded striæ, which bifurcate in a nearly uniform manner about half way to the base; striæ crossed by elevated sub-imbricating concentric lines. A few imbricating lines of growth are distinct towards the margin of the older shells.

This species is distinguished from the last by the stronger and more prominent striæ, which are likewise more regularly bifurcating. The beak of the dorsal valve is more elevated and acute, giving a greater height to the dorsal area. The ventral valve is about equally convex or gibbous with the last, while it never exhibits any depression along the centre. The depression or sinus in the dorsal valve is usually more abrupt, deeper, and often accompanied by a corresponding elevation on the ventral valve, which does not occur in the preceding species. The young shells of the species under consideration are more gibbous than the last, and have the beak of the dorsal valve more elevated and acute, differing conspicuously in this respect from the previous one.

The variations produced by age, and the difficulty of obtaining a series of specimens, often produce confusion in regard to these similar species, and it will frequently be found a difficult task to make the proper disposition of specimens.

In the young shells of this species, looking upon the ventral valve, the beak of the dorsal valve is distinctly seen projecting beyond the umbo; but as the shell grows older, this part of the ventral valve becomes gibbous, and projects beyond the line of the beak of the opposite valve.

Figs. 2 *a, b, c, d, e.* A series of specimens, illustrating the variations produced by age.
Figs. 2 *f, g, h.* Profile views of specimens of different ages, showing the gradual increasing rotundity of the ventral valve, and also the more acute beak of the dorsal valve as compared to the last.
Figs. 2 *i, k* Front views of young and old specimens.
Figs. 2 *l, m.* Cardinal views of young and old specimens.
Figs. 2 *n, o* Ventral valves of a young and old specimen.
Fig. 2 *p.* Interior of the dorsal valve, showing the form of the visceral impression, and the radii near the margin.
Figs. 2 *q, r.* The two lower figures show a slight difference in the character of the visceral impression.
Fig. 2 *s.* Interior of the ventral valve, showing the medial tooth, which is thicker and stronger than in the last species, and is connected with a strong medial ridge which is trifid below. The radii are only shown near the margin of the valve; in which respect, also, it differs from the preceding species.

Position and locality. This is equally abundant with the two preceding and the following one, in many western localities. It occurs at Maysville (Ky.), and Cincinnati; while it is less frequently found at Oxford (Ohio), and at Madison (Ia.).

171. 18. ORTHIS SUBJUGATA (*n. sp.*).

PL. XXXII. C. Figs. 1 *a – m.*

Semioval, with the front somewhat produced; cardinal line nearly equal the width of the shell; dorsal area moderately large, triangular; ventral area narrow, linear; dorsal valve having its greatest elevation just below the beak, or sometimes at the point of the beak; sides somewhat depressed, often flattened, with a deep broad mesial depression; ventral valve convex, gibbous on the centre and towards the umbo; surface marked by even rounded striæ, which are dichotomous and trichotomous towards the margin; concentric lines not very conspicuous; a few imbricating lines of growth visible towards the margin; a mesial elevated ridge in older specimens.

This shell bears considerable resemblance to the last, except that the striæ are much finer, and the concentric lines less distinct. The beak of the dorsal valve is less elevated, and the umbo of the ventral valve, in old shells, more prominent than in the preceding species. There is some variation in the length of the cardinal line, as compared with the width of the shell; but in the one under consideration, it is always proportionally more extended than in the preceding species. The sinus of the dorsal valve is also more distinct in the young shells, and is equally conspicuous in older ones.

This species differs from *O. occidentalis*, in the absence of a depression on the ventral valve, as well as in general form, striæ, and other particulars. It bears about the same relation to the last, that *O. subquadrata* does to *O. occidentalis*.

The distinctions here indicated are believed to depend upon essential differences of structure, which are shown in the three preceding species; and a further collection of disconnected valves will doubtless enable us to discover additional points of disagreement in specific characters. The three preceding species, with this one, are scarcely regarded as distinct, and are usually found mingled together in collections. This species, and *O. sinuata*, often suffer distortion from pressure, and on this account are frequently inequilateral, and the sinus of one valve, with the corresponding elevation upon the other, are unduly developed.

Fig 1 *a.* Ventral valve of a young specimen.
Fig. 1 *b.* Profile view of the same.
Fig. 1 *c.* Front view of the same.
Fig. 1 *d.* Dorsal valve of another specimen, with a deep sinus.
Fig. 1 *e.* Front view of the same.
Fig. 1 *f.* Dorsal valve of an older specimen, showing the gibbous ventral valve projecting beyond the cardinal line.
Fig. 1 *g.* Front view of the same.
Fig. 1 *h.* Dorsal valve of an old individual.
Fig 1 *i.* Front view of the same, showing the deep sinus of the dorsal valve, and the corresponding elevation on the opposite valve.
Figs. 1 *k*, *m.* Cardinal views of young and old individuals.

Position and locality. In the Blue limestone of Ohio, at Cincinnati and Oxford (Ohio), Maysville (Kentucky), Madison (Indiana).

Several of the species of Orthis here given, so far as our present knowledge extends, are exclusively confined to western localities, and may not be found in New-York. There are others which will probably be recognized among the imperfect specimens found in the Trenton limestone of New-York, but which are too imperfect for description. All the specimens figured, except those given on the authority of Mr. Conrad, were found associated with well known Trenton limestone fossils, and have been collected by myself, as well as subsequently furnished by several friends in Ohio and elsewhere.

Genus DELTHYRIS, or SPIRIFER.*

We have but a single species of this genus in our older strata, so far as known at the present time; and this one possesses so many abnormal characters, that M. de Verneuil is inclined to regard it as distinct from the true Spirifer, in having, always, the ventral larger than the dorsal valve.

There are also some other reasons why this species may be regarded as an erratic one, possessing in part the characters of both Orthis and Delthyris. We shall have observed, in some of the preceding species of Orthis, a remarkable departure from the general external forms of this genus, and an approach to the Delthyris; this variation in external form is also accompanied by a difference in the internal characters. The area and foramen being common to both valves, is a character of frequent occurrence in Orthis, but rare in the Delthyris, where the ventral valve of normal species scarcely presents the vestige of an area or foramen.

It is very remarkable that the single species known in our older strata, and apparently the earliest created one both on this continent and in Europe, should present characters common to the Orthis, which is so well characterized, and the species of which are very numerous in our older rocks. The Delthyris, we shall observe, also, is not one of the earliest developed forms; for in the first epoch when Brachiopods occur, we find Leptæna, Orthis and Atrypa; while in the epoch of which we are now speaking, we find these three forms largely developed, with a single one assuming the delthyroid type, which, in subsequent periods, becomes so numerous in species.

Glancing for a moment at the Brachiopods in their successive appearance upon our globe, we find that Leptæna, Orthis and Atrypa, appear at the same period: and these must be regarded as types in the order of time, and as those to which we should really look for our ideas of generic character. In the second period, or the one of which we are now speaking, we find the orthoid type has admitted of some modifications, and that the first delthyroid type possesses some of those characters which are thrown off, and the true normal character assumed in subsequent periods.

If we choose to look a little farther, we shall find the leptænoid forms furnished with spines on the cardinal margin (the *Chonetes*, Fischer); and, finally, that as the surface

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* I have preferred to use the term *Delthyris* instead of *Spirifer*, though both names have at the present time the same application. The genus *Spirifer* was proposed by Mr. Sowerby, ten years in advance of Dalman's subdivisions of the Brachiopoda; but the characters given by the former do not separate that genus from *Orthis*, and not only have specimens of that genus, but also of *Atrypa* or *Terebratula*, been confounded under the same term. The spiral appendage within the shell, which gives origin to the name, is found likewise in several species of *Atrypa* in the palæozoic strata; and this therefore cannot be regarded as a distinguishing character, any more than the deltoid foramen in *Delthyris*, which is equally common to *Orthis*. Since, however, the application of the two names is now precisely similar, either one may be used without producing confusion; and I am well satisfied that a subdivision of the genus *Spirifer* (as now limited in Europe) will be made, when the species, varying so much in external character, shall be more carefully studied.

of these forms becomes entirely spinous, they have assumed other characters essentially different from LEPTÆNA, and become the true PRODUCTUS. In the same manner the ATRYPA of the older rocks, having no visible foramen or perforated beak, passes through some other modifications, and gradually assumes the characters of the true TEREBRATULA. At the same time, the deviations from the type of ATRYPA give rise to the Genera PENTAMERUS, STRIGOCEPHALUS, &c.; while some of these approach the DELTHYRIS, which never departs from its normal character to such a degree as to warrant a generic distinction, according to our present knowledge of these forms.

DELTHYRIS BIFORATUS.

Terebratulites biforatus. SCHLOTHEIM, 1820, Petrefacta, p. 265.
Atrypa dorsata? HISINGER, 1837, Lethæa Suecica, pag. 76, pl. 21, fig. 14.
Spirifer biforatus. EICHWALD, 1840, Sil. System in Esthland, p. 144.
— — MURCHISON & VERNEUIL, 1845, Geol. and Pal. Russia, &c. Vol. ii. p. 135.

Var. A. *Spirifer lynx*, EICHWALD.
Var. B. — *dentatus*, PANDER.
Var. C. — *chama*, EICHWALD.

The synonymy above is cited from the work of Messrs. MURCHISON and DE VERNEUIL, on the Geology and Palæontology of Russia and the Ural Mountains. Under this species, three principal varieties are designated, while the *T. biforatus* of SCHLOTHEIM is very rare both in Europe and elsewhere. The characters by which that one is distinguished from the other principal varieties, appear to be, according to VON BUCH, the existence of five plaits in the sinus, and the greater proportional width of the shell. These characters alone are scarcely sufficient to constitute a variety; for we have specimens with five plaits in the sinus, where the width is not extended; while we have others with this number of plaits, where the width is extended; and again we have specimens with a fewer number of plaits in the sinus, where the width is much extended : so that it is scarcely possible to find any constant variety in this respect.

The examination of more than one hundred specimens from different localities has scarcely shown two precisely alike in every particular, except the very young shells, which, both in New-York and in western localities, often present the same essential characters in every respect. We are able to distinguish, in our American specimens, at least an approach to the three varieties cited; but there are so many intermediate forms, that strict distinctions cannot be drawn. This we should expect, when we notice the fact just stated of the extreme variation in the external characters, so that we can scarcely hope ever to find constant forms in any one of the varieties : neither should this be expected, for a constant variety would compel us to admit a specific distinction.

172. 1. Var. A. DELTHYRIS LYNX.

PL. XXXII. D. Figs. 1 *a* – *u*, & A – U.

Terebratula lynx. EICHWALD, 1830, Skizze von Podolie, p. 202.
Spirifer lynx. VON BUCH, 1837, Ueber Delthyris, p. 44.
— — ID. 1840, Mém. de la Soc. géol. de France, Vol. iv. p. 190.
— — EICHWALD, 1840, Sil. System in Esthland, p. 143.
— — SHEPPARDI de Castelnau, 1843, Terrains siluriens de l'Amérique du Nord, p. 42, t. 14, f. 15.
— — MURCHISON and VERNEUIL, 1845, Geol. and Pal. Russia and the Ural Mountains, Vol. ii. pag. 136, pl. 3, figs. 3 *a*, *b*, and 4 *a*, *b*.

Shell scarcely transverse, varying from semielliptical to subquadrate and globose, often nearly as thick as long; length and width as 5 to 9, or equal; cardinal line often exceeding the width of the shell, and usually extended into short acute ears, or rounded at the extremities; area common to both valves, as also the foramen; ventral valve more gibbous than the dorsal valve; surface marked with strong angulated longitudinal plaits, about three to four of which mark the sinus, and four to five the elevated mesial lobe; transversely ornamented by concentric or flexuous elevated subimbricating lines, which are very obvious on the lower half of the shell, becoming very distinct in front, and, in perfect specimens, continuing nearly to the beak. Examined with a magnifier, the surface is seen to be covered with very fine granulations, like those in some specimens of recent TEREBRATULÆ.

It is impossible to assign any definite form or proportions to a shell as variable as this species. The cardinal line, in young shells, usually terminates in small acute ears extending beyond the width of the shell; while in other cases, and particularly in the older and more gibbous specimens, the cardinal line is less than the width of the shell, and its extremities are rounded. There are, somewhat rarely, exceptions to the above observation, where the cardinal line, in old individuals, still extends into small acute ears. The number of plications is very variable also; but there is usually a relation between the number of those on the sinus and medial lobe, and those on either side. The greater or less number of these plications, however, has no reference to the form of the shell.

This species, like many others of the BRACHIOPODA, is influenced by local circumstances, and, in its wide geographical distribution, presents varieties of form, or types peculiar to different localities, dependent apparently upon the condition of the ancient ocean bed. In the dark carbonaceous limestones of New-York, it is almost always small; while in the lighter colored calcareous mud or shale of the West, it reaches a much greater size, and presents a greater variety of form.

The eastern type of this species presents the following characters in its different stages of growth and development:

In the young shell, there first appears three plaits in the sinus of the dorsal valve, with four on the corresponding medial lobe of the ventral valve; these four becoming two about one half or two thirds of the distance from the base to the beak. As the shell grows older, another plait is developed on one side of the sinus, and a corresponding one on the medial lobe; but the five thus developed become two before reaching the beak. In the larger specimens of the New-York type (fig. 1 *d*), there is a fifth plait developed in the sinus, with six upon the corresponding medial lobe. The outer one on each side unites with the adjoining one about half way to the beak, thus making four plaits on the medial lobe, which finally unite in two before reaching the beak. The additional plaits of the medial lobe are developed laterally by a division of the outer one, which takes place at nearly regular intervals corresponding to the increasing size of the shell. The lateral plications in the sinus likewise disappear towards the beak, not by uniting with the adjoining ones as on the opposite valve, but by gradual diminution till they are lost in the surface of the shell. The plications on each side of the mesial lobe and sinus increase in like manner by the development of additional ones towards the margin of the shell; and from seven, the number usual in the smallest shells, they increase to ten or eleven, the greatest observed number in any specimen presenting the characters here given; the increase of lateral ones always keeping pace with the development of additional ones in the sinus and medial lobe.

I have observed, in two specimens, a deviation from this rule; for although they are much larger than any of those before noticed, there are but three plaits in the sinus and four on the mesial lobe; while the lateral plaits are twelve in one specimen, and thirteen in the other, on either side of the sinus. This curious deviation from the rule before observed, seems due to the non-development of medial plaits, which have been developed upon the sides instead of the sinus; the total number on each valve being nearly the same as when the medial ones are more numerous.

The western types begin in like manner with three plications in the sinus and four on the mesial lobe, while the lateral plications are almost uniformly seven (sometimes six and rarely five). As the size increases, however, the medial plications do not, as a prevailing character, increase as in the eastern types, but remain still three on the sinus and four on the lobe, till the shells reach to four or five times the dimensions of the largest New-York specimens. At the same time, also, the prevailing number of lateral plications is seven on each side of the sinus or lobe; and so long as the mesial plications remain three and four, so long the lateral ones are seven. As soon as there is even an appearance of a departure from this number on the mesial lobe and sinus, and where the rudiment of an additional plait is visible, we then find the lateral plaits to be nine or ten. These changes take place independent of the size of the shell, or of its rotundity; all variations in the plaits of the sinus being accompanied by a change in the number of lateral plates. This is illustrated in the figures of nearly equal dimensions, where the specimen fig. 1 A has three plaits in the sinus and four on the mesial lobe, and seven on each side; while fig. 1 G has a partial development of the fourth plait in the sinus, and an obscure rudiment of a fifth on the mesial lobe, and at the same time it has ten on each side of the sinus. Even irregularities in the development of the mesial plications are followed by irregularities in the lateral ones. A single specimen has two plications in the sinus and three on the mesial lobe, and also on one side of the slope of the sinus, as well as on the slope of the mesial lobe, a single plication, which is intermediate to the mesial or lateral series; and the lateral plaits, in this case, are six on one side and seven on the other.

In one individual (fig. 1 B), approaching to *S. chama*, and having but one fully developed plication in the sinus and two on the mesial lobe, the lateral ones are nine and ten. In two other specimens resembling the last, where the mesial plates are better developed, the outer ones being still smaller, the lateral plications are eight on each side. In two other somewhat similar specimens, the lateral plications are six on each side; while in a single smaller one, there are but five plaits on each side of the middle lobe and sinus.

In the six specimens here enumerated, the shell is more distinctly trilobate; the sinus deeper and more elevated in front, lifting up the mesial lobe higher in this part than it is in the centre of the shell, thus contrasting with the prevailing forms before noticed.

These forms constitute a variety, which, though easily traced to the prevailing form, is nevertheless somewhat constant, and worthy of attention, being the nearest approximation to the Var. B. *Sp. dentatus*, which occurs in Russia.

It has only been possible to illustrate the characters of this species by a great number of figures, drawn from a selection of specimens, both of New-York and the Western States, which exhibit in the best manner the gradations in form, and other characters which this truly protean species presents.

Figs. 1 *a*, *b*, *c*, *d*. A series of specimens, showing the gradations in size, and the increase in number of plications as the shell becomes older. The smaller specimen 1 *a* has three plaits in the sinus and four on the mesial lobe, with seven on each side, thus: 7 $\frac{4}{3}$ 7. In fig. 1 *b*, there is the partial development of a fourth plication in the sinus, and a fifth on the mesial lobe, though there is no increase in the number of lateral ones. In figs. *c* and *d*, there is a full development of the $\frac{6}{5}$ medial plications, and 10 lateral ones; the last specimen being about the size of this type in the New-York rocks.

Figs. 1 *e* and *f*, are front views of *a* and *d*.

Fig. 1 *g*. Profile view of the specimen *d*.

Fig. 1 *h*. Ventral valve of another form, showing extended beaks. Medial plications $\frac{4}{3}$; lateral ones 13 on each side.

Fig. 1 *i*. Front view of the same.

Figs. 1 *k*, *l*, *m*, *o*, *q*, *s*, *u*. A series of western specimens, with the mesial and lateral plications (7 $\frac{4}{3}$ 7); showing no tendency to increase of either number, though the size of the shell increases as in the previous series. Figs. 1 *m*, *q* and *s*, show the cardinal extremities more extended and acute than in the other forms; while the specimens *o* and *u* have the cardinal extremities shorter, scarcely equalling the width of the shell.

Figs. 1 *n*, *p*, *r*, *t*, are front views of figs. 1 *m*, *o*, *q*, *s* and *u*, respectively.

Fig. 1 A, B. Cardinal and profile view of an extremely globose specimen, having the cardinal line much less than the width of the shell, and the extremities rounded. The area is broad, and very well defined. The plications are 7 $\frac{4}{3}$ 7.

Fig. 1 C. Dorsal valve of a specimen, having the cardinal line extended beyond the width of the shell, and terminating in short acute ears.

Fig. 1 D. Front view of the last, showing the plications, which are 10 $\frac{5}{4}$ 10.

Fig. 1 E. Profile view of the same.

Fig. 1 F. Cardinal view of another specimen, with the extremities extending beyond the greatest width of the shell below.

Fig. 1 G and H. Front view and profile of a specimen similar in form to 1 B, but having the plications 10 $\frac{5}{4}$ 10. The cardinal line is less than the width of the shell, and the extremities rounded.

Fig. 1 I, K. Front view and ventral valve of a cuboidal specimen, showing some irregularity in the development of the plications; a single one in the sinus and two on the medial lobe being fully developed, with smaller ones on each side, while the lateral plications are six and seven.

The following present some deviation from the prevailing forms, and approach to the Var. B. *Sp. dentatus* of DE VERNEUIL. The front of the medial lobe, in all of them, is elevated higher than the centre of the same valve; while in the previous ones, the greatest elevation is in the centre of the shell, the front curving downwards.

Fig. 1 L, M, N. Ventral, dorsal, and profile view of a small specimen, with the plications arranged thus: 5 $\frac{4}{3}$ 5.

Fig. 1 O, P, Q. Ventral, front, and profile view, having the same form and proportions as the last, but having an additional plication upon each side.

Fig. 1 R, S, T, U. Ventral valve, front, cardinal, and profile views of the same specimen, which is remarkably extended on the hinge line. This specimen has a single fully developed plication in the sinus, and two on the mesial lobe, with the rudiment of another on each side of the sinus and of the medial lobe, while the lateral plications are ten on each side.

Position and locality. This species occurs in numerous and widely separated localities of the Trenton limestone, being confined to the rocks of this period in the United States, and unknown in New-York above the Utica slate, though this line of demarcation cannot be recognized at the West. Within the State of New-York, it is found at Middleville, Trenton Falls, Herkimer, Jacksonburgh, and other localities in the Mohawk valley. It is also found at Turin, Watertown, and other places towards Lake Ontario, and is likewise known at several places in the Champlain valley. It is found in great numbers at Maysville and Frankfort (Kentucky), near Nashville (Tennessee), at Cincinnati and Oxford (Ohio), at Madison (Indiana), at Mineral Point (Wisconsin), and on the northwest shore of Lake Michigan and towards Green Bay. It likewise occurs at several localities in Canada East and West, showing a geographical distribution equal to the extent of the lower silurian strata of our country. It appears likewise in the lower silurian strata of Russia and the north of Europe, having there, as elsewhere, a wide geographical distribution.

(*State Collection.*)

ATRYPÆ OF THE TRENTON LIMESTONE.

Several species of this genus are widely diffused in the Trenton limestone, though none of them are so abundant in New-York as the LEPTÆNA and ORTHIS. The species most common in this State are known to occur in Ohio, Indiana and Kentucky, in the same formation, and ranging throughout a much greater thickness of strata. While several species of the LEPTÆNA, and the *Orthis testudinaria*, occur at nearly every locality of the Trenton limestone in New-York, the ATRYPÆ are for the most part restricted, and the different species can only be sought successfully at different localities. It should be observed, however, that many of our most prolific localities of fossils have been but partially explored, and therefore we cannot speak with certainty of all; still it is believed that the palæontologist will find the above remarks generally true in relation to the distribution of species.

173. 6. ATRYPA EXTANS.

PL. XXXIII. Figs. 1 *a*, *b*.

Atrypa extans, CONRAD in MS. EMMONS, Geol. Report, 1842, pag. 395, fig. 6.
Compare *Atrypa sublobata*, PORTLOCK, Geol. Tyrone, &c. 1843, pag. 567, pl. 38, fig. 2 *b* and *k*.
— *undata*. SOWERBY, Sil. System, 1839, pag. 637, pl. 21, fig. 2.

General figure somewhat irregularly globose, or subrhomboidal and gibbous, with the front produced; length and breadth nearly equal, measuring the projection of the ventral valve; cardinal line remarkably extended, which is very perceptible in fig. 1 *b*; beaks very small; dorsal valve transversely oval, with a broad, deep, not angular mesial sinus, defined by subangular margins; ventral valve with a prominent rounded mesial elevation, well defined at the margins by a shallow groove; front produced, and but little elevated by the corresponding sinus; surface marked by concentric somewhat undulating filiform lines, and less distinct longitudinal striæ.

Length and breadth varying from $\frac{5}{8}$ to $\frac{7}{8}$ of an inch.

This shell is somewhat common at one or two localities about Watertown in Jefferson county, in a grey subcrystalline limestone, associated with *Trochus lenticularis*, *Orthis pectinella*, *&c.* It is remarkable for the extended cardinal line, which is more conspicuous in the ventral valve; as also the profound mesial depression and elevation, neither of which are angular. The concentric lines are not imbricated, but simple elevated striæ, more prominent than the fine longitudinal striæ that usually appear towards the margin.

Fig. 1 *a*. Dorsal valve. *b*. Ventral valve.

Position and locality. Watertown, Jefferson county; Lowville, and Sugar River near Boonville in Lewis county, in the higher portions of the Trenton limestone.

(*State Collection.*)

174. 7. ATRYPA NUCLEUS.

Pl. XXXIII. Figs. 2 *a*, *b*, *c*.

Compare *A. extans* ut supra.

General form subangularly globose; length and breadth about equal; cardinal line regularly curved; beaks small, close pressed, that of the dorsal valve incurving over the other; margins of the valves uniting very closely and neatly; mesial sinus broad, flat, extending about two thirds the length of the shell, and produced into a linguiform extension, which is much elevated in front; mesial elevation prominent, rounded, extending about two thirds of the distance to the beak, where it is lost in the general convexity of the shell; surface of both valves crossed by filiform concentric lines, which are undulated in crossing the mesial sinus and elevation; no visible longitudinal striæ.

This shell resembles the last one very closely, the principal difference being the extended cardinal line in the former; the mesial sinus in the latter is flat and more elevated in front, while the mesial elevation on the opposite valve is less extant, rising more gradually from the surface of the shell, and not so distinctly margined by a shallow groove, nor produced in front.

A comparison of a larger number of specimens may prove the existence of a gradation in the characters, here noticed as distinctive.

Fig. 1 *a*. Ventral valve. *b*. Dorsal valve. *c*. Profile view.

Position and locality. Middleville, Herkimer county, in the central portions of the Trenton limestone, associated with Conularia.

175. 8. ATRYPA CUSPIDATA† (*n. sp.*).

Pl. XXXIII.* Figs. 1 *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*.

Obtusely pyramidal or somewhat obcordate; width greater than the length; dorsal valve smaller than the ventral, convex at the sides, with a broad subangular depression which commences near the beak, and becomes broader, deeper and more angular, elevating the front of the shell into a cuspidate extension; lower half of the sinus marked by a distinct narrow groove in the centre; ventral valve very gibbous, with a broad mesial lobe which continues nearly to the beak, and extends in front scarcely so far as the line of the shell on each side; beaks nearly equal, that of the dorsal valve incurved over the ventral valve, the latter being much more gibbous below the beak; margins of the shell sharp; surface ornamented with fine elevated concentric striæ, which are imbricated towards the margin. The lower half of the shell, particularly on the ventral valve and sinus of the dorsal valve, is marked by numerous sharp radii, which gradually disappear above.

This species bears a close resemblance to *Atrypa extans*; but the specimens of that shell which I have been able to see, are all of separated valves, and differ from this one in the

† Pl. xxiii.* is a supplementary plate.

straight hinge line, and produced front of the medial lobe, as far as can be ascertained, though it has some obscure longitudinal striæ.

The shell is frequently much expanded laterally, and compressed towards the edges; the beaks are almost equally elevated, that of the ventral valve being more gibbous than the other. There is some variation in the sinus of the dorsal valve, which, in some specimens, is more produced and acute in front than in others, while the medial lobe often becomes angular.

This species is apparently quite distinct from *A. nucleus*, which has a flat sinus in the dorsal valve, rounded at its extremity, and the surface of the shell presents no longitudinal striæ.

Fig. 1 *a*. Ventral valve of a perfect specimen. *b*. Front view of the same.
Fig. 1 *c*. Dorsal valve. *d*. Profile view.
Fig. 1 *e*. Front view of a specimen, where the sinus is narrower and more angular than in the preceding.
Fig. 1 *f*. Profile view of the same.
Fig. 1 *g*. Dorsal valve of a specimen, which is more extended laterally.
Fig. 1 *h*. Front view of the same specimen.

Position and locality. This species is known to me only as occurring in the central part of the Trenton limestone, at Lowville, Lewis county. (*State Collection*.)

176. 9. ATRYPA BISULCATA.

Pl. XXXIII. Figs. 3 *a*, *b*, *c*, *d*, *e*.

Orthis bisulcata. Emmons, Geol. Report, 1842, p. 395, fig. 4 *a*, *b*.

Small, ovoid; dorsal valve with a well defined, narrow, mesial sinus, which continues about half way to the beak, and from there the centre becomes much elevated; beak of the dorsal valve strongly incurved over that of the opposite valve; ventral valve depressed-convex, prominent on the umbo, beak very small and abruptly incurved; front with two short well defined furrows, ending in two plications, which close on each side of the projecting plait formed by the extension of the mesial groove of the dorsal valve.

This peculiar little shell has no analogue in any of the lower strata, though there are one or two approaching to it in form in the higher rocks. Its neat ovoid form, smooth or concentrically striated surface, with the two small plaits and grooves in one valve and one in the other, are marks to be sought for in identifying the species. It is extremely rare, and has been found only in one or two localities.

Fig. 3 *a*. Dorsal valve. *b*. Ventral valve. *c*. Cardinal view. *e*. Front view. *d*. Enlarged profile view.

Position and locality. Adams, Jefferson county, in shaly Trenton limestone, associated with Murchisonia and Pleurotomaria, and in a situation where few Brachiopods occur. (*State Collection*.)

177. 10. ATRYPA DEFLECTA (*n. sp.*).

PL. XXXIII. Figs. 4 *a, b.*

Sub-planoconvex, with the margins compressed, and deflected towards the front; length and breadth about equal; cardinal line somewhat extended, curved; dorsal valve with a prominent ridge along the middle; beak extended, prominent, incurved; ventral valve depressed-convex, with a mesial sinus; surface with about 20 small regular radiating striæ, which are rarely divided towards the margin.

A few specimens only of this shell have been found; in these, the form is constant, as represented in the figure; but the markings and general aspect approximate it to the next species.

Fig. 4 *a.* View of dorsal valve. *b.* Front view, showing the form of the two valves.

Position and locality. Near Martinsburgh, Lewis county, in the central part of the Trenton limestone.

178. 11. ATRYPA RECURVIROSTRA (*n. sp.*).

PL. XXXIII. Figs. 5 *a, b, c, d.*

Elliptical, somewhat ovoid, very symmetrical; breadth one fourth of an inch, length a little greater; dorsal valve with the middle elevated, regularly convex on the sides, the beak extended and gracefully incurved over the beak of the ventral valve, which is regularly convex, with a slight longitudinal depression; surface of each valve marked by about 24 regular simple longitudinal striæ, which continue entirely to the beak.

The preceding species approximates to this one in general form and character of striæ; but the sides are more expanded, and the shell has a distinct mesial sinus and elevation. These characters usually increase with the age of a shell; and since the form of the one under consideration is very constant in a large number of specimens, which are of nearly uniform size, and smaller than the one figured, we may presume that it is a distinct species. It will be readily recognized by its rotund symmetrical form, which is more elongated, and more finely and evenly striated than any other species in the rock, except the preceding one.

Fig. 5 *a.* Dorsal valve.
Fig. 5 *b.* Profile view.
Fig. 5 *c.* Cardinal view, showing the incurved beak of the dorsal valve.
Fig. 5 *d.* Ventral valve separated from the dorsal. This valve is nearly circular, the beak being scarcely extended beyond the cardinal margin.

Position and locality. This shell occurs in considerable numbers in a compact greyish blue bed of limestone near the centre of the Trenton limestone, near Martinsburgh, Lewis county. It has also been seen at Lowville and at Middleville. (*State Collection.*)

179. 12. ATRYPA EXIGUA (*n. sp.*).

PL. XXXIII. Figs. 6 *a, b, c, d*.

Plano-convex; length and breadth about equal; cardinal line considerably extended; dorsal valve elevated in a ridge along the middle, depressed at the sides, and slightly inflected towards the cardinal extremities; beak small, straight, much extended beyond the cardinal line; ventral valve considerably shorter than the dorsal, depressed-convex, with a broad depression along the centre, reaching half way from the base to the beak; beak small, and close pressed into the foramen beneath the beak of the opposite valve; surface scarcely marked with fine concentric lines, and a few indistinct longitudinal rays near the margin.

In the largest specimen which I have seen, there are evidences, under a magnifier, of small radii commencing below the centre of the valve. Since, however, they are not perceptible to the naked eye, they are of minor importance, unless it should be found that this is the young of a species which changes with growth. The specimens yet seen, however, are minute, and it may properly be doubted whether the species attains a size beyond the largest figures given. The valves are often close pressed, and deflected at the margin.

It bears considerable resemblance to a small species occurring in the Schoharie grit; but that one is readily distinguished by the absence of any depression in the ventral valve, which is a rare feature among the ATRYPÆ, and probably indicates a departure from the true normal character of the genus.

Fig. 6 *a*. Ventral valve: the depression is proportionally too narrow in the figure.
Fig. 6 *b*. Dorsal valve of the same.
Fig. 6 *c*. Cardinal view, showing the acute slightly incurved beak.
Fig. 6 *d*. Two figures of the dorsal valve of a small and large individual, the form and extension of the acute beak being well represented.

Position and locality. In the central part of the Trenton limestone at Lowville, and near Martinsburgh, Lewis county. (*State Collection*.)

180. 13. ATRYPA MODESTA.

PL. XXXIII. Fig. 15.

Producta modesta. SAY, Collection of the Acad. Nat. Sciences, Philadelphia.

Suborbicular or plano-convex, with the beak extended; width a little greater than the length; cardinal line distinctly marked and somewhat extended; dorsal valve convex, with an elevated ridge along the centre, occupied by four plaits which are stronger than the others; beak prominent, incurved and perforated, the perforation extending below the beak and occupying a portion of the area; ventral valve depressed-convex, broadly oval or nearly circular, with a broad but ill defined sinus along the middle, the central plication stronger than the others, with a smaller one on each side; each valve with about 18 simple rounded plications; surface obscurely punctate.

This neat and beautiful little species well merits the name bestowed upon it by Mr. Say, which I am happy to preserve. It is a rare species in New-York, while it is abundant in Ohio, Indiana and Kentucky. It is, in a large number of specimens examined, very constant in the characters given above. The central elevated portion consists of four stronger plications, which appear to be in two pairs, from being separated in the middle by a deeper and wider groove, while the groove between each pair is narrower than between the other plaits of the shell. These characters, with the stronger plication in the centre of the ventral valve, are constant, and apparently reliable in distinguishing the shell. The mesial sinus on the ventral valve, which is scarcely conspicuous in young shells, becomes deeper and more strongly marked in older ones, and produces a strong depression in the front of the shell.

Fig. 15. The two upper figures are of the dorsal and ventral valve of a specimen above the common size. The lower figure is of a small specimen, having the same characters.

Position and locality. I have seen this species in New-York only from the Utica slate, or upper shaly part of the Trenton limestone, at Turin, Lewis county. It is quite abundant at numerous western localities, particularly Oxford and Cincinnati (Ohio), Madison (Indiana), Frankfort and Maysville (Kentucky).

This species, with the three preceding ones, form a group, presenting characters which may require a separation from the true Atrypæ. These characters consist in the elevation of the dorsal valve along the centre, with a depression or sinus on the ventral valve, being the reverse of the usual arrangement. The beak is incurved, with a perforation at the apex, which occupies, also, a part or all of the deltidial area, being usually narrow and long.

Mr. Conrad, some time since, proposed the name *Stenocisma* for some specimens of the group of Atrypæ or Terebratulæ, which he subsequently abandoned. Should the characters here noticed be found persistent, and accompanied by the narrow foramen, I propose to restore the name first indicated by Mr. Conrad for the genus.

181. 14. ATRYPA CIRCULUS (*n. sp.*).

Pl. XXXIII. Figs. 7 *a, b, c.*

Depressed orbicular; valves equally and uniformly convex; margins close pressed, with scarcely a conspicuous undulation in front; beaks equally prominent, one slightly larger, approximate; surface marked by fine concentric lines, and obsolete longitudinal striæ, which are only visible by the aid of a magnifier.

This shell appears sufficiently distinct from any other species in this rock, to merit a separation. Its circular form, and equally convex valves with margins almost uniform, render it difficult to imagine a gradation to the succeeding species. It must be confessed, however, that it approaches in some degree to the young of fig. 10; though in fig. 10 *d*, a specimen of equal size, the plications are very distinct, while, in this species, they are not visible.

Fig. 7 *a*. Dorsal valve. *b*. Cardinal view. *c*. Profile view.

Position and locality. This species occurs in the compact black limestone, with others of the genus, at Middleville, Herkimer county.

182. 15. ATRYPA AMBIGUA (*n. sp.*).

Pl. XXXIII. Figs. 8 *a*, *b*, *c*, & 9 *a*, *b*.

Subrhomboidal, trilobate; length and breadth about equal; cardinal line somewhat extended in a regular curve; beaks subequal, approximate; dorsal valve convex near the beak, depressed towards the sides, with a deep, somewhat flat mesial sinus, which is extended and considerably elevated in front; ventral valve with a prominent elevated mesial fold along the middle, which disappears before reaching the beak; surface crossed by fine concentric lines, with a few obscure or incipient plications in the mesial fold and sinus; sides of the shell rarely plicated.

Figs. 8 *a* and *b*, represent this shell in its usual form, with a simple trilobate aspect, and free from plications.

Fig. 8 *c*. Front view in outline, showing two incipient plications in the sinus.

Fig. 9. Four valves are represented precisely as they occur on the surface of a slab of limestone. In two of these figures, a ventral and dorsal valve, the shell is free from plications either on the mesial fold or on the sides; while in *a* (a dorsal valve), both the mesial sinus and the sides of the shell are very distinctly plicated, and the contiguous figure of a ventral valve is subtriplicate in the mesial fold only.

This great deviation in external markings suggests the inquiry whether this shell may be a variety of some other species. The simple unplicated form approaches to *Atrypa nucleus;* but the form of the shell, the mesial sinus, and its extension in front, are all too different to allow of our confounding them. On the other hand, the plicated forms bear some resemblance to fig. 10, from which this differs in the greater length of the sinus, which extends nearly to the beak, while in that one it is short, terminating abruptly, and extending little more than half way to the beak; and in young shells, where the incipient plications are observed, the sinus is barely perceptible.

Position and locality. In the lower part of the Trenton limestone at Middleville.

183. 16. ATRYPA HEMIPLICATA (*n. sp.*).

PL. XXXIII. Figs. 10 *a, b, c, d, e, f.*

Subglobose, pentagonal, wider than long, thickness often equal to the length ; cardinal line distinct, short, with (in some specimens) the appearance of a small area on the dorsal valve ; dorsal valve depressed-convex, with an abrupt, broad, not deep sinus, which commences nearly half way from the beak to the base, the beak very small and closely incurved ; ventral valve very convex, becoming gibbous, with a broad mesial elevation commencing one third of the distance from beak to base, more gibbous towards the beak ; sinus marked by two or three strong plications, with three or four upon the mesial lobe and two or three upon each side, all of which reach from one third to one half the distance from the base to the beak of the shell, leaving the upper half entirely free from these markings ; entire surface ornamented by fine, concentric, filiform, subimbricating lines, which are more conspicuous towards the base of the shell, and beautifully undulated in crossing the plications.

This peculiar and beautiful species is rarely found in western localities, but is nevertheless extensively distributed in New-York. It is readily distinguished by its usually rotund figure, and the short prominent plications on the lower half of the shell, while it is smooth above, or only marked by the fine concentric lines. The sinus at the base usually occupies about one fifth of the circumference of the shell, which, with the basal and cardinal slopes, gives it a pentagonal appearance. In many specimens, collected from the crystalline limestone, I have been able to observe only the plications on the mesial portion ; while in the softer or shaly limestone, the lateral ones have all the distinctness of those presented in the figures.

Fig. 10 *a.* Dorsal valve of a specimen of the ordinary size.
Fig. 10 *b.* Profile view of the same.
Fig. 10 *c.* Front view of the same, dorsal valve below, showing three plications in the sinus and four on the mesial lobe.
Fig. 10 *e.* Ventral valve of a large specimen, with only three plications on the medial lobe.
Fig. 10 *f.* Front view of the same, showing the extreme gibbosity of the ventral valve.
Fig. 10 *d.* Dorsal valve and front view of a young specimen, having but a single plication in the sinus, which is only rudimentary, and two on the medial lobe. The two valves in this shell are almost equally convex, the beak of the dorsal valve curving very neatly over that of the ventral valve.

Position and locality. In the thin shaly layers near the base of the Trenton limestone at Middleville, and in the higher crystalline portions of the same rock at Watertown, Turin, and other localities in the northwestern part of New-York. (*State Collection.*)

184. 17. ATRYPA ——— (*Species undetermined*).

PL. XXXIII. Figs. 11 *a*, *b*, *c*.

Somewhat circular or suborbicular; dorsal valve flat or depressed at the sides, depressed in the centre, with a broad curving sinus which is little elevated in front; beak small, scarcely incurved; ventral valve very convex, somewhat gibbous, with a broad medial elevation and sloping sides; beak small, incurved within that of the dorsal valve; surface marked by filiform concentric lines, without longitudinal plications.

I have been inclined to regard this species as the young of *A. extans* or *A. cuspidata*, but there are some objections to thus referring it. The sinus is broad and shallow, not distinctly margined, and is broadly rounded in front, as is also the mesial lobe of the opposite valve. The dorsal valve is flatter, and the beak appears to be less incurved than in either of the species named. It differs from the last species in the inequality of the valves, and the absence of plications either upon the sinus or sides of the shell.

Fig. 11 *a*, *b*. Ventral and dorsal valves of this species.
Fig. 11 *c*. Front view of the same; the dorsal valve below.
Fig. 11 *d*. Profile view of the same.

Position and locality. In the central portions of the Trenton limestone at Middleville, Herkimer county.

185. 18. ATRYPA SUBTRIGONALIS (*n. sp.*).

PL. XXXIII. Figs. 12 *a*, *b*, *c*.

General form subtriangular, with a rounded base; length and greatest breadth equal; cardinal line short, well defined, with the appearance of a small triangular foramen under the beak of the dorsal valve; cardinal slopes long, straight; basal margin regularly curved, with a slight emargination at the sinus; valves almost equally convex; dorsal valve extended beyond the ventral, beak scarcely incurved; surface marked by about 20 rounded radii, three of which are in the mesial sinus and four on the mesial elevation, ornamented by elevated concentric lines which are undulated in crossing the plications.

A distinguishing character of this shell is its triangular form, with extended small beak; the mesial sinus and elevation are narrow, and continue only about two thirds of the distance from base to beak.

This species is rare, occurring only in one or two localities. It may perhaps be regarded as a variety of *Atrypa increbescens;* but it differs considerably in form, and has a larger number of plications, as will be seen on comparison; even the oldest individuals of fig. 13 rarely having more than fifteen plaits, though specimens of twice the size of this are often found.

Fig. 12 *a*. View of the ventral valve, with the beak of the dorsal valve projecting above.
Fig. 12 *b*. Profile view of the same.
Fig. 12 *c*. Front, with the dorsal valve below.

Position and locality. In the upper part of the Trenton limestone at Turin, Lewis county.
(*Collection of* Mr. ALSON CLARKE, *of Turin, on whose authority this species is quoted from the Trenton limestone.*)

186. 19. ATRYPA INCREBESCENS (*n. sp.*).

PL. XXXIII. Figs. 13 *a* – *y*.

Compare *Terebratula plicatella*, DALMAN (*Anomia plicatella*, LINNÆUS), 1827, Vet. Acad. Handl. pag. 56, pl. 6, fig. 2.
— — HISINGER, 1837, Lethæa Suecica, pag. 80, pl. 23, fig. 4 *a*, *b*, *c*.

Spheroidal, gibbous, ovoid or subtriangular; length and breadth nearly the same, in older specimens very variable; dorsal valve with a broad, more or less deep sinus, which, in older specimens, reaches nearly to the beak, and is marked by three or four plications, which finally become much elevated in front, producing a deep emargination in the opposite valve; beak of the dorsal valve small, acute, and, in young specimens, slightly incurved, with a perforation beneath the apex. In older shells, the beak becomes strongly incurved, and closely pressed against the opposite valve. Ventral valve regularly convex in young shells, with a slight elevation in front; as the shell advances in age, the medial lobe is developed, and, in old specimens, reaches nearly to the beak. Surface of the shell marked by twelve to sixteen plications, three or four of which are in the sinus and four or five on the medial lobe, the plaits never subdivided; transversely marked by elevated flexuous imbricating lines, which, in young and well preserved specimens, continue entirely to the beak.

This species is an associate of *Delthyris lynx*, and is equally variable with that shell. It has been referred to *Terebratula tripartita* (SOWERBY, *Sil. System*, Vol. ii. fig. 15), a Caradoc species; but I regard our shell as quite distinct from that one. The smaller varieties approach more nearly to *T. pusilla* (SOWERBY, *Sil. System*, pag. 641, pl. 21, fig. 18). If described at all, in any foreign work within my reach, the species does not present the remarkable variation in form, on the other side of the Atlantic, that it does in this country.

This species, like its constant associate *Delthyris lynx*, is much more developed in the West than in New-York, where all the specimens I have seen are small, and rarely approach the globose forms of western localities. The most common forms in New-York are those represented in figs. 13 *a*, *b*, c and *d*.

In fig. 13 *a*, *b*, ventral valve and front view, the specimen has 16 or 17 distinct plications, four of which are elevated upon the mesial lobe. The form of the shell is somewhat triangular, the mesial elevation scarcely distinct, and the sinus short, extending less than half way to the beak; the plaits are more angular, from a partial exfoliation of the shell.

Fig. 13 *c, d* Ventral valve and profile view. The specimen more rotund, and the surface marked by fifteen plications; the medial lobe is more elevated, and the sinus extends nearly to the beak. The flexuous imbricating striæ, in both these specimens, are nearly destroyed from exfoliation of the shell.

Fig. 13 *e, f.* Ventral valve and profile of a more gibbous form, the valve being nearly circular or broadly oval, and the beak less exsert than in the last. The number of plaits is 16, and they are distinctly marked by the concentric flexuous lines.

Fig. 13 *g, h, i.* Front, profile and ventral valve of a larger and more rotund specimen, having a deeper and more strongly defined sinus and medial lobe, and the beak of the dorsal valve closely curved over the ventral valve. The surface is marked by 16 plications, which, as in the preceding specimens, are defined entirely to the beak.

This specimen is the maximum size to which those of New-York attain; but in the western localities, we are able to trace the species from its smaller forms through all the grades here presented, beyond which it assumes the more globose appearance shown in some of the following figures.

Fig. 13 *k.* A small specimen of the western type, corresponding very nearly with 13 *a* in size and form.

Fig. 13 *l, m, n, o.* Ventral valves and front views of two larger individuals, showing a gradation in size. Every possible intermediate form between 13 *k* and the following specimen may be found in almost every locality.

Fig. 13 *p, r, s.* Ventral valve, profile and front view of a larger specimen, varying but little in its proportions from the preceding ones. The sinus is deeper and more strongly defined, and the ventral valve more emarginate in front, from the extension of this portion of the dorsal valve.

Fig. 13 *t, u.* Profile and front view of a more gibbous specimen.

Fig. 13 *w.* Profile view of a very gibbous specimen, which has become nearly globose, the thickness equalling the length of the shell.

Fig. 13 *x.* Front view of the same, showing the sinus of the dorsal valve much extended and elevated in front, filling the deep emargination of the opposite valve.

Fig. 13 *y.* Cardinal view, showing the sinus and medial elevation, extending nearly to the beaks of the shell.

Specimens are frequently seen, where the gibbosity of the shell is much more extreme than in this one, the thickness being one third greater than the height of the shell.

A series of this species, and of *Delthyris lynx*, showing all the variations in form and size, constitute a very interesting collection for the study of those changes in species of the Brachiopoda, induced by age and local influences.

Position and locality. This species is found in New-York, in the central and higher part of the Trenton limestone, very rarely in the lower part. It is found in all western localities of this rock, ranging through several hundred feet in thickness. It occurs at Middleville, Trenton Falls, Herkimer, Turin, Watertown and other places in New-York. It is abundant at Cincinnati and Oxford (Ohio), Madison (Indiana), Maysville and Frankfort (Ky.), and numerous other places. (*State Collection.*)

187. 20. ATRYPA DENTATA (*n. sp.*).

PL. XXXIII. Figs. 14 *a*, *b*, *c*.

Pyramidal, subtriangular; breadth somewhat greater than the length; cardinal line short; margins of the shell sloping abruptly downwards; surface marked by about eight or nine strong and deep plications, two of which are much elevated on the mesial fold of the ventral valve; dorsal valve with the sinus broad, deep and angular, with a single plication in the centre, extremely elevated in front; plications crossed by zigzag or advancing and retreating filiform lines; beak of the dorsal valve small, acute, incurved, with no visible perforation.

This remarkable little shell is distinguished by its deep mesial sinus and strong plications, particularly the central ones. The plaits are simple, reaching entirely to the beak, and enlarging rapidly below. An analogous species, the *A. duplicata*, with fewer plications, occurs in the Chemung group.

Fig. 14 *a*. Dorsal valve.
Fig. 14 *b*. Front view of the same; the dorsal valve below.
Fig. 14 *c*. Profile view.

Position and locality. In the higher part of the Trenton limestone at Turin, Lewis county. (*Collection of* MR. ALSON CLARKE, *on whose authority I have placed it among the Trenton species, not having myself collected the same from the rock.*)

188. 21. ATRYPA SORDIDA (*n. sp.*).

PL. XXXIII. Fig. 16.

Circular: valves equally convex; beak of the dorsal valve extended beyond the other; surface marked by small simple radiating striæ, which are crossed by elevated lines, giving a rugose appearance; no mesial sinus or elevation.

This is probably a young shell, having the sharp striæ more distant than the spaces between them.

The precise locality of this specimen is uncertain, but, from its association, there can be no doubt of its position being that of the Trenton limestone.

ACEPHALA OF THE TRENTON LIMESTONE.

Plates XXXIV., XXXV. & XXXVI.

In the fossils of this class, we find a much greater difficulty in the determination of genera and species, than in the Brachiopoda, where the external characters alone are often sufficient for this purpose. The Acephala, also, are usually less perfectly preserved, and separate from the rock with greater difficulty, rarely presenting us with any of those characters on which generic distinctions in such shells are commonly founded. In far the greater number of instances they occur as separated valves imbedded in the stone, and in parts of the rock of such a nature that the shell is partially or entirely exfoliated, obliterating even the means of identifying them by this slender aid. The form of the fossil, therefore, is generally the principal or only means of its identification; and every palæontologist knows how liable this is to variation, from pressure, and other causes of which we can have but a slight knowledge. It will not be surprising, therefore, that differences of opinion may exist as to the propriety of the reference of many of these species to recent genera, or to genera constituted to receive analogous fossil species of a later epoch, which have been studied with better advantages.

Notwithstanding the general paucity of species of this order, I am able to present a much larger number than have ever before been known from the Lower Silurian period, where they have been regarded as very rare. Among these there are two or three forms which present characters requiring a generic designation, and which appear to me not only thus distinct, but equally distinct from analogous forms in the later deposits. Acting therefore upon the conviction that more good can be accomplished by attempting to discriminate, than to risk confounding with what is really unlike, I have attempted to point out characters which may serve at least to distinguish several fossils now generally referred to recent genera, and from which all our knowledge, as well as analogy, would teach us to separate them.

The Genus Cypricardia has heretofore been the receptacle of a large number of species widely differing from each other, and few, if any, of which probably belong to the genus. The name of Nucula has also been appended to shells, having few or none of the essential characters of that genus. Avicula, in like manner, has been the name applied to many shells possessing a remote analogy to some forms of that genus; and Inoceramus, a genus of the Oolitic and Cretaceous periods, has received both Silurian and Carboniferous species.

It is true, as just observed, that in many instances it is almost impossible to ascertain with certainty the essential generic characters of these shells; but in such cases we should study with more care the external form, and the structure of the shell, which may enable us to arrange the fossil species in natural groups.

189. 1. NUCULA LEVATA (*n. sp.*).

PL. XXXIV. Figs. 1 *a* – *i*.

Compare *Nucula lævis*, SOWERBY in Sil. System, pag. 535, pl. 22, fig. 1.

Somewhat obliquely ovate or subrhomboidal, gibbous; anterior extremity broad, rounded; posterior side narrower and somewhat obliquely truncated; umbones usually about one third of the length from the anterior extremity, elevated and incurved; cardinal line slightly curved; crenulations extending nearly twice as far on the posterior as on the anterior side; surface obscurely marked with concentric lines; muscular impressions visible near the anterior and posterior extremities.

This little shell presents considerable variation in form, even in the same locality, becoming greatly increased in height over the prevailing form. It often becomes almost cylindrical from compression vertically; and again, from lateral pressure, the umbones are much elevated, and the shell broader than the natural form.

This is apparently identical with the species occurring in several western localities; though in these situations it rarely or never attains the great elevation of the umbones, or general gibbosity of the shell, which the eastern forms present. Notwithstanding this prevailing difference, I am unable to find any characters indicating a specific distinction, and therefore arrange them both under the same name.

Fig 1 *a*, *b*. Left valve and posterior view of a specimen of the prevailing form in New-York. The muscular impressions † † are distinctly visible.

Fig. 1 *c*, *d*. Similar views of a larger shell, slightly varying in its proportions.

Fig. 1 *e*. Left valve of a very gibbous specimen, in which the posterior side is less extended.

Fig. 1 *f*. A specimen less elevated, and approaching the western forms.

Fig. 1 *g*. Cast of a western specimen, showing more distinctly the muscular impressions † †.

Fig. 1 *h*. Cardinal view of the same, showing the crenulations of the hinge, and the same enlarged.

Fig. 1 *i*. A smaller specimen of the same, with the shell showing faint concentric lines.
This is the prevailing form of the western specimens, while 1 *g* is intermediate to this and the common New-York forms.

Position and locality. This shell occurs in New-York, in the central portions of the Trenton limestone, at Middleville, Jacksonburgh, Trenton Falls, and other places. The western specimens figured are from Mineral Point (Wisconsin), whence they were sent with other fossils peculiar to the Trenton limestone. (*State Collection.*)

190. 2. NUCULA POSTSTRIATA.

PL. XXXIV. Figs. 2 *a*, *b*.

Nuculites poststriata. EMMONS, Geol. Report, 1842, pag. 399, fig. 4.

Oblong, somewhat quadrangular, compressed ; extremities of nearly equal width ; anterior extremity rounded, posterior one obliquely truncated ; umbones compressed, sharp, with an angular elevation extending obliquely to the posterior basal margin ; posterior slope strongly striated with diverging elevated lines ; remainder of the shell apparently smooth.

I have referred this specimen, with some hesitation, to the Genus NUCULA, having seen no evidence of crenulations on the hinge line, and the strong striæ upon the posterior slope are characters not usual in species of this genus.

The species under consideration is rare in the Trenton limestone, and has heretofore been regarded as belonging to the Hudson-river group, where it is more frequently seen, and where it attains a larger size ; but since I have adopted the invariable rule of giving the species where it first appears, this one is presented here.

Fig. 2 *a*. Right valve of this species. *b*. Cardinal view of the same specimen.

Position and locality. In the compact part of the Trenton limestone, associated with several other species of shells peculiar to the rock. Carlisle, Pa.

GENUS TELLINOMYA.

[From *Tellina* and *Mya*, from the form of the shell.]

Character. Equivalve, inequilateral, somewhat compressed below, but becoming gibbous at the umbones ; umbones not angular ; outline of the shell curved, without angular ridges ; shell thin, closely laminated ; hinge without visible teeth or crenulations ; muscular impressions two in each valve, near the dorsal margin ; often apparently gaping at the posterior extremity. *T. nasuta*.

This is one of several fossil shells of the Acephalous Mollusca, in the Trenton limestone, which cannot be satisfactorily referred to any of the existing or fossil genera with which I am acquainted. It is with great diffidence, however, that I propose a generic designation for it ; being willing to avoid, if possible, the multiplication of names, where the continuance of previous ones, or the reference to recent genera, will not produce confusion.

I am well aware of the difficulty, not to say impossibility, of properly characterizing a genus, where the specimens are in the condition of these ancient fossils ; and, therefore, general external form, and the structure of the shell, must be allowed some weight. In the present instance, the form of the shell, and some other characters in the typical species, are so widely different that they cannot fail to arrest attention.

191. 1. TELLINOMYA NASUTA (*n. sp.*).

Pl. XXXIV. Figs. 3 *a*, *b*, *c*.

Transversely elongated, inequilateral; anterior extremity rounded; posterior extremity greatly extended into a kind of beak, which is narrowed and compressed, contracted on the base by a shallow sinus; umbones prominent, rounded; shell thin; surface marked by fine concentric lines. The muscular impressions are strongly marked upon the cast, and the umbones are more obtusely angular; there is no evidence of teeth or crenulations.

This shell is readily distinguished by the prolonged posterior extremity, which is obliquely truncated and constricted by a sinus on the base. This character is more conspicuous on the cast than in the perfect shell; the anterior portion of the shell is more gibbous, and regularly rounded at the extremity.

This is a rare species, the form of which I was at first inclined to regard as accidental; but having seen three specimens in which it is constant, there can remain no question of its title to a place among the species of this period.

Fig. 3 *a*. Right valve of a specimen on which the shell is preserved. The posterior side of the shell is less extended than in the other specimens.
Fig. 3 *b*. Similar view of a cast, showing the muscular impressions *a a*.
Fig. 3 *c*. Dorsal view of the same.

Position and locality. In the dark colored upper portions of the Trenton limestone at Middleville, Trenton Falls, &c.

192. 2. TELLINOMYA SANGUINOLAROIDEA (*n. sp.*).

Pl. XXXIV. Figs. 4 *a*, *b*.

Inequilateral, transversely extended, compressed, subelliptical, narrowed posteriorly; anterior extremity broadly semi-elliptical; posterior half subcuneate, compressed and acute; umbones (in the cast) moderately prominent, thin, approximate; cardinal line extended, without visible teeth or crenulations; basal margin regularly curved; shell thin, closely marked by fine concentric laminæ.

The only specimen which I have been able to obtain is a cast, and I have seen another in the same condition. It is readily distinguished from the last, by being more compressed, the umbones less prominent, the front more uniformly and regularly rounded, while the posterior extremity is cuneate and the basal margin regularly curved, presenting no evidence of a sinus or depression as in the last.

Fig. 4 *a*. Right valve, showing the posterior muscular impression *a*.
Fig. 4 *b*. Cardinal view of the same specimen.

Position and locality. In the lower part of the Trenton limestone at Canajoharie and Middleville.

193. 3. TELLINOMYA GIBBOSA (*n. sp.*).

PL. XXXIV. Figs. 5 *a*, *b*.

Subequilateral, transversely extended to a length more than once and a half the height, compressed below and very gibbous towards the umbones, which are prominent, large and distant, giving a broad space on the cardinal line; posterior slope oblique; anterior slope straight, and extended so as to interrupt the curvature of the anterior extremity; ventral margin with a shallow sinus below the posterior side of the umbones.

The specimen, though not absolutely denuded of the shell, has the markings entirely obliterated. The form and general character of the surface, and, as far as can be determined, the structure of the shell, correspond with the preceding species of this genus. It differs conspicuously from either of the others, in the more prominent umbones and general gibbosity of the shell, as well as the more nearly equal extremities. The anterior portion of the cardinal slope is more nearly at right angles to a perpendicular drawn from the beak to the base; thus giving a totally different outline to this part of the shell, when compared with the other species. The slight sinus in the base is a character approaching to *T. nasuta;* but in this one it is more nearly central, and less conspicuous.

Fig. 5 *a*. Right valve of this species. *b*. Dorsal view.

Position and locality. In the central part of the Trenton limestone at Middleville.

194. 4. TELLINOMYA DUBIA (*n. sp.*).

PL. XXXIV. Figs. 6 *a*, *b*, *c*, *d*, *e*, *f*.

Subequilateral, elliptical, the length almost twice the height, the two extremities nearly equal; umbones subcentral, moderately elevated, with a scarcely prominent ridge along the posterior slope; anterior extremity regularly rounded; posterior one often narrower, and somewhat obliquely truncated or contracted; shell thin; surface marked by fine concentric lines. The structure of the shell is precisely similar to those already described.

In this species the umbones are more central than in any other, but the remaining characters appear sufficient to warrant its arrangement with the previous specimens. The posterior extremity is often contracted, though this appears due to accidental circumstances; for in a great number of specimens examined, much the larger proportion were free from any such characteristic.

Fig. 6 *a*. Cardinal view of the two valves in connection.
Fig. 6 *b*. Left valve of the same, which is slightly contracted behind.
Fig. 6 *c*. A separate valve, in which the posterior contraction is scarcely perceptible.
Fig. 6 *d*. Left valve of a specimen, in which the posterior side is much contracted.
Fig. 6 *e*, *f*. Separate valve of an old shell, with a view of the dorsal margin. The specimen is almost equilateral, and the two extremities are of nearly corresponding form.

Position and locality. This shell, which is more abundant than any other of the order, occurs in the central and higher part of the Trenton limestone at Middleville, Trenton Falls, Herkimer, and other places.

195. 5. TELLINOMYA ANATINIFORMIS (*n. sp.*).

Pl. XXXIV. Fig. 7.

Oblong, subelliptical, slightly inequilateral; umbones little elevated above the cardinal line, which declines posteriorly; anterior extremity rounded; posterior narrower, subtruncated. On each side of the umbones is a shallow sinus or groove, extending obliquely downward to the posterior and anterior ventral margin.

The specimen has only a small portion of the shell remaining upon it, and its structure cannot be so well ascertained, but it appears nevertheless to belong to this genus, though deviating somewhat from the usual characters in the slight oblique fold upon each side of the umbo. The partial truncation in front, and contraction of this part of the shell, are characters common to several species of the genus.

This is evidently a rare species, two specimens only having been seen.

Position and locality. In the upper crystalline portions of the Trenton limestone at Watertown, Jefferson county. Dr. Crawe.

196. 1. CARDIOMORPHA VETUSTA (*n. sp.*).

Pl. XXXIV. Fig. 8.

Subrhomboidal, gibbous, abruptly rounded anteriorly, sloping abruptly from the posterior cardinal extremity; umbones much elevated, nearly over the anterior extremity; surface marked by strong concentric ridges, with small depressions of equal width between.

This species is only represented by a single imperfect specimen, which is well exhibited in the figure. The specimen has suffered slightly from compression, and the umbones were probably higher originally than they now appear.

I have referred this species to *Cardiomorpha* of de Koninck, from its analogy in form to some species of that genus, not having had an opportunity of learning the essential characters on which it is founded. I believe this genus, as well as *Edmondia*, has been constituted by M. de Koninck for the reception of several Carboniferous species, and it may perhaps be found to preclude those of lower Silurian epochs.

Position and locality. In the central part of the Trenton limestone, in thin shaly layers. Middleville, Herkimer county.

The three following species are of forms which have heretofore been referred to the genera CYPRICARDIA, CARDIUM, &c.; but I am satisfied that this is an improper reference, and that the shells have not the characters of these genera. They approach more nearly to SAXICAVA and VENERIRUPIS among recent shells, but they differ from any of these. The reference of Silurian fossils to CYPRICARDIA should be regarded with distrust, since species of that genus are so rare among recent shells, and all the fossil species yet referred to it are of Silurian, Devonian or Carboniferous age; while during the long interval between the latter period and the present, the genus has been absent from the fauna of the globe.

The most obvious characters of the following species will be found in the rigid straight hinge line, like CUCULLEA, with the umbones placed near to, or over, the anterior extremity, which, in most instances, is abruptly rounded. Shells often very gibbous.

M. DE VERNEUIL has suggested to the Author, that several of these will fall under the genus *Edmondia* of DE KONINCK. Not being able fully to ascertain the characters on which this genus is founded, I place them with some hesitation under that name. It may probably be found hereafter that they will require a separation from this genus.

197. 1. EDMONDIA VENTRICOSA (*n. sp.*).

PL. XXXV. Figs. 1 *a, b, c, d, e, f.*

Rhomboidal, cuneate, ventricose above, with the umbones large and prominent, and almost in a line with the anterior margin of the shell; cardinal line short, from the posterior extremity of which the shell slopes abruptly towards the ventral margin; posterior dorsal margin compressed; anterior extremity obtuse; posterior extremity acute, cuneate; surface with fine concentric striæ.

Nearly all the specimens seen are casts, with the surface markings more or less obscure or exfoliated. By placing the posterior extremity downwards, the shell is obtusely cuneate, diminishing rapidly in that direction. The specimens usually found are casts, and suffer various distortions from compression in different directions, giving, in some instances, a widely different form to the shell. Anterior profile cordiform.

Fig. 1 *a.* Right valve of a large and perfect specimen.
Fig. 1 *b.* Anterior extremity of the same, showing the ventricose character of the shell.
Fig. 1 *c.* Dorsal view of the same.
Fig. 1 *d.* Left valve of a smaller individual.
Fig. 1 *e.* Left valve of a specimen which has been compressed vertically, and is covered by a fine striated lamina of shale.*
Fig. 1 *f.* Dorsal view of the same.

* Many shells, suffering from pressure in the soft shaly rocks, become coated by a thin striated film of shale, marked like the "slickensides," as if the surrounding parts had been moved after partial solidification. In other instances, there appears to be a collection of shaly matter in a concretionary form around the shell, having also a striated surface. This aggregation of matter around the tube of the *Orthoceras*, has been regarded as a portion of the animal petrified; but it happens equally to other shells.

The proportions of length and breadth in this specimen are greatly altered by compression, the umbones depressed, and the length of the shell apparently increased.

Position and locality. In the central and higher part of the Trenton limestone at Middleville, Herkimer, Trenton Falls, Lowville, and other places. (*State Collection.*)

198. 2. EDMONDIA? SUBTRUNCATA (*n. sp.*).

Pl. XXXIV. Fig. 9; and Pl. XXXV. Fig. 3 *a*, *b*, *c*.

Dorsal and ventral margins subparallel; anterior extremity abruptly rounded, extending a little beyond the umbo; posterior slope straight, oblique; umbones moderately elevated, with an obtuse prominent ridge extending obliquely backwards, and becoming obsolete below; surface marked by fine concentric lines.

This species is less gibbous than the following, though it is much expanded below the umbones, and the front very obtuse. A single specimen preserves a portion of the shell, which is marked by fine striæ upon the centre and anterior portion; while upon the posterior slope it presents a few strong subimbricating ridges, which are still marked by the striæ. In the casts of this species from the crystalline portions of the limestone, these ridges are often preserved, while other portions are quite smooth. In such instances, there is no evidence of muscular impressions in any part of the specimens.

Plate xxxiv. fig. 9. A specimen preserving a part of the shell; from the soft limestone at Middleville.
Plate xxxv. fig. 3 *a*, *b*. Casts of the same in the crystalline limestone at Watertown.
— fig. 3 *c*. Cast of the same, showing strong imbricating ridges towards the base.

Position and locality. In the central or higher part of the Trenton limestone at Middleville, and in the crystalline part of the rock at Watertown. (*State Collection.*)

199. 3. EDMONDIA? SUBANGULATA (*n. sp.*).

Pl. XXXV. Figs. 2 *a*, *b*.

Subelliptical, with the anterior narrowed and slightly projecting; umbones very prominent, subangular, with an obtusely angular elevation extending thence to the posterior ventral margin; hinge line short, deeply grooved near the margin for the insertion of the ligament; surface nearly smooth, or marked by fine striæ which become undulating ridges upon the posterior slope.

This shell has a greater proportional length than the preceding, and there is a distinct obtusely angular ridge extending from the umbones nearly to the posterior ventral margin. The umbones are more angular than the last, the cardinal line shorter, and the anterior margin more extended.

Fig. 2 *a*. Left valve of this species. *b*. Dorsal view of a single valve.

Position and locality. In the concretionary lower part of the Trenton limestone at Watertown, Jefferson county. (*State Collection.*)

GENUS MODIOLOPSIS.

[*Modiola*, and ὄψις, appearance; from its similarity to MODIOLA.]

Character. Equivalve, inequilateral, elongated, becoming broader posteriorly; umbones near the anterior extremity, which is marked by a single strong muscular impression as in MODIOLA. A sinus often extends from the anterior side of the umbones, obliquely backwards, leaving the anterior portion separated as a kind of lobe. Surface marked by fine concentric striæ; shell thin.

This genus, as defined, includes a very natural group of shells found in the older silurian strata, some of which have been referred to CYPRICARDIA, MODIOLA, PTERINEA, and other genera. One of the most prominent characters is the strong muscular impression, which is close to the anterior margin: this is often visible in the shell, forming a little circumscribed elevation, and more conspicuous in the cast, where it is usually well preserved. There is often a slight contraction or sinus below, or posterior to, the umbones, but this is not always conspicuous. The shells of this genus are, for the most part, smooth, or marked only by fine concentric lines, indicating the laminæ of the shell, and they are generally free from angular ridges. *Cypricardites modiolaris* (CONRAD).*

200. 1. MODIOLOPSIS MYTILOIDES (*n. sp.*).

PL. XXXV. Figs. 4 *a*, *b*.

Subcylindrical, enlarging posteriorly; cardinal line extending about half way from the umbones to the posterior extremity; umbones small, compressed anteriorly, with a slight depression extending obliquely backwards, and producing a small sinus in the ventral margin; anterior extremity rounded, with the muscular impression reaching to the margin (in the cast); posterior extremity becoming broader, and sloping rapidly from the extremity of the cardinal line to the ventral margin; surface marked by fine concentric lines; cast smooth.

This shell is distinguished by its elongated cylindrical form, and gradual enlargement towards the posterior extremity. The anterior side is small, and somewhat abruptly narrowed. It is usually found as casts, presenting some remains of the concentric markings; the muscular impression is nearly oval, acute above, and contiguous to the margin of the shell.

Fig. 4 *a*. Right valve of a specimen, showing the muscular impression.
Fig. 4 *b*. Dorsal view of the same specimen.

Position and locality. In the thin shaly beds near the upper part of the Trenton limestone, Middleville. (*Cabinet of* Mr. VANUXEM.)

* I find myself compelled to abandon the use of the name *Cypricardites*, as applied to shells differing so widely as these do from the CYPRICARDIA, and belonging apparently to the MONOMYARIA and not DIMYARIA. So far as it is possible to ascertain, none of the species of the older strata possess two muscular impressions, and therefore do not strictly fall under the genus *Cypricardites* of CONRAD (*Ann. Geol. Report*, 1841, p. 51).

201. 2. MODIOLOPSIS PARALLELA.

PL. XXXV. Fig. 5.

Cypricardites parallela. CONRAD in MS.

Subcylindrical; sides nearly parallel; hinge line extended; umbones not prominent.

I find the above figure among those of the Trenton limestone by Mr. CONRAD, marked *Cypricardites parallela.* Not having seen the original, I cannot give a full description. It is evidently a species of MODIOLOPSIS closely allied to the preceding one, but distinguished by its nearly parallel sides and greater extension of the hinge line.

202. 3. MODIOLOPSIS FABA.

PL. XXXV. Figs. 6 *a*, *b*, *c*, *d*.

Nuculites faba, CONRAD. EMMONS, Geol. Report, 1842, pag. 395, fig. 5.

Subelliptical or obliquely ovate, ventricose, with a sinus extending from beak to base; umbones prominent, near the anterior extremity; posterior side expanded, sometimes becoming alate, rounded at the extremity; muscular impression close to the anterior margin; surface marked by fine concentric lines, and sometimes a few imbricating lamellæ which leave an impression upon the cast.

This species is strongly marked by a depression, commencing at the beaks, and becoming broader and deeper below, producing a conspicuous sinus in the base. This depressed line from the beak sometimes appears to divide the two sides of the shell more equally than in others, often leaving the sinus in the base near the centre. The beaks in some specimens, both young and old, approximate towards the centre, giving the fossil a somewhat equilateral aspect; but these characters are deviations from the prevailing ones. It should be observed, also, that the anterior lobe produced by this sinus is often compressed and extended, giving an Avicula-like feature to the shell.

Fig. 6 *a*. A large and characteristic form of this shell, the muscular impression visible at the anterior extremity.

Fig 6 *b*. A smaller specimen, less regularly rounded.

Fig. 6 *c*. A specimen having a more oblique form, with the anterior lobe more compressed and extended.

Fig. 6 *d*. A young specimen, having the umbones and sinus nearly central.

Position and locality. In the concretionary layers of the Trenton limestone at Watertown; in the black compact strata of the same rock at Sugar River (Lewis county), and in the higher crystalline strata at Middleville. (*State Collection.*)

203. 4. MODIOLOPSIS NASUTUS.

Pl. XXXV. Fig. 7.

Compare *Cypricardites nasuta*, Conrad, Ann. Report, 1841, p. 52.
— — Emmons, Geol. Report, 1842, pag. 403, fig. 4.

Elongated; sides subparallel; umbones scarcely elevated above the cardinal line; posterior side extended, gradually widening and rounded at the extremity; anterior side contracted and extended into an acute beak; surface marked by concentric, elevated, and subimbricating lines.

This is probably the young of the species which appears in the Hudson-river group, where it has attained a much greater magnitude.

Position and locality. In the compact Trenton limestone, Carlisle (Pennsylvania).

204. 5. MODIOLOPSIS ARCUATUS (*n. sp.*).

Pl. XXXV. Fig. 8.

Obliquely ovate, with a broad sinus below the umbones; an obtuse subangular ridge extending from the umbones, in a somewhat curvilinear direction, to the posterior ventral margin; posterior side broadly spatulate, rounded at the extremity; anterior extremity narrow, extended; shell thin, with fine concentric lines.

The only specimen of this fossil which I have seen is almost entirely denuded of the shell, a small portion remaining on the lower side. It has the form of an Avicula; but from its analogy with other species of this genus, I am induced to place it among them.

Position and locality. In the shaly part of the Trenton limestone at Herkimer.

(*State Collection.*)

205. 6. MODIOLOPSIS SUBSPATULATUS (*n. sp.*).

Pl. XXXV. Figs. 9 *a*, *b*.

Somewhat obliquely obovate, the anterior extremity narrowed and truncate; posterior extremity broadly rounded; shell compressed; umbones small, prominent, placed almost in the direction of the longitudinal axis of the shell, and in a line with the anterior extremity; cardinal line ascending rapidly from the umbones to the summit of the shell; surface marked by fine concentric lines and a few imbricating ridges; anterior lobe of the shell small; sinus obscure; muscular impression scarcely visible.

This shell deviates in a great degree from the typical forms of this genus, and may, perhaps, with the previous one and the two following species, constitute a distinct genus. This species is distinguished from the last, by the more ascending direction of the hinge line, and less extended anterior side, as well as the more rapid expansion of the shell posteriorly.

Fig. 1 *a*. View of the right valve of this species. *b*. Dorsal view of the same.

Position and locality. In the crystalline upper part of the Trenton limestone at Watertown, Jefferson county.

(*State Collection.*)

206. 7. MODIOLOPSIS LATUS (*n. sp.*).

PL. XXXV. Figs. 10 *a*, *b*.

Subrhomboidal, gibbous, broadly rounded below; umbones prominent, obtuse, not incurved; anterior side somewhat compressed and subulate, with a slight sinus in the margin, extending beyond the umbones; posterior side compressed and expanded; surface marked by close imbricating lamellæ.

This species departs somewhat from the typical form of the genus, but possessing many of the essential features, I am not prepared to refer it to any other at the present time. I have been unable to discover the characteristic muscular impression upon this species, though I have indeed obtained no perfect casts, and it may yet be discovered.

Fig. 10 *a*, *b*. The left valves of two specimens, showing a slight variation in form.

Position and locality. In the upper crystalline portions of the Trenton limestone at Watertown, Jefferson county.

207. 8. MODIOLOPSIS CARINATUS (*n. sp.*).

PL. XXXV. Figs. 11 *a*, *b*, *c*.

Obliquely subovate, with an acute carina extending from the umbo to the posterior ventral margin; umbones near the anterior margin, having a depression extending from thence to the base, producing a shallow sinus; cardinal line extending little more than half the length of the shell; posterior extremity obliquely truncated; the slope between the margin of the shell and the carina occupies more than one third the entire surface; surface marked by conspicuous elevated lines, which become more prominent and coalesce towards the anterior extremity.

The anterior portion of this shell closely resembles the *M. faba;* but it is readily distinguished from that one, and all other species of the lower rocks, by the conspicuous carina which marks the posterior slope. It is a rare shell, few specimens having been found.

There is a very similar species in the Hamilton group, but it is distinguished by the less prominence of the umbones, which are not so near the anterior margin, and by the two sides of the shell being more nearly parallel; the striæ, also, are sharper and more distinctly defined, and the posterior truncation is more nearly vertical.

Fig. 9 *a*. A large specimen, with prominent umbones.
Fig. 9 *b*. A smaller specimen, showing the true form of the shell more distinctly than the last.
Fig. 9 *c*. A smaller specimen, in which the posterior margin is less oblique.

Position and locality. In the compact central portion of the Trenton limestone at Middleville. Mr. WADLEIGH.

208. 9. MODIOLOPSIS AVICULOIDES (*n. sp.*).

Pl. XXXVI. Figs. 1 *a*, *b*.

Obliquely ovate, ventricose; cardinal line very oblique; umbones prominent, with an obtusely subangular ridge extending to the posterior ventral margin; a slight parallel depression just forward of the umbones; posterior side somewhat extended and compressed, having a winglike appearance; anterior extremity pointed, and projecting slightly beyond the umbones; surface marked by fine concentric lines and a few prominent undulations.

The specimen figured is somewhat imperfect, the compressed posterior margin being broken off; and the anterior extremity has apparently suffered a little pressure. In its general features it resembles other species of this genus, being closely allied to *Modiolopsis mytiloides*.

Fig. 1 *a*. A view of the left valve of this specimen. *b*. Dorsal view of the same.

Position and locality. In the thin shaly layers which alternate with the more compact strata in the central part of the Trenton limestone at Middleville.

209. 10. MODIOLOPSIS? TRENTONENSIS.

Pl. XXXV. Fig. 10.

This figure is given by Mr. Conrad, as a species of Cypricardites from the Trenton limestone. It bears so many characters analogous to the larger species of Modiolopsis, that I have referred it to that genus, giving the figure to call the attention of geologists to the existence of such a species in the rock.

210. 1. AVICULA TRENTONENSIS.

Pl. XXXVI. Figs. 2 *a*, *b*, *c*, *d*.

Avicula trentonensis. Conrad, Jour. Acad. Nat. Sciences, Vol. viii. pag. 240, pl. 12, fig. 10.
— *aviformis.* Id. Ib. pag. 243, pl. 13, fig. 11.

Obliquely obovate, gibbous, expanding towards the posterior extremity, which is somewhat obliquely truncated from the extremity of the hinge line, narrowed anteriorly, and constricted just below the umbones; anterior wing small, acute; posterior wing narrow and long, forming a kind of border to the shell; surface marked by strong radii and concentric subimbricating ridges.

An examination of several specimens has convinced me that the two species cited above are identical. In perfect specimens, the surface is marked by strong radii and less distinct concentric undulations. In worn or macerated specimens, the radii become obscure or obsolete, and the concentric elevated ridges become more distinct. The two valves are equally convex, and marked alike in perfect and unworn specimens. There is often a slight difference in the form of the anterior wing, as will be seen on reference to the figures; and the posterior extremity is often obtusely angular, and sometimes rounded, depending on the oblique truncation.

This shell approximates very nearly to the *Modiolopsis arcuatus* (Pl. XXXV. fig. 8); but the posterior extremity in that is broadly rounded, and there is no evidence of a posterior wing. The one under consideration presents obscure evidences of a posterior wing in the marginal expansion of the shell; and this, with the existence of diverging radii, remove it from the preceding genus.

Fig. 1 *a*. A worn specimen, showing only obscure traces of radii, with strong concentric ridges. (This figure is taken from the original of *A. aviformis*.)

Fig 1 *b*. A similar specimen, with obscure radii, having the anterior wing more extended.

Fig. 1 *c*. The opposite valve of a specimen of similar form as the last, with the radii better preserved.

Fig. 1 *d*. A large specimen of the left valve, with strong radii.

The presence or absence of the radii is here clearly shown to be due to wearing of the surface.

Position and locality. In the compact central and higher portions of the Trenton limestone at Middleville, and in the calcareous layers in the Utica slate at Coldspring, Montgomery county. (*State Collection*.)

211. 2. AVICULA ELLIPTICA (*n. sp.*).

Pl. XXXVI. Fig. 3.

Compare *Avicula obliqua*, Sowerby, Sil. System, pag. 635, pl. 20, fig. 4.

Inequivalve, subelliptical, narrowing towards the anterior extremity, compressed; umbones small, their direction nearly rectangular to the hinge line; posterior wing triangular, distinct above, and gradually merging into the margin of the shell; anterior margin sloping from the beak with a gentle curve, without a well defined wing; cast of the muscular impression in the left valve oblong, rounded above, and somewhat diverging and striated below; surface marked by a few obsolete concentric lines.

This specimen has the greater part of the shell removed, and perfect specimens may possess characters not obvious in this one. It corresponds in many respects with the one cited above, and its similar geological position induces me to regard it as an analogue at least.

It is doubtful if this species belongs to the true Avicula, and it may be found to approach more nearly to the following genus, which is distinguished from the Avicula by some characters possessed by this.

Position and locality. In the fine-grained black limestone, central part of the Trenton limestone at Middleville. A rare shell.

Genus AMBONYCHIA.

[Greek, αμβων, the boss of a shield, and ονυξ, a claw or talon; in allusion to the rounded incurved umbones in the typical species.]

Character. Equivalve, inequilateral, compressed, alate or subalate posteriorly, obtuse and abruptly declining or curving downwards on the anterior margin. General form somewhat obliquely ovate, gibbous or inflated towards the umbones and on the centre of the shell; cardinal margin very oblique, or approaching a line parallel to the direction of the umbones, which are often incurved at the extremity, and equal, or project beyond, the line of the anterior extremity; surface marked by more or less prominent concentric striæ, strong undulations, or fine radiating striæ. Muscular impressions large: one in each valve.

The description includes several species of fossil shells, which, in some respects, vary in character, while, so far as regards general form and other prominent features, they evidently form a natural group.

This genus may be again subdivided, when we become better acquainted with the species which are at present arranged under it. Several of these species have heretofore been referred to Inoceramus, and Pterinea, to which they bear some resemblance; but have a structure of the hinge different from the former, as well as being equivalve; while they differ from authentic specimens of the latter, in having no anterior alation, which renders it desirable to distinguish these early forms by another name. It appears probable that *Pterinea carinata* of Goldfuss may be referred to the same genus, not being a true Pterinea according to the definition of that author.

212. 1. AMBONYCHIA BELLISTRIATA (*n. sp.*).

Pl. XXXVI. Figs. 4 *a*, *b*, *c*.

Obliquely subovoid, ventricose, very inequilateral, height much greater than the length; umbones very ventricose, and extended into long and incurved beaks, which bend forward at their extremities; anterior margin not alated, or extending beyond the beaks; posterior side compressed, subalate; base regularly rounded; cardinal line short, very oblique to the umbones; surface marked by fine radiating striæ, with a few elevated concentric lines of growth.

This beautiful fossil shell is readily distinguished by its external form and markings. The umbones are extended into long incurved beaks, which are very ventricose, and rise abruptly from the shell towards the summit; the central and lower part of the shell is regularly convex, becoming more compressed towards the margin. The anterior side extends almost in a right line from the beaks towards the base.

Fig. 4 *a*. Left valve of a very symmetrical specimen.
Fig. 4 *b*. Right valve of a larger specimen.

Fig. 4 *c*. Profile view of the same. The specimen appears to be inequivalve, which is due to the sliding down of one valve below the other, as is clearly shown in the lower part of the figure, and in 4 *b*.

Fig. 4 *d*. A portion of the surface enlarged, showing the fine undulating striæ crossed by the concentric lines of growth.

Position and locality. In the central part of the Trenton limestone at Middleville, Trenton Falls, &c. (*Cabinet of* Mr. Moore, *of Trenton Falls.*)

213. 2. AMBONYCHIA ORBICULARIS.

Pl. XXXVI. Figs. 5 *a, b, c, d*.

Pterinea orbicularis. Emmons, Geol. Report, 1842, pag. 397, fig. 3.

Rhomboidal or suborbicular, very ventricose in the middle and upper parts of the shell, regularly curved anteriorly, and somewhat compressed and alate behind; umbones ventricose, narrowing above, very prominent, extended and incurved into a kind of hook or claw, which turns forward at the extremity; cardinal line moderately extended, straight; surface of the shell ornamented by fine radiating striæ, which are crossed by sharp concentric elevated lines; cast smooth, marked by the large oval muscular impression of the shell.

This species, in its young state, bears considerable resemblance to the preceding one; but the radiating striæ are always stronger, and distinctly marked by concentric lines; and the shell is wider, though it does not attain so great a proportional width in the young as in the older specimens. It is not rare in the concretionary limestone at Watertown, where it is usually found in the condition of a cast, the material of the shell forming a thin crystalline coating upon the surface, in which the original structure is not apparent. In a few specimens, I have detected small portions of the beautifully marked shell represented in fig. 5 *d*. The proportions of height and breadth, shown in the figures, sometimes varies; but the usual forms of perfect specimens are there represented.

The associates of this shell are a single species of Tellinomya (*T. anatiniforms*), *Modiolopsis faba*, *Edmondia subangulata*, and a slender Orthoceratite. The *Edmondia subtruncata*, *E. ventricosa* and *E. undata*, occur in a higher position, where the present species is never seen.

Fig. 5 *a*. Right valve of a specimen, showing the muscular impression.

Fig. 5 *b*. Left valve, retaining a portion of the shell, which is beautifully ornamented by radiating and concentric striæ.

Fig. 5 *c*. Anterior profile view of a single valve.

Fig. 5 *d*. A portion of the shell enlarged.

Position and locality. This shell occurs in the lower concretionary and irregularly bedded Trenton limestone at Watertown, Jefferson county.

214. 3. AMBONYCHIA AMYGDALINA (*n. sp.*).

Pl. XXXVI. Figs. 6 *a*, *b*, *c*.

Obliquely ovate or elliptical, with the umbones extended, height much greater than the length; umbones oblique, nearly parallel to the anterior margin, and bending forward at the apices; anterior margin obtuse, straight for a short distance below the beak, and thence broadly curving around to the base; surface regularly convex in the middle, becoming gibbous above; posterior margin compressed, subalate.

The only specimen known is a cast, from which the figures and descriptions are taken. It will be readily recognized by the form, which differs from that of any other species. The lower part of the specimen presents a very regular elliptical figure, intercepted above by the oblique direction of the umbones, which are slightly curved forward at the extremities. The anterior edge presents a distinct oblong lunule beneath the apices of the umbones. A few obscure undulations are visible upon the cast, but nothing from which the character of the original surface can be ascertained.

Fig. 6 *a*. Right valve of this specimen.
Fig. 6 *b*. Profile from the posterior side.
Fig. 6 *c*. Profile of the anterior extremity, showing a kind of lunule below the beaks.

This species resembles in form *Inoceramus rostratus*, a species from the Lias (Goldfuss, *Petrefacta*, Vol. ii. pag. 110, tab. 115, fig. 3 *a*, *b*).

Position and locality. In the higher part of the Trenton limestone at Adams, Jefferson county. Its associates are *Murchisonia*, *Pleurotomaria*, *Atrypa bisulcata*, and fragments of *Orthoceratites*.

215. 4. AMBONYCHIA UNDATA.

Pl. XXXVI. Figs. 7 *a*, *b*.

Pterinea undosa. Conrad in MS.
— *undata.* Emmons, Geol. Report, 1842, pag. 395, fig. 1.
Compare *Inoceramus vetustus*, Sowerby, Min. Conchology, 1829, Vol. vi. pag. 162, tab. 584, fig. 2.
— — var. *priscus*, Portlock, Geol. Report, 1843, pag. 423, pl. 32, figs. 1, 2, 3.
— — Goldfuss, Petrefacta, 1831 – 1840, Vol. ii. pag. 107, tab. 108, fig. 5.

Obliquely ovate or subrhomboidal, with the base rounded, ventricose; anterior margin obtuse, straight above and curving below; posterior margin compressed, scarcely alate above; cardinal line straight, oblique; umbones ventricose, elevated, narrowing above and scarcely incurved, with the extremities bending forward; surface with broad, smooth, concentric undulations, which curve downward more abruptly on the centre of the shell; anterior side scarcely concave below the beaks; no definite lunette.

This species has been referred to PTERINEA by Mr. CONRAD, with the remark that it "has much resemblance to certain species of the Genus INOCERAMUS." It is probably identical with that described by Mr. PORTLOCK (cited above), who adds the remark, that Professor PHILLIPS regards it as belonging to the Genus POSIDONIA of BRONN. It is true that our shell approaches to POSIDONIA in many respects; but in other essential characters, it differs from that genus. The species here grouped under a new generic name, may be regarded, perhaps, as the representatives of a type, which, in a later geological period, appears in the POSIDONIA; but the species under consideration, and its congeners, cannot, I apprehend, be properly placed under the Genus POSIDONIA. Strictly speaking, the present species has few of the distinguishing characters of INOCERAMUS, except the broad undulations which mark some species of that genus as well as of POSIDONIA. It cannot therefore be admitted into that genus, and we are compelled to construct a new term, under which this and the preceding ones may be arranged.

Our species bears a close analogy with *Inoceramus vetustus* of SOWERBY, from the Carboniferous limestone; but that one is more distinctly alated, both as represented by SOWERBY and by GOLDFUSS: neither can we, for a moment, believe that this species of the older Silurian rocks, after such an immense lapse of time, should reappear in the Carboniferous strata, while we have scarcely an analogous form in all the intermediate strata. If the geological position of Mr. SOWERBY's specimen be correctly cited, it is not probable that the one described by Capt. PORTLOCK is identical; for from its associates, as well as precise similarity to our own, we regard it as of lower silurian age.

Fig. 7 *a*. Right valve of a specimen which is imperfect on the lower side.
Fig. 7 *b*. Profile of the same, looking upon the posterior side.

Position and locality. In the higher crystalline portions of the Trenton limestone, associated with *Edmondia subtruncata*, *Subulites elongata*, and several of the common Brachiopods of the rock. Watertown, Jefferson county. (*State Collection, from* Dr. CRAWE.)

216. 5. AMBONYCHIA OBTUSA (*n. sp.*).

PL. XXXVI. Figs. 8 *a*, *b*.

Obliquely ovate, short, gibbous; umbones short, obtuse, scarcely incurved or bending forwards; shell somewhat compressed towards the lower margin, convex on the centre and becoming inflated above; anterior side obtuse, rounded, scarcely extending beyond the umbones; posterior side compressed, scarcely alated; cardinal line straight, margin of the shell curving from its posterior extremity; surface?

The specimens seen are casts, where the markings of the shell are not preserved. This species is distinguished from the others by its short ovate form, as well as the shorter, very obtuse and gibbous umbones. It departs somewhat from the typical forms of the genus; but it has nevertheless the essential features, and cannot be referred to any other genus.

I have a specimen from the northwest part of Wisconsin, which is apparently identical with the one here figured, but presents a slight ridge extending from the summit down the anterior side of the shell, as if produced by a contraction in that direction. The specimen is a cast, differing in no other respect from the one figured.

Fig. 8 *a*. Right valve of this species. *b*. Profile view from the posterior side.

Position and locality. In the higher part of the Trenton limestone, associated with the preceding, at Watertown.

217. 6. AMBONYCHIA?

PL. XXXVI. Figs. 9 *a*, *b*.

The specimen here figured has been unfortunately lost, so that a description cannot be given. It bears in some respects the characters of the present genus, but is equilateral, with a distinct prominent umbo. The surface is marked by thin sharp concentric ridges, as shown in the figure.

Fig. 9 *a*, *b*. View of the single valve, and profile of the same.

Position and locality. In the thinbedded higher portions of the rock at Middleville.

There are several other species of the preceding, or allied, genera of ACEPHALA, in the Trenton limestone; but the condition of the specimens which I have seen is such that they cannot be satisfactorily described. Further examination will doubtless increase the number, and render us better acquainted with the character and relations of those already described.

Notwithstanding that several of these species are widely distributed, and may be found in almost every locality of the rock, they are never abundant. Of several species, only two or three specimens have been seen, and careful researches have been but poorly rewarded. It is evident from what we find in subsequent formations, that the nature of the sediment, or the condition of the ocean, was not favorable to their development during this period. In this respect they contrast with the species of BRACHIOPODA, which, for the most part, are abundant in one or more localities.

An interesting comparison may be drawn between this and the subsequent period, or a later part of the same epoch, during which the shales of the Hudson-river group were deposited. In the latter group, the BRACHIOPODA known, with the exception of two species, are identical with those previously found in the Trenton limestone; while the species of ACEPHALA are, for the most part, distinct from previously existing forms. Several species of those already described do appear in the shales and sandstones of the Hudson-river group; but a large majority of the forms are quite distinct, though belonging to the same genera. From these facts we are able to infer that the condition of the ocean, during the deposition of the calcareous strata, was more favorable to the development of the Brachiopoda, than of the Acephala; also that the former are less susceptible to the influence of change, or more enduring than the latter, which, with the exception of three species, are not known in the succeeding strata.

We shall find, also, in all subsequent palæozoic formations, that the calcareous strata have proved comparatively barren of the Acephala, though very prolific in the Brachiopoda; while, on the contrary, the periods of sandy and shaly deposits have been far more productive of the Acephala, with a comparatively larger proportion of Brachiopoda than we find of the Acephala in the calcareous deposits. We must take into account, however, in making this comparison, the character of both the calcareous and other deposits; for, as in the case of the Trenton limestone, we may have a considerable proportion of shale; and in formations where the other materials predominate, we shall find also a large amount of calcareous matter. In such instances we usually discover, as in the present case, that the Brachiopods are most abundant in the calcareous part (often, perhaps, constituting a large proportion of the same), while the Acephala occur in the shaly part of the formation.

In the present instance, we have an opportunity of making a comparison with the same formation in its western extension, where the subdivisions made in New-York are scarcely recognizable, showing that the Acephala are less abundant throughout the formation than in New-York; while several of the species known here in the higher part of the formation, occur there in a lower position, and others ascend perhaps quite to the upper limits of the formation, and there become more numerous than elsewhere.

GASTEROPODA OF THE TRENTON LIMESTONE.

PLATES XXXVII., XXXVIII., XXXIX. & XL.

We are at present acquainted with about thirty species of this order in the Trenton limestone. One or two of these are known in a lower position, and about the same number pass upwards into the shales of the Hudson-river group. They belong mainly to the genera PLEUROTOMARIA and MURCHISONIA, with a few others which cannot be satisfactorily referred to these genera. There are, also, one or more species of BELLEROPHON, and some others of an allied genus. A few of the species only are abundant and widely distributed, while the others are comparatively rare and circumscribed in their distribution.

Shells of this order are apparently more numerous in New-York than in the western extension of the same formation, where we know, at present, but few species. Two or three forms, however, are quite frequent in western localities, one of which, and the most abundant, has not yet been satisfactorily identified in New-York.

Unfortunately for accurate determination, many of these species are usually found as casts, the shell having been removed; and it is only in favorable localities that the characteristic surface markings are preserved. Several species have never been seen except as casts, and these can only be determined by their general form and proportions.

GENUS HOLOPEA.

[Greek, ὅλος, entire, and ὀπή, an aperture; in allusion to the entire margin of the aperture.]

Character. Shells conical, ventricose, more or less oblique or nearly direct; aperture round ovate; margin entire; surface marked by simple fine curved striæ, or cancellated.

The shells constituting this genus have the general form of TURBO or PALUDINA, differing somewhat in the form of the aperture. They are distinguished from the PLEUROTOMARIA by the absence of a slit in the margin of the aperture, or of angular bending in the striæ upon the surface, as well as being generally more ventricose, and the volutions more regularly rounded.

There are also some other reasons for separating these shells from the Genus TURBO, which probably had not come into existence at so early a period; since most of those heretofore referred to it, and other allied genera, have been subsequently discovered to belong to distinct genera, and to possess reliable characters for their separation. As examples of these, may be instanced MURCHISONIA and LOXONEMA, which have become well known within a short time, and generally distinguishable from other genera by obvious characters. The two forms in the Calciferous sandstone, referred to the Genus TURBO, probably belong to the genus here proposed.

218. 1. HOLOPEA SYMMETRICA (*n. sp.*).

Pl. XXXVII. Fig. 1.

Spire conical, elevated, apex acute; height much greater than the breadth; volutions four or five, rounded, ventricose, increasing gradually from the apex; surface marked with fine crowded striæ, which curve gently backwards from the sutures; aperture nearly circular.

This is a very pretty symmetrical shell, with the spire elevated and the volutions ventricose, resembling some species of Paludina. The striæ are fine, close, and sometimes crowded together and elevated in fascia or undulations. All the specimens examined present the uniform character here given, and show scarcely a perceptible variation even in the size of the shell.

Position and locality. In the upper crystalline portions of the limestone at Middleville. (*State Collection.*)

219. 2. HOLOPEA OBLIQUA (*n. sp.*)

Pl. XXXVII. Figs. 2 *a*, *b*, *c*, *d*.

Spiral, oblique, height and breadth nearly equal; spire very short, acute at the apex, composed of three or four volutions, diminishing rapidly above, the last one very ventricose; aperture somewhat circular, entire, transversely extended, with the outer lip thin; surface smooth, or covered with fine striæ.

This shell has heretofore been referred to the Genus Natica, from its general resemblance, though it is not probable that it is a true Natica. It is more oblique, and the spire is shorter and more abruptly acute than in either of the other species described. The aperture, in two specimens examined, is rounded upon the outer side, contracting towards its junction with the body whorl. In the largest specimen seen, the surface is marked with vertical curving undulations or rounded ridges; but these appear due to age, or other circumstances not constant in their influence, though something of the kind is obscurely visible in another specimen. The volutions are somewhat more appressed at their junction than the succeeding species.

Fig. 2 *a*. View of the aperture of a small specimen.
Fig. 2 *b*. View of the back of the shell.
Fig. 2 *c*. Profile view of the same.
Fig. 2 *d*. Back of a larger specimen.

Position and locality. This species occurs in the higher shaly part of the Trenton limestone at Middleville. The specimen fig. 2 *d* is from the upper crystalline portion of the rock at Watertown, Jefferson county. (*State Collection.*)

220. 3. HOLOPEA PALUDINIFORMIS.

Pl. XXXVII. Figs. 3 *a*, *b*.

Pleurotomaria. Emmons, Geol. Report, 1842, pag. 397, fig. 1.

Spiral, scarcely oblique, elevated ; height greater than the breadth ; volutions four or more, rounded, ventricose, enlarging somewhat rapidly from the apex ; aperture round ovate ; surface ? The specimen is a cast, preserving no surface markings.

This species resembles the first described, but it is comparatively more gibbous, and the spire less elevated in proportion to the size of the shell. In form and aperture, it closely resembles the larger Paludinæ.

Fig. 3 *a*. View of the back of the shell. *b*. View of the aperture.

Position and locality. The only specimen known, is from the crystalline upper part of the Trenton limestone at Watertown, Jefferson county. (*State Collection.*)

221. 4. HOLOPEA VENTRICOSA (*n. sp.*).

Pl. XXXVII. Figs. 4 *a*, *b*.

Spiral, oblique, subglobose, very ventricose ; height and breadth nearly equal ; spire short ; volutions about three, rounded, rapidly enlarging from the apex, and becoming ventricose ; aperture rounded oval, slightly contracting at the upper side ; surface ?

The specimen is a cast, preserving some slight evidences of striæ as in fig. 1, which appears to have been the prevailing character of the markings on the surface. But few specimens of either of the species have been seen, and they are much more rare than the Pleurotomaria, and occur almost entirely or altogether in the upper part of the rock.

Fig. 4 *a*. View of the back of the spire. *b*. View of the top of the spire.

Position and locality. In the upper crystalline part of the Trenton limestone at Middleville, Herkimer county.

Several other imperfect specimens, apparently referable to this genus, have been observed in the Trenton limestone, but none of them in a condition to furnish specific characters. There are smooth casts of Pleurotomaria, resembling in general form these or smaller species of the same genus, being sometimes regularly rounded ; but in most instances they preserve some evidence of the angular form of the last volution, which is never seen in the Holopea.

222. 10. PLEUROTOMARIA SUBTILISTRIATA (*n. sp.*).

PL. XXXVII. Figs. 5 *a, b, c, d.*

Lenticular; spire much depressed; volutions four or five, even, smooth, forming a very depressed cone, with an elevation little more than one third the width of the shell; aperture transversely extended into a somewhat triangular form; umbilicus very small; surface marked by fine close striæ, which bend gently backwards on the upper half of the volution, and more abruptly on the lower half, finally running almost parallel to the outer margin; outer margin of last volution sharply angular, with a mesial band parallel to the edge, indicating the generic character of the shell.

This species is much smaller and more depressed than either of the others, most of the specimens being scarcely visible to the naked eye. The surface is apparently smooth, but under a magnifier, is clearly marked by fine striæ as described. The outer volution is slightly concave near the margin, the others being plane.

Fig. 5 *a.* View of the spire of a large specimen.
Fig. 5 *b.* Profile of the same.
Fig. 5 *c, d.* View of the spire and profile of the largest specimen seen.

Position and locality. This species is known to me only as occurring in the concretionary and irregularly bedded limestone, near the base of the Trenton limestone, at Watertown, Jefferson county.

223. 11. PLEUROTOMARIA LENTICULARIS.

PL. XXXVII. Figs. 6 *a, b, c, d.*

Trochus lenticularis (?) SOWERBY in Sil. Researches, 1839, pag. 642, pl. 19, fig. 11.
Pleurotomaria lenticularis, CONRAD in MS. EMMONS, Geol. Report, 1842, p. 392, f. 2; p. 393, f. 2 & 3.
Compare *Helicites qualteriatus,* SCHLOTHEIM, 1820, Petrefacta, p. 103; ID. Nachträge, pl. 11, fig. 3.
— *obvallatus,* WAHLENBERG, 1821, Act. Soc. Sci. Upsal, Vol. viii. pag. 73, pl. 4, f. 1 & 2.
Solarium petropolitanum, PANDER, 1830, Beiträge zur Geogn. Russland, pag. 150, pl. 1, fig. 3.
Euomphalus pseudoqualteriatus, VON BUCH, 1830, Karst. Archiv, p. 156 – 158.
Delphinula obvallata, HISINGER, 1831, Petrif. de la Suede, p. 8.
Euomphalus qualteriatus, GOLDFUSS, 1834, in Kloden Verst. Brandenburg, p. 155.
— — BRONN, 1835, Leth. Geognostica, pag. 94, pl. 2, fig. 1.
— *pseudoqualteriatus,* HISINGER, 1837, Leth. Suecica, pag. 36, pl. 11, fig. 5.
— *qualteriatus,* ESCHWALD, 1840, Sil. Syst. in Esthland, p. 115.
— — GOLDFUSS, 1844, Petref. Germanicæ, Vol. iii. pag. 81, pl. 189, fig. 3 *a, b.*
— — VERNEUIL, 1845, Pal. Russia and the Ural Mountains, pag. 333, pl. 23, fig. 1 *a, b*; and var. A. fig. 2 *a, b.*
Not *Pleurotomaria lenticularis,* GOLDFUSS, Petrefacta, Vol. iii. pag. 65, pl. 183, fig. 2.

Lenticular; spire depressed, subdiscoidal; volutions scarcely four, flattened above, last one obtusely angular at the margin and somewhat ventricose below; aperture transversely extended, subtrigonal; umbilicus large, extending to the apex; surface marked by fine striæ, which curve gently backwards from the suture, making an abrupt retral bend in passing over the angles of the last volution.

This species usually occurs as casts of the interior, the shell being rarely preserved. I have seen a single specimen in which some remains of the shell can be distinguished; and there is also an obscure indication of the spiral band on the angular margin of the last volution, but the details cannot be made out.

This species is probably the same as that described by Mr. Sowerby, cited above; and its similar geological position is a further reason to regard it as identical. It possesses the essential characters of Pleurotomaria, which are better seen in the analogous succeeding species.

This species is regarded by M. de Verneuil as identical with *Euomphalus qualteriatus*, cited above; but it appears to me that there are some reasons for separating it. That species, judging from the figures of Schlotheim, Wahlenberg, Hisinger, Goldfuss and de Verneuil, is less depressed than our shell, and the last volution below the angle more vertical and ventricose, giving the aperture a different form as represented by the authors quoted, that of Wahlenberg approaching more nearly to our shell, but being insufficiently extended transversely. In our specimens, the extent of the aperture, from the suture with the next volution, is greater than the vertical height; while in the figures cited, except that of Hisinger, the vertical diameter is equal to, or greater than, the transverse, and, in that of Goldfuss, nearly twice the transverse extent from the suture to the outer angle. Our specimens are very uniform in character, and we can scarcely conceive such a change to have taken place in the same species on the other side of the Atlantic. The succeeding species bears a more close resemblance to the *E. qualteriatus*, in the form of the aperture and expansion of the last volution.

Fig. 6 *a*. View of the spire (the specimen is a cast).
Fig. 6 *b*. Lateral view, shewing the elevation of the spire.
Fig. 6 *c*. Base of a smaller specimen (a cast), showing the umbilicus.
Fig. 6 *d* Front view of the same, showing the aperture.

Position and locality. This fossil is more abundant in the higher crystalline portions of the rock at Watertown, than at any other locality. It is rarely found at Middleville, and other localities in the Mohawk valley. At the first named locality, it is more abundant than any other univalve in the rock, except the *Bellerophon bilobatus*. (*State Collection.*)

224. 12. PLEUROTOMARIA ROTULOIDES (*n. sp.*).

Pl. XXXVII. Figs. 7 *a*, *b*, *c*.

Compare *Euomphalus qualteriatus*, and synonymy as in the preceding species.

Depressed conical; spire composed of about four volutions; height about equal to half the width of the shell; outer volution angular at the margin, ventricose below and slightly concave above; upper ones becoming convex above, and slightly elevated vertically at the suture; umbilicus small; aperture subquadrate; surface marked by distinct sharp striæ, which curve gently backwards from the suture above; edge of the outer volution distinctly marked by a spiral band, with abruptly curving striæ, indicating the marginal slit.

This species, in form, bears considerable resemblance to the one cited above; but it is uniformly smaller, more distinctly striated, and has the spire more elevated, with the volutions vertically elevated at the sutures. The umbilicus is also smaller than in *E. qualteriatus*, and the outer margin less nearly vertical. It is distinguished from the preceding species, with which it has usually been confounded, by the greater elevation of the spire and the convexity of the volutions, and also in the form of the aperture, which is nearly subquadrate. It is a very neat symmetrical species, occurring much more rarely than the *P. lenticularis*.

Fig. 7 *a*. View of the aperture and front of the shell, showing the elevation of the spire.
Fig. 7 *b*. View of the top of the spire.
Fig. 7 *c*. View of the base, showing the umbilicus.

Position and locality. In the lower part of the Trenton limestone at Middleville.

225. 13. PLEUROTOMARIA SUBCONICA (*n. sp.*).

PL. XXXVII. Figs. 8 *a, b, c, d, e*.

Compare *Trochus ellipticus*, HISINGER, Leth. Suecica, pag. 35, pl. 11, fig. 1.
— *trochiformis*, PORTLOCK, Geol. Rep. Londonderry, 1843, pag. 414, pl. 30, fig. 9.

Trochiform; spire elevated, apex acute; volutions about five, flattened above, with a projecting carina just above the suture; last volution strongly carinated on the outer edge, and marked with a spiral band, ventricose below; aperture transverse, subquadrate, angular on the outer side and round below; surface marked by fine striæ, which bend gently backwards from the suture, and more abruptly on the lower part of the whorl; spiral band a distinct groove, margined by sharp elevated edges, upon which the striæ bend backwards in an abrupt curve; below this the striæ bend gently forward, and thence curving backwards, terminate in the umbilicus; longitudinal striæ crossed by transverse sharp elevated lines which are finer than the longitudinal ones.

This is a beautiful trochiform shell, with a symmetrical conical spire, and beautifully cancellated surface. The finer concentric striæ are often obliterated from wearing or maceration, the longitudinal ones only remaining, and these also are often obliterated. The spiral band is distinct on the last volution, and the striæ upon it appear to be crowded into ridges. The suture is formed just at the lower margin of the band, leaving it visible at the lower edge of the higher volutions. In casts of this species, the outer angle of the last volution is distinctly carinated, as also the lower margin of the higher volutions.

Fig. 8 *a*. Front view of a specimen preserving the shell in a very perfect manner; the aperture imperfect.
Fig. 8 *b*. Base of the same, showing the small partially closed umbilicus.
Fig. 8 *c*. An enlarged portion of the surface, showing the cancellated striæ which are scarcely visible to the naked eye.
Fig. 8 *d*. Cast of another specimen.
Fig. 8 *e*. Front view of the same, showing the form of the aperture.

These figures are of specimens of the ordinary size; they are frequently smaller, and others attain an elevation of nearly two inches.

Position and locality. This species occurs in the lower part of the Trenton limestone, near its junction with the Black-river mass, at Watertown, Jefferson county. I have also seen the same species in the shales of the Hudson-river group at Turin and Pulaski.

(*State Collection; Cabinet of* Dr. Crawe.)

74. 7. PLEUROTOMARIA UMBILICATA.

Pl. XXXVIII. Figs. 1 *a, b, c, d, e, f, g*.

Reference *Pleurotomaria umbilicata*, pag. 43, pl. 10, fig. 9 of this volume.

This variable species is widely distributed in the Trenton limestone, occurring in nearly all localities of the rock. The description of the forms in the Birdseye limestone apply to those of the Trenton limestone, though they are usually better preserved in the latter rock. The last volution is sometimes angulated along the margin of the umbilicus; and, in a single specimen, apparently not differing specifically, there is an additional carina on the side of the shell. If this prove only a deviation from the prevailing character of the shell, we may be inclined to refer the *P. quadricarinata* (page 43 of this Report) to the same species. The specimens, in both instances, however, are much compressed and partially distorted, so that further examination may be required to determine this point.

The specimen fig. 8 *g* is from Mineral Point (Wisconsin), having the upper part of the spire replaced by sulphuret of lead. It is apparently identical with the New-York specimens, though the spire appears to be more elevated than in the prevailing forms.

Mr. Conrad (*Proc. Acad. Nat. Sci. Philadelphia*, Vol. i. p. 330) regards this shell as identical with *Pleurotomaria angulata* of Sowerby (*Sil. System*, pag. 641, pl. 21, f. 20); but in this species, the cast of the volutions is distinctly biangular, thus differing from the figure of Sowerby.

Fig. 1 *a*. Back of the shell, showing an elevated spire.
Fig. 1 *b*. Front view, showing the aperture.
Fig. 1 *c*. Base of the shell, showing the umbilicus.
Fig. 1 *d*. View of the top of the spire of a larger specimen.
Fig. 1 *e*. Front view of the same, showing a depressed spire.
Fig. 1 *f*. Base of the same, showing the large umbilicus.
Fig. 1 *g*. Specimen from Mineral Point, showing a greater elevation of the spire.

Position and locality. This species occurs in almost every part of the Trenton limestone, usually in the intercalated shaly strata, and more rarely in the compact or crystalline portions of the rock. It has been found at Middleville, Herkimer, Trenton Falls, Lowville, Turin, Watertown and Adams, and probably occurs in many other localities.

This species has already been shown to exist in the Birdseye limestone, and it has been rarely seen in the Hudson-river group. (*State Collection.*)

226. 14. PLEUROTOMARIA INDENTA (*n. sp.*).

Pl. XXXVIII. Fig. 2 *a*.

Pleurotomaria. Emmons, Geol. Report, 1842, pag. 396, fig. 5.

Obliquely depressed conical; spire short, acute; volutions about three, rapidly enlarging towards the aperture; the last one, composing the greater part of the shell, is ventricose, biangulated above and rounded below; angles subnodulose, with indentations between the two and below the lower one; aperture rounded or transversely broad oval; surface marked by fine striæ.

This species usually occurs in the form of casts of the interior, scarcely preserving any remains of the surface markings. It is readily distinguished by its small acute spire above the last volution, which is distinctly nodulose on the two angles. In this character, it differs from any other in the Trenton limestone.

Position and locality. This species is known only in the black limestone at Watertown, being the lower portion of the rock at this place. (*State Collection.*)

227. 15. PLEUROTOMARIA AMBIGUA (*n. sp.*).

Pl. XXXVIII. Figs. 3 *a, b*.

Depressed conical, width about equal the height; spire short, obtuse; volutions few (three or four), rapidly increasing towards the aperture, subangular, ventricose; the last volution distinctly bicarinate on the outer edge, upper ones with a single carination near the lower side; suture canaliculated; aperture subquadrate, with the angles rounded above and expanding below; umbilicus small, scarcely distinct.

This species resembles in many respects the *Pleurotomaria umbilicata*, but differs in some important particulars. The spire is higher, each volution being less compressed vertically; the space between the two marginal angles of the volution is less, and these angles less prominent. The umbilicus is scarcely distinct, and the aperture is less extended transversely, and angulated below, approaching in this respect to Murchisonia.

I have but a single specimen sufficiently perfect to figure, and this one is somewhat distorted from pressure, and the aperture imperfect.

Fig. 3 *a*. View of the back of the spire.
Fig. 3 *b*. Front of the same, showing the aperture.

Position and locality. In the higher shaly limestone at Adams, Jefferson county, associated with the preceding species. (*State Collection.*)

228. 16. PLEUROTOMARIA PERCARINATA (*n. sp.*).

PL. XXXVIII. Fig. 1.

Somewhat obtusely conical, ventricose; spire short, obtuse; volutions three or four, rounded, marked by numerous spiral carinæ, which are crossed by vertical or undulating striæ; aperture not distinctly visible, but apparently it is broadly oval or rounded; umbilicus none.

This species is readily distinguished from all the others known in this rock, by the numerous spiral elevated ridges or carinæ which mark the surface. It approaches very nearly in character to the *Pleurotomaria bilix* of CONRAD (*Jour. Acad. Nat. Sciences*, Vol. viii. pag. 211, pl. 16, fig. 10); but differs from that shell in being more ventricose, and in the volutions being rounded above, while in that species they are flattened, and abruptly contracted below, giving it a more trochiform aspect.

This species and the preceding one differ from PLEUROTOMARIA in the form of the aperture, and approach in this respect to MURCHISONIA.

Position and locality. In the compact blue limestone, upper part of the Trenton limestone. Middleville.

229. 6. MURCHISONIA BICINCTA.

PL. XXXVIII. Figs. 5 *a* – *h*.

Compare *Pleurotomaria angulata*, SOWERBY in Sil. Researches, pag. 641, pl. 21, fig. 20.

Obliquely subconical; spire elevated, acute; volutions four or five, angular, rapidly enlarging towards the aperture; last one ventricose below, tricarinate, the lower carina hidden by the suture of the next volution at the upper inner angle of the aperture; central carina on the outer angle of the volution, margined on either side by a sharp elevated line, with a narrow groove between, producing a double spiral band; aperture oblong, angulated below; surface marked by fine sharp striæ, which bend gently backwards, and are but slightly undulated in passing the first carina, from whence they turn more suddenly backwards to the mesial band, making an abrupt retral angle, and then bending forwards below, pass in a vertical direction to the suture. In the last volution, the striæ pass vertically to the lower slight carina which corresponds with the suture in the other volutions, and from thence bend slightly backwards, curving into the umbilicus.

The minute description here given will be found perfectly applicable to entire and unworn specimens; but it is often found in fragments and casts, with the surface markings more or less obliterated. The double spiral band becomes obsolete, and only a single ridge is manifest; the lower carina on the last volution is not visible in casts, and there is but an obscure indication of the upper one. The entire casts, therefore, present scarcely more than the single marginal angle, indicating the direction of the mesial band, and, in this respect, correspond with *P. angulata* cited above; but the volutions in our shell are more ventricose.

Fig. 5 *a*. Front view of a nearly perfect specimen, showing the form of the aperture. *b*. Back view.

Fig. 5 *c*. Front view of a specimen with the last volution broken off behind the aperture, giving it a different form.

Fig. 5 *d*. View of an imperfect specimen, showing the direction of the striæ.

Fig. 5 *e*. An enlarged view of the same.

Fig. 5 *f*. A smooth cast from crystalline limestone, scarcely preserving the upper carination in an obscure angle. These specimens are of the ordinary size of the shell in most localities.

Fig. 5 *g*. View of a large imperfect specimen, still preserving the striæ upon the surface.

This specimen preserves the same form and proportions as the others figured; but although retaining the shell, it does not present the double mesial band, a single obtuse carina being all that is visible. The sharp lines on either side have doubtless been obliterated without removing the vertical striæ.

Fig. 5 *h*. A portion of the same enlarged.

Position and locality. This species occurs more frequently in the lower shaly portions of the Trenton limestone at Middleville. It is found occasionally in the higher crystalline part of the same rock at that place. The cast fig. 5 *f* is from the higher part of the same rock at Turin in Lewis county. The larger specimen 5 *g* is from the compact lower part of the rock at Watertown. (*State Collection.*)

230. 7. MURCHISONIA TRICARINATA (*n. sp.*).

Pl. XXXVIII. Figs. 6 *a*, *b*, *c*.

Subfusiform; spire elongated, acute; volutions five or more, gradually expanding below, tricarinate, the central carina more prominent than the other two; aperture suboval, acutely extended below; surface marked by sharp prominent striæ, which are distinctly undulated in passing over the central carina; umbilicus none.

This species somewhat resembles the last, but the spire is more extended and gradually enlarging below; the central carina is not margined by two smaller ones, and both the carinæ and striæ are stronger and more distinctly elevated above the surface. The form of the aperture, so far as can be seen, is more distinctly oval, and not so straight upon the pillar lip. The shell is somewhat distorted by pressure, and therefore cannot be perfectly represented.

Fig. 6 *a*. View of the back of the shell.

Fig. 6 *b*. Front view, showing the aperture, which is imperfect on the outer side.

Fig. 6 *c*. This fragment belongs apparently to the same species, but the striæ are much better preserved, and the carinæ sharply projecting. The striæ between the suture and upper carina are directly vertical; between the first and second carinæ they bend backwards, making an acute retral angle on the mesial carina, below which they again turn forwards, and, in passing the lower angle, bend backwards. These characters are clearly distinct from either of the other species described in this place.

Position and locality. This species occurs at Mineral Point (Wisconsin), associated with *Pleurotomaria umbilicata* and several other Trenton limestone fossils.

(*Cabinet of* Mr. Conrad.)

231. 8. MURCHISONIA PERANGULATA, *var.* A.

Pl. XXXVIII. Figs. 7 *a*, *b*.

Subfusiform; spire elongated, direct, apex sharp; volutions six or more, close, angular, not ventricose, gradually enlarging below; mesial angle very prominent, appressed above and below; mesial band double, as in *M. bicincta;* surface marked by distinct vertical striæ, which make an abrupt retral angle on the mesial band; aperture not visible.

This species resembles the *M. bicincta* in its surface markings, but the volutions are more numerous, and enlarge much more gradually below; it is also less ventricose, and the upper carina of each volution is nearer the suture. It will probably prove identical with *M. perangulata* of the Birdseye limestone, which differs only in the absence of the upper carina, which is distinct in this one.

Fig. 7 *a*. Back of the spire, showing six volutions
Fig. 7 *b*. A portion of the surface, with the striæ enlarged.

Position and locality. This species occurs, with *M. bicincta*, in the lower shaly layers at Middleville.

232. 9. MURCHISONIA UNIANGULATA (*n. sp.*).

Pl. XXXVIII. Fig. 8.

Fusiform; spire elongated, rapidly ascending, acute; volutions about five, angular, the last one ventricose below; aperture oval, extended below; surface marked by a single carina upon the centre of the volutions, which are crossed by vertical striæ bending backwards upon the carina.

This species has the form of the last one, but the volutions ascend more rapidly, and there is but a single carination upon the centre of the volution. The latter character distinguishes it from the other species, which all have a smaller carina near the upper margin of the volution; and the last whorl has one below the centre, corresponding to the sutural line, which is not seen in the present species.

Position and locality. This species occurs with the preceding at Middleville.

233. 10. MURCHISONIA BELLICINCTA (*n. sp.*).

Pl. XXXIX. Figs. 1 *a*, *b*, *c*, *d*, *e*.

Compare *Turritella cingulata.* Hisinger, 1837, Leth. Suecica, pag. 39, pl. 12, fig. 6.
Pleurotomaria cingulata. Von Buch, 1840, Beitr. zur Geol. Russland, p. 116.
Murchisonia cingulata. D'Archiac & Verneuil, Bull. de la Soc. géol. de France, Vol. xii. p. 459.
— — Murchison & Verneuil, Pal. Russia, &c. 1845, pag. 339, pl. 22, fig. 7 *a*, *b*.
Pleurotomaria. Emmons, Geol. Report, 1842, pag. 396, fig. 6.

Elongated; spire composed of eight or more volutions, which are regularly convex, and somewhat rapidly enlarging from the apex; volutions moderately oblique, marked upon the centre by a flat spiral band, which is margined by slight sharp elevations; striæ bending backwards from the suture to the mesial band, upon which they make an abrupt curve forwards; aperture rounded, extending below, with the pillar lip nearly straight.

This is a large and beautiful species, known by its moderately ascending spire and regularly convex or ventricose whorls, which render it readily distinguishable, in its usual condition, as casts of the interior. The mesial band divides the volution almost equally, producing no appreciable elevation except at the sharp marginal carina; and where these are worn down, as they sometimes are, the volutions preserve their equal convexity.

The figure of Hisinger (6 *a*) corresponds very closely with our shell in form; but the mesial band is much below the centre of each volution, while ours is central. The cast 6 *b* is too slender, and does not correspond with our species. The figure of M. de Verneuil is also too slender to correspond with our species, and the mesial band produces a carina, which is not a feature of the American fossil. The specimen figured by Hisinger is from the more recent limestone of the Transition period; and those in the Palæontology of Russia and the Ural Mountains, are regarded as belonging to the Upper Silurian strata. The united testimony of these authors induces me to regard our species as distinct, belonging to the older Silurian limestone, and never known above the Hudson-river group. In the western strata of the same age, there is another more slender species, with obtusely carinated volutions; but I have never seen the outer surface of the shell.

Fig. 1 *a*. A small imperfect specimen, preserving the striæ and mesial band in a very perfect manner.
Fig. 1 *b*. A specimen with the striæ partially removed, showing the extension of the aperture below.
Fig. 1 *c*. A cast, showing the form of the aperture, which is nearly entire.
Fig. 1 *d*. A fragment of a larger specimen, preserving the striæ and mesial band.
Fig. 1 *e*. Cast of a larger specimen, the lower volutions broken off.

Position and locality. This shell is widely distributed, and is very common in the form of casts. It is more abundant in the higher part of the limestone at Watertown than elsewhere, but is occasionally found in the lower strata at Middleville. It is likewise found at Trenton Falls, Herkimer, Turin, and other places.

(*State Collection; Cabinet of the Albany Institute.*)

234. 11. MURCHISONIA SUBFUSIFORMIS (*n. sp.*).

Pl. XXXIX. Figs. 2 *a*, *b*.

Fusiform, elongated; spire rapidly ascending; volutions about six or more, flattened, lower one large and ventricose; aperture oval, acutely extended below; surface?

All the specimens discovered are casts, which preserve no remains of external markings. This species is readily distinguished from the last, by the greater obliquity of the volutions, which are flattened, and never present the regularly convex outline of that species. These features are preserved in the figure, and will generally be found sufficient to identify the species.

Fig 2 *a*. View of the back of the spire; the apex imperfect.
Fig. 2 *b*. View, showing, imperfectly, the form of the aperture.

Position and locality. In the higher shaly part of the limestone at Adams, Jefferson county, and Turin, Lewis county.

235. 12. MURCHISONIA VITTATA (*n. sp.*).

Pl. XXXIX. Figs. 3 *a, b.*

Elongated, fusiform, slender; volutions oblique, scarcely ventricose, last one moderately expanded; suture apparently banded; aperture extremely elongated.

This species has the volutions as oblique as the preceding, and differs principally in the less expansion of the lower one, and the more elongated aperture. The suture appears to be banded, but the single specimen seen is a cast, and this character is somewhat obscure. In general characters, the two last more nearly resemble Loxonema than Murchisonia; but never having seen the former genus well characterized in the Lower Silurian strata, I am unwilling to admit it upon the evidence of a cast alone.

Fig. 3 *a.* View of the back of the spire.
Fig. 3 *b.* A partial front view, showing a part of the aperture.

Position and locality. In the higher shaly layers of the limestone at Adams, Jefferson county.

236. 13. MURCHISONIA GRACILIS (*n. sp.*).

Pl. XXXIX. Figs. 4 *a, b, c.*

Slender, elongated; volutions not less than ten, ventricose, subangulated on the middle, very gradually increasing in size from the apex towards the aperture; surface marked by a carinal band upon the centre of the volution, with curving striæ above and below.

This is the most slender species known in the rock. It is quite distinct from either of the preceding, in the gradual enlarging of the volutions, and its uniformly small size. The centre of the volutions is distinctly marked by an obtuse carina, giving them a subangular character quite different from the *M. bellicincta*. Casts of the shell are entirely free from the angular carina.

All the specimens seen in the limestone of New-York are of the size of those figured, and preserve, but imperfectly, the shell. It is quite similar to, and perhaps identical with, the slender species found in western localities, but is entirely distinct from *M. angusta* of the Birdseye limestone.

Fig. 4 *a.* Fragment showing six volutions.
Fig. 4 *b.* Another fragment, showing one of the lower volutions partially covered by the shell.
Fig. 4 *c.* A small fragment, on which the shell is partially preserved.

Position and locality. In the crystalline portions of the Trenton limestone at Watertown and Middleville in New-York, at Carlisle in Pennsylvania, and also in the lower shaly beds at Middleville.

Genus SUBULITES (Conrad).

Character. "Subulate; volutions wide, with a very oblique suture; aperture approaching that of Terebra."

"The exact form of the aperture is unknown, the base being imperfect."

The above description of this genus is copied from Mr. Conrad's manuscript notes. The specimen figured (Pl. XXXIX. fig. 5 *a*), is the original one on which the genus has been founded.

237. 1. SUBULITES ELONGATA.

Pl. XXXIX. Figs. 5 *a*, *b*, *c*.

Subulites elongata, Conrad in MS. Emmons, Geol. Report, 1842, pag. 392, fig. 3.

Elongated, subfusiform or subulate; spire rapidly ascending to an acute point; volutions six or more, flattened; suture banded; aperture longitudinally extended, narrow, contracted posteriorly; surface smooth?

This remarkable species is easily distinguished by its elongated fusiform shape, and flattened volutions which are very oblique. The last volution is extremely elongated, contracting gradually below the centre, and terminating in an acute point. The aperture is narrow posteriorly, gradually enlarging to the centre, and contracting to the anterior extremity.

In its usual condition, as casts of the interior, the banded suture is not observed; but in a single specimen from Middleville, and another from Mineral Point (Wisconsin), the shell is partially preserved, and the suture distinctly banded. In both these specimens there are no visible surface markings, but these may have been obliterated by maceration.

Fig. 5 *a*. Imperfect cast of a large specimen, showing a part of the aperture.
Fig. 5 *b*. A specimen preserving a portion of the shell, and showing the great length of the last volution and aperture.
Fig. 5 *c*. A fragment preserving the shell, and showing more distinctly the banded suture.

Position and locality. This species is not unfrequent in the higher crystalline portions of the limestone at Watertown. It is extremely rare in other localities, and I have seen but two specimens from Middleville and one from Wisconsin, showing that it has a wide geographical range. (*State Collection, from* Dr. Crawe.)

GENUS CARINAROPSIS.

[*Carinaria*, and ὄψις; from its resemblance to CARINARIA.]

Character. Symmetrical, subconical, patelliform, subangulated or carinated on the dorsal line; apex incurved or convolute; aperture oval, narrowed posteriorly.

There are two or three species of shells having the characters here given. They are usually associated in the rock with the *Bellerophon bilobatus*, and are rarely seen in any other situation.

238. 1. CARINAROPSIS CARINATA (*n. sp.*).

PL. XL. Figs. 1 *a*, *b*, *c*.

Depressed conical; apex incurved; aperture broadly expanded, with a narrow sinus in the posterior dorsal margin, from which a strong dorsal carina extends to the apex; surface concentrically striated.

This species is remarkable for the broadly expanded aperture and sudden contraction towards the apex, which is acutely pointed and incurved.

Figs. 1 *a*, *b*. Lateral and dorsal views.
Fig. 1 *c*. Lateral view of another specimen, showing a more elevated carina.

Position and locality. In the dark compact limestone at Middleville and Trenton Falls, associated with the *Bellerophon bilobatus*.

239. 2. CARINAROPSIS PATELLIFORMIS (*n. sp.*).

PL. XL. Figs. 2 *a*, *b*.

Obliquely subconical, patelliform, the apex incurved and extended in a line with or beyond the margin, obtusely carinated upon the dorsal line; aperture broadly oval, slightly narrowed posteriorly; surface marked by fine concentric sublamelliform striæ.

This species resembles in form the recent CAPULUS; but the structure of the shell is quite different, being, in this respect, closely allied to the BELLEROPHON. There are one or two other species in the Hudson-river group, and a single more elevated one in the Trenton limestone, which has not been satisfactorily determined.

Fig. 2 *a*. Dorsal view. Fig. 2 *b*. Lateral view of the same specimen.

This one and the preceding species are arranged in this connection, both from similarity in the structure of the shell to *Bellerophon*, and from an analogy in the form of *C. carinata*.

Position and locality. In the compact finegrained limestone, with the preceding species, at Middleville.

240. 1. BELLEROPHON BILOBATUS.

PL. XL. Figs. 3 *a*, *b*, *c*, *d*.

Bellerophon bilobatus. SOWERBY in Sil. Researches, 1839, pag. 643, pl. 19, fig. 13.
— — EMMONS, Geol. Report, 1842, pag. 392, fig. 6.

Involute, subglobose; height and width about equal; aperture bilobate, large, subreniform; surface marked by fine striæ, which, ascending from the umbilicus, form a broad arch on the side of the shell, and, bending downwards, meet in an abrupt curve on the dorsal line.

The form of this shell can be readily understood from the two figures, which are of a full grown individual. The arching of the striæ upon the dorsal line corresponds with the sinus in the aperture. The greater number of individuals of this species are smaller than the one figured.

This species is doubtless identical with the one described by SOWERBY under this name. It is abundant in the Trenton limestone, occurring in almost every locality. It is unknown in the Utica slate and lower part of the Hudson-river group, though in the higher part of the same it is often found, and in some localities is numerous. In the last named situation, it corresponds exactly with specimens in the Caradoc sandstone of Great Britain, its associated fossils being precisely similar. Its occurrence in the Trenton limestone, and its reappearance near the top of the Hudson-river group, show its vertical range to be greater than heretofore supposed. In western localities this fossil is equally abundant, ranging through the entire extent of strata of the same period. It is there, however, usually destitute of the shell, and much distorted from pressure.

Fig. 3 *a*. Dorsal view, showing the sinus of the aperture.
Fig. 3 *b*. Lateral view, showing the involution of the whorls.
Fig. 3 *c*, *d*. Two views of a smaller specimen.

Position and locality. In the Trenton limestone at Middleville, Trenton Falls, Herkimer, Turin, Watertown, Glen's Falls, Plattsburgh, and numerous other localities.

(*State Collection.*)

241. 2. BELLEROPHON BILOBATUS, *var.* ACUTUS.

Pl. XL. Figs. 4 *a*, *b*, & 5 *a*, *b*.

Compare *Bellerophon acutus*, Sowerby in Sil. Researches, pag. 643, pl. 19, fig. 14.

Involute, suborbicular, compressed, elongated; last whorl acutely angular: aperture oblong, subtriangular; surface smooth or finely striated; umbilicus small.

The length of this shell is about once and a half the height, and the height twice the breadth. It is more elongated and less orbicular than the figure of *B. acutus* of Sowerby; it is also less acutely carinated, particularly at the commencement of the involution. The acutely angular, almost carinated, dorsal margin, contrasts strongly with the prevailing forms of *B. bilobatus*; and this deviation does not appear entirely the effect of pressure, but is an original character of the shell, which, in other important particulars, retains the features of the species.

Fig. 4 *a*, *b*. Dorsal and lateral view of the specimen.

The specimen fig. 5 presents another variety of this species, which is apparently due to pressure. The aperture is broadly expanded, and in form like the characteristic varieties; but the shell is rapidly compressed below, becoming sharply angular, and even distinctly carinated. The striæ are similar to those of the more globose varieties, but meeting in a more acute angle on the dorsal line.

These varieties all occur in a similar position in the strata, and in the same localities, and are all doubtless referable to the single species.

242. 3. BELLEROPHON BILOBATUS, *var.* CORRUGATUS.

Pl. XL. Figs. 6 *a*, *b*.

This shell has the form of the *B. bilobatus*, with similar surface markings. The dorsal side, below the aperture, is characterized by strong folds which reach half way to the umbilicus. These folds are more or less developed in different individuals, sometimes becoming as distinct as in the one figured. The aperture in such specimens is more angular, and the sinus on the dorsal margin less regularly curved. In other respects there appears to be no essential difference between this fossil, and that marked by simple striæ. Both in the specimens having this character, and in those with striæ alone, the dorsal margin is sometimes obtusely angular, and in others flattened.

The specimen fig. 6 *a* is in a stone with three others, only one of which shows a slight development of these dorsal folds.

Fig. 6 *b* is a specimen less distinctly corrugated.

This variety of form occurs in the same localities and position as the preceding; being, however, of comparatively rare occurrence. (*Cabinet of* Mr. Moore, *Trenton Falls.*)

243. 3. BUCANIA EXPANSA (*n. sp.*).

Pl. XL. Figs. 7 *a*, *b* *c*, *d*.

Convolute, trumpet-shaped; volutions three or four, subangular, the last one elongated, rapidly enlarging and abruptly expanded at the aperture; aperture broadly semicircular or sublunate, with a sinus at the dorsal side; dorsal line obtusely carinated; section of the last volution, below the aperture, subtriangular; of the inner volutions, subelliptical, with the extremities obtusely angular; original surface striated. Specimen a cast.

This shell is not unlike *Bellerophon cornuarietis* (Sowerby, *Min. Conchology*, tab. 469, fig. 2); but the volutions in that species are represented as not contiguous. The species under consideration differs from either of the two preceding in a very obvious manner. The broadly expanded aperture and obtuse carina of the last volution are prominent features; and in fragments, the subtriangular form of sections of the last volution are often sufficient to enable us to identify the species. The strongly marked carina commences at the base of the last volution, and continues to the aperture. The volutions are closely pressed against each other, the convex dorsal side producing a corresponding depression on the ventral side of the contiguous volution.

Fig. 7 *a*. View of the back of the shell, showing the strong carina, expanded aperture, and sinus on the dorsal margin. *b*. Lateral view of the same.

Fig. 7 *c*. Transverse section of the last volution, below the aperture.

Fig. 7 *d*, *e*. Lateral and front view of another specimen, from which the expanded portion of the aperture is broken off, and showing also a little deviation in form.

Position and locality. In the lower irregularly bedded portions of the Trenton limestone, and in the strata resting on the Black-river limestone, at Watertown, Jefferson county.

(*State Collection.*)

244. 4. BUCANIA BIDORSATA (*n. sp.*).

Pl. XL. Figs. 8 *a*, *b*, *c*, *d*, *e*, *f*, *g*.

Convolute, subglobose, with a deep umbilicus; volutions about three, the last one extended and somewhat straight, gradually enlarging and more abruptly expanding towards the aperture; dorsal margin with a double or grooved carina, on the centre of which is a narrow elevated line; on each side of the dorsal band is a broad groove or depression, and an obtusely angular ridge, the latter being half way between the centre and margin of the shell; surface ornamented by transverse filiform striæ, which, receding from the umbilicus, bend abruptly backwards near the centre, making a more gentle curve on the dorsal band; aperture sublunate.

In young specimens, the carinal band is very conspicuous, with a narrow elevated central line. The lateral carinæ or ridges scarcely affect the direction of the striæ; the depressions on the outside of these are less conspicuous than on the inner side. In this respect, however, there is some variation in specimens from different localities. In casts of the shell, the detail of the surface markings is partially lost, and a broad dorsal carina is sometimes all that is observable; the marginal carinæ are often faintly distinguishable by a slight depression on either side. A section below the aperture presents an extremely excentric ellipse, which is depressed on the ventral side by the convexity of the contiguous volution.

Fig. 8 *a.* Dorsal view of a small specimen, preserving a portion of the shell.
Fig. 8 *b.* View of the aperture, which is very imperfect.
Fig. 8 *c.* A fragment, showing the carinæ and dorsal band very distinctly. *d.* The same enlarged.
Fig. 8 *e.* Cast of a larger specimen, imperfect towards the aperture, and showing only the broad dorsal carina. *f.* Lateral view of the same, showing the umbilicus.
Fig. 8 *g.* Section of the last volution below the aperture.

Position and locality. This species occurs in the lower shaly portions of the rock at Middleville, and in the compact lower layers of the same rock, immediately above the Black-river limestone, at Watertown, Jefferson county. (*State Collection.*)

245. 5. BUCANIA PUNCTIFRONS.

PL. XL. A. Figs. 1 *a, b, c, d, e.*

Bellerophon punctifrons. EMMONS, Geol. Report, 1842, pag. 392, fig. 5.

Convolute, suborbicular; volutions about three, gradually enlarging, rounded upon the back; dorsal line marked by an abrupt narrow carinal band; sides of the volutions abruptly rounded, suddenly depressed into a broad deep umbilicus, which reveals the inner volutions; surface marked by rounded or rhomboidal punctures, which are regularly arranged in lines in two directions; carinal band marked by close curved striæ; the last volution is little extended, and abruptly expanded near the aperture, which has a shallow sinus on the dorsal margin.

This beautiful species is readily distinguished by the peculiarly ornamented surface. The dorsal band is sometimes abruptly elevated, and at other times even with the surface of the shell, and marked by curved striæ. In a single specimen I have detected lateral longitudinal ridges, which interrupt the regularity of the surface markings; but these appear to be accidental.

Fig. 1 *a.* Dorsal view of a small specimen. *b.* Lateral view, showing the umbilicus.
Fig. 1 *c.* Dorsal view of a larger specimen, showing the elevated carinal band, which does not rise above the surface on the lower part of the shell.
Fig. 1 *d.* Lateral view of another specimen, showing the side of the shell, which is obtusely angular with obscure longitudinal ridges.
Fig. 1 *e.* A portion of the surface enlarged.

Position and locality. This species occurs in the higher crystalline portions of the rock at Middleville and Watertown. (*State Collection.*)

246. 1. CYRTOLITES COMPRESSUS.

Pl. XL. A. Figs. 2 *a, b, c, d, e, f.*

Reference *Phragmolites compressus*, Conrad, Ann. Geol. Report, 1838, p. 119.

Discoidal; volutions scarcely contiguous, very gradually enlarging, rounded on the sides, sharply and profoundly carinated on the dorsal margin; greatest diameter of the volutions from the dorsal to the ventral side; aperture scarcely expanded; surface ornamented by transverse, zigzag or abruptly undulating, elevated, subimbricating lamellæ, and finer transverse and longitudinal striæ.

This very beautiful and unique species is readily distinguished by the undulating elevated lamellæ, which mark the surface at more or less distant intervals. Every forward bend of these lines is accompanied by a slight depression behind it, and every retral bend shows a broad slightly elevated ridge behind. This character is not, however, always conspicuous, but sometimes gives a nodulose appearance to the shell. The sharp dorsal carina fills a narrow groove in the ventral side of the inner volutions, the sides of which are not otherwise in contact.

The Genus *Phragmolites* of Conrad (ut supra) was founded upon this species, on the supposition that it was septate internally, which is not true, as I have had opportunities of examining the interior. The undulated lines are merely superficial, and rarely at equal distances from each other in different shells. The Genus *Cyrtolites* was organized by Mr. Conrad for the reception of a species from the Hudson-river shales: that species, like the present, is profoundly carinated; the carina filling a groove in the ventral side of the volutions, which are scarcely contiguous. The surface in both is peculiarly ornamented and subnodulose, the volutions having a greater longitudinal than transverse diameter. I have therefore removed this species from Phragmolites, and placed it under Cyrtolites, the typical species of which is *C. ornatus*. It may be remarked, in this place, that these species differ in essential characters from any of the Bucaniæ, to which they are in some respects allied.

Fig. 2 *a*. Lateral view of a specimen, having the sinuous lamellæ at the ordinary distance asunder.
Fig. 2 *b*. Dorsal view of the same.
Fig. 2 *c*. Lateral view of a specimen, where the elevated lamellæ are more distant.
Fig. 2 *d*. Lateral view of another, showing the lamellæ closely arranged.
Fig. 2 *e*. A cast, which is smooth, with the exception of the elevated carina.
Fig. 2 *f*. A portion of the surface enlarged, showing the finer transverse and longitudinal striæ, and the subnodulose appearance of the surface.

Position and locality. This species occurs, in its greatest perfection, in the lower shaly strata of the Trenton limestone at Middleville. It is found, also, in the higher crystalline part of the rock at the same place; and, in the form of casts, in the higher crystalline portions of the same rock at Watertown.

247. 2. CYRTOLITES TRENTONENSIS.

Pl. XL. A. Figs. 3 *a, b, c, d;* and Pl. XLI. Figs. 1 *a, b, c.*

Cyrtolites trentonensis. Conrad, Jour. Acad. Nat. Science, 1842, Vol. viii, pag. 270, pl. 17, fig. 4.
Compare *Ecculiomphalus minor*, Portlock, Geol. Rep. Londonderry, 1843, pag. 412, pl. 30, figs. 11 & 12.

Shell slender, angular, gradually curving and tapering to an acute point, making rather less than an entire volution; dorsal and ventral margins angulated or subcarinated; lower side distinctly angulated; upper side less prominently angulated, and suddenly contracted on the inner margin; section subquadrangular; aperture scarcely expanded; surface marked by obliquely transverse striæ.

This peculiar little shell has the appearance of a claw or talon, making from two thirds to nearly an entire volution. It bears considerable resemblance to *Ecculiomphalus minor*, cited above. It differs in some important characters from the typical species of *Cyrtolites* of Conrad, which he describes, however, as being in form like *Cyrtoceras.** It is usually an obscure fossil, occurring as casts of the interior, and destitute of surface markings.

Plate XL. A.

Fig. 3 *a, b.* View of the upper surface of two individuals.
Fig. 3 *c.* Lower surface of the same.
Fig. 3 *d.* Dorsal view.

Plate XLI.

Fig. 1 *a.* Lower surface of an imperfect specimen.
Fig. 1 *b.* A portion of the surface striæ enlarged.
Fig. 1 *c.* Section of the shell below the aperture; the upper side of the figure being the dorsal margin.

Position and locality. In the higher strata of the Trenton limestone at Middleville; in a lower position, in the same rock, on the Mohawk valley, associated with *Isotelus, &c.;* and in the same rock at Carlisle, Pa. (*State Collection; Cabinet of* Mr. Conrad.)

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* Mr. Morris (*Catalogue of British Fossils*, p. 216) regards *Cyrtolites* as identical with *Ecculiomphalus*, and remarks that the former should be retained. Although unwilling to allow the present and succeeding species to remain under *Cyrtolites*, I have so arranged them for the present; believing that the Genus *Ecculiomphalus*, or some other, will include those forms like the one under consideration.

248. 3. CYRTOLITES FILOSUM.

PL. XLI. Figs. 3 *a*, *b*

Cyrtoceras [*Cyrtolites?*] *filosum*, CONRAD in MS. EMMONS, Geol. Report, 1842, pag. 372, fig. 4.

Shell forming a nearly straight, gradually tapering, rounded tube in its upper part, curving towards the extremity, and making little more than half a volution; surface marked by fine transverse lamellose striæ, which bend downwards in an arch on the back of the shell; section circular.

This species has been given by Dr. EMMONS as a *Cyrtoceras*, but inadvertently, as he considers it destitute of septa. The specimen figured is the only one known, and it is imperfect towards the aperture. The shell is removed and broken in several places, but reveals no evidence of septa, though the surface markings indicate that it is a cephalopod. I am, therefore, still uncertain as to the true place of this species.

Fig. 3 *a*. Lateral view of the specimen imbedded in stone, the apex being concealed.
Fig. 3 *b*. View of the dorsal side of a small portion of the shell, showing the arched striæ.

Position and locality. This species has been seen only in the higher crystalline part of the rock at Watertown, Jefferson county. (*State Collection.*)

I have seen fragments of one or two other species of analogous form, where there was no evidence of septa, but have hesitated to arrange them in this association, hoping that that some fortunate discovery would reveal their true character. I am the more doubtful in this matter regarding forms like the CYRTOCERAS, since I have learned that the tubes of the true ORTHOCERAS do exist without any evidence of a septate character, while other specimens, precisely similar in every other respect, are provided with septa. The absence of septa, in such cases, does not always appear due to accidental destruction, but to their non-development; and perhaps the same may be true in regard to those forms like CYRTOCERAS.

CEPHALOPODA OF THE TRENTON LIMESTONE.

Plates XL. A. (in part), & XLI. – LVIII.

The great abundance of a single family of this order, the Orthocerata, constitutes a peculiar feature of the strata of this period. Here they attain their maximum development, and at no subsequent period during the palæozoic era do they appear in any thing like equal abundance. At the base of this rock, in the Black-river limestone, I have already shown (page 52) that there was a remarkable development of individuals of this family, though comprising a few species only. During the present period, we find a large number of species, many of which are exceedingly abundant and widely distributed; while others, so far as known, are of rare occurrence.

Near the base of the Trenton limestone, where I have had good opportunities of seeing the strata, the Orthoceras is very rare; while the few species of Cyrtoceras, known in the rock, seem almost confined to that position. As we ascend in the strata, specimens of Orthoceras are occasionally found, but never abundantly in the lower half of the deposit. The Trocholites, which differs from Lituites principally in the position of the siphuncle, is abundant in the central part of the rock, occupying but a small thickness, and mostly confined to a few localities in the vicinity of Middleville and Trenton Falls. At about the same point we find the Orthocerata increasing in numbers, and, in succeeding beds, they occur in such profusion as to lie in contact with each other, imbedded in myriads. In the highest beds of this limestone, in many places they have nearly disappeared, though in some portions of the succeeding slate they are again abundant. It is not a little remarkable, that notwithstanding the abundance of this genus of chambered shells, so few species of other cephalopods should occur in the same strata. The two species of Lituites known in the Black-river limestone, are not known in this position; the only representative of the family, known, being a single species, besides the Trocholites just noticed.

From the immense profusion of the Orthocerata, which can scarcely be overstated, we should expect to find specimens so well preserved that the entire form and structure could be ascertained; but this is not true. Almost all, and indeed every specimen found, is more or less imperfect; whether young or old, of large or small species, they have suffered injury, in a greater or less degree, before being imbedded in the sediment which now envelops them. This condition of the specimens, many of which are small, we are not prepared to find, if we regard them as internal shells, where the muscular body of the enclosing animal might have protected them till they were surrounded with the soft calcareous mud. In their present condition, however, we are compelled to depend upon fragments, and to indicate the specific differences by the surface marking when preserved; or, in its absence, by the form of the tube, distance of the septa, and position of the siphuncle.

In another place, I shall endeavor to illustrate the habits of the Orthocerata more in detail; showing their structure, mode of development, and other peculiarities derived from the examination of a vast number of specimens obtained from the Trenton and Black-river limestones.

249. 1. TROCHOLITES AMMONIUS.

PL. XL. A. Figs. 4 *a – k*.

Trocholites ammonius. CONRAD, Ann. Geol. Report, 1838, p. 119. See also Generic description of *Trocholites* revised, in Jour. Acad. Nat. Science, 1842, Vol. viii, p. 274.
— — EMMONS, Geol. Report, 1842, pag. 372, fig. 4.
Compare *Lituites cornuarietis*, SOWERBY in Sil. Researches, 1839, pag. 643, pl. 20, f. 20, & Ib. pl. 22, f. 18.
— — PORTLOCK, Geol. Rep. Londonderry, 1843, pag. 382, pl. 28 B, fig. 7 *a, b*.
— — VERNEUIL, Pal. Russia and Ur. Mountains, 1845, pag. 359, pl. 25, fig. 7 *a, b*.
— *odini*, ID. Ib. pag. 361, pl. 25, fig. 8. *Clymenia odini?* EICHWALD, 1840.

Discoidal; volutions in the same plane, about four, rounded, slightly concave on the ventral side, gradually enlarging in size towards the aperture, which is slightly expanded; surface marked by lamellose irregular and oblique transverse striæ or ridges, between and upon which are finer lamellose striæ, covering the outer surface, and giving it a peculiar textural or netted appearance; striæ meeting in an arch upon the back; septa direct, or slightly undulated on the dorsal side; outer chamber large; siphuncle ventral.

This is a very beautiful and interesting shell, and its usual appearance is very correctly represented in the figures. In examining a large number of specimens, I have never found one where the last volution extended in a direct line. I have been inclined to regard our species as identical with *Lituites cornuarietis* of SOWERBY; but if the one figured by DE VERNEUIL is identical, our species presents some important variations. The striæ meet in an arch upon the back, and not in an acute angle forming a V as in the latter. In a single injured specimen, however, I have detected a few of the striæ near the aperture, meeting in this manner upon the back, while the others present the usual appearance. The peculiar character of the surface is produced by the numerous crowded edges of lamellæ, which, in perfect specimens, are somewhat regularly undulating. When the shell is partially exfoliated, the textural character of the surface is destroyed, and it is only marked by fine oblique striæ. The stronger striæ are very variable, being sometimes so prominent as to deserve the name of ridges, and at other times are only slight undulations; while in many instances they are not at all developed, and the surface is marked only by the finer lamellose striæ.

Upon a careful examination of the figures and descriptions of *Lituites odini* of VERNEUIL (*Clymenia* of EICHWALD), I am satisfied that our species is closely allied, if not identical with that one, and that it is quite distinct from the *L. cornuarietis* of Russia. The striæ of *L. odini* are arcuate upon the back, precisely as in our specimens; the septa are likewise slightly undulating or bent towards the aperture on the back, particularly those of the inner volutions; and the whole aspect of the shell is decidedly like the New-York specimens, where the outer surface is exfoliated. In the Russian specimen, however, the siphuncle is not represented so close to the ventral side of the volution as it is in our specimens. This may happen in the last volution, where it is produced in a direct line, and less appressed on the ventral side by contact with the inner ones.

There may be some doubt as to the propriety of separating this species from LITUITES, which has been done principally on account of the ventral position of the siphuncle; since this deviation is not usually regarded as important. M. DE VERNEUIL, speaking of this position of the siphuncle in *L. odini*, does not consider it as sufficient to found a generic distinction.

Fig. 4 *a*. A small perfect specimen, showing the lamellose striæ in great perfection.
Fig. 4 *b*. A large specimen, preserving the lamellose surface.
Fig. 4 *c*. Dorsal view, showing the archings of the striæ upon the back.
Fig. 4 *d*. A specimen denuded of the shell, showing the septa and deep outer chamber.
Fig. 4 *e*. Section, showing the position of the siphuncle.
Fig. 4 *f*, *g*. Lateral and dorsal view of a fragment of an inner volution, showing a slight undulation of the septa on the back.
Fig. 4 *h*. Lateral view of a fragment partially denuded of the shell, showing only the oblique transverse ridges.
Fig. 4 *i*. Dorsal view of the same, showing the arching of the striæ upon the back.
Fig. 4 *k*. Section of the same, showing the position of the siphuncle.

Position and locality. This shell occupies a central position in the Trenton limestone, being unknown in the lower part, but passing upwards into the Utica slate, where it is of less frequent occurrence. (*State Collection.*)

250. 1. CYRTOCERAS LAMELLOSUM (*n. sp.*).

PL. XLI. Figs. 2 *a*, *b*, *c*.

Subcylindrical, gradually curving and tapering; aperture somewhat expanded, and the shell slightly constricted just behind; septa closely arranged; surface with transverse undulating squamose lamellæ, which are abruptly bent backwards on the dorsal line; lamellæ equidistant with the septa, but not corresponding to them; spaces between the lamellæ marked by fine transverse striæ.

The form of the entire shell is unknown, the only specimen seen being a fragment: this, however, is well characterized in its surface markings, which resemble in some degree those of the *Cyrtolites compressus;* but the lamellæ are more squamose, and less abruptly undulating, as well as more closely arranged than is usual in that species. An exfoliation of the shell on one side exposes the interior, which is clearly septate.

Fig. 2 *a*. Lateral view of the fragment
Fig. 2 *b*. Dorsal view of the same.
Fig. 2 *c*. Magnified portion of the surface.

Position and locality. In the lower part of the Trenton limestone at Middleville.

251. 2. CYRTOCERAS ANNULATUM (*n. sp.*).

Pl. XLI. Figs. 4 *a, b, c, d;* and Fig. 5.

Gradually curving, expanding towards the aperture; surface annulated by strong ridges, which, with the intermediate spaces, are marked by fine transverse striæ; siphuncle central; septa plain.

This species is readily recognized among all the others, at present known, in this rock, by its elevated annulating ridges and fine striæ, in which it is very similar to some of the Orthocerata. The shell is pretty uniformly curved, gradually enlarging, and more abruptly expanding towards the aperture. It occurs in fragments, a perfect specimen not having been seen. The central position of the siphuncle is a departure from the usual character of *Cyrtoceras*, and on this account may be regarded as a bent *Orthoceras;* but it enlarges more rapidly towards the aperture than ordinary species of that genus, and being constant in its curvature, this may be regarded as its normal form.

Fig. 4 *a*. A large fragment, which is a cast, retaining the annulations.
Fig. 4 *b*. A smaller fragment, retaining the shell and transverse striæ.
Fig. 4 *c*. Section of the last, showing the siphuncle.
Fig. 4 *d*. A portion of the surface magnified.
Fig. 5. A fragment of the same species, nearer the aperture.

Position and locality. In the lower shaly strata at Middleville, and in the higher crystalline strata of the same rock at Watertown. (*State Collection.*)

252. 3. CYRTOCERAS MACROSTOMUM.

Pl. XLII. Figs. 1 *a, b, c,* & 3 *a, b.*

Cyrtoceras marginalis. Conrad, Proc. Acad. Nat. Sciences, 1843, Vol. i, p. 334.
Not *Cyrtoceras marginale*, Phillips, Pal. Fossils, 1841, pag. 115, pl. 46, fig. 219.

Subconical, slightly incurved, rapidly enlarging from the apex; outer chamber large, forming about half the length of the fragment; septa closely arranged; siphuncle dorsal; section not entirely circular; surface?

The fragment measures four inches, the outer chamber occupying one half the length. There are twenty-five septa remaining in the portion preserved. The diameter of the smaller extremity is half an inch; and of the larger, one inch and seven-eighths, the edge being broken. The septa are interrupted, and slightly bent upwards along the dorsal line, by the siphuncle. The elliptical form of the section is due to pressure, the natural form being circular.

The larger specimen described is from Wisconsin, where it occurs associated with Trenton limestone fossils. Fragments of the same have been seen in New-York and in Pennsylvania. The fragment 3 *a b* is probably of the same species, since a careful examination shows that it is not identical with 3 *c d*. This specimen is marked by closely arranged lamellose striæ, which bend abruptly downward over the dorsal line, in form like the letter V. The siphuncle is also dorsal.

Fig. 1 *a*. A fragment, showing a partial section.
Fig. 1 *b*. A large fragment, showing the wide outer chamber.
Fig. 1 *c*. Section of the smaller extremity of the last.
Fig. 3 *a*. Dorsal view of a fragment probably identical: the striæ in the figure do not bend so abruptly as in the original.
Fig. 3 *b*. Lateral view of the same.

Position and locality. In the Trenton limestone at Middleville (N. Y.), Carlisle (Pa.), and in light buff-colored limestone of the same age at Mineral Point (Wisconsin).

(*State Collection; Cabinet of* Mr. Conrad.)

253. 4. CYRTOCERAS CONSTRICTOSTRIATUM (*n. sp.*).

Pl. XLII. Figs. 2 *a*, *b*, and 3 *c*, *d*.

Very gradually curving, and enlarging towards the aperture, which is but little expanded; septa approximate; siphuncle dorsal; surface marked by filiform transverse striæ, which, at intervals, are bent abruptly downwards, or constricted; section elliptical.

This species, from its very slight curvature and gradual tapering, might perhaps be regarded as an Orthoceras; from which, however, I believe it to be distinct. I have relied mainly on the external markings to characterize the species, but have arranged with the one thus marked, other fragments, which appear to me of the same species, though destitute of the shell.

Fig. 3 *c*. A fragment, showing the surface markings.
Fig. 3 *d*. Section of the same, which does not show the siphuncle.
Fig. 2 *a*. A fragment, showing several of the septa and a part of the outer chamber.
Fig. 2 *b*. Transverse section, somewhat compressed, showing the position of the siphuncle.

Position and locality. This species usually occurs in fragments in the lower shaly layers of the Trenton limestone at Middleville. A single specimen, only, has been found in the upper part of the rock at the same place.

254. 5. CYRTOCERAS MULTICAMERATUM (*n. sp.*).

Pl. XLII. Fig. 4.

This specimen is a fragment denuded of the shell; it is somewhat straight above, more abruptly curving below, and gradually tapering. It is remarkable for the close approximation of the septa.

The specimen is too obscure and imperfect to be reliable, but is given as clearly showing its distinction from the other species.

Position and locality. In the lower shaly beds of the Trenton limestone at Middleville.

(*State Collection.*)

255. 6. CYRTOCERAS ARCUATUM (*n. sp.*).

Pl. XLII. Figs. 5 *a, b, c.*

Broadly curving, and very gradually tapering; septa approximate, thin; section elliptical; siphuncle dorsal?

This species has the appearance of a curved Orthoceras; but I have seen several fragments of the same, all of which are curved, while I do not know a straight species having the same characters. The specimen figured is compressed, giving the section a very eccentric elliptical form. The siphuncle is obscure, but there is some indication of its existence upon the dorsal margin.

Fig. 5 *a.* Lateral view of the specimen, which is crushed towards the lower extremity.
Fig. 5 *b.* Section of the same.
Fig. 5 *c.* The base of a parasitic coral, or of a crinoid, attached to the fossil.

Position and locality. In the lower shaly layers of the Trenton limestone at Middleville.

256. 7. CYRTOCERAS CAMURUM (*n. sp.*).

Pl. XLII. Fig. 6.

This species is somewhat similar in form to the last, but curving more rapidly. The septa are more distant, being once and a half those of the last species. The siphon is dorsal, as shown in some fragments of the same.

This species is not rare in the lower strata of the Trenton limestone; but it is almost always so intermingled with other fossils, that it cannot be separated except in fragments. It is clearly distinct from the other species, though it is at present impossible to designate the important characters of an entire specimen.

Position and locality. In the lower strata of this rock at Middleville, in a situation where all the other species of the genus known in the Trenton limestone are found, two only being known in a higher position in the same rock.

Genus ONCOCERAS.

[Greek, ογκος, a bending or protuberance, and κερας, a horn; the central portion of the fossil resembling a flexed and enlarged joint.]

Character. Tube curved; aperture constricted; lower part of the outer chamber, and upper part of the septate portion, ventricose, abruptly contracting towards the apex; siphuncle small, dorsal; septa plane, nearly flat, slightly elevated on the dorsal margin.

This genus will probably be found restricted to the lower palæozoic strata.

257. 1. ONCOCERAS CONSTRICTUM (*n. sp.*).

PL. XLI. Figs. 6 *a – f*, and 7 *a, b, c, d*.

Shell curving, ventricose in the middle, abruptly constricted near the aperture, and rapidly tapering towards the apex; septa very slightly convex, numerous, approximate, slightly undulating and bending upwards on the dorsal margin; section ovate, with the dorsal side narrower and somewhat obtusely angular; siphuncle small, dorsal; surface striated transversely.

The characters here given are those presented by a number of specimens examined, though with some little variation, depending on local circumstances, or the nature of the strata. I have decided to retain all the various forms as one species, though we may yet be able to separate them.

This fossil has the form of PHRAGMOCERAS, which it resembles in the contraction of the aperture; while the position of the siphuncle is different, being dorsal as in CYRTOCERAS. It appears sufficiently distinct from the latter to constitute a new genus, allied to PHRAGMOCERAS, and in some respects to GOMPHOCERAS. It is recognized when perfect, not only by the contraction of the aperture, but by the ventricose character of the lower part of the outer chamber and upper part of the septate portion, below which it is again suddenly contracted towards the apex. The base of the shell is often nearly perfect, but the apex is usually destroyed, or extends into a curved prolongation like that represented in 6 *f*, in which there is no evidence of septa. I have seen this kind of termination in two or three instances, while all the other specimens have been imperfect like 6 *d e*. The septa are exceedingly thin; and from the slight convexity, the edges of the chambers in the cast are remarkably angular and sharply defined, presenting an appearance very different from the CYRTOCERAS or ORTHOCERAS of the Trenton limestone, and which is sufficient to distinguish the species even in casts of a single chamber.

Fig. 6 *a*. View of the ventral side of an imperfect specimen.

Fig. 6 *b*. Lateral view of the same, showing the sudden contraction below the outer chamber: the aperture is imperfect.

Fig. 6 *c*. Section of the lower extremity, showing the small dorsal siphuncle.

Fig. 6 *d*. A smaller specimen, showing the same form as the last.

Fig. 6 *e*. A shorter and more ventricose specimen. (The transverse lines on the upper half of the figure, indicating septa, are incorrect.)

Fig. 6 *f*. The apicial extremity of the fossil. Two or three specimens have been found, with an appendage or termination of this kind.

Figs. 7 *a, c*. Dorsal and lateral views of a fragment, showing the direction of the septa.

Figs. 7 *b, d*. Sections of different specimens, showing the position of the siphuncle, and the narrowing of the dorsal side of the shell.

Position and locality. This species is comparatively rare in all the localities examined. It occurs at Middleville, in the lower part of the rock; while at Watertown a few specimens have been seen in the higher part of the same rock, and I have received a specimen from Mr. JOSEPH CLARKE, of Cincinnati, Ohio. (*State Collection.*)

258. 11. ORTHOCERAS ARCUOLIRATUM (*n. sp.*).

PL. XLII. Figs. 7 *a*, *b*, *c*.

Cameroceras trentonensis* (siphuncle), CONRAD in MS. EMMONS, Geol. Report, pag. 397, fig. 4.

Slender, very gradually tapering to an acute point; surface marked by strong and extremely arching or undulating annulations, and, obscurely, by fine longitudinal striæ; annulations about equalling the spaces between them; outer chamber and aperture unknown; section circular; siphuncle central.

The distinguishing features of this species are its slender form and extremely arched annulations, which, in half the circumference, ascend twice the width of the space between each annulation. All the other annulated species have the ridges less arched upon the back.

Fig. 7 *a*. A fragment near the apex of the shell.
Fig. 7 *b*. A fragment of larger diameter, showing the convexity of a septum.
Fig. 7 *c*. Transverse section, showing the central position of the siphuncle.

Position and locality. This species occurs both in the lower shaly strata of this rock at Middleville, and in the higher crystalline portions of the same rock at Watertown.

(*State Collection.*)

259. 12. ORTHOCERAS TERETIFORME (*n. sp.*).

PL. XLII. Figs. 8 *a*, *b*.

Orthoceratite. EMMONS, Geol. Report, 1842, pag. 396, fig. 3.

Robust; tube strong, somewhat rapidly tapering towards the apex; outer chamber and aperture unknown; surface marked by strong, slightly undulating annulations, the centres of which are distant from each other about twice the diameter of the ridges, longitudinally marked by coarse striæ; section circular; septa having a convexity exceeding one third the diameter of the tube; siphuncle small, central.

The specimens of this fossil which have been seen, are imperfect, and have only a portion of the shell remaining, which preserves some strong longitudinal striæ without any visible finer markings. It differs from the preceding species in the stronger annulations, which are less undulated than in that species; the surface markings are also stronger, and the tube enlarges more rapidly towards the aperture.

The summit of the lower specimen is covered by the dorsal valve of *Orthis testudinaria*, which gives an irregular convexity to the outline.

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* Mr. CONRAD (*Jour. Acad. Nat. Sci. Philadelphia*, 1843, Vol. viii, p. 267) has proposed the generic name of *Cameroceras* for a species of Orthoceratite with a large lateral siphuncle, which exhibits strong oblique ridges at the junction of the septa. This specimen is clearly septate within, and is therefore not the siphuncle. (See also Plate lvi. of this Report.)

Fig. 8 *a*. Fragments of two specimens connected by the dotted lines. The annulations are represented as too broad.
Fig. 8 *b*. Section showing the position of the siphuncle.

Position and locality. This species is only known to me as occurring in the higher crystalline portion of the limestone at Watertown, Jefferson county. (*State Collection*.)

260. 13. ORTHOCERAS TEXTILE (*n. sp.*).

PL. XLIII. Figs. 1 *a*, *b*.

General figure cylindrical, very gradually tapering, marked by prominent transverse or slightly arching annulations, which are distant about one third the diameter of the shell; entire surface marked by fine longitudinal and transverse striæ, which are closely arranged, the series being equidistant from each other, giving the surface the appearance of a woven texture; septa rather deeply concave, distant about one third of the diameter; section circular; siphuncle?

This fossil bears some resemblance to *O. calamiteum*, as figured by PORTLOCK (*Geol. Rep. Londonderry*, pag. 365, pl. 25, fig. 1 *a*, *b*); but our specimens never present any "strong longitudinal threads or stripes" passing over the annulations, the striæ being uniform in this respect. It also differs essentially from *O. tubicinella* of SOWERBY, which we find in our Hamilton group.

Fig. 1 *a*. A fragment of the natural size.
Fig. 1 *b*. A portion of the surface enlarged, to show the striæ.

Position and locality. In the lower concretionary beds of the Trenton limestone at Watertown.

261. 14. ORTHOCERAS BILINEATUM (*n. sp.*).

PL. XLIII. Figs. 2 *a*, *b*, *c*, *d*.

Compare *Orthoceras calamiteum*, MUNSTER, 1839, heft i, pag. 36, pl. 17, fig. 5; ID. 1840, heft iii, p. 102.
— — D'ARCHIAC & DE VERNEUIL, 1842, Trans. Geol. Soc. London, 2d series, Vol. vi, [p. 346.
— — PORTLOCK, Geol. Rep. Londonderry, 1843, pag. 365, pl. 25, fig. 1.
— — VERNEUIL, Pal. Russia and the Ural Mountains, 1845, pag. 353, pl. 25, fig. 5.

General form cylindrical, gradually tapering, marked by slightly arched or undulating rounded annulations distant about two fifths the diameter; surface marked by longitudinal sharp elevated lines, which alternate with finer lines in equal number; transversely marked by fine scarcely visible striæ, which are interrupted by the longitudinal lines; section circular; siphuncle excentric.

The two series of longitudinal lines, one being more than twice the elevation of the other, are distinguishing features of this fossil. The annulations are more arched on the back than in the last species, but still rounded. The transverse fine striæ, under the magnifier, give a kind of varicose appearance, being closely arranged and slightly arched between the longitudinal ones, following the oblique direction of the annulations. The difference in the size of the longitudinal and transverse lines is a striking peculiarity of the species, rendering it readily distinguishable from the last.

I have referred above to the *O. calamiteum* of Munster, which, however, is from the higher silurian or devonian rocks, from which circumstance alone it is proper to presume it distinct from this one. The figure of Portlock corresponds in some degree with our species, but is represented with two or three finer longitudinal striæ between the larger ones, while the transverse striæ are as strong as the fine longitudinal ones; in which characters, the one under consideration is quite different. M. de Verneuil has represented the *O. calamiteus* as destitute of transverse striæ; though the one referred to that species by D'Archiac and de Verneuil, cited above, has transverse striæ.

The species under consideration is not only quite distinct from *O. tubicinella* of Sowerby, but from all the species in our higher strata, though having some resemblance to them.

Fig. 2 *a, b.* View of two individuals, showing the annulations and longitudinal striæ.
Fig. 2 *c.* Transverse section of *b.*
Fig. 2 *d.* Portion of the surface enlarged.

Position and locality. In the lower shaly strata of the Trenton limestone at Middleville, Turin and Lowville. A fragment or impression of the same species has been found at an exposure of the Trenton limestone one mile east of Albany, which was incorrectly figured on Plate VII. (See page 35). (*State Collection.*)

262. 15. ORTHOCERAS BILINEATUM, var. α.

Pl. XLIII. Figs. 3 *a, b, c, d.*

This variety differs from the typical forms, in the absence of the intermediate finer longitudinal striæ; the single series, which is pretty constant, corresponds in distance to the coarser ones in the other specimens. A careful examination of several specimens, however, has shown an occasional deviation from this rule, and smaller striæ are sometimes present. In other characters, it is not essentially different from the last, and therefore can scarcely constitute a distinct species.

Fig. 3 *a.* A fragment of this variety.
Fig. 3 *b.* Transverse section, slightly compressed, showing the siphon.
Fig. 3 *c.* An enlarged portion of the surface.
Fig. 3 *d.* A fragment denuded of the shell, showing the lines of septa which do not correspond to the annulations.

Position and locality. Same with the preceding.

263. 16. ORTHOCERAS CLATHRATUM (*n. sp.*).

Pl. XLIII. Figs. 4 *a*, *b*, *c*.

Compare *Orthoceratites undulatus*, Hisinger, Leth. Suecica, 1837, pag 28, pl. 10, fig. 2.

Cylindrical, gradually tapering, marked by moderately elevated subangular annulations, longitudinally marked by sharp elevated lines distant $\frac{1}{48}$ of an inch in the specimen figured; between and crossing these longitudinal lines are still finer transverse lines or striæ, one third the distance of the longitudinal ones; section circular; siphuncle?

I have seen but the small fragment of the fossil here figured, but it is quite distinct from any other species in its surface markings. The transverse ridges are angular, and distant about one half the diameter; the longitudinal lines are at equal distances, sharp and prominent; the transverse striæ are stronger and more clearly marked than in the preceding species, and distinctly cross the longitudinal ones, producing finely crenulated edges.

Fig. 4 *a*. The fragment, natural size. *b*. Magnified portion of the surface. *c*. Transverse section.

Position and locality. In the lower shaly limestone at Middleville.

264. 17. ORTHOCERAS VERTEBRALE (*n. sp.*).

Pl. XLIII. Figs. 5 *a*, *b*, *c*.

Cylindrical, very gradually tapering, annulated with abruptly elevated angular ridges, which are distant from each other about one fourth the diameter of the tube, slightly arched upon the back, and direct on the ventral side; surface marked by strong longitudinal striæ and finer transverse ones, giving it a cancellated appearance; siphuncle apparently central or subcentral.

The specimen figured is somewhat compressed, scarcely diminishing towards the apex. The septa are not visible, though there is some evidence of a siphuncle at one extremity.

This species differs from any of the preceding ones, in the abruptly elevated and angular annulations, which are comparatively more distant from each other, and but slightly arched upon the back. The tube is more gradually contracted towards the apex, and the annulations less arched upon the back. In this respect it resembles a species in the higher strata, but is otherwise very distinct from it.

Fig. 5 *a*. Ventral side of the fragment.
Fig. 5 *b*. Portion of the dorsal side, showing the slightly arched annulations.
Fig. 5 *c*. Transverse section of the specimen.

Position and locality. In the compact limestone at Middleville. (*From* Mr. Wadleigh.)

265. 18. ORTHOCERAS ANELLUM.

PL. XLIII. Figs. 6 *a*, *b*, *c*, *d*, *e*, *f*.

Orthoceras anellus. CONRAD, Proc. Acad. Nat. Sciences, 1843, Vol. i, p. 334.

Elongated, very gradually tapering, annulated by prominent sharp slightly sinuous ridges which are distant about one fourth the diameter of the shell, longitudinally marked by fine crowded wrinkled striæ; septa moderately convex; siphuncle excentric, but not marginal; section circular.

This species is readily distinguished from any of the preceding by the angular approximate annulations, which are sharper and more elevated than those of any other species known in the rock. The length of the larger fragment figured is one inch and a half: the diameter at the larger extremity is half an inch; at the smaller end, three eighths of an inch. The smaller specimen differs from the other in the striæ being less crowded, though otherwise similar.

Fig. 6 *a*. A fragment of the septate portion of the shell. *b*. Transverse section of the same.
Fig. 6 *c*. Enlarged portion, showing the striæ, which, on a great part of the surface, are covered by a calcareous coating.
Fig. 6 *d*. A smaller fragment. *e*. Transverse section. *f*. Portion of the surface enlarged.

Position and locality. The larger specimen is from Mineral Point (Wisconsin), where it is associated with several other Trenton limestone species. The smaller specimen is from the lower part of the same rock at Middleville. (*Cabinet of* MR. CONRAD.)

266. 19. ORTHOCERAS UNDULOSTRIATUM (*n. sp.*).

PL. XLIII. Figs. 7 *a* – *k*.

Compare *O. trochlearis*, HISINGER, Leth. Suecica, pag. 28, pl. 9, fig. 7.

Cylindrical, very gradually tapering, annulated by oblique undulating angular ridges, which are distant about one fourth the diameter; annulations transverse on the ventral side, and abruptly arching towards the apex on the dorsal side; surface marked by fine crowded transverse undulating striæ; section circular; siphuncle slightly excentric.

This species is readily distinguished from the others, by the transverse undulating striæ without longitudinal lines. The annulations are subangular, and abruptly arched on the dorsal side, in this respect resembling the longitudinally striated species. In its external characters, it corresponds with *O. trochlearis* of HISINGER ut supra; but the position of the siphuncle is more nearly central, and the annulations more angular.

This species may be confounded with *O. bilineatum*, and the variety of that species, where the shell is removed; but it differs from those, in the more angular character of the annulations, and their more extreme undulation upon the back, as well as the different direction of the striæ and position of the siphuncle.

Specimens of this species, as well as of the others, are often much flattened, presenting an elliptical section ; and the specimens which I have, show all grades in this respect, from circular to extremely elliptical, proving the latter forms to be due to compression ; which is probably true of all, or nearly all, the elliptical species of Orthoceras.

Fig. 7 *a*. Ventral side of a fragment, showing the nearly transverse direction of the annulations. The striæ are scarcely preserved.
Fig. 7 *b*. Dorsal side of the same ; the specimen cylindrical.
Fig. 7 *c*. Transverse section of the same.
Fig. 7 *d*, *e*. Two smaller fragments of the species, compressed in different degrees.
Fig. 7 *f*, *g*. Transverse sections of the two last.
Fig. 7 *h*. An enlarged portion of the surface.
Fig. 7 *i*, *k*. Another fragment and section, showing the position of the siphuncle.

The *Orthoceratites trochlearis* of Hisinger is from the more ancient calcareous strata of the palæozoic period, in Dalecarlia (Sweden), corresponding in position to our Trenton limestone ; which circumstance, together with the similarity in form and markings, induces me to make a comparison between the two, believing at first that they were identical.

Position and locality. In the lower shaly layers at Middleville.

267. 20. ORTHOCERAS (*Species undetermined*).

Pl. XLIII. Fig. 8.

Cylindrical, very gradually tapering ; annulations rounded, undulating, distant a little more than one third the diameter ; section circular ; septa moderately convex ; siphuncle central.

This fragment possesses some peculiarities, which indicate a difference between it and those already described ; the annulations are more rounded than those of any other species, except the *O. textile* and *O. bilineatum*.

Position and locality. At Middleville, in the lower shaly strata of the Trenton limestone.

I have discovered several other imperfect specimens of annulated Orthocerata in the shaly strata of the Trenton limestone ; but the surface markings are either obscure or obliterated, so that it is scarcely possible to point out specific distinctions. Nearly all these specimens are more or less compressed, so that the sections present variable elliptical forms, and this compression distorts the annulations in such a manner that these cannot be relied upon for specific distinction. In the absence of surface markings, therefore, it is impossible to characterize species with any degree of certainty.

268. 21. ORTHOCERAS LATIANNULATUM (*n. sp.*).

Pl. LIV. Figs. 1 *a*, *b*.

Elongated, cylindrical, annulated by very strong rounded somewhat oblique ridges, which correspond to the distance between the septa ; septa distant from each other a little less than one third the diameter of the shell ; siphuncle small, excentric ; surface ?

Fig. 1 *a*. A fragment, showing four chambers. 1 *b*. Section and siphuncle.

We know nothing of the external characters of this shell, having seen only fragments of the casts, which are marked by strong and broad annulations. The siphuncle is comparatively small, and could never have contained any embryo tube, like the somewhat similar species *Endoceras annulatum*.

Position and locality. In the higher part of the Trenton limestone at Middleville.

269. 22. ORTHOCERAS JUNCEUM (*n. sp.*).

Pl. XLVII. Figs. 3 *a*, *b*, *c*, *d*, *e*, *f*.

Slender, terete-cylindrical, tapering very gradually ; septa thin, distant from one fourth to one third the diameter ; outer chamber deep ; siphuncle small, central ; section circular ; surface finely striated transversely, but without longitudinal striæ.

This species presents a surface marked precisely similar to *Endoceras proteiforme*, var. *lineolatum ;* but the shell is much more slender and gradually tapering, the siphuncle being always central. The septa, towards the outer chamber, are more closely arranged, sometimes two or three in the usual space of a single one.

This is a constant species, presenting no important variation in its characters. All the specimens seen are imperfect, and the interior is often filled with crystalline matter, which obliterates the septa and siphuncle. The outer chamber, though incomplete, is proportionally very deep. Very little variation in size has been observed in all the specimens obtained.

Fig. 3 *a*. A fragment denuded of the shell, showing a part of the outer chamber, and septate portion of the tube.

Fig. 3 *b*. A smaller specimen, showing the marks of septa which appear to be slightly oblique. The shell covering the lower part of the specimen is crystalline, and preserves no markings upon the surface.

Fig. 3 *c*. A small fragment, showing the convexity of a single septum.

Fig. 3 *d*. A section of the last, showing the central position of the siphuncle.

Fig. 3 *e*. A small fragment, showing the closer approximation of the septa near the outer chamber.

Fig. 3 *f*. A small fragment, preserving the shell and the striated surface.

Position and locality. This species is known only in the lower concretionary beds of the Trenton limestone at Watertown, where it is abundant. (*State Collection.*)

270. 23. ORTHOCERAS AMPLICAMERATUM (*n. sp.*).

Pl. LI. Figs. 1 *a* – *g*.

Teretely cylindrical, extremely elongated, very gradually tapering ; outer chamber profound ; septa distant about one third the diameter, very convex ; siphuncle excentric, small ; surface ? section circular.

The peculiarities of this species are its great length, and very gradual diminution from the larger extremity, and the distant and very convex septa, which seem sufficient to distinguish it from all other species known in this rock.

In all the specimens examined, there is no enlargement of the siphuncle sufficient to admit the development of embryo tubes, unless they are mainly confined to the outer chamber, a longitudinal section of which does not reveal any thing of that kind.

Fig. 1 *a*, *b*. Parts of the same individual, preserving a large portion of the outer chamber, with an equal length of the septate part of the tube.

Fig. 1 *c*. A transverse section of the specimen, at the upper extremity of 1 *a*, showing the excentric position of the siphuncle.

Fig. 1 *d*, *e*. A fragment of another specimen, showing the same distance of the septa and excentric position of the siphuncle.

Fig. 1 *f*. A fragment of the septate portion of a much larger specimen.

Fig. 1 *g*. Transverse section of the same, showing the position of the siphuncle.

Position and locality. This species is found in the central and higher part of the Trenton limestone at Middleville. (*State Collection.*)

271. 24. ORTHOCERAS STRIGATUM (*n. sp.*).

Pl. LVI. Figs. 1 *a*, *b*, *c*, *d*.

Compare *O. lineatum*, Hisinger, pag. 29, pl. 9, fig. 6.

Elongated, teretely cylindrical, gradually tapering ; outer chamber large ; septa distant about one fifth the diameter of the shell, very convex ; siphuncle small, central ; surface marked by flexuous elevated longitudinal lines, which are indistinctly visible on the cast.

In the comparative distance of the septa, this species approaches some of the varieties of *Endoceras proteiforme ;* but the septa are more convex, and the siphuncle always central. The longitudinal striæ differ essentially from the ridges in the next species, and are more distinct than in any of the species without annulations. The transverse striæ, if any exist, are much finer, and not preserved where the shell is exfoliated.

This species approaches in character to the *O. lineatum* of Hisinger ; but the longitudinal striæ are stronger than in that species, judging from the character of the surface, which is imperfectly preserved in our specimens.

Fig. 1 *a.* A young specimen, with the shell partially exfoliated; a few of the septa being indistinctly visible.

Fig. 1 *b.* A fragment, showing the shell in a considerable degree of preservation.

Fig. 1 *c.* A portion of the surface of the last enlarged, showing the flexuous character of the striæ.

Fig. 1 *d.* A large specimen, preserving but indistinctly the striæ. About twenty of the chambers are preserved, as well as a large part of the outer chamber. This specimen shows a small septate tube within the open extremity, but it is probably accidentally present.

Position and locality. This species occurs in the higher part of the Trenton limestone at Middleville.

17. 2. ORTHOCERAS LAQUEATUM.

Pl. LVI. Figs. 2 *a, b, c.*

Reference Plate iii, fig. 12 of this Report.

Small, teretely conical, somewhat gradually tapering; surface marked by sharp elevated longitudinal ridges, alternating with finer intermediate ones; no transverse striæ; septa? siphuncle? section circular.

This is evidently identical with the species fig. 12 of Plate III. In that specimen, there are no indications of the intermediate finer lines, which are indistinctly visible in the larger specimen fig. 2 *a*, while they are very distinct in the smaller one. I have been unable to find a specimen showing either septa or siphuncle.

Fig. 2 *a.* A fragment imbedded in compact limestone.

Fig. 2 *b.* A small fragment, showing the intermediate finer striæ.

Fig. 2 *c.* A portion of the surface enlarged.

Position and locality. This species is comparatively rare in New-York, but still has a wide geographical and somewhat extensive geological range; the one figured on Plate III being found in the upper part of the Calciferous sandstone, while the specimen 2 *a* is found in the lower part of the Trenton limestone at Watertown. The smaller specimen is from the middle portion of the same rock at Middleville.

272. 25. ORTHOCERAS LAQUEATUM? *var. α.*

Pl. LVI. Fig. 3.

This specimen is marked by sharp longitudinal ridges, about equally distant with the stronger ones in the preceding figures, but having no intermediate ones. The surface is well preserved, and presents an aspect somewhat different from the preceding, and may perhaps prove a distinct species.

Position and locality. In the lower shaly strata of the Trenton limestone at Middleville.

273. 5. ENDOCERAS* ANNULATUM (*n. sp.*).

PL. XLIV. Figs. 1 *a*, *b*.

Cylindrical, very gradually diminishing towards the apex, annulated by broad rounded ridges, which are equal to the depressed spaces between, and distant from each other one fifth the diameter of the tube, slightly arched upon the back; surface markings unknown; septa deeply concave, and bending more abruptly backward just before reaching the

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* Since the name *Endoceras* was proposed in the early pages of this report, I have learned from M. DE VERNEUIL that the Genus *Hyolithes* had been previously proposed by M. EICHWALD for the embryo tubes of the ORTHOCERAS; but it does not appear to have been adopted by subsequent writers. M. DE VERNEUIL (*Pal. Russia and the Ural Mountains*, p. 350) regards this tube as a mould of the interior of the siphon; but since we find so many specimens having the embryo tube connected with the parent shell, we can hesitate no longer in our decision regarding these bodies.

I have felt some hesitation in pressing the adoption of the proposed name of *Endoceras;* though I have no doubt that when we become better acquainted with these curious fossil bodies, such a separation will be admitted. There can be no longer any doubt of the development of the embryo sheaths within the large siphuncle of many species of the *Orthoceras;* while, in others, the siphuncle is evidently too small to admit of such development. That these embryo tubes do contain within them other tubes, which are septate, and which finally become developed into the form of the parent shell, I believe can be demonstrated, though we do not yet know all the steps of the process, or whether they are expelled from the siphon of the parent, or take the place of the enclosing body, which decays, and leaves the young and vigorous animal alone. The occurrence of several tubes, one within the other, would induce a belief that they were separable from the parent body without its destruction; while, in other cases, the existence of a single tube enclosing another differently marked, suggests the idea that the former may not leave the siphuncle.

From these facts, and from the evidence shown in the succeeding illustrations, it is desirable that any proposed name should include both the parent and embryo tube, as the latter has not an independent existence, but depends on the former, which differs from many of the Orthocerata in the enlarged siphon.

There are, however, difficulties in the way of a clear separation of the species having this character, from the ordinary *Orthoceras*, which has a small siphuncle. In the young specimens which I have had an opportunity of examining, the siphuncle is always small, and it is not easy to conceive of its enlargement to such a degree as to admit of the development of the embryo tubes within it. Owing to these facts, and the possibility of confusion which will result in a multiplicity of species, it may be preferable for the present to indicate the *Endoceras* as a subordinate term under ORTHOCERAS; noting only such species as are proved to have the large siphuncle with enclosed embryo tubes.

So far as my present knowledge of the ORTHOCERATA extends, those possessing the characters given above are confined to the Lower Silurian strata. All those of the higher strata, so far as examined, have simple small siphuncles, giving no evidence of enclosed tubes. Should this suggestion prove true in regard to this family of fossils, it may be of importance in its application to the identity of the older silurian rocks in localities where other characteristics are not satisfactory.

I am aware that a part of the description given as characteristic of *Endoceras*, is likewise applicable to the *Actinoceras* as defined by M. BRONN. But the tubes of *Endoceras* do not extend throughout the entire length of the siphuncle; they are cylindrico-conical, filling the siphuncle at its outer extremity, and gradually tapering to a point. The space between this tube and the inner wall of the siphon is usually filled with crystalline carbonate of lime; but the tube is always smooth, and never in any manner presents radiating plates or verticillations. The character of *Actinoceras*, as given by BRONN, is often seen in the *Ormoceras*, where a slender ill defined tube of crystalline matter extends through the centre of the siphuncle, with verticillating plates of the same material. These, however, never present, in American specimens, any evidence of organization, and are inconstant in their occurrence even in the same species. The Genus *Endoceras*, therefore, may be known from *Actinoceras*, by the internal tube being of a cylindrico-conical form, not continuous with the siphuncle, and having a smooth surface without radii or verticillations connecting it with the walls of the siphuncle.

siphuncle, more approximate than the annulations; siphuncle large, subdorsal, containing a smooth embryo tube; section circular.

A fragment of this species, two feet in length, is all that I have seen, though the original must have been at least three times this length. This is the largest of the annulated species, and is clearly different from all the others in the rock, which have small siphons, and are of far smaller size, with more abruptly elevated annulations. The annulations in this species are broadly arched on the dorsal side, which is at the left hand of fig. 1 *a*. The septa are direct and plainly arched, being distant about three fourths as far as the annulations. The internal tube, within the siphon, is not annulated. There is also, apparently, the apex of another tube within this one, which is not central; but this appearance may be due to accidental displacement.

Fig. 1 *a*. Lateral view of a fragment, showing the arching of the annulations towards the left side. The fine dark transverse lines indicate the edges of the septa.

Fig. 1 *b*. Longitudinal section of the last, showing the position of the siphuncle, convexity of the septa, and internal tubes.

Position and locality. This species occurs in the compact lower strata of the Trenton limestone at Watertown. (*From* Dr. Crawe.)

ENDOCERAS PROTEIFORME (*n. sp.*)

Plates XLV. to L., & LIII.

General form cylindrico-conical, more or less elongated, often compressed, tapering somewhat unequally in different specimens; young specimens terminating in an extremely acute point; surface marked by distinct transverse striæ, which usually appear like narrow subimbricating bands, with one edge well defined and more elevated than the other, more or less distinctly striated longitudinally; striæ varying from extreme tenuity to distinct elevated threadlike lines; section circular; septa distant from one fifth to one fourth the diameter; siphuncle excentric or submarginal.*

I am able to characterize three distinct varieties of this species, which are the prevailing forms: these depend mainly on the surface markings of the young shell. The old shells are recognized by a large submarginal siphuncle, which usually contains a smooth cylindrico-conical embryo tube or sheath. This tube is sometimes irregularly tapering, and always free from visible surface markings or sculpture. Within this embryo tube are the young shells, sometimes perfectly formed Orthocerata, and at other times destitute of septa or

* This is a very variable species, which, in its extreme varieties, I have been disposed to regard as specifically distinct. The engravings of the two first plates (xlv and xlvi) were made with this view; and the parent shell, with the smooth embryo tubes figured on the subsequent plates, was considered distinct, presenting no characters which could be identified as common with those figured on Plate xlv. It is only by some fortunate discoveries made since the engraving was completed, and while my descriptions are passing through the press, that I am able to present the true characters of this protean species. The two plates xlv and xlvi were figured during the early part of the preparation of this work in 1843, and my subsequent investigations have furnished the other specimens which appear on the following plates. This will account for the want of unity or completeness in the grouping of the different varieties.

siphuncle. These young shells are also frequently found separate from the parent shell or embryo tube, when we are compelled to rely upon the surface markings for their determination. The position of the siphuncle, convexity of septa, and some other characters, are usually constant in all the varieties, which only exhibit a change in the character of the surface. In the absence of septa and siphuncle, which is of common occurrence in the young shell, the character of the surface is reliable for determining the species.

274. 6. ENDOCERAS PROTEIFORME, *var.* TENUISTRIATUM.

Pl. XLV. Figs. 1 *a*, *b*; and Pl. XLVII. Figs. 1 *a*, *b*, and 2 *a*, *b*, *c*, *d*, *e*.

This variety is known by the character of the surface, which is marked by regular transverse striæ, sometimes appearing as if imbricated, or having one edge elevated. The longitudinal striæ are not more than one fourth as large as the transverse ones, and visible only under a magnifier; they often become obsolete and scarcely perceptible, and the transverse striæ assume a slightly imbricating and lamellose structure. The transverse striæ are often crowded together in bands or fasciæ, as shown in the figures.

In examining other specimens, we find the longitudinal striæ becoming more distinct, until finally they are equal to the transverse ones, and the entire aspect of the surface is changed.

All the specimens examined of this variety are more or less imperfect, and, with a single exception, disconnected from the parent tube, and destitute of septa. In a specimen five inches long, the diameter of the larger end is one inch and a quarter, while that of the smaller end is half an inch. In another specimen with a diameter of half an inch at the larger extremity, the smaller end is one eighth of an inch in diameter.

Plate XLV.

Fig. 1 *a*. A fragment of the young shell, of the natural size.

Fig. 1 *b*. An enlarged portion, showing the longitudinal striæ.

Plate XLVII.

Fig. 1 *a*. A smaller and more slender specimen of the same species.

Fig. 1 *b*. A portion of the surface enlarged, showing the cancellated lines.

Fig. 2 *a*. This specimen presents very similar surface markings, and cannot be distinguished from the last, though the transverse striæ are less prominent. The specimen consists of a double or triple tube; the outer one 2 *b* showing externally marks of septa, which are distant about one fourth the diameter. The shell is exfoliated, and the surface markings are unknown. The inner tube, which is shown in the upper part of the figure, is likewise septate in its upper part, the septa being at about the same proportional distance as in the last. A portion of the shell still remains upon this one, which preserves the markings before described.

Fig. 2 *c*. An enlarged portion of the surface; the longitudinal striæ are too strong in the figure.

Fig. 2 *d*. A small portion still farther magnified, showing the proportionate size of the transverse and longitudinal striæ.

Fig. 2 *c*. Transverse section of the specimen 2 *a*, showing the proportional diameters of the two, and the section of a still smaller tube within 2 *a*.

In this instance, the specimen does not reveal enough to show whether the internal tubes are embraced within a siphuncle or not : the outer one is clearly marked with septa upon the outside, similar to the one within it ; but of the interior one we know nothing. The first internal tube is clearly not a cast within the outer tube; for it preserves a shell with surface markings, as well as septa externally. This figure is given to show the similarity, general form and surface markings, both in the septate and non-septate tubes, which belong apparently to the same species.

275. 7. ENDOCERAS PROTEIFORME, *var.* TENUITEXTUM.

Pl. XLV. Figs. 2 *a b*, 3 *a b*, & 5 *a b c* ; and Pl. XLVIII. Fig. 2 *a b c*.

This variety does not differ in form from the preceding. The longitudinal and transverse striæ are more distinctly elevated and threadlike, being of nearly equal size in both directions, giving the surface a texturate or weblike appearance. These striæ are sometimes distinctly visible to the naked eye, while in other specimens they can only be distinguished by the magnifier. The septa are distant a little less than one fifth the diameter of the tube ; section circular ; siphuncle excentric.

In some specimens of the last variety, the striæ become more distinctly developed, and gradually assume the decided characters of such specimens as are described in the following figures.

Plate XLV.

Fig. 2 *a*. A fragment of a tube destitute of septa, presenting strong transverse and longitudinal striæ.

Fig. 2 *b*. A portion of the surface enlarged.

Fig. 3 *a*. A specimen with finer striæ, showing the marks of septa.

Fig. 3 *b*. A portion of the surface enlarged. The specimen 3 *a* diminishes more rapidly towards the apex than the preceding one, and the cancellation of the surface is finer.

Fig. 5 *a*. This specimen presents a double tube or sheath, the outer one (or embryo tube) being entirely smooth, while the inner one, which is but little smaller, is marked by longitudinal and transverse striæ as in the preceding figures.

Fig. 5 *b*. A portion of the same enlarged to show the striæ.

Fig. 5 *c*. A section of the same, showing no septa or siphuncle.

Plate XLVIII.

Fig. 2. An embryo tube, containing a young specimen of this variety. It has been broken at *a b c*, and presents the sections *a b c* at the bottom of the plate, showing the septa and excentric siphuncle. The surface marking of this young shell is precisely like fig. 3 *a b*, Pl. xlv.

276. 8. ENDOCERAS PROTEIFORME, *var.* LINEOLATUM.

PL. XLV. Figs. 4 *a, b, c, d, e*; PL. XLVI. Figs. 1 *a b c*, 2 *a b*, & 3; and PL. XLVII. Figs. 4 *a, b, c, d, e*.

Compare *Orthoceratites centralis*, HISINGER, Leth. Suecica, 1837, Pl. 9, fig. 4.
— *bacillus*, EICHWALD, 1830, Zool. specialis, Vol. ii, pag. 31, pl. 2, fig. 11.
— — ID. 1840, Sil. Syst. in Esthland, p. 94.
— *linearis*, MUNSTER, 1840, Beitr. zur Petrefacten, Heft iii, pag 99, pl. 19, fig. 1 *a, b*.
— — D'ARCHIAC & DE VERNEUIL, 1842, Trans. Geol. Soc. London, New series, Vol. vi, part 2, p. 345.
— *bacillus*, VERNEUIL, 1845, Pal. Russia and Ural Mountains, pag. 353, pl. 21, fig. 8 *a, b*.

This variety is usually more slender than the prevailing forms of the last, but is not essentially different. The surface is marked by fine transverse striæ, scarcely visible to the naked eye; striæ somewhat irregular, lamellose, and crowded into bands or fasciæ. The siphuncle is equally excentric with the last, and the septa have a concavity of about one third their diameter; section circular.

The length of the fragment fig. 4, pl. 45, is 4½ inches; the comparative diameters of the two extremities are as 4 to 1. In fig. 2, pl. 46, the length is 5¼ inches, and the two diameters as 13 to 3, or about the same as in the other specimen.

The surface of some specimens, when highly magnified, presents very minute or evanescent longitudinal striæ, approaching in this character to the var. *E. tenuistriatum*, into which it finally passes by a greater development of the longitudinal striæ. The transverse striæ are often imbricating, as if produced by the elevated edges of lamellæ which are frequently broken or irregular. They also sometimes become vesicular, giving the surface a blotched appearance as in fig. 4 *e*, pl. 47. Towards the extremity they often become more distinct, and assume the character of sharp annulations.

This variety differs from the *O. centralis* of HISINGER, in the excentric position of the siphuncle, and in the finer striæ, in which it approaches to *O. bacillus*, which has likewise a central siphuncle and more conical form.

The finely striated surface of this species is very similar to one or two species in our higher strata; but in those the striæ are usually stronger, and they do not become, in any variety, cancellated in like manner with fine longitudinal striæ. It will be desirable, therefore, to recollect these distinctions, in order to avoid confounding what are really distinct, and from different geological periods.

PLATE XLV.

Fig. 4 *a*. A young shell, with the outer chamber and apex broken off. This specimen represents the prevailing form and dimensions of this variety.

Fig. 4 *b*. Transverse section of the larger extremity of 4 *a*, showing the position of the siphuncle.

Fig. 4 *c*. A fragment of the smaller extremity of the shell, which is annulated by fine sharp ridges.

Fig 4 *d*. The same enlarged.

Fig. 4 *e*. A fragment of another tube, marked as fig. 4 *a*, showing at the lower extremity a septum and siphuncle.

PLATE XLVI.

Fig. 1 *a*. A fragment of the parent shell, enclosing an embryo tube within the siphuncle. The young shell within this tube is marked precisely as fig. 4 *a*, pl. 45.

Fig. 1 *b*. Transverse section of the last, showing the large lateral or excentric siphuncle of the old shell. The shell is crushed, as shown in the upper figure, so that a perfect section cannot be given.

Fig. 1 *c*. The surface marking of the young shell, enlarged.

Fig. 2 *a*, *b*. The external shell, and a longitudinal section of a young shell, which is destitute of septa.

Fig. 3. This is marked upon the surface as other specimens of the var. *lineolatum*. The septa in the figure are erroneously represented by the engraver much nearer than they are in the specimen.

PLATE XLVII.

Fig. 4 *a*. A fragment from the apex of one of these tubes, which is septate as in the larger specimens.

Fig. 4 *b*. A transverse section.

Fig. 4 *c*. A fragment which is annulated near the apex, and septate to the extreme point.

Fig. 4 *d*. Section near the apex.

Fig. 4 *e*. A fragment of a similar young shell, where the lamellose striæ have become vesicular, giving a rough scaly appearance to the surface.

I have given so great a number of figures of this variety, in order to show the various forms and aspects under which it appears. The separated and enclosed tubes, or young shells, are all identical; some of them being septate, and others without septa. It is impossible to determine when these bodies assume the septate character, or whether they are always so except when the septa are removed by accident; which may be the explanation of their absence in larger tubes, while they are present in smaller ones as I have shown in the preceding figures.

277. 9. ENDOCERAS PROTEIFORME, *var.* STRANGULATUM.

PL. XLVI. Figs. 4 *a*, *b*, *c*, *d e*.

It is not entirely certain that the character on which this variety is founded does not exist in the var. *lineolatum*; since, in all the specimens of that one examined, the outer chamber is not preserved. The surface markings are precisely similar in the two; some specimens being quite destitute of longitudinal striæ, while in others they are faintly preserved, and the surface resembles the var. *tenuistriatum*. The distance of the septa is from one fourth to one third the diameter of the tube, corresponding closely with those of the var. *tenuitextum* (Pl. xlv, fig. 3 *a*). There is a slight difference in this character in the two specimens figured, but the parent shells are also shown to be somewhat variable in the distance of the septa. The position of the siphuncle in the best preserved specimen is nearly central, while in another specimen it is somewhat excentric. In this respect, the var. *lineolatum*, as well as other species of ORTHOCERAS, is variable. In the small specimens with septa, figured on Pl. XLVII, figs. 4 *a*, *b*, *c*, *d*, the siphuncle is nearly central, and, in the smallest one, it scarcely deviates from that position. This character, therefore, is not to be regarded as of primary importance. The dimension of the siphuncles in the two varieties is precisely similar in specimens of equal size.

In the figures given, one or two of the last septa are represented as more approximate than the other. This character is likewise common to other species, and, I believe, to nearly all those where I have had an opportunity of examining this portion of the shell.

In the variable character of the striæ, and the crowding together in bands, this one presents all the variations observed in the preceding variety.

Fig. 4 *a*. A fragment, showing the contraction below the aperture.

Fig. 4 *b*. Transverse section, showing the nearly central position of the siphuncle.

Fig. 4 *c*. A portion of the surface of a specimen enlarged.

Fig. 4 *d*, *e*. Two specimens denuded of the shell, showing a uniform character in the contraction of the tube, with a slight difference in the distance of the septa.

ENDOCERAS PROTEIFORME.

ILLUSTRATIONS OF THE OLD SHELLS, WITH THE EMBRYO SHEATHS OR TUBES SEPARATE AND ENCLOSED WITHIN THE SIPHUNCLE, etc.

Pl. XLVI. Figs. 1 *a*, *b*; Pl. XLVIII. Figs. 1, 2, 3, 4; Pl. XLIX. Figs. 1 *a* – *e*; Pl. L. Figs. 1, 2, 3; and Pl. LIII. Fig. 2.

These figures illustrate some of the many different forms in which this species occurs. They further show that the smooth embryo tube or sheath is almost constantly present within the siphuncle, as well as often separated from it. In all the specimens figured, it will be observed that the apex of this tube is directed towards the apex of the parent shell, thus precluding the idea of its accidental occurrence in this situation and position. The uniformly smooth surface of these tubes, which have never been found to contain septa or siphuncle, while on the other hand they contain septate tubes with peculiar surface markings, indicates that they performed some other function, and probably only changed their position by accident, or the death of the enclosing animal, and consequent destruction of its habitation. We shall perceive, from the evidences to follow, that the young shell of this species, at least, was enclosed during its early stages, and probably always until fully developed, within a shelly tube.

Plate XLVI.

Fig. 1 *a*, *b*. This specimen has been noticed before, as containing a young shell of the var. *lineolatum*. The parent shell, or cast, has the septa distant about one fifth or one sixth the diameter of the shell. The embryo tube is smooth, slightly projecting at one extremity, and containing a smaller striated tube. The specimen is crushed, so that the section is imperfect.

Plate XLVIII.

Fig. 4. A fragment of a large specimen, composed of twenty or more chambers, one side of which is worn down, exposing the siphuncle, which contains the embryo tube, within which is a young shell *a*.

Fig. 4 *b*, *b*. The larger or embryo tube, which is broken at the lower extremity.

Fig. 4 *c*. The siphuncle, the space surrounding the tube being filled with calcareous spar. This specimen shows, in a very satisfactory manner, the position of these tubes within the parent shell. Unfortunately we have not yet been able to obtain the apex of one of the larger shells, to determine whether the siphuncle continues of the same dimensions throughout. A small portion of the upper part only of the embryo tube is preserved in this specimen.

Fig. 3. An embryo tube with a longitudinal section on one side, showing a slender septate tube within, which is nearly destroyed by weathering.

Fig. 2. A similar tube, free from striæ, and like the others. This tube has been broken at *a*, *b*, *c*; and the transverse sections *a*, *b*, *c*, at the bottom of the plate, represent its appearance. The outer tube contains an inner one, which is septate throughout its entire length, and furnished with an excentric siphuncle, which is distinctly represented in the section *a*. An exposure of the surface of this septate tube shows precisely the same sculpture as that represented in the specimens 2 and 3 of plate 45, and also the small enclosed tube fig. 5 of the same plate.

Fig. 1. A separate embryo tube, nearly perfect, and showing some inequalities near the base, apparently from contact with the inner side of the siphuncle.

Plate XLIX.

Fig. 1 *a*. Ventral side of a fragment, showing the siphuncle, which is worn through in the lower part, showing the smooth embryo tube. This specimen shows the more abrupt arching of the septa as they approach the siphuncle.

Fig. 1 *b*. A fragment, preserving the embryo tube.

Fig. 1 *c*. Transverse section of the last, which is slightly elliptical from compression. The embryo tube is pressed against the upper side of the siphuncle, the outline of which is only faintly represented.

Fig. 1 *d*. A similar fragment, embracing a portion of the embryo tube. In this one the septa are a little more approximate than in the other specimens, but it does not differ in other respects.

Fig. 1 *e*. A nearly perfect embryo tube, with a few of the septa of the parent shell still attached.

The tenacity with which this tube retains its connexion with the parent shell, as shown in all these fragments, and particularly the last one where the outer shell is nearly destroyed, would indicate something more than accidental possession of the siphuncle. In all these specimens, the septa are distant one fourth to one sixth the diameter of the outer shell.

Plate L.

Fig. 1 *a*. An embryo tube containing a young shell. This specimen is more elongated, and less rapidly attenuating than the prevailing forms of the species. The outer tube is smooth, while the inner one is striated; but the crystalline condition of the rock renders it difficult to determine the character of the tubes with accuracy.

Fig. 1 *b*. This tube is more slender than the usual forms, but does not differ in other respects.

Figs 2 *a*, *b*. Fragments of smooth embryo tubes, apparently of the same species, differing only in being more suddenly contracted and aculeate near the apex. This character does not probably influence the young shells developed within them.

Figs. 2 *c*, *d*. Parts of the siphuncle separated from larger shells, still retaining the embryo tube within. Several such specimens have been found, though none in which the embryo tubes contain young shells. The similar character in these tubes, with the marks of septa upon the siphuncle equally distant with the preceding figures, appears to be sufficient to warrant their reference to the same species. The siphuncle is marked by oblique or ascending annulations, indicating the junction of the septa. This ascending direction of the annulations is due to the lateral or excentric position of the siphuncle. The slight variation in the distance of the septa, as marked on the siphuncle, is no more than is shown in different specimens in the preceding figures.

Fig. 3. An embryo tube, more conical than any of the others. I have referred it, with some hesitation, to the same species, until further discoveries shall prove it distinct.

PLATE LIII.

Fig. 2. A large fragment of this species, in which the embryo tube is preserved, while the surrounding shell has been partially removed. All that part of the parent shell remaining is septate, the outer chamber having been broken off; which is likewise true of all other specimens of this species that have fallen under my notice.

Position and locality. This species is found in the central and higher part of the Trenton limestone at Middleville and the valley of West-Canada creek, where it is far more abundant than any other species in the rock. It occurs less frequently at Turin, Lowville and Watertown, as well as in the same position in the Champlain valley. (*State Collection.*)

I have been inclined to regard this species as very closely allied to, if not identical with, *Orthoceratites duplex*, as described by WAHLENBERG and HISINGER (*Act. Soc. Sci. Upsal*, Vol. viii, p. 88; *Leth. Suecica*, pag. 28, pl. 9, fig. 1); but the figures given by DE VERNEUIL (*Pal. Russia and the Ural Mountains*) differ from that of HISINGER in the distance of the septa, and in having the siphuncle quite marginal. This difference will be seen by a comparison of the figures here given, with those of the author last cited (pl. 24, fig. 7, and pl. 25, fig. 2 *a*, *b*), where the distance of the septa is comparatively greater, and the siphuncle larger and quite marginal. The young shells of this species, however, are represented as constricted near the aperture, as in the one under consideration. It is not improbable that more than a single species is known in Europe under the name of *O. duplex*, and the *Endoceras proteiforme* is represented in one of them.

For synonyms and references of *O. duplex*, see page 220, under *Endoceras distans*.

278. 10. ENDOCERAS PROTEIFORME? *var.* ELONGATUM.

Pl. LII. Fig. 1 *a*, *b*.

Teretely cylindrical, very gradually tapering and extremely elongated; septa distant about one sixth to one fifth the diameter of the shell; siphuncle large, excentric.

This species is closely allied to *E. proteiforme*, in the character of septa and siphuncle. The external shell and embryo tubes have not been discovered, and it is from the great size of the siphuncle that I have referred the species to the Genus Endoceras. It is usually found in fragments, which are more or less compressed and distorted. The one figured is a small portion of a much larger specimen which was imbedded in a nearly perfect condition, but is broken from the weathering and decay of the rock.

Fragments of this species are not unfrequent in the higher part of the Trenton limestone, but, like all the others attaining great size, it is nearly impossible to procure characteristic specimens.

Fig. 1 *a*, *b*. Parts of the same individual, united as represented by the dotted line.

Position and locality. In the higher shaly beds of the Trenton limestone at Middleville.

ENDOCERAS PROTEIFORME.

Pl. LVIII. Fig. 1.

Reference page 208 of this Report.

Since the preceding pages were in press, I have obtained from Dr. Emmons the specimen figured on Plate LVIII. It is apparently identical with the preceding, and very similar to the var. *elongatum*, if this be a distinct variety of so variable a species. This one shows very conclusively that the young shell is developed within the siphuncle of the parent one, and furnishes more evidence than any other instance I have seen, that the old shell is succeeded by the young one, which assumes the place of the parent, which gradually decays. The specimen preserves twelve or more chambers of the parent shell, which are pierced by an extremely large submarginal siphuncle. This siphuncle embraces the young shell, which projects beyond the last septum of the old one preserved, nearly ten inches, and is imperfect at its extremity. The part of the young shell thus projecting, numbers between forty and fifty chambers, the lower or larger part of it being partially enclosed by the embryo tube.

Two specimens of this character have been found, and, when taken in connexion with the preceding illustrations, leave little doubt as to the actual mode of development among the shells of this genus. It would appear from this one that the embryo tubes and young shells within keep pace in their growth with the parent, all the specimens of the young bearing a uniform proportion to the size of the enclosing or parent shell. Sufficient, however, has already been said in reference to this part of the subject, and new facts are constantly presenting themselves in favor of the views here advanced, which, from their novelty, and the imperfection and obscurity of many of the specimens, have heretofore been regarded as untenable and unsatisfactory.*

Position and locality. This specimen is from the valley of West-Canada creek, near Middleville, and in the same position as those previously noticed. (*Cabinet of* Dr. Emmons.)

Plate LIX.

In the figures 1, 2, 3, I have attempted to give the precise markings presented on the surface of the varieties of *E. proteiforme*, which are somewhat more distinct than the lithographic impressions.

Fig. 1 *a, b.* var. *tenuitextum.* The surface markings on two different specimens, somewhat enlarged beyond the natural size.

Fig. 2 *a, b.* var. *tenuistriatum.* The surface markings on two different specimens, both slightly magnified. A careful examination shows a slight difference in the strength of the markings, which becomes more extreme in other specimens.

Fig. 3 *a.* var. *lineolatum.* This one presents only transverse striæ; but some specimens show minute longitudinal ones, passing into the preceding variety.

Fig 3. var. *lineolatum.* The surface is covered by fine spots or stigmata, as if some adhering softer substance had been separated from it. The same is observed in fig. 2 *b*, in a less degree. The markings are very similar to the bases of the cells of a Flustra.

279. 11. ENDOCERAS ARCTIVENTRUM (*n. sp.*).

Pl. LI. Figs. 2 *a*; *b*.

Elongated, very gradually tapering; septa distant about one third the diameter of the shell; siphuncle marginal (ventral), slightly contracted at the junction of the septa; section oval (probably from compression); embryo tube slender.

The specimen is a fragment, preserving about eight or nine of the chambers; but these, with the siphuncle, are different from any other species of this period. The siphuncle is remarkably narrow, somewhat longitudinally wrinkled, and slightly contracted at the junction of the septa.

The small embryo tube contains a young shell, which has the appearance, in a small portion visible, of *Orthoceras junceum;* but this cannot be demonstrated till we obtain other specimens.

Position and locality. This species occurs, associated with the preceding, in the higher part of the Trenton limestone.

* This view of the development of the Orthocerata was first imperfectly made known at the meeting of the American Association of Geologists and Naturalists, at Washington, in 1844, and subsequently more fully explained at the New-York meeting in 1846.

280. 12. ENDOCERAS ANGUSTICAMERATUM (*n. sp.*).

PL. LI. Fig. 3.

Teretely cylindrical, very gradually tapering; septa distant about one sixth the diameter of the shell; outer chamber deep; siphuncle excentric?

The specimen is a fragment somewhat compressed, giving a greater breadth in the figure than the actual diameter. The outer chamber contains a small tube, which is too obscure to determine satisfactorily its character, though indicating that the species belongs to the Genus ENDOCERAS. The siphuncle of this specimen cannot be satisfactorily examined, and therefore I have some hesitation as to the true character of the fossil. The specimen is denuded of the shell, so that the surface markings are unknown.

Position and locality. This species is found in the higher part of the Trenton limestone at Middleville.

281. 13. ENDOCERAS MAGNIVENTRUM (*n. sp.*).

PL. LIII. Figs. 1 *a, b, c, d, e.*

Elongated, very gradually tapering; siphuncle very large, occupying about three fifths the diameter of the shell; septa extremely convex, distant one eighth the diameter of the shell.

The specimen figured is a fragment of an individual, which, when perfect, could not have been less than six feet in length. The septa are more convex than in any other species known to me, being in this respect slightly irregular as shown in the figure. The siphuncle is proportionally larger, and the septa more approximate than in any other species described.

Fig. 1 *a.* A fragment, showing several of the chambers, with the large siphuncle projecting above.

Fig. 1 *b.* An artificial longitudinal section, showing the proportional diameter of the siphuncle and shell, as well as the extreme convexity of the septa, which are correctly represented as somewhat irregular in this respect.

Fig. 1 *c.* A transverse section of the larger extremity, which is worn off obliquely. At *d d* the outer line indicates the edge of the siphuncle, the inner one being perhaps an exfoliation from the same, but too obscure to determine its character. At *e*, the embryo tube, with a young shell, is clearly distinguishable within the siphuncle. The position of the same is shown in the longitudinal section, which slightly cuts its outer edge. The small size of the embryo tube indicates that this section is distant from the outer chamber, at which point this tube usually fills the siphuncle.

Position and locality. In the higher part of the Trenton limestone near Middleville.

282. 14. ENDOCERAS MAGNIVENTRUM? *var.*

PL. LIV. Fig. 2 *b.*

This specimen consists of a portion of an extremely large siphuncle, with a few septa attached. The septa are equally convex with those of the specimen figured on Plate LIII; but their distance is equal or greater, though the diameter of the siphuncle is less.

Position and locality. Same with the preceding.

283. 15. ENDOCERAS APPROXIMATUM (*n. sp.*).

Pl. LIV. Fig. 2 *a*.

Cylindrical, gradually tapering; septa with a convexity little more than one fourth their diameter, distant about one fifth the diameter of the shell; siphuncle large, marginal, obliquely annulated by the thin edges of the septa.

This specimen is a fragment, preserving about five or six chambers, with a portion of the siphuncle projecting above.

In many respects, this species resembles the *E. proteiforme;* but the markings of the septa upon the siphuncle are more approximate in proportion to its diameter. In the one figured, they are distant about one third the diameter of the siphuncle; being actually nearer than those of smaller siphuncles of that species figured on Plate L, which are distant two fifths of the diameter of the tube.

There is, however, still some obscurity in regard to these parts of the shell, and we are not able to decide whether their proportions are constant. This can only be determined by a comparison of all the parts of a large number of specimens of authentic species. I have examined three specimens of what appear to be, very satisfactorily, the siphuncles of *E. proteiforme*, two of them containing a portion of the embryo tube. In all these the diameter is almost precisely the same, and the distance of the septa corresponds. On this account, I have thought it preferable to indicate this one as a distinct but approximating species.

Position and locality. This species is found, associated with the preceding, in the higher part of the Trenton limestone near Middleville.

284. 16. ENDOCERAS DUPLICATUM (*n. sp.*).

Pl. LV. Fig. 1.

Cylindrical, gradually tapering; septa distant about three eighths of an inch; siphuncle extremely distended, and containing two embryo tubes, within each of which is a young shell.

The only specimen seen is much compressed, and distorted so that its original form can not be made out. It evidently contains two embryo tubes, which apparently belong to the specimen. This is quite distinct from the *Endoceras gemelliparum* of the Black-river limestone, both in its general form, distance of septa and character of the tubes, showing a second species with double embryo sheaths.

Position and locality. This species occurs in the upper shaly part of the Trenton limestone near Middleville. (*Cabinet of* John Gebhard, Jr.)

285. 17. ENDOCERAS DISTANS (*n. sp.*).

PL. LVII. Figs. 1 *a*, *b*.

Teretely cylindrical, very gradually tapering ; septa thick, distant one half the diameter of the shell, moderately convex ; siphuncle marginal, large (more than two fifths the diameter of the shell) ; external surface ? section circular.

The specimen figured is compressed towards the larger extremity, which gives it the appearance of enlarging more rapidly than it really does. The siphuncle is large, but is apparently of equal width throughout. The distance of the septa is much greater than in *Orthoceras amplicameratum*, and the siphuncle much larger and lateral. In these particulars it is clearly distinct from any described species.

In the dimensions of the tube, position and size of the siphuncle, it corresponds precisely with a specimen of *O. duplex* from Sweden ; but the septa are more distant than usually represented in that species. Our species will probably prove to be a true ENDOCERAS, judging from the dimensions of the siphuncle, though the specimen under consideration apparently contains no embryo tube.*

Fig. 1 *a*. A weathered cast of a fragment of this species.
Fig. 1 *b*. Transverse section of the smaller extremity of the same, showing the large siphuncle.

Position and locality. This species has been found only in the upper part of the Trenton limestone at Turin, Lewis county.

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* The following references and synonyms of the *Orthoceratites duplex*, are given from the work of MURCHISON and DE VERNEUIL on the Palæontology of Russia and the Ural Mountains.

KLEIN, 1731, Descr. *tubulorum marinorum*, Pl. 2, fig. 1 *a*, *b* (*c*, *d*, exclusis).
7ᵉ *espèce d'Orthoceratites*, BREYN, 1732, Dissert. de Polythalamiis, Pl. 5, fig. 1 – 4.
Orthoceratites duplex, WAHLENBERG, Act. Soc. Sc. Upsal, Vol. viii, p. 86.
— *spiralis*, FISCHER, 1829, Bull. de Moscow, p. 323.
— — PANDER, 1830, Beitr. zur geogn. Russland, pag. 109, pl. 30, fig. 1.
— — FISCHER, 1837, Oryct. de Gouv. de Moscow, pag. 125, pl. 10.
— *duplex*, HISINGER, 1837, Leth. Suecica, pag. 28, pl. 9, fig. 1.
— — KUTORGA, 1837, Beitr. zur geogn. Dorpat, pag. 32, pl. 5, fig. 9.
— *giganteus*, ID. Ib. pl. 6, fig. 6 (non id SOWERBY).
— *spiralis*, EICHWALD, 1840, Sil. Syst. in Esthland, p. 92.
— *duplex*, QUENSTEDT, 1840, Neues Jahrb. fur Mineralogie, p. 262.
— — TROOST, 1841, Sixth Geol. Rep. Tennessee, p. 10.
— — VERNEUIL, 1845, Pal. Russ. & Ur. Mountains, pag. 351, pl. 24, f. 7 ; & pl. 25, f. 2 *a b*.

Genus CAMEROCERAS (Conrad).

Character. "Straight; siphuncle marginal; a longitudinal septum, forming a roll or involution with the margin of the siphuncle."

The above description is quoted from Mr. Conrad (*Jour. Acad. Nat. Sci. Philadelphia*, 1842, Vol. viii, p. 267); and although dissenting from his opinion of the characters in part, I have adopted it as a distinct genus, closely allied to Endoceras. There is no evidence of a longitudinal septum as described above, in the specimens I have examined; nor is it probable that such a character exists. The character of the siphuncle, though resembling that of Endoceras, is different from any examined.

286. 1. CAMEROCERAS TRENTONENSE.

Pl. LVI. Figs. 4 *a*, *b*, *c*.

Cameroceras trentonensis. Conrad, Jour. Acad. Nat. Sci. Philadelphia, Vol. viii, pag. 267, pl. 16, fig. 3.

Elongated, gradually tapering; section elliptical, with diameters about as five to seven, slightly contracted at intervals; septa distant about one third the longest diameter of the tube; siphuncle marginal, contracted between the septa, obliquely annulated at the junction of the septa.

The single species differs from the Endoceras in its oval form, which is slightly contracted at intervals. The siphuncle is marginal, occupying one of the extremities of the ellipse, which is unequal at the two ends. The siphuncle is not only marked with the septa, but is contracted between them, in some slight degree, like Ormoceras. The oval form and contraction of the shell is constant and uniform in four specimens examined; and the same is true of the one described by Mr. Conrad, on which account we may presume it to be the original form of the shell.

This is a rare species, and the only one of the genus known.

Fig. 4 *a*. A fragment of the shell, preserving about three of the chambers, beyond which the siphon is extended to an equal distance.
Fig. 4 *b*. Another fragment, with the siphuncle still more extended.
Fig. 4 *c*. Transverse section, showing the position of the siphuncle.

Position and locality. This species occurs in the higher part of the Trenton limestone, associated with the other species of the same family, at Middleville. (*State Collection.*)

89. 1. ORMOCERAS TENUIFILUM?

PL. LVIII. Figs. 2 *a, b, c.*

Reference *Ormoceras tenuifilum*, Plates XV & XVI of this volume.

The specimen fig. 2 *a* is a part of a siphuncle, with a small portion of the shell adhering. The edges of the annulations are somewhat irregular and more sharply angular than is usual in this species, but otherwise it presents no important differences.

The specimen fig. 2 *b*, and section 2 *c*, is a fragment worn down on one side somewhat obliquely, showing the siphuncle in the lower part of the figure, which is precisely similar to those previously figured.

These specimens have been given to me, the one by Gen. SPINNER, of Mohawk, and the other by Dr. BUDD, of Turin, Lewis county, as coming from the Trenton limestone. It is possible, that in the Mohawk valley, where the Orthoceratite limestone of the Black river is not clearly recognized, some of its fossils may be found in the base of the Trenton limestone. This is the only explanation I am able to offer at present, if the specimens are really from the localities given; for among many hundreds examined from the central and higher part of the Trenton limestone, I have never observed a fragment of the ORMOCERAS.

These specimens are figured in this place, though I do not regard them as characteristic of the Trenton limestone.

287. 1. CONULARIA TRENTONENSIS.*

PL. LVIII. Figs. 1 *a, b, c, d, e, f.*

Compare *Conularia quadrisulcata*, MILLER. SOWERBY, Min. Conchology, Vol. iii, pag. 107, tab. 260.
— — DALMAN, Vet. Acad. Handlingar, 1824, tab. 4, fig. 3.
— — HISINGER, Leth. Suecica, 1837, pag. 30, tab. 10, fig. 5.
— — SOWERBY in Sil. Researches, pag. 626, pl. 12, fig. 22.
— *Sowerbii.* DEFRANCE, Dict. des Sci. naturelles.
— — BLAINVILLE, 1828, Malacologie, pag. 377, tab. 14, fig. 2 *b, c, d, e.*
— — TROOST, 1840, Fifth Geol. Rep. Tennessee.
— — VERNEUIL, 1845, Pal. Russ. and Ural Mountains, pag. 348, pl. 24, fig. 5 *a, b.*

Pyramidal, obtusely quadrangular; angles sulcate; sides somewhat rounded; a slightly impressed line along the centre of each side, from the apex to the base; surface marked by sharp obliquely transverse ridges, which, extending from each angle of the shell towards the mouth, meet those from the opposite angle in the centre of each side, producing a slightly impressed line, along which the ridges are less prominent; longitudinally marked by finer striæ, which are slightly convergent towards the angles, and divergent from the centre of each side (these striæ are most prominent in the depressions between the transverse ridges); septa transverse, very convex, smooth; siphuncle excentric.

* The Genus *Conularia* is usually placed under the Family PTEROPODA. This species is provided with septa which are perforate as in *Orthoceras*, and, on this account, I have allowed those described to remain under CEPHALOPODA.

There is little difficulty in identifying this curious and beautiful fossil, which is quite abundant in the Trenton limestone. The obliquely transverse ridges and nearly vertical striæ, which are always more prominent in the depressions than upon the ridges, are constant in a large number of specimens. The shell at the angles seems to be slightly folded inward, producing a groove, which interrupts the transverse ridges. It is but rarely that the septa and siphuncle can be seen; the latter is usually excentric, but in one specimen there is an obscure appearance of a duplicate siphuncle. When the outer lamina of the shell only is removed, the cast preserves the sharp transverse ridges, the longitudinal striæ being obliterated. The entire cast is smooth, with a deep groove at the angles, and a shallow one on the centre of each face of the pyramid.

Fig. 1 *a*. A specimen (natural size), with the apex broken off.
Fig. 1 *b*. Another specimen, more abruptly acute.
Fig. 1 *c*. Transverse section of *a*, near the apex, showing the septum and siphuncle.
Fig. 1 *d, e*. Lateral and transverse view of a fragment, showing the convex septum.
Fig. 1 *f*. A portion of the surface enlarged.

Position and locality. In the central and higher part of the Trenton limestone at Middleville, Jacksonburgh, Trenton Falls, and other places.

288. 2. CONULARIA GRANULATA (*n. sp.*).

Pl. LIX. Fig. 2.

Conical or pyramidal; specimen compressed, tapering rapidly to an acute point; angles marked by linear grooves or sulci; surface marked by distinct transverse striæ, which are crossed by finer longitudinal ones, giving, under a magnifier, a granulated or papillose appearance to the shell; no septa or siphuncle visible.

This species is quite distinctly marked; and from the examination of several specimens, I have no doubt of the propriety of its reference to the Genus Conularia. The specimen figured is in soft shaly limestone, and presents no more than a thin laminar expansion. It differs essentially from the last in the character of its markings, which are also much finer, being scarcely visible to the naked eye. The surface is marked by longitudinal lines or folds, which are probably due to the folding of the shell from pressure.

Fig. 2 *a*. A specimen nearly entire, giving the general form of this species.
Fig. 2 *b*. A portion of the surface enlarged.

Position and locality. In the upper shaly portion of the Trenton limestone, associated with *Lingula*, *Orbicula*, *&c.*

289. 3. CONULARIA PAPILLATA (*n. sp.*).

Pl. LIX. Figs. 3 *a*, *b*.

Compare *Conularia quadrisulcata*, Dalman, Vet. Acad. Handlingar, 1824, pag. 374, pl. 4, fig. 3.

Pyramidal, sulcated at the angles, gradually diminishing towards the apex; surface marked by regular lines of granulations or papillæ, which appear to be produced by regular transverse and longitudinal depressed striæ, the spaces between which are elevated ; shell slightly folded inward at the angles, forming a shallow groove, which is partially marked by the granulations ; lines of granulations slightly curving upwards, or towards the apex, at the angles.

This species is readily distinguished by the regularly arranged granulations, which are separated by equal transverse and longitudinal depressed lines. The surface is more coarsely marked than the last, and more distinctly granulated. These granules appear to be capable of separation from the shell, leaving small punctures ; or they are hollow pustules, which, when worn down, leave a small pit. Such a character is shown by D'ARCHIAC and DE VERNEUIL in the structure of *Conularia gervillei* and *C. gerolsteinensis*, from the older deposits of the Rhenish Provinces.

The specimen figured is completely flattened ; and the longitudinal and transverse wrinkles, shown in the figure, are, in part, due to this pressure. The fragment here given diminishes towards the apex less rapidly than either of the preceding.

Fig. 3 *a*. An imperfect specimen, of the natural size. *b*. A portion magnified.

Position and locality. This species occurs in the higher part of the Trenton limestone, near Middleville.

290. 4. CONULARIA GRACILE (*n. sp.*).

PL. LIX. Figs. 4 *a*, *b*.

Slender, conical or pyramidal, slightly bent or arcuate ; angles sulcate, and a scarcely conspicuous depressed line along the centre of each side ; surface marked by sharp undulating transverse striæ, and scarcely conspicuous longitudinal ones.

This species is more narrow and elongated than either of the preceding ; the grooves on the angles are shallow, and the shell has less the appearance of being folded inwards along this line. The transverse striæ are regularly arched downwards, or towards the mouth of the shell, between the straight longitudinal ones. The shell appears to be exceedingly thin and fragile.

The three last species are comparatively rare, while the first is abundant. They are apparently quite distinct in character, and, though much flattened, preserve the general aspect of other species of the genus. From the minute and indistinct markings, I had been inclined, on hasty examination, to refer them to the inner side of partially exfoliated shells of the *C. trentonensis ;* but that species never presents any similar markings, either as casts or partially exfoliated surfaces. We are able to add, therefore, to this genus, comparatively rare in species, four new forms from one of our older rocks, in a position lower than they have been before discovered.

Fig. 4 *a*. A specimen, natural size ; the apex broken off.
Fig. 4 *b*. A portion of the surface enlarged.

Position and locality. In the shaly upper part of the Trenton limestone near Middleville.

TRILOBITES OF THE INFERIOR STRATA.

It is in the Trenton limestone that we are first made acquainted with this class of animals, in any considerable number. In the preceding rocks, their remains are exceedingly rare and obscure. The few species known in the Chazy limestone are confined to a limited district, and to a small thickness of strata; and their condition, also, is such as to render their characters indistinct and unsatisfactory. In the Birdseye limestone, we are forced to depend on a few fragments for the determination of all we know in that rock. In the Trenton limestone, we have at least fifteen or sixteen well characterized species, and an immense number of individuals in a more or less perfect condition. They appear to have been as abundant, even, as the ORTHOCERATA of this rock, or of the Black-river limestone. If we were to designate this rock by its most striking, abundant, and peculiar fossils, it would very appropriately be termed the Older Trilobite limestone; for nowhere in the series do we find, in a single rock or formation, so many species as in this. We may indeed confidently rely upon these fossils alone to characterize the rock, at least throughout New-York, Canada, and some of the Western States. Those species in a lower position can scarcely lead to any confusion, since they are few in number, and rare in all the localities examined.

It is true that several species of this limestone reappear in the shales of the Hudson-river group; but it has already been shown how intimately related are these two formations, constituting, in fact, but a single natural group. This group, in its western extension, is characterized throughout by the presence of TRILOBITES, which, in New-York, are almost entirely restricted to the Trenton limestone. On this account, I have thought it better to arrange the species of this rock in connection with those occurring in the succeeding shales.

This arrangement seems the more necessary, since, in the western extension of this group, where the calcareous matter is augmented, many of the species continue throughout its entire thickness, terminating only with the deposit itself. The period of the existence of certain species in this position is limited in New-York solely by the cessation of calcareous deposits; since it is clearly shown, that in other situations, where the formation continued to be calcareous, they existed for a longer time.

I have already shown, in regard to the BRACHIOPODA and MONOMYARIA (and the same is true of other fossils), that the former are far more abundant in the Trenton limestone, in the calcareous part of the formation; while the latter increase in the Hudson-river, or in the shaly portion of the group. That all these changes are dependent on the nature of the sediment, can be clearly shown when we continue our observations to the western extension of the same formation. These facts should be borne in mind by the geological student, in his investigations of the New-York strata, and the same succession of strata elsewhere.

The general proposition regarding not only the TRILOBITES, but other fossils, may be stated thus: That all those forms requiring calcareous sediment for their full development, will flourish during the deposition of such material, but become diminished or entirely exterminated when a change to argillaceous or arenaceous deposits takes place. On the other hand, those forms which require a very small proportion of calcareous matter, and flourish in the argillaceous mud, are diminished or cease altogether when a calcareous deposition supervenes. The forms which maintain a bare existence through a series of calcareous deposits, become extensively developed so soon as the nature of the sediment changes; and the same may be said of those requiring calcareous sediment, during a period of argillaceous deposits.

Those changes in the nature of the sediment, which may affect the majority of species in the way we have mentioned, will, in others, produce a total destruction or extermination, because they are not adapted to encounter such extreme changes. This is, in a great degree, true of the TRILOBITES. Of the species known in the Trenton limestone of New-York, scarcely one fourth are found in the shaly strata which succeed; and, with two exceptions (the *Calymene* and *Trinucleus*), those which are known are extremely rare.

In a case like the present, where the higher shaly part of the formation much exceeds the lower calcareous part, reaching the thickness of nearly one thousand feet, we are very likely to lose sight of the characteristic fossils of the lower division of the group, and to regard them as of little or no importance in the identification of the higher strata. Neither are they, while the nature of the deposit continues uniformly argillaceous; but so soon as the calcareous matter is increased, we find, spontaneously as it were, the appearance of forms which we have before known in the lower part of the formation. We may recollect, however, that not only are certain families affected by this change in the sediment, but different species of the same family are differently affected. In the present instance, the *Triarthrus* and *Trinucleus* become more abundant in the shaly portion of the strata, and we find two other forms which have not been seen in the calcareous part of the formation.

Nearly all the characteristic genera of TRILOBITES appear at once during this period; and all the subsequent forms in our strata are referable to these, or some modification of them. Some of them, as *Phacops* and *Calymene*, are continued throughout the Silurian and Devonian rocks, with scarcely any modification of form in some species, while others present a wide departure from the original type. The *Platynotus*, *Illænus** and *Acidaspis*, reappear in the Upper Silurian strata; while *Trinucleus*, *Ceraurus*, *Isotelus*, *Asaphus* and *Ogygia*, are unknown beyond the strata of this period.

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* I refer here to *Bumastis barriensis* of the Niagara strata, which, though it may constitute a distinct genus, is nevertheless, constructed as the true *Illænus* in its important parts.

TRILOBITES OF THE BIRDSEYE LIMESTONE.

PLATE LX. (in part).

291. 1. OGYGIA? VETUSTA.

PL. LX. Fig. 1.

Compare *Asaphus tyrannus*, MURCHISON, Sil. System, pl. 24, and pl. 25, fig. 1 *a*, *b*.

Caudal shield obtusely subtriangular; middle lobe with 16 articulations, abruptly narrowing from above towards the middle, below which it is of nearly equal width; lateral lobes with 15 distinct segments, the posterior ones meeting the middle lobe at a very acute angle, and terminating in a thickened or recurved border; surface, near the margin, marked by imbricating lines or lamellose striæ.

The only specimen yet known is the caudal shield here figured; it bears a very close resemblance to the *A. tyrannus* of MURCHISON, and, from its geological position, it is doubtless a closely allied species. It will at once be recognized by the numerous segments of the caudal shield, the axis of which reaches only about $\frac{5}{7}$ of the whole length. A few of the last articulations of the lateral lobes are nearly parallel to the central lobe, while the first ones are nearly perpendicular to it. Each articulation of the lateral lobe is marked by a sudden and slight bending or contraction, about two thirds the distance from the axis to their outer extremity. The specimen is almost denuded of the crust, so that its original character cannot be entirely known.

I have referred this species to the Genus OGYGIA, on account of the striated or lamellose surface, which does not belong to any of the species of PHACOPS with which I am acquainted. In the absence of other portions of the fossil, this reference must be given with some hesitation. The surface markings of some species of ASAPHUS do not differ materially from this specimen, and it may prove to belong to that genus. In the present state of our knowledge, we must regard the ASAPHUS and OGYGIA as confined to the older silurian strata, appearing among the earlier forms of the Crustaceans, and limited to a single epoch of geological time.

Position and locality. In the compact Birdseye limestone of the Mohawk valley.

292. 3. ASAPHUS? EXTANS (*n. sp.*).

Pl. LX. Figs. 2, 2 *a*.

Buckler unknown; thorax with nine articulations visible, those of the lateral lobes bifurcate or grooved; caudal shield very convex, with the middle lobe very prominent and terminating abruptly behind, the posterior extremity much elevated above the margin; the three anterior segments of the middle lobe distinct, the posterior portion nearly smooth; lateral lobes each with five segments, the two last ones terminating in a thickened marginal expansion, which extends beyond the middle lobe; surface marked by fine imbricating lamellose striæ.

Two individuals only have been seen, and both these are from the Birdseye limestone. The fossil is remarkably distinct from the last, and is easily distinguished from any other in the lower strata, by the prominent projecting central lobe of the caudal shield, and the thickened margin.

This species, having nine or more articulations of the thorax, varies from the true Asaphus, and, in this and some other characters, approaches to Phacops. The caudal shield, however, showing but three distinct articulations in the axis, has more the character of Asaphus, to which genus I have provisionally referred the species.

Fig. 2 *a*. A caudal shield. *b*. Lateral view of the same.
Fig. 2 *c*. Another fragment, showing nine articulations of the thorax.

Position and locality. In the Birdseye limestone of the Mohawk valley, and in the same position near Watertown. (*Cabinet of* John Gebhard, Jr., *and of* Dr. Emmons.)

293. 1. CALYMENE MULTICOSTA (*n. sp.*).

Pl. LX. Fig. 3.

Thorax and caudal shield with at least 25 articulations.

The specimen is from the Birdseye limestone of Ile la Motte, and, though very obscure, is evidently distinct from any thing we know in the older strata of New-York. The figure is presented in the hope of calling attention to the occurrence of such a species, and the explorations in Vermont will doubtless bring to light more specimens.

Position and locality. Associated with *Illænus* and *Orthoceras*. Ile la Motte, Lake Champlain. (*State Collection.*)

TRILOBITES OF THE TRENTON LIMESTONE.

Plates LX. (in part), LXI. – LXV., & LXVI. (in part).

40. 2. ILLÆNUS CRASSICAUDA.

Pl. LX. Figs. 4 *a*, *b*, *c*, *d*.

Entomostracites crassicauda. Wahlenberg, Nov. Act. R. Soc. Sc. Upsal, 1821, Vol. viii, pag. 27, no. 2, tab. 2, fig. 5 & 6; and pag. 294, no. 1, tab. 8, fig. 5 & 6.
Illænus crassicauda. Dalman, Vet. Acad. Handlingar, 1826, pag. 248, pl. 5, fig. 1 *a*, *b*, *c*.
— — Hisinger, Leth. Suecica, 1837, pag. 16, tab. 3, fig. 4.
— — Portlock, Geol. Rep. Londonderry, 1843, pag. 300, pl. 10, figs. 3 *a*, 3 *b*, 4, 5.
Illænus trentonensis. Emmons, Geol. Report, 1842, pag. 390, fig. 3.
Compare *Illænus perovalis*, Murchison, Sil. System, 1839, pag. 661, pl. 23, fig. 7 *a*, *b*.

Oval with the longer axis more or less extended, convex; buckler large, convex, rotund; posterior extremities obscure; eyes prominent, distant from the axis; maxillary shield small; thorax distinctly three-lobed, the divisions continuing a short distance into both the cephalic and caudal shields; articulations ten, smooth, slender, those of the lateral lobes extended; caudal shield large, semicircular, convex, having the rudiment of a central lobe; entire surface smooth, or with fine curving subimbricating lamellose striæ.

The general form of this species is variable from its contractility, none of the individuals yet seen being quite perfect. It is distinguished from Isotelus by the number of articulations, and by the more rotund and less equal extremities.

In the rocks of New-York, the cephalic and caudal shields of this fossil are frequently found; but from the delicacy of the articulations of the thorax, they are rarely preserved.

Fig. 4 *a*. The caudal shield of a large individual.
Fig. 4 *b*. Middle lobe of the cephalic shield, the lateral portions being separated at the sutures.
Fig. 4 *c*. Lateral view of a small entire specimen.
Fig. 4 *d*. Dorsal view of the specimen, showing the great width of the middle lobe, and abrupt incurving of the cephalic shield.

Position and locality. In the Trenton limestone at Middleville, Watertown, Turin (New-York), Carlisle (Pennsylvania), and in the upper part of the Birdseye limestone on Ile la Motte (Vermont).

294. 3. ILLÆNUS TRENTONENSIS.

PL. LX. Fig. 5.

Bumastis trentonensis. EMMONS, Geol. Report, pag. 390, fig. 1.

General form oval-ovate, very convex; buckler semicircular, rounded and ventricose in front, elevated behind; glabella scarcely distinct, narrow in the middle, but expanding before; eyes approximate, large, form? facial suture making a deep and abrupt sinus at the eyes, from whence it turns outward and backward; central lobe of the thorax broad; segments plane, flat, continuing into the lateral lobes; longitudinal furrows shallow, undefined, slightly continuing into the buckler, and less distinctly into the caudal shield; caudal shield subtriangular, very convex in the middle, and descending abruptly at the sides, the margin slightly expanded. Surface marked by fine converging imbricating striæ, as in other specimens of the genus.

This rare fossil was obtained by Dr. EMMONS, from a boulder near Hogansburgh (N.Y.); but from other associated fossils, it clearly belongs to the Trenton limestone.

The original of the perfect specimen has been lost, and our description is taken from a plaster cast. I have placed it under the Genus ILLÆNUS, to which it properly belongs, the distinctions between this genus and the BUMASTIS being scarcely decisive.

295. 4. ILLÆNUS LATIDORSATA (*n. sp.*).

PL. LX. Figs. 6 *a*, *b*.

General form broadly elliptical; buckler convex, ventricose, thickened in front; thorax with ten narrow articulations; middle lobe of the thorax very broad; lateral lobes narrow; surface marked by prominent imbricating lamellose striæ.

The specimen is a fragment, preserving five of the articulations very distinctly, and fragments of five others in the stone. The buckler is crushed and broken, so that it cannot be perfectly represented. The articulations are very slender, those of the lateral lobes being suddenly bent forward just outside of the longitudinal depression. The great width of the central lobe (which is four times wider than the lateral lobe), the well defined longitudinal groove, and sudden bending forward of the articulations of the lateral lobes, are distinguishing features, and show it to be clearly distinct from the two preceding species.

Fig. 6 *a*. The fragment, natural size.
Fig. 6 *b*. Three of the articulations enlarged, showing the lamellose striæ.

Position and locality. In the Trenton limestone near Watertown (New-York).

(*Cabinet of* MR. ALEXANDER FITCH.)

43. 1. ISOTELUS GIGAS.*

PL. LX. Figs. 7 *a – i*; PL. LXI. Figs. 3 *a – m*, & 4 *a b c*; PL. LXII. Figs. 1 *a b c*, & 2; and PL. LXIII.

Asaphus platycephalus. STOKES, Trans. Geol. Soc. London, New series, 1822, Vol. i, p. 208, pl. 27.
Isotelus gigas, and *I. planus.* DE KAY, 1824, Ann. Lyc. Nat. Hist. New-York, Vol. i, pag. 176, pl. 13, fig. 1, 2; and pl. 13, fig. 1, 2.
Isotelus gigas. GREEN, Monograph, 1832, p. 67 & 68.
Isotelus cyclops, *I. megalops*, and *I. stegops.* ID. Ib. p. 69, 70 & 71.
Asaphus platycephalus. BUCKLAND, Bridgw. Treatise, Vol. ii, pag. 76, pl. 45, fig. 12.
Isotelus gigas. VANUXEM, Geol. Rep. New-York, 1842, pag. 46, fig. 1.
— — EMMONS, Geol. Rep. New-York, 1842, pag. 389, fig. 1.
Isotelus gigas, and *I. planus.* PORTLOCK, Geol. Rep. Londonderry, 1843, pag. 295, pl. 7, figs. 1, 2 & 3.
Compare *Asaphus cornigerus*, BRONGNIART, Crust. fossiles, 1822, pag. 18, pl. 4, fig. 10 (not pl. 2, fig. 1 A, B).
Brongniartia isotela, EATON, Geol. Text-Book, 1832, pl. 2, fig. 19.
Asaphus powisii, MURCHISON, Sil. System, 1839, pag. 661, pl. 23, fig. 9.
Isotelus powisii, PORTLOCK, Op. cit. pag. 297, pl. 6, fig. 1.
Isotelus ovatus, *I. intermedius*, *I. sclerops*, and other figures. PORTLOCK, Op. cit. pag. 297 – 299, plates 6, 8, 9 & 10.
Isotelus megistos, LOCKE, Am. Jour. Science, 1842, Vol. xlii, p. 366.
— — Trans. Assoc. Am. Geologists and Naturalists, 1843, Vol. i, pag. 221, pl. 6.

General figure oval-oblong, with the sides rather straight; buckler in the form of "a spherical triangle," obtuse or more or less rounded at the posterior extremities; cephalic shield convex in the middle, rapidly descending in front and at the sides, margined by a narrow elevated rim or border; eyes sublunate, prominent, "subpedunculated," strongly supported on the inner and concave side by a projection of the glabella; facial suture continuing from the centre of the front, nearly parallel to the margin, until in a line with the eye, when it turns backward, and leaving the eye upon the maxillary portion, turns outwards and backwards, coming out at the base of the shield distant from the angle; thorax with eight articulations, the middle lobe about once and a half the breadth of the lateral lobes, the longitudinal grooves continued slightly into the buckler, and more distinctly into the caudal shield; segments of the middle lobe flat above, those of the lateral lobes with a groove on their upper surface, extending nearly half way to their extremities; caudal shield of nearly the same form as the buckler, presenting externally some evidence of a trilobate character, sharpened at its upper lateral angles, and having a single transverse groove on each of the lateral lobes extending from the axis more than half way to the margin; entire surface finely punctulated.

When the crust of the buckler is removed, a narrow shallow groove is visible at the base. In young specimens the caudal extremity is more pointed, and presents the marks of eight anchylosed articulations; in older specimens, these increase in number, but the external

* I have adopted the name of DE KAY, though aware that the name of STOKES has precedence in point of time. If it be proved that ISOTELUS cannot be separated from ASAPHUS by any important characters, we must abandon the genus; but at present it is well known to all American naturalists, and a change of name would not be attended with any beneficial results.

crust presents scarcely any traces of them. When the crust is removed, however, they are often very distinct (as in Pl. 61, fig. 3 *g*). When the thick crust of the margin of the caudal shield is separated, the lower part presents a striated surface, which is also common to corresponding parts in the buckler, and apparently to the entire under surface of the animal, as well as to those portions of the articulations which come in contact with each other.

After examining several hundred specimens of all sizes, and in every possible degree of perfection, I am satisfied to refer all those of New-York to a single species. The models of Green present no greater differences in form than may be witnessed in specimens ordinarily found, and which, if regarded as specific, would give us a different species for nearly every individual; depending on difference of size, in the manner of being imbedded, the nature of the mass in which it is found, etc. The same remark will apply to several of the species given by Capt. Portlock. I have therefore thought it better to bring back the whole to the original species; believing that such a course will cause far less difficulty and confusion, than an attempt to identify and establish distinct species upon characters which are insufficient, or so variable as not to be relied upon.

Notwithstanding the great number of individuals which existed at the period of the Trenton limestone, it is extremely rare to meet with perfect specimens. This is, doubtless, in part owing to their great size, which exposed them to be more frequently broken, than the smaller species; but it would appear, also, that they were more easily separated at their joints and sutures, than some other species, as shown from the condition of the parts which we find. Owing to this circumstance, we are able to illustrate its structure more perfectly than in most other species; and I am induced to present many of these figures, not only with this view, but also to aid students in difficulties which I find are not uncommon in identifying isolated portions of the fossil.

Plate LX.

Fig. 7 *a*. A specimen preserving the thorax, caudal extremity, and central lobe of the buckler. (The base of the latter is too far extended in the engraving.) The caudal shield is denuded of the shell.

Fig. 7 *b*, *c*. The maxillary portions or cheeks of the buckler. These have been supplied from specimens which are frequently found separated from the other parts. E E. The eyes, which are always separated with the maxillæ.

Fig. 7 *d*. The inside of the lower crust of the cephalic shield, the upper part having been separated at the lateral suture.

Fig. 7 *e*, *f*. The lower side of the cephalic shield, towards the extremities of which the upper and lower crusts are folded together, so as to present the appearance of projecting spines.

Fig. 7 *g*. The epistoma or labrum, the place of which is indicated in the centre of the lower side of the previous figure. The epistoma is rarely found connected with the head of the fossil. It was attached by a suture, and probably easily separated. Two circular depressed spots are represented in the figure, which are always observed in well preserved specimens : these probably indicate the points for the attachment of muscles or tendons upon the inside. The horns or processes of this organ are flat on the outside, and angular on the inner side. The crust of the lower side of the head, as above, shows a longitudinal suture extending down the middle to the point of junction at the epistoma, but it does not continue into this organ.

Fig. 7 *h*. The central lobe of the cephalic shield.

Fig. 7 *i*. The same part of a larger individual. Specimens of this kind are very frequently found, and are sometimes mistaken for parts of other trilobites. The lateral or maxillary lobes of the buckler often remain connected, while the central portion is separated at the suture.

Plate LXI.

Fig. 3 *a*. The buckler of an individual of medium size. This is more extended in front, and the eyes are more prominent than usual.

Fig. 3 *b*. The caudal shield, corresponding in size to the buckler. The crust is removed, showing the lines of the articulations.

Fig. 3 *c*. A portion of the surface of the buckler enlarged, showing a peculiar punctate structure which is scarcely visible to the naked eye.

Fig. 3 *d*, *e*. Lateral and dorsal view of a small perfect specimen. The figure preserves all the important marks of the species. The buckler is somewhat compressed or bent in front, so that the facial suture is not shown to its full extent. This specimen is from Kentucky.

(*Cabinet of* W. H. Pease.)

Fig. 3 *f*. Buckler of an individual of ordinary size. The eyes are prominent, but less proportionally elevated, and the whole less convex than the specimen 3 *a*. The course of the facial suture is distinctly visible.

Fig. 3 *g*. Caudal shield corresponding in size to the buckler 3 *f*. The marks of the transverse segments scarcely visible.

Fig. 3 *h*. View of the eye of 3 *f*, natural size, as seen looking forwards and outwards.

Fig. 3 *i*. Oblique front view of the eye, which, under ordinary magnifying glasses, presents no granulations.

Fig. 3 *k*. The labrum or epistoma, showing the inner or upper side.

Fig. 3 *m*. A portion of the same enlarged, showing the striæ upon the surface.

Fig. 4 *a*, *b*, *c*. Front, lateral, and dorsal views of the original specimen, to which Green applies the name of *I. cyclops*. Its proportions vary in no essential manner from other individuals of *I. gigas*. It is abruptly bent downward before, and the sides of the buckler are worn off, giving it the appearance of being narrower than usual. The whole specimen is much worn, and the crust almost entirely removed. The bases, only, of the eyes remain, which are round; but this is true of all the others, when worn off in the same manner.

Plate LXII.

Fig. 1 *a*. A specimen folded so that the two extremities meet. The fossil is rarely found in this condition; and in many instances where it has originally assumed this form, it has been subsequently crushed.

Fig. 1 *b*. The caudal shield of a young individual, showing the marks of the articulations, and preserving the trilobate form more perfectly than older specimens.

Fig. 1 *c*. A magnified portion of the surface of one of the articulations of a large individual, showing, in addition to the punctures upon the surface, a series of curving impressed lines. The latter are not observed upon the buckler or caudal shield, which preserves a double series of punctures as shown in Pl. 61, fig. 3 *c*.

Fig. 2. This specimen has the crust almost entirely removed. The upper part of the cephalic shield has been separated at the marginal suture, leaving the lower portion with the epistoma attached, as represented in the figure. The position of the eyes is represented by the letters *e e*. This interesting specimen was obtained by Mr. BULLIONS, Civil Engineer, from the Utica slate on the Mohawk valley, and by him presented to the Cabinet of the Albany Institute.

PLATE LXIII.

The lower figure represents the caudal shield, and five of the articulations of a very large specimen, from the Collection of Mr. MOORE, of Trenton Falls. The superior covering is removed, showing the converging striæ in the deep groove along the margin. This individual, when perfect, could not have been less than nine or ten inches in length. The buckler is of nearly corresponding size. The narrow thickened border, and course of the facial suture, are well shown in this specimen. The posterior angles are represented in the figure too much rounded, the one from being broken, and the other from being covered by the stone. The eyes are nearly perfect and remarkably prominent.

Position and locality. In certain portions, particularly the black fine-grained layers, of the Trenton limestone, this species is often abundant, though perfect specimens are exceedingly rare. The bucklers, caudal shields, and fragments of the thoracic segments, are met with in nearly every locality of this rock in the State of New-York. Beyond the limits of New-York, we know of its existence in Canada, Ohio, Indiana, Kentucky and Tennessee, being equally characteristic of the Lower Silurian rocks in all these places. In our own State, it is occasionally found in the Utica slate and Hudson-river group, though it does not appear to have flourished in these situations.

In Ohio, one or two other species have been described as occurring in the lower strata ; but in no instance, within my knowledge, has it been found in any rocks above the Hudson-river group. The species, therefore, and even the genus, may be regarded as eminently characteristic of the inferior rocks ; and a single fragment, so far as our present knowledge extends, is sufficient to decide the age of the rock in which it occurs. The more calcareous nature of the older strata in their western extension, and perhaps other causes combined, have continued the existence of this species, in great numbers, long after it had nearly or quite ceased in New-York ; and its remains characterize the higher portions of the Blue limestone of Ohio, Indiana and Kentucky.

Genus PLATYNOTUS (Conrad).*

"Depressed, apparently not contractile; buckler with oculiferous tubercles situated on the front or middle lobe; abdomen with about 12 articulations; mesial and lateral lobes depressed; ribs with oblique grooves."

This description may be amended, so as to read: Buckler five-lobed, or with the central lobe trilobate; oculiform tubercles situated on the outside of the lateral divisions of the middle lobe (or of the inner lateral lobes); thorax with 11 articulations.

(These characters will be more fully illustrated under the descriptions of the genera of Trilobites.)

This genus was founded by Mr. Conrad, for the reception of the *Paradoxides boltoni* of the Niagara group. It is clearly distinct from any other established genus, unless it may be the *Lichas* of Dalman. The following species is clearly referable to this genus, possessing a very similar character to the *P. boltoni*. It is also probably identical with *Nuttainia hibernica* of Capt. Portlock, cited below, being a species of the same genus.†

296. 1. PLATYNOTUS TRENTONENSIS.

Pl. LXIV. Figs. 1 *a*, *b*, *c*, *d*, *e*.

Asaphus? trentonensis. Conrad, Jour. Acad, Nat. Sciences, 1842, Vol. viii, pag. 277, pl. 16, fig. 16.
Compare *Nuttainia hibernica*, Portlock, Geol. Rep. Londonderry, 1843, pag. 274, pl. 1, fig. 1 *a*, *b*, *c*, *d*; and pl. 5, figs. 1, 2, 3.

Buckler ventricose, granulated or pustulate, somewhat five-lobed; glabella clavate, narrow behind, arched and expanded in front, extending beyond the centre of the inner

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* Ann. Geol. Rep. New-York, 1838, p. 118.

† The very curious reasoning adopted by Capt. Portlock in establishing the Genus *Nuttainia* of Eaton, has induced me to give the generic description of *Platynotus* in this place.

The Genus *Nuttainia* of Eaton was founded upon a specimen of *Trinucleus* obtained from the slates of the Hudson-river group, near Waterford (New-York), the one which Green afterwards acknowledged to have received from Eaton, being the same species on which he founded his Genus *Cryptolithus*. The *Nuttainia sparsa* of Eaton was a specimen of the central lobe of the buckler of *Dipleura* (*Homalonotus*) *dekayi*, preserving a very prominent elevated band or articulation at the base, which was mistaken for the front of the buckler. Both the specimens alluded to were collected by myself, and are still in my cabinet.

Although the descriptions of Eaton may have been imperfect, there was no reason for removing the species *N. concentrica* to the Genus *Cryptolithus*; and still less, if possible, for allowing the other fragment to remain as the representative of the Genus *Nuttainia*, when it is unequivocally a part of the *Dipleura dekayi*. Neither do I conceive it proper to attempt to restore the Genus *Nuttainia*, by applying the name to so entirely different a form from that intended by its author, even should *N. hibernica* be found generically distinct from *Platynotus*. That genus must remain as a synonym of *Trinucleus*, which has priority of date; though *Nuttainia* was established before *Cryptolithus*, and, after *Trinucleus*, is the most appropriate name. The Genus *Metopias* of Eichwald may, perhaps, be identical with *Platynotus*; but I have not seen his description or figures.

The fact that the Genus *Platynotus* is already in use among the Coleoptera, is not a sufficient argument for rejecting it in this place.

lateral lobe; pygidium composed of two or three articulations above, with a fourth and last which is very long, and abruptly narrowing towards the extremity; lateral lobes with three articulations on each side, which are marked by a narrow groove for about one third of their length; central lobe separated from the lateral lobe by a deep narrow groove.

The specimens which we possess are too imperfect to give a complete description of the fossil. Two of these are from Carlisle (Pa.), being the same figured by Mr. Conrad as cited above. It is certainly quite distinct from Asaphus, and clearly referable to Platynotus, when compared with specimens from Lockport, which have the posterior part of the glabella much narrower proportionally, and the entire fossil is less convex. The Lockport species likewise differs in the anterior extension of the buckler, which is not shown in our specimens, or in those figured by Capt. Portlock. The articulations of the thorax differ in their character; and the posterior extension of the middle lobe of the caudal shield is much narrower in the Trenton species, than in the other. This feature is shown in our figures, as well as in those of Portlock before referred to.

Emmrich, in his description of Nuttainia, quotes *N. hibernica* as the typical form, remarking that "a perfectly corresponding species occurs at Lockport in North America." I have already remarked that the Lockport species is distinct from the one under consideration, as well as from the figures of Portlock; and the specimen referred to must be either distinct, or not from Lockport.

Fig. 1 *a*, *b*. Portions of the buckler and caudal shield of this species.
Fig. 1 *c*. A fragment of the buckler, more compressed than the preceding.
Fig. 1 *d*. A magnified portion of the crust, showing the pustules upon the surface.
Fig. 1 *e*. This figure is from a plaster cast of a specimen, the original of which is in the cabinet of Mr. Carly of Cincinnati. The specimen is from the Blue limestone of Ohio, and is apparently identical with our species. The oculiform tubercles are well preserved, but their true character cannot be learned from a cast.

Position and locality. This species, so far as known, is confined to the Trenton limestone, or rocks of the same period. The specimens 1 *a*, *b*, are from Carlisle (Pa.), where they are associated with other Trenton limestone fossils. Fig. 1 *c* is from Middleville (N. Y.). Fig. 1 *e* is from a corresponding position at Cincinnati (Ohio).

It is an interesting fact, that species of this genus appear in three distinct positions in the Silurian strata; the first in the Trenton limestone, the second in the Niagara group, and the third in the Delthyris shaly limestone, which we must regard as near the termination of the Silurian period.

297. 1. CALYMENE BECKII.

PL. LXIV. Figs. 2 *a, b, c, d, e.*

Brongniartia carcinoidea EATON, 1832, Geol. Text-Book.
Triarthrus Beckii. Monthly Journal of Geology, 1832, p. 560.
— — GREEN, 1832, Monograph, pag. 87, fig. 6 (cast no. 34).
— — HARLAN, 1835, Trans. Geol. Soc. Pennsylvania, Vol. i, p. 105.
— — ID. 1840, Med. and Phys. Researches.
Paradoxides Beckii, and *P. Eatoni.* HALL in Am. Jour. Science, 1838, Vol. xxxiii, p. 137.
Atops trilineatus. EMMONS, Taconic System, 1844, p. 20, figs. 1, 2.
— — ID. Agr. Rep. New-York, 1846, pag. 64, figs. 1, 2. (See Pl. lxvii of this volume.)

General form an elongated ellipse, with the posterior extremity narrower, and the sides often straight; buckler broadly semioval, the posterior angles rounded; glabella of equal width from base to front, rounded before, deeply trilobate on each side, with a prominent thoracic ring at the base; frontal lobe narrowed longitudinally; thorax with thirteen segments, those of the central lobe with a short spine or tubercle upon the back, those of the lateral lobes deeply grooved along the centre; caudal shield with six or seven segments in the middle lobe, and five in the lateral lobes; posterior extremity obtuse.

This fossil is of rare occurrence in the Trenton limestone; but since it has been found in this rock, I have given it among the other forms associated in the same position. In the compact limestone it presents a very symmetrical form, and is usually more perfectly preserved than in the Utica slate, where it is more abundant.

Fig. 2 *a.* An imperfect specimen, preserving the thorax and caudal shield, and the left maxillary portion of the buckler.

Fig. 2 *b.* A perfect specimen, with the exception of the maxillary portions, which are separated at the facial suture.

Fig. 2 *c.* A similar specimen, preserving the maxillary parts, which give a different outline to the cephalic shield.

Fig. 2 *d.* Part of a single articulation enlarged, showing the spine upon the centre, with papillose surface.

Fig. 2 *e.* A portion of the surface of the buckler enlarged, showing the papillose character of the surface.

For further illustrations, see Trilobites of the Utica slate, Plate LXVI.

Position and locality. This species is found in the Trenton limestone at Middleville and other places, but is rare in this position. It is one of the most abundant and characteristic fossils of the Utica slate, and is more rarely found in the shales of the Hudson-river group. It occurs in several western localities, being common in the soft shales of the Blue limestone formation at Cincinnati and elsewhere. (*State Collection.*)

298. 2. CALYMENE SENARIA.

Pl. LXIV. Figs. 3 *a* – *n*.

Calymene Blumenbachii. Green, Monograph, 1832, pag. 28 (Cast no. 1).
— *callicephala*. Id. Ib. pag. 30 (Cast no. 2).
— *selenecephala*. Id. Ib. pag. 31 (Cast no. 3).
— *senaria*. Conrad, Ann. Geol. Rep. New-York, 1841, p. 49.
— — Emmons, Geol. Report, 1842, pag. 390, fig. 2.
Compare *Calymene Blumenbachii*, Brongniart, Dalman, Wahlenberg, Hisinger, Murchison, &c.
See also *Calymene Blumenbachii* of the higher strata of New-York, in this Report.

Buckler semicircular or sublunate, regularly rounded in front, or slightly projecting in front of the glabella, with a distinct thoracic ring at the base; posterior angles subacute or rounded; glabella separated from the cheeks by a deep broad groove, wider behind or often of nearly equal width throughout, with three tubercles or lobes on each side, the anterior one often obscure; cheeks triangular; eyes truncato-conical, situated a little outward from the inner edge of the cheek; facial suture terminating nearly in front of the eye; thorax with thirteen segments, those of the lateral lobes with a deep groove extending from the base more than half way to the extremities; caudal shield small, with seven segments in the middle lobe and five in each lateral one, the latter with an impressed line or shallow groove the whole length.

This species is very abundant in the dark compact portions of the Trenton limestone, though perfect individuals are comparatively rare.

A comparison of specimens from this rock in New-York and Ohio, with those from Gothland in Sweden, shows no essential difference. The only difference in the Niagara specimens is a rougher granulation of the surface, and a slightly greater width of the front of the glabella, which latter character is variable from different causes. The large specimens from the Schoharie grit present a slight difference in the direction of the facial suture, as well as some other characters which may prove essential in the designation of the species.

On comparison with a well preserved specimen of the *Calymene blumenbachii* from Dudley in England, the most obvious difference consists in the slight but conspicuous tuberculation of the segments of the middle lobe of the thorax, at their extremities. The articulations of the lateral lobes of the caudal shield show a strong impressed line towards their extremities, but not towards the base, as in well preserved Trenton specimens. The glabella of the Dudley specimen is broader in front than that of the Trenton species, and its surface is more coarsely granulated. In other respects, the two resemble each other.

Fig. 3 *a*. A large specimen from the Trenton limestone, with the buckler abruptly curved downward in front. This specimen is of unusually large size.
Fig. 3 *b*. A small specimen from the same rock. 3 *c*. Lateral view of the same.
Fig. 3 *d*. A small specimen from the Hudson-river group, showing no essential difference of character.
Fig. 3 *e*, *f*, *g*. Three views of a contracted specimen from the Blue limestone of Ohio.
This is the *C. callicephala* of Green; but I am unable to perceive any essential dif-

ference between it and specimens of the same size from Trenton falls. The buckler is somewhat flattened on the top, and the lobes of the glabella are more distinct than is usual in this species. I have examined the original specimen described by GREEN, which presents scarcely so great a deviation from the prevailing forms as does this one. The figure of BURMEISTER, who adopts this species, is widely different from the original, in the cabinet of J. P. WETHERELL, Esq., which is now in the Academy of Natural Sciences of Philadelphia.

Fig. 3 *h*. Lateral view of the eye of this species, enlarged. The eye is obtusely conical, with a depression or cavity at the apex, which is granulated as shown in fig. 3 *i*. From the oblique conical form, this depression opens outwards and upwards, being protected on all sides by a thick crust. This portion may have been originally of softer material, which contracted on the death of the animal.

Fig. 3 *k*. The buckler of this species separated at the facial sutures, showing the form of the maxillary portions γ γ, which embrace more than half the oculiform tubercle.

Fig. 3 *l*. Front view of the buckler, showing the termination of the facial sutures. λ is the labrum, which occupies this position beneath the buckler; but I have not been able to determine the exact form and proportion of the part intervening between this and the front of the glabella, to which it is attached by a suture.

Fig. 3 *m*. The same enlarged, showing the lines of the frontal suture, and the termination of the facial sutures.

Fig. 3 *n*. The inside of the glabella, having the maxillary and basal portions separated.

It is evident that the characters of the eyes, or oculiform tubercles, in CALYMENE, have not been well understood, from the usually ill preserved condition of this part of the fossil. The granulations mentioned, though not as regular or strongly marked as in PHACOPS, are nevertheless interesting and important, since this small oval part of the tubercle must have been alone the seat of vision. The labrum figured was discovered beneath the glabella of a specimen, its posterior extremity extending back as far as the first segment of the thorax. See also the same organ in *C. beckii*, Pl. 66.

Position and locality. This species is abundant in the Trenton limestone, at many localities. The vicinity of Middleville and Trenton falls has furnished many thousands of specimens in a more or less perfect condition. It occurs also at Herkimer, Jacksonburgh, Turin, Lowville and Watertown; and at Plattsburgh, Glen's falls, and other places in the Hudson and Champlain valley. It is likewise common in the same rock at Bay Quinta and other places in Canada.

It is found in the Hudson-river group at Turin, Lowville and elsewhere, and it appears to be almost equally abundant in the western extension of this group; occurring at Cincinnati, Lebanon, Oxford and other places in Ohio; at Maysville and Frankfort, Kentucky; at Madison, Indiana; and at Mineral Point, Wisconsin.

This is one of the most abundant and widely distributed fossils of any in our palæozoic strata; and the only detraction from its value in the identification of strata, is the great similarity or absolute identity of the species in the shale of the Niagara group.

(*State Collection.*)

Genus ACIDASPIS (Murchison).

ODONTOPLEURA (Emmrich).

I prefer to adopt the name of Murchison, which is well understood in its application to a species in the central or higher Silurian strata of New-York. It is not easy to determine whether the name of Murchison or Emmrich has priority in regard to time; the works of the former, and the dissertation of the latter, bearing the same date.

Dr. Loven (*Ofv. Vet. Acad. Sci. Stockholm*, 1845) has attempted to show the identity of Acidaspis, Odontopleura and Ceraurus; but the latter genus is quite distinct, as I shall show in the succeeding pages.

299. 1. ACIDASPIS TRENTONENSIS.

Pl. LXIV. Figs. 4 *a, b, c, d, e, f.*

Compare *Ceraurus crosotus,* Locke in Am. Jour. Science. 1843, Vol. xliv, no. 2, p. 346.
Odontopleura ovata, Emmrich, Dissertation, 1839.
— *bispinosa,* Id. Scient. Memoirs, 1845, Vol. iv, part 14, pag. 275, pl. 4, fig. 12.

Cephalic shield subcrescent-form, broadly rounded and dentated in front, produced into elongated spines at the posterior angle, the connate segment at the base distinct; glabella of nearly equal width, somewhat straight, and having a projecting spine at the posterior margin, and two distinct rounded lobes or tubercles on each side, or in the furrow between the glabella and cheeks, being nearly disconnected with the former; cheeks with a longitudinal or slightly oblique groove from the inner posterior base of the eye, extending forward, and a ridge from the front of the eye, extending forward and inward along the facial suture; outer margin of the maxillæ fimbriated; eyes round smooth tubercles; body ten-jointed; lateral lobes with a row of small tubercles on the anterior edge of each articulation; caudal shield two-jointed, with a spinous margin.

In our specimen, both the spines from the angles of the buckler, and the one from the posterior part of the glabella, are broken off. That they existed in accordance with other species of the genus, is clear from the appearance of the remaining portion. The extremities of the pleura, or lateral articulations, are prolonged into short spines as in the *Odontopleura bispinosa* of Emmrich cited above, and in the figure of the same species given by Burmeister; but the character of the caudal extremity, and the serratures on the margin of the buckler, as well as the tubercles of the middle lobe of the thorax, as represented by these authors, are different from our specimen. The form of the buckler, the tubercles of the glabella, eyes, etc., clearly point to *Acidaspis* of Murchison. We have another analogous species in the Delthyris shaly limestone, which resembles the *Acidaspis brightii* of England.

I have examined fragments of a similar species in the collection of Mr. Carly of Cincinnati; but the fimbriæ beneath the maxillæ in that one are longer and fewer in number, which I conceive to be a specific distinction. In that species, the central posterior spine of the buckler is very long, extending half the length of the thorax.

A comparison of our species with the one figured and described by Dr. Locke (cited above), shows several points of resemblance. The fimbriæ beneath the maxillæ are the same in number; but the representation of the cephalic shield, particularly the glabella, is quite different, as also the nodes or tubercles upon the segments of the thorax. These differences are clearly distinguishable on a comparison of the figures. The species of Locke is undoubtedly an *Acidaspis*, and not a *Ceraurus*, which differs in many essential characters.

Fig. 4 *a.* Front view of the specimen, which is folded (natural size).
Fig. 4 *b.* The same enlarged, to show more distinctly this part of the fossil.
Fig. 4 *c.* Dorsal view (natural size). *d.* The same enlarged.
Fig. 4 *e.* The caudal extremity and part of the thorax enlarged.
Fig. 4 *f.* Margin of the maxillæ enlarged, showing the fimbriæ.

Position and locality. I have received this specimen from Mr. Logan, the Geologist of Canada, who obtained it, with the *Calymene senaria* and other Trenton limestone fossils, at the Bay of Quinta on Lake Ontario.

300. 2. ACIDASPIS SPINIGER (*n. sp.*).

Pl. LXIV. Fig. 5.

Glabella oval, margined laterally by a deep broad groove, front nearly straight, posteriorly extended into a strong spine; surface tuberculated.

This fragment is all that I have seen of this species within the State of New-York: another similar one, with a spine an inch in length, has been obtained by Mr. Logan near Montreal. The western species alluded to, bears some analogy to this one.

I have referred this fragment to the Genus Acidaspis, from the long posterior spine of the glabella, which is known to me as occurring only in this genus and Trinucleus. The tuberculated surface is likewise peculiar, and different from that of other genera in the lower strata.

Position and locality. In the central part of the Trenton limestone in the Mohawk valley, and in a similar position near Montreal.

301. 2. CERAURUS PLEUREXANTHEMUS.

PL. LXV. Figs. 1 *a – n*; and PL. LXVI. Figs. 1 *a – h*.

Ceraurus pleurexanthemus. GREEN, 1832, Monograph, pag. 84, fig. 10 (Cast no. 33).
Calymene? speciosus, DALMAN HISINGER, Leth. Suecica, Suppl. 2, 1840, pag. 6, pl. 39, fig. 2.
— — DALMAN, Palæaden, p. 74; Vet. Acad. Handlingar, 1826, p. 285, who quotes *Trilobites indeterminatus,* STERNBERG in Verhandl. des Gesellsch. des Vaterl. Museums in Bohemie, pag. 85, tab. 1, fig. 5.
Amphion gelatinosus. PORTLOCK, Geol. Rep. Londonderry, 1843, pag. 289, pl. 3, fig. 4 *a, b, c.*
Compare *Trilobites ignotus,* BRONGNIART, Crust. fossiles, 1822, pl. 4, fig. 11.
Calymene? verrucosa, DALMAN, Vet. Acad. Handlingar, 1826, p. 285.
Trilobites (Calymene?) verrucosa, Dr. LOVEN, Ofv. Vet. Ac. Forhandl., March 1845, p. 52, t. 1, f. 5 *a b c.**

Buckler crescentform, with a prominent connate articulation at the base, and the posterior angles extended into long curved spines; eyes small, distant, sublunate, granulated (not reticulated); glabella clavate, more or less convex, deeply four-lobed on each side, leaving the front one broader; thorax with eleven articulations; caudal shield with four (scarcely five) anchylosed articulations in the axial lobe, and three on each lateral lobe, the upper of these lateral articulations thickened and extended into a long curved spine, the others terminating in blunt points; surface entirely papillose or granulated, the buckler with scattered larger tubercles; two ranges of small papillose tubercles along the central lobe, and three ranges of mammillary tubercles on each lateral lobe; labrum ovate, attached to the front margin of the glabella by a straight suture.

The above description comprises the most essential characters of this peculiar Trilobite, which is presented to us under a variety of obscure phases, no single specimen exhibiting all the essential characters. The whole surface, when perfect, is papillose. Upon all parts of the cephalic shield are interspersed small mammillary tubercles, and two similar ones on each articulation of the axial lobe, making two ranges of tubercles. Each articulation of the lateral lobes, presents three large mammillary tubercles; the first formed by an oblique furrow from the upper side of the articulation, downwards and outwards; the third, by a furrow from the upper edge, downwards and inward, or toward the axis: the meeting of these furrows leaves above them the second, or middle tubercle (see Plate lxvi, figs. 1 *a* and 1 *e*). This remarkable feature is unknown to me in any other trilobite.

The ovate labrum attached directly to the front of the glabella, is shown in Plate lxv, fig. 1 *d e*. From each upper angle of the labrum commences the facial suture (more distinctly shown in Plate lxvi, fig. 1 *a e*), which, proceeding to the eye in a slightly curving line, divides the oculiform tubercle, and thence slightly ascending to the junction of the marginal fillet, it bends abruptly downwards.

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* I have referred to this species, which appears to be a true *Ceraurus* allied to the *C. pleurexanthemus;* and since its geological position is very similar, judging from the locality (Llandeilo), its occurrence is doubly interesting.

Plate LXV.

Fig. 1 *a*. A nearly entire specimen, with the maxillary portions obscure or partially removed.

This is the original specimen upon which Prof. Green founded the Genus Ceraurus. The buckler is partially crushed and obscured by soft shaly matter, and the oculiform tubercle very imperfectly preserved. The posterior prolongations of the buckler are distorted and obscure, as are also the spines proceeding from the caudal shield. Although very obscure, a careful examination shows that the structure of the articulations, form and lobes of the glabella, correspond with the better preserved specimens represented in the succeeding figures.

Fig. 1 *b*. A specimen of the same partially folded, with the buckler curved forward and the margin broken off. The crust is partially exfoliated, so that the surface markings are not well preserved.

Fig. 1 *c*. Front view of the buckler, showing the junction of the epistoma.

Fig. 1 *d*. A large imperfect specimen of the same species, showing more distinctly the peculiar structure of the articulations. The buckler is imperfect, but still partially preserves the posterior spines. The caudal spines are broken off.

Fig. 1 *e*. Lower side of the buckler of the last, showing the epistoma joined by a straight suture to the front of the glabella.

Fig. 1 *f*. A separated labrum, with upper margin broken off, being the form in which they are usually found in the rock.

Fig. 1 *g*. A buckler, with the maxillæ removed.

Fig. 1 *h*, *i*. The glabellæ of two large individuals. Such fragments are very frequently found, while perfect specimens are exceedingly rare. 1 *i**. A magnified portion of the surface.

Fig. 1 *k*. A caudal shield, with the spines removed.

Fig. 1 *l*. The spines of the caudal extremity, with a single articulation connecting them. View from the lower side.

Fig. 1 *m*. The caudal shield, with the spines attached. This specimen preserves the characteristic features of this part of the fossil in great perfection. The spines are attached to the first segment only, which is enlarged and greatly expanded laterally, and, as it curves downwards, throws out a process above, to which the segments of the thorax are joined. 1 *m**. A magnified portion of the surface.

Fig. 1 *n*. A transverse section, showing the elevation of a segment, and the lateral extension of the articulations into fin-like processes.

Plate LXVI.

The specimens illustrated upon this plate were obtained after the previous plate had been engraved.

Fig. 1 *a*. A fragment of a large individual, preserving the buckler and eight articulations of the thorax. The surface is beautifully and evenly granulated or papillose, with larger tubercles upon the cephalic shield, and mammillary tubercles upon the articulations. These are enlarged in the figures 1 *b*, *c*, *d*.

Fig. 1 *e*. Front view of the specimen 1 *a*, showing the elevation of the oculiferous tubercles.

Fig. 1 *f*. One of these tubercles magnified. When magnified to this degree, they exhibit only rounded granulations.

Fig. 1 *g*. The cephalic shield, represented in fig. 1 *a*; showing the separation of the maxillæ γ γ at the facial sutures.

Fig. 1 *h*. The right maxilla, separated from the cephalic shield, as it appears in a fragment of the limestone.

Much confusion in regard to this species exists in the works of foreign authors, several distinct forms being erroneously referred to the same; while the real one, which doubtless occurs in several localities, is referred to another genus. Capt. PORTLOCK, though disposed to recognize and identify all American species, has failed in this instance, and his *Amphion gelatinosus* can scarcely be any other than our species. This difficulty has arisen in part from the obscure specimen from which GREEN's cast was made, the character of the buckler being very indistinct, though the nodulose articulations are well preserved.

EMMRICH, in his memoir, remarks that the *Amphion gelatinosus* of PORTLOCK belongs to *Phacops*, a section of the Genus *Calymene* of BRONGNIART, having reticulated eyes. This is quite untrue, however; for the eyes of *Ceraurus* are peculiar, and quite different from those of *Phacops*, as they are from those of *Calymene;* while the facial suture is similar in direction to the former, and the labrum, as in that genus, is attached by a suture to the front of the glabella.

More recently, Dr. LOVEN (*id cit.*) has attempted to prove the identity of *Ceraurus*, *Odontopleura* and *Acidaspis;* but he has misapprehended the characters of the *Ceraurus*, owing to the obscurity of the model of GREEN. I shall hereafter be able to show that the *Ceraurus* is restricted to the lower epoch of our palæozoic strata, while *Acidaspis* (*Odontopleura*) is a genus continued into the lower and middle palæozoic strata, and differing essentially from *Ceraurus* in many other particulars, as well as in the direction of the facial suture.

I have given the numerous figures of this species, and of the parts usually found in the Trenton limestone, with a view of establishing the characters of the genus, and its clear distinction from other genera of Trilobites in the older strata. Notwithstanding all that is given, however, the entire characters of the species are not represented, as will be seen from the transverse view of a single articulation (Pl. 65, fig. 1 *n*), which is well preserved on the surface of a slab of limestone, showing the extended extremities, which bend abruptly downwards and curve slightly backwards, terminating in an obtuse point.

Position and locality. This species, so far as known in New-York, is restricted to the period of the Trenton limestone. It is found at Middleville, Trenton falls, Lowville and Watertown, and is more rarely seen in localities in the Champlain valley. It is also known in several western localities and in Canada, showing a wide geographical range. The large fragment figured on Plate 66 is from near Cincinnati, Ohio.

302. 3. CERAURUS VIGILANS.

PL. LXV. Figs. 2 *a – h*.

Compare *Entomolithus*, No. 2, LINNE, Vet. Acad. Handlingar, 1759, T. 1, fig. 2.
Entomostracites punctatus (*Trilobus punctatus*, BRUNN.), WAHLENBERG, Act. Soc. Sc. Upsaliensis, 1821, Vol. viii, pag. 32, no. 7, tab. 2, fig. 1.
— — BRONGNIART, Crust. fossiles, 1822, pag. 36, tab. 3, fig. 4.
Trilobites punctatus, SCHLOTHEIM, Nachträge, 1823, Vol. ii, pag. 37, no. 23.
Calymene punctata, DALMAN, Vet. Acad. Handlingar, 1826, pag. 233 & 267, pl. 2, fig. 2 *a b*.
— — HISINGER, Leth. Suecica, 1837, pag. 12, pl. 1, fig. 6.
— ? ? — MURCHISON, Sil. System, 1839, pag. 661, pl. 23, fig. 8 *a b*.
Amphion multisegmentatus, PORTLOCK, Geol. Rep. Londonderry, 1843, pag. 291, pl. 3, fig. 6.

Buckler subcrescent-form, with the posterior angles extended into long sharp spines, which, when perfect, reach backward to the commencement of the caudal shield; entire surface of the buckler studded with strong tubercles; glabella not lobed, front margin thickened and studded by two lines of tubercles; oculiform tubercles subconical, remarkably prominent, granulated; facial suture as in the preceding species; maxillary shield thickened and tuberculated at the margin; labrum small, ovate, attached directly to the front of the glabella; thorax with eleven articulations, the lateral lobes three times the width of the central lobe; pleuræ much extended; caudal shield elongated, the lateral lobes with nine simple segments, while the central lobe has twice as many; every second segment of the central lobe of the thorax is marked by a tubercle or short spine, and every third (or fourth) segment of the central lobe of the caudal shield; alternate segments of the lateral lobes more or less distinctly tuberculated.

In all the specimens which I have seen, the body is partially contracted, and the lateral articulations bent downwards so that their terminations cannot be seen; it is not improbable that some of them terminated in spinous processes, as in the preceding species. The posterior angles of the buckler, when perfect, terminate in long spines, which extend to the caudal shield, and are curved upwards at the extremity; but these are frequently broken off, and the species might readily be mistaken. Surface of the buckler marked by pustular tubercles. The articulations are granulated, and every second one of the axial lobe of the thorax has a prominent tubercle or short spine, which is not often seen, however. The caudal shield closely resembles the figures cited above, though the glabella given by WAHLENBERG as of the same species is totally different from our species, and probably not belonging to the caudal shield there figured. The great disproportion in the number of articulations of the middle and lateral lobes of the pygidium is very remarkable; every third articulation in the central lobe is furnished with a short spine, which is usually broken off in all the specimens yet seen.

Nearly all the specimens are distorted by being bent downwards just behind the buckler, while the latter is elevated and thrown somewhat backwards, giving it a remarkably prominent appearance.*

* I have a specimen from Dudley, in England, marked *Calymene punctata*, in which there are two caudal shields,

Fig. 2 *a*. An entire specimen, preserving the posterior spines of the buckler.

Fig. 2 *b*. Front view of the same, showing the elevation of the oculiferous tubercles.

Fig. 2 *c*. A small specimen with the surface markings obscure.

Fig. 2 *d*. Lateral view of a specimen, showing the extension of the extremities of the lateral articulations.

Fig. 2 *e*. Caudal shield of a larger individual.

Fig. 2 *f*. An enlarged portion of the buckler of 2 *a*, showing pustulose tubercles, which appear much like the tubercles on the surface of ECHINUS or CIDARIS, for the attachment of the spines. The oculiferous tubercle, under an ordinary magnifying glass, presents only small unarranged granulations.

Fig. 2 *g*. The caudal shield and a portion of the thorax enlarged, showing the tubercles upon alternate and third segments.

Fig. 2 *h*. Profile of the same.

Position and locality. This rare species occurs in the lower shaly portions of the Trenton limestone, being scarcely known except in the soft argillaceous beds, which admit of their nearly perfect preservation. I am indebted to Mr. WADLEIGH, of Middleville, for several very good specimens. (*State Collection.*)

303. 4. CERAURUS? PUSTULOSUS.

PL. LXI. Figs. 2 *a*, *b*.

The specimen is a fragment, apparently of the lower side of the maxillary shield, with the prolonged posterior extremity. It is clearly distinguishable from the preceding species, by the large pustulose markings with a finely granulated surface between.

It is not easy to decide positively regarding this fragment, and further discoveries may prove it to belong to the Genus *Acidaspis*, which in its surface marking is allied to *Ceraurus*. The margin presents some elevated tubercles or fine lines which are not represented in the figure.

Fig. 2 *a*. The fragment, natural size. 2 *b*. A magnified portion of the same.

Position and locality. This fragment was obtained from the higher beds of the Black-river limestone, near its junction with the Trenton limestone, at Watertown.

(*From* Dr. CRAWE.)

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very similar to the one under consideration, and the difference of geological position renders it desirable to point out any differences of character. In the Dudley specimens, though not larger than ours, there are at least twenty-five segments in the middle lobe and eight or nine in the lateral lobe, every fourth articulation is tuberculated, and the tuberculations on the lateral lobes are nearer the axial lobe. The surface, also, appears not to have been as roughly granulated as in the Trenton species. HISINGER cites *Calymene punctata* as from the more recent Transition limestone, and MURCHISON has given it from the Caradoc sandstone. There are doubtless two species referred to this name, and I have regarded the one under consideration as differing from the species of WAHLENBERG, DALMAN, &c., though closely allied to it.

304. 1. PHACOPS CALLICEPHALUS.

PL. LXV. Figs. 3 *a – i.*

Compare *Phacops Dalmanii*, PORTLOCK, Geol. Rep. Londonderry, pag. 282, pl. 2, fig. 7 *a, b, c;* and pl. 3, fig. 7 *d.* Also *Phacops Murchisonii*, pl. 2, fig. 9 *a, b;* and pl. 3, fig. 9 *c, d.*

Buckler somewhat semicircular or sublunate, convex, produced at the posterior angles into a broad rounded wing-like expansion; glabella broad and rounded in front, narrowing posteriorly, and three-lobed upon each side, the lower lobe short, with a tubercle at the base, or between it and the posterior angle of the eye; anterior angle of the eye reaching to the groove between the frontal and second lobe of the glabella; eyes lunate, reticulated, elevated to the same line as the most prominent part of the glabella; thorax with eleven articulations, the lateral ones grooved; caudal shield rapidly tapering, with fourteen or fifteen articulations in the axial lobe, and nine in each lateral lobe; the latter are distinctly grooved, and all terminate in a smooth border. Surface of the buckler pustulose-punctate; of the articulations, less distinctly marked.

This is a beautiful little species, bearing a very close resemblance to the *Phacops dalmanii* cited above; the only essential difference being in the small tubercles between the last lobe of the glabella and the posterior angle of the eye, which are not mentioned in that one, and the number of articulations in the caudal shield, which are, in PORTLOCK's species, nine in the central, and six in the lateral lobes.

The surface of the buckler is very beautifully marked with small rounded pustules, the surface of which, and the spaces between, are finely punctulate; differing in this respect from any other species. The axial lobe of the thorax has the surface marked with elongated or irregular pustules, with fine punctæ; while the lateral lobes are more finely papillose or granulate, and the same characters are more or less distinct in the caudal shield. It is the only species of the genus known to me in our lower strata, and differs from PHACOPS, as restricted by EMMRICH, in having more than eleven articulations in the caudal shield. It must be regarded, however, as one of the earliest representatives of that type, which afterwards became more numerous, and varied in form, in the higher palæozoic strata. In this species the thorax and caudal shield have the characters of CALYMENE, and it would be difficult to determine from these alone the true nature of the fossil. The eyes are as distinctly marked as in any of the subsequent species, and the direction of the facial suture is the same.

Fig. 3 *a*. Cephalic shield of this species. The specimen is well preserved, and shows the extension of the posterior angles in a very perfect manner.

Fig. 3 *b*. A small entire specimen of the same species.

Fig. 3 *c*. The caudal shield, showing the number of articulations, etc.

Fig. 3 *d*. A magnified portion of the surface of the buckler, showing the pustulose-punctate character of the surface.

Fig. 3 *e*. A magnified portion of the articulations of the thorax, showing the irregular pustulose surface.

Fig. 3 *f*. Lateral view of the eye of this species. 3 *g*. Magnified view of the eye.

Fig. 3 *h*. A contracted specimen. The lobes of the glabella are obliterated, and the surface of the eye crushed or absorbed. The portion of the cheek supporting the inner and upper margin of the eye still remains, in the form of a subconical tubercle.

Fig. 3 *i*. View of the same specimen, showing the caudal shield and front of the buckler.

This specimen, and one or two others which I have obtained, are scarcely recognizable as the same species, from the lobes of the glabella being obliterated, and the eye appearing more like the preceding species in form, or altogether obliterated. The species is clearly contractile, as well as those having fewer articulations in the caudal shield.

Position and locality. This species occurs in the lower shaly layers at Middleville, associated with *Ceraurus*. It is likewise found in the higher part of the rock at Watertown, Jefferson county, but has not been observed in the succeeding shales. (*State Collection.*)

305. 2. PHACOPS? LATICAUDUS.

PL. LXIV. Fig. 3.

Pygidium broadly subtriangular, the middle lobe with about fourteen segments; lateral lobes each with ten or more undivided segments, which terminate in a thickened continuous margin.

It is impossible to decide satisfactorily in regard to this species, since the surface markings are entirely obliterated in the specimen. The form of this part of the species is very similar to that on Pl. 60, fig. 1; but the axial lobe extends nearly to the posterior margin, and the segments of the lateral lobes are less numerous and of a different character. An equal difference will be perceived when compared with *Asaphus tyrannus* of MURCHISON, before cited.

Position and locality. In the upper subcrystalline portion of the Trenton limestone, at Turin, Lewis county. On the authority of Dr. BUDD. (*Cabinet of* Dr. EMMONS.)

306. 3. ASAPHUS? NODOSTRIATUS.

PL. LXI. Figs. 1 *a*, *b*.

Several fragments of the form here represented have been obtained, but nothing which will enable us to decide satisfactorily as to the character of the entire animal. The fragment appears to be the middle lobe of the buckler or glabella, and is in form very similar to the glabella of *Asaphus angustifrons*; but the surface markings are different.

It is impossible to decide positively whether this fragment be a glabella, or the labrum of some species, the form being similar to the labrum of CALYMENE. The surface markings are sufficient to distinguish it from any other species known to me in the Trenton limestone.

Fig. 1 *a*. The fragment, natural size.

Fig. 1 *b*. A magnified portion of the surface, showing the lamellose striæ, with small nodes which interrupt the lines.

Position and locality. All the specimens known, are from the lower part of the Trenton limestone, near Watertown. (*State Collection.*)

307. 1. TRINUCLEUS CONCENTRICUS.

PL. LXV. Figs. 4 *a*, *b*, *c*; also pag. 255, and pl. 67.

Trinucleus. LHWYD, Phil. Transactions, 1698, Vol. xx, p. 279.
Trilobites. BRONGNIART, Crust. fossiles, 1822, pag. 145, pl. 1, figs. 6, 7 A B C.
— BIGSBY, Ann. Lyc. Nat. Hist. New-York, 1824, Vol. i, pag. 214, pl. 15, fig. 1.
Nuttainia concentrica. EATON, Geol. Text-Book, 1832, pag. 128, pl. 1, fig. 2.
Cryptolithus tessellatus. GREEN, Monograph, 1832, pag. 74.
Trinucleus caractaci. MURCHISON, Sil. System, 1839, pag. 659, pl. 23, figs. 1 *a b c d*.
Asaphus seticornis, and *A. cyllarus.* HISINGER, Leth. Suecica, Suppl. ii, 1840, pag. 3, pl. 37, figs. 2 and 3.
Trinucleus caractaci. BURMEISTER, 1843, pag. 65, tab. 1, fig. 1.
Compare *Entomostracites granulatus*, WAHLENBERG, Act. Nov. Soc. Sc. Upsalensis, 1821.
— — BRONGNIART, Crust. fossiles (figure after WAHLENBERG).
Asaphus granulatus, DALMAN, Vet. Acad. Handlingar, 1826, pag. 238, tab. 2, fig. 6.
— — HISINGER, Leth. Suecica, pag. 11, pl. 2, fig. 4.

Buckler semicircular or subcrescent-form, the posterior angles produced into long slender straight spines; glabella very prominent, finely granulated, produced posteriorly into a short spine; cheeks prominent, finely granulated; marginal fillet marked in front by three, four, or five rows of deep rounded pores or punctures; these rows increase by one or two additional ones on the sides of the shield, and towards the lateral posterior angles are often irregularly scattered.

The buckler or cephalic shield alone is figured here, as I have no specimen of the thorax or caudal shield from the Trenton limestone, though the buckler is often abundant. I have restored the specific name given by EATON, adopting the generic name of LHWYD given by MURCHISON. There is indeed no reason for a separation on account of the number of rows of pores, as they are variable, and the specimens are more often without the long spines of the buckler than otherwise. The specimen figured by GREEN, is one before referred to, as coming from the slates of the Hudson-river group, near Waterford, which at that time were regarded as almost non-fossiliferous. Though destitute of the small spines at the posterior angles of the buckler, it is specifically the same as those here presented, and doubtless identical with the figures of MURCHISON, though more doubt may be entertained as to its identity with those of WAHLENBERG and DALMAN.

Fig. 4 *a*. The cephalic shield of this species, still preserving one of the slender spines from the posterior angle. The posterior spine of the glabella is broken off, though the fracture is not conspicuous.

Fig. 4 *b*. Lateral view of the cephalic shield of a smaller specimen.

Fig 4 *c*. The cephalic shield of a small specimen, in which the glabella preserves its posterior spine.

These specimens present some variety in the number of rows of punctures in the border, and the same is true in many other individuals, showing that this character is not reliable for specific distinction.

Position and locality. In the higher subcrystalline portions of the Trenton limestone, and sometimes in the more shaly part of the rock, the bucklers of this trilobite are abundant. The fragile thorax is very rarely preserved, and I do not recollect to have seen one in the limestone in the whole course of my investigations. It is found at Trenton falls, Middleville, Turin, Lowville, Watertown, Glensfalls, and many other localities of this rock. Although more abundant in the Hudson-river group, it is unknown in the intermediate Utica slate.

TRILOBITES OF THE UTICA SLATE AND HUDSON-RIVER GROUP.

PLATE LXVI. (in part).

The important and characteristic TRILOBITES of these rocks are species which appear, though less conspicuously, in the Trenton limestone, and have been already noticed. The rule I have adopted, however, renders it necessary to speak of them here, giving illustrations of specimens from these rocks. The most numerous forms are those of *Calymene beckii* and *Trinucleus concentricus ;* and the condition of the specimens in the shaly strata is so different from the same in the compact limestone, that both require illustration. Two or three forms appear in these rocks, which are thus far unknown in the limestones below, and which are probably peculiar to this period, becoming developed only after the commencement of argillaceous deposits.

297. 2. CALYMENE BECKII.

PL. LXVI. Figs. 2 *a – k ;* and PL. LXVII. Figs. 4 *a, b, c, d, e.*

Reference pag. 237, pl. 64 of this report.

Much confusion has arisen respecting this species, which is abundant in the Utica slate. It was first described by Prof. EATON, under the name *Brongniartia*, from imperfect specimens of the cephalic shield, in the calcareous beds of the Utica slate, at Coldspring, Montgomery county. These specimens are more convex than those in the softer slate, and their true character is not obvious on a cursory examination. Prof. GREEN substituted the name of *Triarthrus* for that proposed by Prof. EATON ; still regarding the small imperfect cephalic shields as the entire animal. Dr. HARLAN, in correcting this error of EATON and GREEN, described the buckler as destitute of oculiform tubercles ; and I have, myself, fallen into the same error in describing as distinct species two nearly entire specimens, owing to the absence of the maxillary shields in one, and their partial preservation in the other.*

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* SILLIMAN's Am. Jour. Science, Vol. xxxiii, p. 137.

The buckler of our species bears considerable resemblance to that of specimens of *Olenus gibbosus* from Sweden; but the true *Olenus*, as in *Paradoxides*, has the facial suture terminating at the posterior margin of the buckler, distant from the angles, while in this one it terminates at the angles as in *Calymene*. The labrum found in the slate associated with this species, has also the form of that organ in *Calymene senaria;* and taking these two facts in connection, I have preferred to refer the species to *Calymene*, since it is more nearly related to other species of that genus than to the *Oleni*. There is still some little difficulty in determining the number of articulations of the thorax, since the greater number of specimens are imperfect; and in a single large specimen there appear to be fourteen or fifteen. This fact indicates an increase in the number of thoracic rings with age, a character which Emmrich has given of the *Olenus*. The articulations of the lateral lobes are marked by a simple straight groove extending their entire length, and terminate in an obtuse point, unlike those of the true *Oleni* as represented by various authors. On account of these characters, it is impossible to refer the species satisfactorily to the Genus *Olenus*, though in some of its characters it evidently forms a link between that genus and *Calymene*. Farther investigation of this species may develop characters sufficiently distinct from *Calymene* to establish the Genus *Triarthrus*, which was proposed with a very imperfect knowledge of the entire animal.

The most prominent character of this species, distinguishable in the segments of the thorax, are the tubercles or short spines which mark the centre of the axial lobe, and are usually more or less distinctly preserved under all circumstances. No other trilobite in the lower strata possesses this character; the *Ceraurus pleurexanthemus* having a double row of less prominent ones, while in the *C. vigilans* every second or third segment only is marked in this manner.

In order to illustrate this species, and, if possible, to clear up the difficulty and obscurity attending it, I have given numerous figures of its different parts, and of the same parts preserved under different circumstances and in different materials.

Fig. 2 *a*. An entire specimen, with the exception of the maxillary shields, which are separated at the facial suture, leaving the cephalic shield in the usual form. The crust of the central lobe of the thorax is removed, obliterating the tubercles

Fig. 2 *b*. An imperfect specimen, with the maxillary portions partially preserved, but separated at the suture and pressed downwards.

Fig. 2 *c*. The thorax and caudal shield, preserving the crust with the tubercles upon the middle lobe, in a very perfect manner.

Fig. 2 *d*. The cephalic shield, with the maxillary portions separated at the facial suture.

Fig. 2 *e*. The cephalic shield entire, but so much compressed that the eyes are obliterated. The posterior angles are too much rounded in the figure; in other respects, the true form of the buckler is represented.

Fig. 2 *f*. The cephalic shield preserved in compact calcareous stone. This specimen is from the same locality, and very similar to the one on which Eaton founded the Genus *Brongniartia*.

Fig. 2 *g*. A larger specimen, in compact limestone, preserving a more convex form in all its parts.

Fig. 2 *h.* A small individual, preserving the thorax and the maxillary portion of the buckler, the glabella being separated. Specimens of this kind are not rare among the young individuals.

Fig. 2 *i.* The maxillary shields, as they frequently occur in the slate, separated from any other part of the fossil. The position and partial form of the base of the eye is clearly distinguishable.

Fig. 2 *k.* A single maxillary shield of this species.

It is impossible, from the slender and fragile nature of these portions of the fossil, to decide whether the suture continues entirely across the front of the glabella, or is interrupted as in other species of CALYMENE. The specimen 2 *i*, shows a continuous slender fillet in front; but this may be joined to the lateral portions by sutures, since the specimen fig. 2 *k* terminates as in *Calymene senaria.*

Position and locality. It has already been observed that this species is more abundant in the Utica slate than elsewhere, being in fact the only trilobite usually seen in that rock. Large surfaces of the laminæ are often almost entirely covered with the fragments and more or less perfect individuals. The most prolific localities are Coldspring, on the Erie canal, Montgomery county; Oxtungo creek, above Fort Plain; Martin's Hill, near Amsterdam; Turin, Lewis county; and less abundantly at Utica and numerous other localities. (*State Collection.*)

PLATE LXVII.

Atops trilineatus. EMMONS, Tac. System, pag. 20.
— — ID. Agr. Report, pag. 64.

Fig. 4 *a.* The buckler, with a few of the articulations of the thorax. The specimen is very much compressed, and the crust removed. It is imbedded in a gritty micaceous slate, and in such a condition as to render it somewhat obscure. The form of the buckler, with the lobate character of the glabella, leave no doubt of the true nature of the fossil.

Fig. 4 *b.* A specimen of the same fossil, presenting nearly the entire length of the individual; the form and markings of the buckler are obscure, but still visible, and evidently identical with the fossil from the Utica slate.

Fig. 4 *c.* An impression of the body of this fossil, showing the indentations produced by the short spines upon the back.

Fig. 4 *d.* A portion of the same enlarged, showing the impressions of the fine granulations of the crust.

Fig. 4 *e.* This fragment preserves an impression of a part of the central and one lateral lobe of this species. (See EMMONS' *Taconic System*, pag. 19, pl. 2, fig. 3; and *Agricultural Report*, pag. 63, pl. 14, fig. 3.)

These specimens are all in the thinly laminated, folded, and partially altered slates, on the east side of the Hudson. The occurrence of these fossils is sufficient evidence of the age of the strata, without the evidence furnished in the structure of the country as presented in the sections. This species likewise occurs in the unaltered slates of the Hudson-river group, in Lewis, Jefferson and Oswego counties.

308. 4. CALYMENE (*Species undetermined*).

Pl. LXVI. Figs. 3 *a*, *b*.

Caudal shield with seven or more articulations in the lateral lobes, and ten in the middle lobe; articulations of the lateral lobes of the thorax and caudal shield with a distinct groove extending nearly their entire length; extremities obtuse; lateral lobes nearly once and a half the width of the middle lobe.

The width of the lateral lobes of the thorax, compared with the middle lobe, is much greater than in *Calymene beckii*, and somewhat greater than in *C. senaria*. The continuous, nearly direct, groove in the articulations of the lateral lobe, is different from the same in *C. senaria*, and may perhaps prove a sufficient distinction to identify fragments of the two species. The two fragments figured are the only parts of the fossil yet observed, and from these the crust is entirely removed, so that no aid in distinguishing the species can be obtained from the surface markings.

Fig. 3 *a*. A part of the thorax, preserving eight or nine articulations.
Fig. 3 *b*. The caudal shield, with a few segments of the thorax.

Position and locality. These specimens were obtained in the Utica slate, near Canajoharie, Mohawk valley. The *Calymene beckii* occurs in the same locality.

(*From* Mr. Everett, *Principal of the Canajoharie Academy*.)

309. 5. ASAPHUS? LATIMARGINATA (*n. sp.*).

Pl. LXVI. Figs. 4 *a*, *b*.

Compare *Asaphus tyrannus*, Murchison, Sil. System, 1839, pag. 662, pl. 25, fig. 1 *a b*.

Caudal shield with fourteen articulations in the lateral lobes, and about the same number in the middle one; the posterior articulations of the latter lobe join the axis in an acute angle, and all terminate in a flat border; surface (of exfoliated portions) marked by imbricating lamellose striæ; outer surface of the crust finely punctured.

The fragment of a caudal shield of a much larger specimen (fig. 3 *b*), was found in the same stone as the other, and, from its surface markings, doubtless belongs to the same species. The articulations are narrow, as in *Asaphus tyrannus*, and terminate in a broad flat border; it is impossible, however, to decide that it is identical with that species. It also bears some analogy with the fragment found in the Birdseye limestone, but on comparison proves clearly distinct.

Numerous fragments of articulations of the thorax were found with the specimens here figured. In one of these, an articulation of the lateral lobe is marked by a broad groove, extending about two-thirds of its length from the axis; beyond which, it presents a broad flattened surface, sharpened upon the upper edge, and obtuse at the extremity.

Fig. 4 *a.* The caudal shield of a small individual.
Fig. 4 *b.* A fragment of the lateral lobe of the caudal shield of a larger individual.

Position and locality. This species has been seen only in a single fragment of slate, from near Watertown, Jefferson county. I should not have ventured to figure it in this place, since there is some little doubt as to its precise locality; but that the same fragment contains one or two other peculiar fossils, known only in the slates of this period.

(*From* Dr. I. B. Crawe.)

43. 1. ISOTELUS GIGAS.

Pl. LXVI. Fig. 5.

Reference pag. 231, pl. 60, 61, 62 and 63 of this report.

I have obtained from the Utica slate, in the Mohawk valley, the large labrum here figured. The dimensions are twice as great as any other specimen I have seen; and judging from this circumstance, the animal must have been at least eighteen inches long. The distance between the extremities of the processes is less, and these parts are proportionally shorter than in specimens from the Trenton limestone; but these differences do not appear to be sufficient to found specific distinctions.

Fragments of other portions of this species are often found in this slate, and also in the shales of the Hudson-river group; but the animal does not appear to have existed in any considerable numbers, after the deposition of the Trenton limestone.

TRILOBITES OF THE HUDSON-RIVER GROUP.

307. 1. TRINUCLEUS CONCENTRICUS.

PL. LXVII. Figs. 1 *a–h*. Also PL. LXV. Fig. 4.

The specimens from the slates of the Hudson-river group are more flattened than those from the Trenton limestone. In a large number of specimens examined, there are four rows of punctures in front of the buckler, while a few have but three rows; on the other hand, those with four rows are rare in the Trenton limestone, while those with three rows are the prevailing form. This difference, however, cannot be regarded as essential, for in a few instances there are five rows, and very frequently five or six rows on the maxillary margin, near the posterior termination of the buckler.

The specimens in the Hudson-river group rarely preserve the posterior spine of the glabella, but it is shown in fig. 1 *d*, and is never wanting except from accident. The long spines from the posterior angles of the buckler correspond in the specimens from the two rocks.

The thorax consists of six free articulations, the lateral ones being bifurcate or grooved; the caudal shield has seven segments in each lateral lobe, and about fourteen in the central lobe. The crust is exceedingly thin, almost always separating; and when preserved in the shaly strata, rarely shows any surface markings. The animal had the power of contracting or folding itself, at least to a certain degree, though this does not appear to have been its habit.

Fig. 1 *a*. A large individual, destitute of spines upon the posterior angles of the buckler and glabella. The border in front of the glabella has three distinct rows of punctures, four in front of the cheeks, and five on each side, with six or seven near the base.

Fig. 1 *b*. The thorax and caudal shield enlarged, to show more clearly the character of the segments.

Fig. 1 *c*. A smaller specimen, preserving the spines of the buckler. There are four rows of punctures in front, and six on each side of the buckler.

Fig. 1 *d*. The buckler, preserving the posterior spine of the glabella.

These specimens are from the soft shales in the upper part of the Hudson-river group, at Loraine.

Fig. 1 *e*. Fragments of the cephalic border, showing a variable number of rows of punctures in front; one having five, with seven or eight at the posterior margin.

Fig. 1 *f*. A portion of the marginal fillet, where the crust is partially removed, showing the little studs or points which fill these pores from below.

Fig. 1 *g*. A fragment of a large buckler, having but two distinct rows of punctures in front of the glabella.

Fig. 1 *h*. A portion of the thorax and caudal extremity, from the glazed slate, at Waterford. The long spine appears as if attached to the caudal extremity; but it is scarcely in a direct line with the axis of the specimen, and is not quite symmetrical on the two sides at its base. I am, therefore, inclined to regard this as a spine from the buckler, which has been accidentally placed in this position.

I have not yet been able to find any marks of specific distinction among these fossils, though I have examined more than one hundred nearly perfect specimens, and as many fragments, from the slate and limestone. The small spine-like process at the base of the glabella has not been heretofore observed, but it will be found to exist in all perfect specimens; the cause of its absence is fracture, which may often be obscure or indiscernible.

I am indebted to Dr. Emmons for an opportunity of examining a beautiful collection of specimens of this species, from the shales of the Hudson-river group, at Loraine. Many of the small slabs are completely charged with them, and several hundreds were obtained in the space of a few feet.

Position and locality. This species is found throughout the rocks of the Hudson-river group, occurring in the lower part of the same at Turin and Martinsburg. At Loraine and Pulaski, this fossil occurs in the higher parts of the group; and at Waterford, near Cohoes falls, in the glazed and plicated slates of the same group. It has likewise been found in one or two places in the Mohawk valley, in a similar position. (*State Collection*.)

310. 1. OLENUS ASAPHOIDES.

Pl. LXVII. Figs. 2 *a*, *b*, *c*.

Elliptocephalus asaphoides. Emmons, Tac. System, 1844, pag. 21, fig. 1, 2, 3.
— — Id. Agr. Report, 1846, pag. 65, figs. 1, 2, 3.
Compare *Asaphus* (*Ogygia*) *Buchii*, Brongniart, Crust. fossiles, pag. 20, pl. 4, figs. 2 *a b*.
Asaphus Buchii, Murchison, Sil. System, pag. 662, pl. 25, fig. 2.
Ogygia (*Asaphus*) *Buchii*, Burmeister, pag. 69, pl. 1, fig. 2.
Olenus of Dalman, Burmeister, &c.*

Buckler semielliptical or subcrescent-form, with the posterior margins produced into sharp spines; eyes indistinctly marked; glabella lobed; direction of the facial suture as in

* The species under consideration is either an *Olenus* or *Ogygia*, as the genera of this class of animals are now defined, and I therefore arrange it with the former for reasons to be given. The name *Elliptocephalus* could scarcely be admitted, since the *Ellipsocephalus* of Zenken is so well known in its application to a very distinct generic form.

Olenus; thorax trilobate, the longitudinal furrows not defined; segments of the middle lobe moderately broad and flat, those of the lateral lobes grooved along the centre, suddenly bent backwards near the extremity, and pointed: surface markings obliterated.

The specimen, which is imperfect, preserves five and part of the sixth articulations only, upon the middle and one lateral lobe. The crust appears to have been very thin, and the whole specimen is very much compressed. The elliptical central portion of the buckler, on which the Genus *Elliptocephalus* is founded, appears to be due in part to the outline of the eyes and the line of the facial suture. This character is not so distinct in the specimen 2 *b*. The specimen 2 *a*, though very indistinct, clearly presents the lobate character of the glabella, which is margined in front, as well as laterally, by a broad coriaceous margin.

The form of the buckler, its prolongation posteriorly into spines, the form of the glabella, and the character of the articulations, the grooved lateral segments, and their abrupt bending backwards with pointed extremities, correspond very closely with *Asaphus* (*Ogygia*) *buchii*. The proportional width of the middle lobe, however, is much greater; and the course of the facial suture is different, so far as can be ascertained. The buckler is more elongated than in *Olenus spinulosus*, which in some respects it resembles.*

Fig. 2 *a*. An imperfect cephalic shield, with several articulations.
Fig. 2 *b*. A smaller imperfect cephalic shield.
Fig. 2 *c*. A fragment of one of the lateral articulations of the thorax.

Position and locality. This species was found associated with *Calymene beckii*, and a few other undetermined fossils, in the dark laminated micaceous slates at Greenwich, Washington county. The position of these slates has already been alluded to; the particular locality is about three miles northeast of Bald mountain, where the lower limestones are clearly exposed, and upon which these plicated and partially altered slates repose.

(*Cabinet of* Prof. Emmons.)

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* This species, with *Calymene beckii* (*Atops trilineatus*), are those given by Dr Emmons as the characteristic trilobites of the Taconic system. I cannot admit the *Atops* to be distinct from *Calymene beckii*; and though the other form is doubtless new, it evidently belongs to a lower silurian type. The discovery of a new species in our older rocks, whether among the disturbed or horizontal strata, is not a matter of surprise, for such discoveries are of frequent occurrence. I have already given my own views in regard to the position of these rocks, and I see no reason to change this opinion. Supposing the existence of a system of strata below the Potsdam sandstone, of which we have no proof, we might fairly infer that the wide interval between the deposition of those strata and the Hudson-river group would give us forms of animal life more widely different than these examples offer. The great analogy between the latter species and the succeeding one, which is from strata scarcely disturbed, shows how similar were the forms of two supposed epochs.

311. 2. OLENUS UNDULOSTRIATUS (*n. sp.*).

PL. LXVII. Figs. 3 *a*, *b*.

Compare *Olenus spinulosus*, DALMAN.

Buckler semielliptical or sublunate, the posterior angles extended into diverging spines; eyes lunate; glabella (apparently not lobate) marked by fine rugæ; facial suture extending from the margin of the cephalic shield, in front of the eye, to the base of the same, distant from the angles; articulations slender, those of the lateral lobes grooved.

The single fragment figured, is all that has been seen of this species. The character of the buckler, form of the eye, and direction of the facial suture, induce me to refer it to the Genus OLENUS. It is, in many respects, analogous to the preceding species, but is too obscure to decide whether the glabella is lobed or not. The segments of the thorax are imperfect, and the extremities are not preserved.

Fig. 3 *a*. The fragment, natural size.
Fig. 3 *b*. A part of the same enlarged, showing the course of the facial suture, and the rugose striated glabella.

Position and locality. This specimen was obtained at Snakehill, Saratoga lake, in the soft olive shales, associated with other species belonging to this group. (*State Collection.*)

312. 1. AGNOSTUS LOBATUS (*n. sp.*).

PL. LXVII. Figs. 5 *a* – *f*.

Minute, trilobate, with a narrow border around the base and sides; middle lobe often with a small tubercle near its larger extremity.

This species bears considerable analogy to the Swedish specimens from a similar geological position, but they are not identical. Our species is always smaller, and I have never seen the small node or tubercle at the base of the central lobe; but it presents a similar character on the other extremity. All our specimens have the appearance of the caudal shield of a small trilobite, and two or three individuals are apparently articulated.

Figs. 5 *a*, *b*. Individuals of the natural size. 5 *c*, *d*. The same magnified.
Figs. 5 *e*, *f*. Specimens showing an articulation of the lobes.

Position and locality. This peculiar little fossil has been found only in some calcareous beds, intercalated with the shales of this group, one mile east of Troy. I am indebted to Dr. SKILTON of that city for good specimens of the same. (*State Collection.*)

ADDENDUM TO THE TRILOBITES.

Among several western species not included in the previous descriptions, I introduce the following, for the purpose of illustrating the characters of a genus proposed by Mr. Conrad, and of showing a new form associated with several well known Trenton species, in the lower limestones of the West.

Genus THALEOPS (Conrad).

"Ovate, profoundly trilobed, lateral lobes wider than the middle lobe; buckler lunate, with very remote oculine tubercles, not reticulated; abdomen with ten articulations; ribs without grooves, and not alternated in size; outer half of lateral lobes suddenly depressed; post-abdomen without ribs or grooves, and profoundly trilobed."

I am not able to perceive the essential difference between this fossil and Illænus, of which it possesses all the characteristics, in the number and character of the articulations of the thorax, in the cephalic and caudal shields, and in the direction of the facial suture.

313. 1. THALEOPS (ILLÆNUS) OVATUS.

Pl. LXVII. Figs. 6 *a*, *b*.

Thaleops ovata. Conrad, Proc. Acad. Nat. Sci. Philadelphia, Vol. i, 1843, p. 332.

"Obtusely ovate; surface minutely punctate; head very wide, lunate, involuted; eyes very prominent, rounded, smooth, placed on a line with the angle in the middle of the side lobes; ribs flattened, smooth, without a border at the extremities, where they are rounded and not expanded; post-abdomen with the middle lobe convex, rounded and well defined at the extremity; inferior margin obtusely rounded. Length two-thirds of an inch; width of the buckler three-quarters of an inch."

This species is clearly distinct from either of those previously described, in the proportional width of the lobes of the thorax; and it is remarkable for the trilobate character of the caudal and cephalic shields. The outer surface of the crust is punctate, and not striated, as in several other species. The eye is remarkably prominent, and somewhat truncato-conical, apparently smooth to the naked eye, and presenting a finely punctate surface, only, under the magnifier.

This species is associated with another species of *Illænus* (*I. crassicauda ?*), *Ceraurus pleurexanthemus*, *Phacops callicephalus*, or an allied species, as well as other well known Trenton limestone fossils.

Fig. 5 *a*. The specimen of the natural size.

Fig. 5 *b*. A part of the cephalic shield magnified, showing the punctures and the course of the facial suture.

Position and locality. This species is found in the lower limestone at Mineral point, Wisconsin. The association of numerous other fossils known only in the Trenton limestone or its representative, leave no doubt of the true position of the rock.

(*Cabinet of* Mr. CONRAD.)

In addition to the preceding species, there are several others described by Prof. GREEN, which I have not examined, except in the plaster models, and cannot therefore describe them satisfactorily. These are the *Asaphus tetragonocephalus*, *A. astragalotes*, and *A. micropleurus*, with one or two other doubtful ones. I shall endeavor to give figures and descriptions of these in a supplement to this work, after having examined the originals. There are one or two other species heretofore erroneously referred to the Trenton limestone, which are now known to be restricted to the higher limestones.

The strata of this period have been too little examined at distant localities, to enable us to speak with certainty of the geographical distribution of the Trilobites; but a very large proportion of the species described are known at various localities within New-York, and in Ohio and Kentucky in the west and southwest; in Canada on the north, and in Wisconsin on the northwest. Several of our species are evidently identical with those of the lower strata of Europe, and more particularly of England, Ireland and Sweden.

It is interesting to observe how similar are the Trilobites of our lower strata with those of the same period in Ireland, given by Capt. PORTLOCK, in his Geological Report (on Londonderry, and parts of Tyrone and Fermanagh). It is evident that among the prevailing forms, those which are identical with our species are more numerous than they are in England or upon the Continent; thus assimilating the ancient fauna of the western extremity of Europe more nearly with that of the new world. Among the most numerous forms of our lower strata, we may mention ISOTELUS and TRINUCLEUS, which are prevailing forms in Ireland. The Genus AMPYX, which is typical of the lower silurian rocks of Europe, was unknown among us till obtained from the eastern prolongation of the slates of the Hudson-river group in Canada, by Mr. LOGAN. In like manner OLENUS and OGYGIA, which have been reckoned among the doubtful genera of our older strata, appear to have existed in the eastern extension of the same, while they are quite unknown at the west. Other similar changes may be noticed in tracing the geographical distribution of the genera of Trilobites, both in the lower and upper silurian strata.

In the present state of my knowledge on this part of the subject, the species here figured, or the Trilobites of the lower silurian strata, embrace about one-third of the species known below the Carboniferous period. In this remark, however, I intend to speak principally of the rocks of New-York, and those portions of the adjoining States which I have examined. It is impossible to say how far this proportion may be varied by further discoveries both in the older and newer strata, but it is not improbable that it may continue very nearly the same; and that the three great periods into which these strata are divided, present almost an equal number of crustaceans.

FOSSIL PLANTS OF THE UTICA SLATE AND HUDSON-RIVER GROUP.

We find in this group several well marked species of marine plants, with other forms simulating, if not actually, organisms of this class. The prevailing forms are similar to those of the preceding strata, but the same species have not been recognized. The nature of the sediment, and the condition of the ocean bed, were favorable to the development and growth of this kind of vegetation; for we find, in almost every locality, evidences of its existence. As our researches have been principally directed to the discovery of animal fossils, little examination has been made in situations most favorable for the preservation of these plants; and we may anticipate a very large accession to the number of species, when careful explorations are made. The species already obtained show a considerable variety of form, and it is evident that we are but commencing our knowledge of the ancient marine flora.

The two following species appear to be quite new, and to require a generic designation.

Genus SPHENOTHALLUS.

[Greek, σφην, a wedge, and θαλλος, a branch or frond; in allusion to the form of the leaves.]

Character. Plant consisting of a stem, with diverging wedge-form leaves, or of detached leaves having this form. Leaves apparently succulent or thickened, and sometimes subcoriaceous.

It will probably be found that plants of this character are restricted to Silurian, and perhaps Lower Silurian strata.

314. 1. SPHENOTHALLUS ANGUSTIFOLIUS (*n. sp.*).

Pl. LXVIII. Fig. 1.

The specimen is a fragment, consisting of a stipe or stem, to which are attached elongated narrow cuneiform leaves. These leaves appear to proceed in tufts, and are accompanied by other smaller and narrower ones about their base. The stem presents no distinct markings, though there are several obscure impressions which may have been the point of attachment for leaves. The leaves are obscurely striated, though nothing like a veined structure can be distinguished.

The fragment has much the appearance of the terminating portions of the *Calamites;* and it is difficult to believe that it is not a land plant, though in a position so far below where anything of the kind has heretofore been discovered.

Position and locality. The specimen figured, with another obscure fragment, were obtained from an authentic locality, between the village of Canajoharie, on the Mohawk, and Schoharie village, by Mr. Lyman Wilder, of Hoosick falls.*

* I am thus particular in stating the locality, and my authority for the specimens, though the succeeding species serves to establish the fact of its occurrence in this position.

315. 2. SPHENOTHALLUS LATIFOLIUS (*n. sp.*).

Pl. LXVIII. Figs. 2 *a* – *f*.

Leaves broadly cuneate, somewhat thickened at the outer margin, and truncate at the lower extremity; surface obscurely striated. The specimens are often marked on one side by a ridge or midrib along the centre, and sometimes transversely wrinkled. These leaves all appear to have been thick and succulent, like the Fuci.

A large number of specimens have been seen, but in no case has one been discovered where the leaves are attached to the stem. Fragments of similar substance are often found with these leaves, which may have been parts of the stems of this species. The specimens present a dark carbonaceous surface, contrasting with the greenish shale in which they are imbedded.

Fig. 2 *a*. A leaf nearly entire, showing a depressed line along the centre.
Fig. 2 *b*. A similar leaf, with a sharp ridge along the centre.
Fig. 2 *c*. A leaf of a narrower and more elongated form, with a broad ridge along the centre.
Fig. 2 *d*. Another fragment, with a ridge extending a part of the length.
Fig. 2 *e*, *f*. Fragments of what may have been stems of this plant.

Position and locality. This species occurs in considerable abundance near Schoharie, in the bed of the creek, in the central part of the Hudson-river group. I have not seen it in any other locality. (*State Collection*; *Cabinet of* Mr. Gebhard.)

316. 4. BUTHOTREPHIS SUBNODOSA (*n. sp.*).

Pl. LXVIII. Figs. 3 *a*, *b*.

Compare *Fucoides antiquus*, Brongniart, Hist. Veg. fossiles, Vol. i, pag. 63, tab. 4, fig. 1.
— — Hisinger, Leth. Suecica, 1837, pag. 106, pl. 31, fig. 3 *a*.

Frond compressed, branched; branches opposite or alternate, subnodulose or vesicular, obtuse at the extremities.

This species is common in the shaly sandstones of the Hudson-river group, in Lewis county. It bears considerable analogy in some of its varieties with the species cited above; and its associations with the *Graptolites* of the older shales in Sweden, are very similar to its association in the rocks of New-York. It differs from the slender species of the Trenton limestone in the branches being shorter and subnodulose, and approaches more nearly to the species of the Clinton group.

Figs. 3 *a*, *b*. Figures of imperfect specimens, illustrating the prevailing form of the species.

Position and locality. This species is common in the central part of the group, at Turin and Martinsburgh, Lewis county; at Loraine, Jefferson county; and at Pulaski, Oswego county. (*State Collection*.)

317. 5. BUTHOTREPHIS ? FLEXUOSA.

Pl. LXIX. Figs. 1 *a*, *b*, *c*.

Fucoides rigida & *flexuosa*. Emmons, Tac. System, 1844, pag. 67, pl. 5, figs. 2 & 3.
— — & — Id. Agr. Report, 1846, pag. 69, pl. 17.

Frond compressed, somwhat irregularly branched ; stems and branches extremely compressed.

This species presents much variation of character, owing in part to the condition of the slate in which it is imbedded. The two species of Dr. Emmons are not separable by any established characters, and we find numerous intermediate forms. The specimens usually consist of a thin carbonaceous film upon the surface of the soft slate ; and slabs of several feet square are often nearly covered with fragments, which appear to have been of a less succulent character than most of the preceding species.

This is one of the species regarded by Dr. Emmons as typical of the slates of the Taconic system, but I can find no evidence to support this assumption. The locality, though containing no characteristic fossils of the Hudson-river group, is surrounded by authentic exposures of these rocks, and the lithological character is the same. Further examination will doubtless enable us to obtain this species in other localities of the group.

Fig. 1 *a*. A large fragment, with numerous branches or leaves. The specimen appears to have been long macerated before it was imbedded.

Fig. 1 *b*. A specimen in the same condition as the last, with the branches less diverging.

Fig. 1 *c*. A fragment of stone, with two smaller specimens retaining more of the original substance of the plant.

Position and locality. In the slates of the Hudson-river group, M'Arthur's quarry, Jackson, Washington county. (*State Collection.*)

318. 5. PALÆOPHYCUS VIRGATUS (*n. sp.*).

Pl. LXX. Fig. 1.

This species is only seen in fragments of long rigid stems, of nearly equal diameter. It appears to have been succulent or tubular, and is always compressed in the stone. Fractured or weathered surfaces of the arenaceous shales often present great numbers of these fragments, imbedded in great confusion.

The species bears some analogy to the *P. simplex* of the Trenton limestone ; but it is impossible to indicate characters either to assimilate or distinguish them. It can be readily identified in the rock, from its resemblance to flattened fragments of stems of succulent plants.

Position and locality. This species is abundant in the shales of this group, in the neighberhood of Union village and Salem, in Washington county. (*State Collection.*)

319. 6. PALÆOPHYCUS (*Species undetermined*).

Pl. LXX. Fig. 2.

This species occurs in short, small fragments, often quite covering the shaly laminæ in some parts of this group. It appears to have been a succulent plant; but no definite character can be assigned to it in the present state of our knowledge. The specimens figured are in a fragment of slate, presenting the usual aspect of the species. It is often found in smaller and in larger fragments, both covering the surfaces and penetrating the thin arenaceous layers.

Position and locality. In the central portions of the group, near Rome, Oneida county; and in Lewis and Oswego counties. (*State Collection.*)

320. 1. GORDIA MARINA.*

Pl. LXXI. Figs. 1, 2.

Gordia marina. Emmons, Tac. System, pag. 67, pl. 1, fig. 2.
— — Id. Agr. Report, pag. 68, pl. 14.

I have given this peculiar form, though doubting whether it be organic. An examination of two specimens shows the slightly elevated ridge to be thoroughly incorporated with the stone on one side, and appear as if they had filled slight depressions in the soft shales beneath. The form and meanderings of this body are not unlike the tracks made by *Melania* and other aquatic and marine shells of the present day; and I am, therefore, inclined to refer it to such a cause. Examined with this, or the other view, it does not detract from the interest attached to this singular marking upon the surface of these ancient strata. I have given figures of two specimens, in which the exact course of the elevated ridge is preserved.

Position and locality. These specimens occur in the same position, and at the same locality, with those forms described on Plate LXIX, from M'Arthur's quarry, Jackson, Washington county.

In addition to the forms here given, and those which are unequivocally of vegetable origin, there are others in which it is impossible to determine their true character. After examining a considerable number of specimens of this kind, I have decided to omit them all, believing that an attempt to indicate species and genera where constant characters are wanting, will be followed by a multiplication of species of which the individuals described would be the only representatives; an occurrence that can be attended with no good results to the science.

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* I have used the generic term *Gordia* in this instance, though aware that the similar name of *Gordius* will preclude its final adoption among naturalists.

GRAPTOLITES OF THE UTICA SLATE AND HUDSON-RIVER GROUP.

The fossils of this genus are numerous in many localities of the Utica slate, as well as in the succeeding greenish or olive shales. In the same shales and slates along the Hudson river, they are more numerons, both as individuals and species, than in any other part of the State, or perhaps of the Continent. This genus, which recently contained but a few species, has become so augmented that it now numbers not less than twenty distinct forms. In consequence of these fossils being usually imbedded in shale, and often extremely compressed, some doubt of their true nature has been entertained, and by some authors they have been placed among plants. When imbedded in calcareous matter, they often preserve their original form and proportions, and reveal more clearly their true character. In this condition, they show a more close analogy with the Linnean Virgularia than with any other among living forms. This opinion has already been advanced by Dr. Beck of Copenhagen (Murchison, *Sil. System*, p. 695); and an inspection of the figures of *G. bicornis*, from specimens in limestone (Plate LXXIII, figs. 2 *m* and *m'*), will sustain this view. Judging from this and several other well preserved specimens, all the Graptolites possessed a semicalcareous body with a corticiform covering; which latter, entirely compressed, is all that is usually preserved in the slates.

321. 2. GRAPTOLITHUS PRISTIS.

Pl. LXXII. Figs. 1 *a – s*.

Prionotus pristis. Hisinger, Leth. Suecica, 1837, pag. 114, pl. 35, sup. fig. 5.
Compare *Graptolithus foliaceus*, Murchison,* Sil. System, 1839, pl. 26, fig. 3.

"Linear, straight, scarcely a line broad, compressed; rachis central, capillary; both sides with broad acute teeth."

This description of Hisinger corresponds precisely with the most abundant and widely distributed species of this genus which we have in the older slates. The species occurs in small short fragments, and in forms which appear to be nearly entire, having a length of two inches. When the specimens are flattened, a central capillary axis is very perceptible, extending the entire length. In some specimens where the serrated portion is removed,

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* Portlock is inadvertently cited as authority for this species, on page 79 of this volume.

this central axis is still preserved, extending beyond the other parts of the fossil. It expands gradually, from what appears to be the base, upwards for some distance, but rarely exceeds a single line in width. The serratures are usually acute, but sometimes obtuse.

The aspect of this fossil is very variable, depending in some degree upon the nature of the mass in which it is imbedded; and it is not easy to determine what shall constitute specific characters in bodies so obscure as these, and of which we have but fragments. In the more calcareous portions of the rock they preserve a considerable thickness, but in the thinly laminated shales they form a mere carbonaceous film upon the surface.

I have given figures of this species from various localities, and in slates of slightly different character, in order to present a faithful illustration of its usual form.

Fig. 1 *a*. A fragment of arenaceous slate, from the Hudson-river group at Turin, preserving the bases of several specimens.

Fig. 1 *b*. A portion of the same magnified.

Fig. 1 *c*. A magnified fragment of the same species on the opposite side of this specimen, showing obtuse serratures.

Fig. 1 *d*. A specimen of the same species, from the black slate of Oxtungo creek, south of Fort-Plain.

Fig. 1 *e*. A magnified portion of the same.

Fig. 1 *f*. A fragment of the same species, from the olive slates of the Hudson-river group, at Loraine.

Fig. 1 *g*. The same magnified, showing the obtuse termination of the teeth.

Fig. 1 *h*. A specimen from the olive slate in Lewis county.

Fig. 1 *i*. A magnified portion of the same.

Fig. 1 *k*. A narrow and somewhat more finely serrated specimen, from the Utica slate.

Fig. 1 *l*. The same magnified.

Fig. 1 *m*. A small specimen, showing the axis extending beyond the serrate portion in both directions.

Fig. 1 *n*. The same magnified.

Fig. 1 *o*. A fragment of the same, from the black slates of the Hudson-river group near Albany.

Fig. 1 *p*. A magnified portion of the same, showing the acute teeth near the base, and the broader obtuse ones above.

All these specimens clearly belong to the same species, and the slight variations are due to accidental causes, or to differences observable in different parts of the same specimen, as is shown in some degree in the magnified portion 1 *p*.

Fig. 1 *r*. This specimen resembles *G. foliaceus* of MURCHISON, and differs slightly from the preceding in the short mucronate points of the teeth, shown in the magnified portion 1 *s*. In other respects it is similar.

Position and locality. This species occurs in the Utica slate, and in the olive slates of the Hudson-river group, often very abundantly, and is widely distributed. It is found in great numbers in the black slate near the city of Hudson; at Stuyvesant, Columbia county; near Albany, Ballston and Baker's falls, in a similar slate; in the Utica slate near Fort-Plain, and at Herkimer, as well as other places in the Mohawk valley; in the olive or greenish slates of the Hudson-river group at Loraine, Jefferson county, and at Turin in Lewis county, as well as several other localities in that part of the State.

322. 3. GRAPTOLITHUS SECALINUS.

PL. LXXII. Figs. 2 *a*, *b*, *c*.

Fucoides secalinus. EATON
— *simplex*. EMMONS, Tac. System, pag. 27, pl. 5, fig. 1.
— — ID. Agr. Report, pag. 71, pl. 17, fig. 1.

Stipe linear, elongated, narrowing towards the base; width variable, from less than one line to one line and a half or two lines; axis usually obliterated, when preserved it is capillary like the preceding; margins serrated, teeth more or less acute.

This species is very closely allied to the preceding, if not identical with it, the difference being due to pressure and the extreme lamination of the parts. When we examine a species of this genus imbedded in calcareous matter, and trace the same in its changes presented in the slates of different character, we shall be ready to admit that the variable expansion or width is an unimportant character. I am therefore scarcely willing to admit this one as a distinct species. The slates of the Hoosick quarries have been more metamorphosed than in any other locality where we find these fossils; they are more perfectly laminated, and the surfaces extremely smooth and glossy. If we can imagine them to have remained in a somewhat plastic state, and with these imbedded fossils to have been acted upon in such a manner that the surface has been extended or spread out, as is always true in altered slaty rocks, we can readily account for the greater expansion of the fronds of these graptolites without supposing them distinct species.

In order to show that such a change may take place, I have introduced figures of specimens in the slate from Hudson and from Baker's falls, where the rocks are partially altered and more regularly laminated than in the Mohawk valley, in order to show the gradual change which supervenes in the *G. pristis* under such circumstances. In these specimens, particularly in fig. 2 *b* from Baker's falls, the substance of the fossil has almost totally disappeared, and is scarcely recognized, except by the difference of color in the surface of the slate. The same is always true in a greater degree of those from the Hoosick quarries, which are often so obscure that a particular direction of the light is necessary in order to distinguish the outlines of the fossil. To such causes, therefore, we may sometimes look for the foundation of species, particularly among forms like the Graptolites.

Fig. 2 *a*. A portion of the surface of a lamina of the Hoosick slate, with specimens of this fossil presenting some variations in character. The broader one crossing the figure has the form and appearance of *Prionotus folium* of HISINGER; but it is evidently only a more extenuated form of the same species as the more elongated and narrower ones.

Fig. 2 *b*, *b*. Fragments of the slate from Baker's falls, with forms intermediate between the more expanded varieties of *G. pristis* and those from Hoosick.

Fig. 2 *c*. A specimen from Hudson, where the slates are partially metamorphic, but much less thinly laminated, and the fossils less expanded, than those at Baker's falls or at Hoosick.

Still further east in the town of Chatham, where the slates are more altered, the Graptolites present a greater approximation to those of Hoosick. After examining great numbers of specimens from numerous localities, I am disposed to believe that the *G. pristis*, *G. foliaceus* and *G. folium*, as well as the one here indicated, may all prove identical, the differences being due to the greater or less degree of lamination in the shale, and the preservation of different parts of the frond.

Position and locality. This variety, in its extreme character, is known only in the roofing slate of Hoosick, in Rensselaer county, which overlies the partially metamorphic Trenton limestone. Approximating forms occur at Baker's falls, on the Hudson; at the city of Hudson, and at Chatham in Rensselaer county.

323. 4. GRAPTOLITHUS MUCRONATUS (*n. sp.*).

Pl. LXXIII. Figs. 1 *a*, *b*, *c*, *d*.

Linear, compressed to a thin film; axis capillary, serrated on both sides; teeth with mucronate tips.

The serratures are slightly more distant than in *G. pristis*, and always mucronate. This character has been observed in several small fragments, which are very closely pressed in the thinly laminated slates. It is scarcely possible to conceive that the *G. pristis* assumes this character in some of its parts, and it cannot be due to pressure, since both forms occur together in the slates.

Fig. 1 *a*. Two fragments of this species.
Fig. 1 *b*. A portion of one enlarged.
Fig. 1 *c*, *d*. Fragments of the same species, one of them much contracted, and both preserving extremely mucronate teeth.

Position and locality. This species has been seen only in the partially altered and folded slates of the Hudson-river group near Albany.

324. 5. GRAPTOLITHUS BICORNIS (*n. sp.*).

Pl. LXXIII. Figs. 2 *a* – *s*.

Stipe linear, elongated, compressed, narrow, gradually widening from the base upwards; width one line or less; serrated on both sides; serratures slightly oblique; teeth about half the width of the stipe, obtuse at the extremities; axis capillary; base or radix bifurcate.

This species is clearly distinct from either of the preceding, and easily identified by the obtuse teeth, which are separated from each other by a narrow slit, and each one about half as wide as the entire width of the fossil; the slit or serrature extends about half way to the axis. The specimens all become gradually narrower towards the base, which presents two diverging forks; these are sometimes thickened or expanded, and in other cases very slender, the serræ often continuing beyond the divergence. But for the direction of the serræ, which are regarded as ascending, we might consider this bifurcation as the summit or termination of the fossil.

When imbedded in calcareous matter, this species has a thickness of about half its width, with a prominent round midrib on one side, and the other is often flat or depressed. The substance of the fossil, in such cases, appears to be calcareous or semicalcareous, with a corticiferous covering, which is probably true of all the graptolites. The specimens preserving their original form have the outer margins of the teeth concave, with the upper and lower angles mucronate; but this character is scarcely ever preserved when the fossil is imbedded in slate.

Fig. 2 *a*. A small specimen of the natural size, showing the bifurcation below.

Fig. 2 *b*. A portion of the same magnified, showing the form of the teeth.

Fig. 2 *c*. A larger specimen, having the same character with a stronger bifurcation, which is thickened at the point of separation.

Fig. 2 *d*. A portion magnified.

Fig. 2 *e*. A specimen having similar obtuse teeth, with the base removed and the midrib projecting above.

Fig. 2 *f*. A fragment of slate, with several specimens preserving the peculiar radical termination, associated with *G. ramosus*.

Fig. 2 *g*, *h*. Magnified portions of these, showing a partly uniform character in the teeth.

Fig. 2 *i*. A fragment of this species in the slate, preserving its original form in a good degree.

Fig. 2 *k*. The same enlarged.

Fig. 2 *l*. A fragment in limestone. 2 *l'*. A more compressed form in the same.

Fig. 2 *m*, *m'*. Enlarged portions of the same.

Fig. 2 *m''*. A magnified view of the edge of a specimen in limestone showing an appearance analogous to *G. scalaris*.

Fig. 2 *n*. Transverse sections of the same magnified.

Fig. 2 *o*. A slender specimen, with the sides parallel.

Fig. 2 *p*. A similar specimen, preserving the capillary axis beyond the remaining portion of the stipe.

Fig. 2 *r*, *s*. Magnified portions of these, showing their identity with the preceding.

Position and locality. This species is among the most common in the slates near Albany, and at Ballston, Saratoga county. It is more rarely seen in the slates in Columbia county, and its occurrence in the Mohawk valley is doubtful. It occurs likewise at Cincinnati and other western localities, and appears to be the most common species in that part of the country. (*State Collection.*)

325. 6. GRAPTOLITHUS RAMOSUS (*n. sp.*).

PL. LXXIII. Figs. 3 *a* – *h*.

Stipe linear, narrow, scarcely one line in breadth, compressed; serrated on both sides, except the branches; teeth obtuse, distant, somewhat narrowed towards the base, more than half the width of the stipe; stipes bifurcating or ramose; branches slender, linear, serrated only on the outer margin.

This species may be distinguished from the last by a careful examination of the serratures, which are proportionally deeper and more distant, as well as slightly more oblique and narrowed towards the base. The radical termination has not been seen, and the species usually occurs in fragments of the simple undivided stem, or with a single bifurcation towards the extremity. Other specimens show a wide bifurcation with divergent branches, and others again are several times branched.

When preserved in a tolerable degree of perfection, this is a beautiful and interesting species, presenting a character before unknown in this genus of fossils. The separate branches which are serrated on one side only, can be readily distinguished from the *G. sagittarius* and *G. tenuis*, as well as from the preceding species, by the form and distance of the teeth, which are quite different in these species.

Fig. 3 *a*, *a'*. Small specimens near the radical termination, having a simple bifurcation above. This is the more common form.

Fig. 3 *b*. A specimen with a more diverging and elongated bifurcation, with a smaller specimen lying obliquely across the right ramus.

Figs. 3 *b'* & 3 *b''*. The same species.

This and the preceding species are here grouped together on the same fragment of slate.

Fig. 3 *c*, *d*. Enlarged portions of the two preceding specimens.

Fig. 3 *e*. A specimen with elongated rami, which are serrated on one side only.

Fig. 3 *f*. A specimen branched below, and bifurcating above. The branches and bifurcate stipe above are serrated on one side only, while the stipe below and between the branches and bifurcation is serrated on both sides. This unique specimen proves that the inhabitant had the power of throwing out lateral shoots without dividing its axis; and also that the axis, when divided, does not afterwards become a perfect stipe in each of its two parts, the serræ continuing on one side only.

Fig. 3 *g*, *h*. Enlarged portions, showing the character of the teeth at the points of divergence, below and upon the branches.

Position and locality. This species has only been obtained from the black glazed slates on the Norman's kill, near Albany, though it will probably be found in the localities of other species in Columbia county, and perhaps at Ballston, Saratoga county.

(*State Collection.*)

326. 7. GRAPTOLITHUS SCALARIS.

PL. LXXIII. Figs. 4 *a* – *g*.

Graptolithus scalaris. LINNE.
Prionotus scalaris. HISINGER, Leth. Suecica, Supplement, 1837, pag. 115, pl. 35, fig. 4 *a b*.

Linear, straight, rigid, compressed, with a capillary central axis ; margins smooth ; spaces on each side of the axis marked by transverse slits or dissepiments, which do not reach the margin ; stipe narrowing towards the base, and terminating in a thickened expansion.

This appears to be identical with the figure and description of HISINGER. I have other specimens which show no central axis, and have but a single range of transverse dissepiments; these I have arranged with the former, believing that this difference is due to accidental causes, or to one side of the specimen only being shown.

This species is more rigid than either of the preceding, except *G. bicornis*, and is readily distinguished by the absence of serratures on either margin.

Fig. 4 *a*. A specimen showing the radical termination.
Fig. 4 *b*. A portion of the same magnified.
Fig. 4 *c*. A more slender and tapering specimen, with a single range of dissepiments.
Fig. 4 *d*. A portion of the same magnified.
Fig. 4 *e, f*. A small fragment, with oblique dissepiments and smooth margins. This resembles the *G. sagittarius*, with both margins uninterrupted.
Fig. 4 *g*. A specimen with, apparently, a single range of dissepiments, and a central capillary axis projecting beyond the stipe.

The forms given are quite variable, possessing a single character in common, that of continuous smooth margins. The specimens are all exceedingly compressed, and it appears as if the apparently continuous margin may be fallacious, or due to the expansion of the thin covering of the stipe beyond the edges of the serræ. This conclusion appears more reasonable when we compare the nearly direct and oblique dissepiments, corresponding to the *G. bicornis* and *G. sagittarius*. The same character has been observed by Capt. PORTLOCK (*id cit.*, pag. 321, pl. 20, figs. 2, 3 and 4). I cannot doubt but this one (represented in fig. 4 *a*, *b*) is the form to which HISINGER applies the name of *Prionotus scalaris*.

Position and locality. This species, fig. 4 *c*, occurs in the Utica slate, on West-Canada creek. The other specimens figured were all obtained from the Norman's kill, near Albany.

(*State Collection.*)

327. 8. GRAPTOLITHUS SAGITTARIUS.

PL. LXXIV. Figs. 1 *a*, *b*.

Prionotus sagittarius. HISINGER, Leth. Suecica, Supplement, 1837, pag. 114, pl. 35, fig. 6.
Graptolithus sagittarius. PORTLOCK, Geol. Rep. Londonderry, 1843, pag. 320, pl. 19, figs. 8 *a b*.

Stipe linear, straight or flexuous, extremely elongated, about one line in width, compressed; one side smooth and the other serrated; teeth oblique, acute, distant about half the width of the stipe.

This species is readily distinguished from the preceding, by the regular strong serratures on one side of the axis only. Specimens of eight or nine inches in length are of frequent occurrence, and these are only fragments of much longer ones. It shows no apparent increase or diminution of width in either direction, and neither the lower or upper termination has been observed. There is, apparently, a capillary axis near the smooth margin, and the surrounding substance of the stipe is sometimes of considerable thickness. The character is very uniform, showing, in a large number of specimens examined, no important deviation from those figured.

This species is distinguished from the *G. clintoni* of New-York by its shorter and stronger teeth, and by the same characters from *G. murchisoni* and *G. sedgwickii* of Europe.

Fig. 1 *a*. A fragment of the slate, showing three nearly parallel stipes of this species.
Fig. 1 *b*. A magnified portion, showing the upper margin of the teeth to be nearly rectangular to the direction of the stipe, while the lower side is oblique.

Position and locality. This species occurs in the glazed and folded black slates on the Norman's kill, near Albany; in the town of Stuyvesant, and near Hudson, Columbia county.

328. 9. GRAPTOLITHUS TENUIS.

PL. LXXIV. Figs. 2 *a* – *d*.

Graptolithus tenuis. PORTLOCK, Geol. Rep. Londonderry, pag. 319, pl. 19, fig. 7 *a b*.

Stipe very slender, filiform, straight or flexuous, with one side obscurely and distantly serrated, the other side smooth.

This species is readily distinguished from the preceding by the appressed, obscure, and more distant serratures. The width in all the specimens examined is less than half that of *G. sagittarius*, and it often appears as if both sides were destitute of serratures.

Fig. 2 *a*. Slender elongated stipes of this species, associated with *G. sagittarius*.
Fig. 2 *b*. A portion of one of these magnified.
Fig. 2 *c*. A small filiform stipe, gradually tapering and bent abruptly backwards.
Fig. 2 *d*. A portion of the same magnified, showing the serratures of the same character as the preceding.

Position and locality. This species has been seen only in the black glazed slates of the Norman's kill, near Albany.

329. 10. GRAPTOLITHUS SEXTANS (*n. sp.*).

Pl. LXXIV. Figs. 3 *a* – *e*.

Slender, bifurcating from the base; branches linear, straight, serrated upon the outside; serratures oblique; teeth sharp, and extended into a slender mucronate point. In perfect specimens, two small setæ extend from the base, one on each side.

This small species appears to be quite distinct from either of the others. In a considerable number of specimens examined, it bifurcates at the base, from beneath which two slender spines or bristles proceed. The bifurcations are straight, and regularly diverging at an angle of sixty degrees. The angular teeth on the outer margin always preserve a mucronate point when perfect, and this character is sufficient for identifying small fragments.

Fig. 3 *a*. A fragment of slate on which are two specimens of this species, with straight diverging branches.
Fig. 3 *b*. A portion of one of these magnified, showing the mucronate teeth.
Fig. 3 *c*. Specimen with larger branches.
Fig. 3 *d, d*. Two specimens, showing the appendages at the base.
Fig. 3 *e*. One of the last magnified.

Position and locality. This species is known to me only in the black slates of the Norman's kill, near Albany. (*State Collection*.)

330. 11. GRAPTOLITHUS FURCATUS (*n. sp.*).

Pl. LXXIV. Figs. 4 *a* – *f*.

Stipes slender, bifurcating near the base; branches diverging, curved in the centre, and converging towards the extremities; stipe below the bifurcation serrated on both sides, branches serrated on the outside; teeth nearly as wide as the branches, rectangular, obtuse; inner side of the branches more obliqely serrated.

This small and peculiar species is readily distinguished from either of the preceding, by its curving bifurcations, and shape of the serratures. In a laige number of specimens examined, it preserves the form and character given in the figures, and a single branch can be distinguished by a careful comparison. It differs in its mode of bifurcating from *G. ramosus*, and is always smaller and narrower.

Fig 4 *a*. An individual on the same stone with 3 *d*, showing the difference in form.
Fig. 4 *b*. A magnified portion of the same.
Fig. 4 *c*. A small specimen, with the branches more converging than usual.
Fig. 4 *d*. A portion of the last magnified, showing no serratures on the inside of the branches.
Fig. 4 *e*. Another specimen, similar in form to 4 *c*.
Fig. 4 *f*. A part of the same magnified, showing serratures on the inside of the branches.

Position and locality. In the glazed slates of the Norman's kill, near Albany.

331. 12. GRAPTOLITHUS SERRATULUS (*n. sp.*).

PL. LXXIV. Figs. 5 *a*, *b*.

Stipe straight, slender, almost filiform, widely diverging from an acute point (the base?); upper or inner edge serrated; teeth triangular, distant nearly the width of the stipe; serratures nearly as deep as half the width of the stipe.

This species closely resembles the *G. sagittarius*, but differs in the greater obliquity of the serratures and the distance of the points of the teeth, which are, in this specimen, equal to that species where the stipe is more than twice as wide. This character may prove sufficiently distinctive to identify small fragments of the two species.

Fig. 5 *a*. A specimen of the natural size, diverging from a slender smooth spine or mucronate radicle below.

Fig. 5 *b*. A portion magnified, showing the form and opposite direction of the serratures at the base.

Position and locality. This is found, associated with several of the preceding species, in the black slates at Norman's kill, near Albany.

332. 13. GRAPTOLITHUS GRACILIS (*n. sp.*).

PL. LXXIV. Figs. 6 *a*, *b*, *c*, *d*.

Stipe very slender, branching from one or both sides; branches slender, gradually enlarging, sometimes dividing, distinctly serrate; serratures oblique; teeth distant, appressed, or scarcely distinguishable above the outline of the branches.

This is much the most slender and graceful species among the Graptolites. In the examination of a large number of specimens, I have not been able to learn that the principle stipe is serrated, though the branches are distinctly so on one side.

Figs. 6 *a*, *b*. Two specimens, natural size, showing the principal stipe and branches, one of the latter being subdivided.

Fig. 6 *c*. A specimen in which the principal stipe is obscure; several branches are subdivided.

Fig. 6 *d*. A fragment magnified, showing the serratures of the branches.

Position and locality. This species is only known to me in the black slates on the Norman's kill, near Albany.

333. 14. GRAPTOLITHUS? LÆVIS (*n. sp.*).

PL. LXXIV. Fig. 7.

Stipe slender, linear, flexuous, smooth on both margins; not branched.

This fossil presents the same appearance as the Graptolites, and occurs in the same position. I have several specimens, all presenting a uniform character; and from its being of common occurrence, I have figured it in this connection.

Position and locality. In the Utica slate, at Turin, in Lewis county.

CORALS OF THE HUDSON-RIVER GROUP.

Plate LXXV.

We have few additional species of the solid corals, beyond those common to the Trenton limestone. The comparatively small amount of calcareous matter furnished during the deposition of the materials of this group, show at once why so few Corals flourished in that period. And we again find, as before remarked, that as the formation becomes more calcareous in its western extension, the Corals increase in number of individuals and species, in some places constituting a large proportion of the rock. In the shaly and arenaceous strata of this group in our own State, we are, for the most part, forced to depend upon the exterior moulds of these forms, the calcareous matter of the coral having been dissolved and removed. In more favorable situations the specimens are well preserved, but they never acquire the perfection and beauty which is seen in those from the same position in Ohio, Indiana and Kentucky.

Genus FAVISTELLA.

[Latin, *favus*, honeycomb, and *stella*, a star.]

Character. Coral massive, hemispheric or globose, composed of polygonal tubes or cells, which increase by interstitial tubes, or by lateral developments of tubes upon the margins of the mass; cells divided transversely by closely arranged diaphragms, and longitudinally by radiating dissepiments; extremities of the tubes starform; rays (dissepiments) about twelve, more or less, meeting in the centre. The rays generally reach one half or two thirds of the distance from the margin to the centre.

334. 1. FAVISTELLA STELLATA (*n. sp.*).

Pl. LXXV. Figs. 1 *a*, *b*, *c*.

Coral hemispheric or spheroidal; cells polygonal, with diameters of one eighth or one tenth of an inch; walls of the cells not separable as in Favosites, but apparently composed of a single partition or lamina.

The tubes are usually six-sided, and two rays or dissepiments proceed from each side; in other specimens of interstitial tubes there are a less number of sides, and consequently a less number of dissepiments. The diaphragms are usually nearly direct, or bending slightly downward at the margins.

This species is one of the most beautiful corals among the older rocks. The ends of the tubes present a beautiful stellate appearance, and the mass is often as open and free from the infiltration of mineral matter as in the recent corals. In weathered specimens, the sides of the tubes show the remains of the vertical and transverse partitions of the adjoining cells.

Fig. 1 *a*. A fragment of this coral, showing a vertical section, with an oblique section of the extremities of the tubes.

Fig. 1 *b*. A transverse section of the cells, showing the starlike extremities.

Fig. 1 *c*. An enlarged view of the extremities of several cells.

Position and locality. This species is scarcely known in New-York, a few obscure specimens being all that I have observed in the shaly parts of the Hudson-river group. In the western extension of the same formation it is abundant, and developed in large spheroidal and hemispheric masses. At Madison, Indiana, this species forms two distinct layers near the top of the shales of this group, occurring in masses of from one to three feet in diameter. (*State Collection.*)

101. 2. CHÆTETES LYCOPERDON.

PL. LXXV. Figs. 2 *a*, *b*, *c*, *d*, *e*, *f*.

Reference pag. 64, pl. 23 and 24 of this report.

This coral acquires its full development in the shaly part of the Trenton limestone, rarely appearing in hemispheric forms in the succeeding shales. In the more calcareous part of the Hudson-river group it occurs in ramose forms, similar to those already described, and assumes some other features in its mode of growth not observed in the limestone. Notwithstanding the fact that it is rarely or never found in the hemispheric form, the animal appears often to have commenced its growth in this way, and to have discontinued it, probably from unfavorable circumstances, while the slender branching forms are numerous in the same situation.

Fig. 2 *a*, *b*. The bases of two hemispherical forms, where the tubes have a barely perceptible extension.

Fig. 2 *c*. A fragment of a ramose form, one of the largest occurring in this group.

Fig. 2 *d*. A subhemispheric form, which commenced its growth upon the column of a crinoid.

Fig. 2 *e*. A fragment of stone, with several ramose forms associated with a crinoidal column, a small *Murchisonia* and *Orthis testudinaria*.

Fig. 2 *f*. Magnified section of a ramose form, showing the columns to be nearly parallel to the axis of the specimen.

Position and locality. This species occurs throughout the Hudson-river group, particularly in the calcareous strata; and though assuming a somewhat different aspect from the same species in the Trenton limestone, is nevertheless identical. The principal localities are Turin, Lewis county; Loraine, Jefferson county; Pulaski, Oswego county; and it is also found in numerous other places. (*State Collection.*)

Genus DISCOPHYLLUM.

[Greek, δισκος, a disc, and φυλλον, a leaf.]

Character. Discoidal, flattened, rays or dissepiments numerous, proceeding from the centre; body of the fossil apparently semicalcareous or corticiferous; margin well defined. From the semi-metamorphic condition of the rock, it is impossible to determine whether this body was calcareous; but it appears to have been otherwise.

335. 1. DISCOPHYLLUM PELTATUM (*n. sp.*).

PL. LXXV. Fig. 3.

Body consisting of a somewhat circular flattened expansion, composed mainly of radiating fibres, which enlarge as they recede from the centre, and terminate in a thickened border.

This fossil appears to have consisted, originally, of a semi-hard circular or oval body, with firmer rays, reaching nearly or quite to the margin. The body becomes thicker and apparently harder towards the margin, and the rays are nearly concealed in its substance. This disc may have been attached by a smaller stipe, proceeding from the lower side, some obscure evidence of such an appendage existing.

Two specimens of this peculiar fossil have been found: one in 1822, and the other a few years since, showing that it is an exceedingly rare form. It is quite unlike any other fossil known in our older strata.

Position and locality. This species occurs in the partially metamorphic arenaceous shales of the Hudson-river group, near the Nail Factory, below Troy, where the only known specimens have been found. (*Cabinet of Troy Lyceum; Cabinet of* Prof. COOK.)

336. 1. (*Undetermined.*)

PL. LXXV. Fig. 4.

The specimen figured is an impression of the outer surface of some incrusting coral, frequently found attached to the shell of the *Orthoceras coralliferum*. It appears to be composed of large elevated points or stars, with an intermediate granulated or papillose surface. It is usually obscure, or very imperfectly preserved, the more elevated points only being visible. The figure is of the natural size, from a specimen adhering to an *Orthoceras*. This coral is also represented in an imperfect specimen attached to another shell of the same species (Plate lxxxvi, fig. 1). It is sometimes found under other circumstances, and attached to other shells, but always so obscurely preserved that its characters cannot be well determined.

Position and locality. This coral is known in many localities of the Hudson-river group, widely separated from each other. It has been found at Turin, Pulaski, Loraine; near Rome, in Oneida county; in the altered shales near Waterford, and in the same situation in Ohio, near Cincinnati. (*State Collection.*)

CRINOIDEA OF THE HUDSON-RIVER GROUP.

Plates LXXVI., LXXVII. & LXXVIII.

Scarcely more than three well marked species are known in this group, and one of these may be regarded as having existed during the period of the deposition of the Trenton limestone. The fragments of these species, and the columns of the same, appear under so many different forms and aspects as to indicate a greater number of species than really exist, and on this account have been more fully illustrated. The characteristic species of the Trenton limestone ceased to exist with that formation, and the peculiar forms so well preserved in that rock do not appear beyond its termination. At this period the nature of the sediment in its eastern part was not well adapted to the growth or preservation of this class of animals; and, as might be expected, we find in the western extension of the same, where the mass becomes more calcareous, an increase of the number, and a better preservation of their remains.

In addition to the unequivocal forms of Crinoidea, the western localities of this group have afforded several species of the asteroid form, which have a very close resemblance to the true Asterias. A single fragment of this character has been found in the shales of this group on the south side of the Mohawk valley, but it is too obscure to be described. All the forms here described, as well as those from the Trenton limestone, terminate their existence with this formation, and the next rock in which such remains occur presents us with a new assemblage.

Genus HETEROCRINUS.

[Greek, ἑτερος, irregular, and κρινος, a lily.]

Character. Column more or less pentagonal; pelvis composed of five plates, which are somewhat irregular; costal plates in a single or partially double series, pentagonal, heptagonal or quadrangular; scapular plates regular; arms variable in character; fingers composed of a double or single series of quadrangular joints, which are not tentaculated.

The two species which I have placed under this genus, have a similar pentagonal column, with the pelvic plates similar in each. The succeeding plates are somewhat irregular, but are few in number, and the entire structure very simple, interposed plates being entirely absent. Although I have but two species, and of these only imperfect specimens, it is evident that they may with propriety constitute a distinct genus, on the basis of Miller's arrangement. The third species, which is provisionally placed under this genus, cannot be satisfactorily determined at present.

337. 1. HETEROCRINUS HETERODACTYLUS.

PL. LXXVI. Figs. 1 *a – o*.

Body short, rounded, subcylindrical, tapering above and below; pelvis composed of five small pentagonal plates, which are succeeded by the same number of larger costal plates, and these again by five scapulars; arms irregularly subdivided; column pentagonal, composed of thick joints, which are nodulose at the angles; joints alternating in size as they approach the pelvis.

This is a peculiar species, remarkable for the small size of the body when compared with the column. The irregularity of the arrangement of the plates in the arms and fingers is likewise a striking characteristic of the species, which is constant in two specimens from different localities. In one of the arms (fig. 1 *d*), the scapular plate (n) supports a regular series of six or more plates ($\frac{K}{d}$ 1) of similar form without division. The arms at the right and left of this one are again unlike each other. The one on the left has three regular and gradually diminishing joints ($\frac{K}{d}$ 2) above the scapular, and of the same form; the last one supports the cuneiform joint ($\frac{L}{K}$), which again supports a double row of joints (or a pair of fingers). The arm on the right of the first mentioned, consists of a pair of quadrangular joints ($\frac{K}{d}$ 3), each of which supports a cuneiform joint ($\frac{L}{K}$ $\frac{L}{K}$). In the remaining two arms, no plates have been traced beyond the scapulars, and consequently the entire form of the species cannot be determined. Sufficient is visible, however, to show the irregular character of the arms, from which its name is given.

Figs. 1 *a*, *b*. Two specimens of the natural size.
Fig. 1 *c*. The body of the same enlarged. 1 *c'*. Transverse section of the column, enlarged.
Fig. 1 *d*. An enlarged figure, representing the structure of this species.
Figs. 1 *e*, *f*. Fragments of slate with pentagonal columns of this species, showing the body at *f'*.
The fragments of round columns in the same specimens are of another species (see Plate lxxvii).
Fig. 1 *g*. A fragment of one of these columns enlarged, showing the nodulose angles.
Fig. 1 *h*. A fragment of a column, with a section of the same.
Fig. 1 *i*. A fragment of slate, showing numerous impressions of the discs or plates of the column.
Fig. 1 *k*, *l*, *m*, *n*, *o*. The same magnified, showing the pentapetalous expansion around the canal, and the deeply impressed striæ, which are different in each one. Where the column is crystalized these markings are not visible.

Position and locality. Fragments of the columns of this species are found in the shales of the Hudson-river group, in nearly all localities. Of the two individuals figured, one is from near Boonville in Lewis county, and the other from Loraine, Jefferson county; it is also found near Rome, Oneida county. I have the same species from the shaly strata near Cincinnati, Ohio. (*State Collection.*)

338. 2. HETEROCRINUS SIMPLEX.

Pl. LXXVI. Figs. 2 *a, b, c, d.*

Body slender, very gradually expanding above the base, and composed of five regular divisions above the pelvic plates; pelvic plates five, four of them irregularly pentagonal, and one with the lateral and upper margins equal; costal plates in two of the divisions single, hexagonal, and supported on the straight upper edges of the pelvic plates, those of the three other divisions double, the lower one pentagonal with the lateral margins short, the second one quadrangular; scapular plates quadrangular, with the upper sides concave and supporting a pentagonal arm-joint; arm-joint supporting on its oblique upper edges a double series of obliquely quadrangular or rhomboidal plates, which gradually diminish in size; column subpentagonal, composed (near the pelvis) of alternating thicker and thinner plates.

This species is readily identified by its structure, which is peculiar in the form of four of its pelvic plates, and the double or subdivided costal plates in three of the divisions; the body and arms, when closed together, present a slender subcylindrical form, scarcely attracting attention, from their resemblance to a collection of small individual columns. The small fragment of a column attached, which is crushed, can scarcely be characterized, but it is clearly pentagonal.

I am indebted to Mr. J. G. Anthony, of Cincinnati, for the specimen here figured.

Fig. 2 *a.* The specimen, natural size.
Fig. 2 *b.* A few joints of the columns enlarged.
Fig. 2 *c.* Section of the same, which is flattened from pressure.
Fig. 2 *d.* An enlarged figure, showing the structure of the body and arms of this species.

Position and locality. In the soft shaly portions of the Blue limestone of Ohio at Cincinnati, equivalent in position to the Hudson-river group of New-York.

339. 3. HETEROCRINUS? GRACILIS.

Pl. LXXVI. Figs. 3 *a, b.*

This is a small slender species, with the body but little expanded, supporting long and slender fingers, which are not fimbriated; column pentagonal, proportionally large; the plates distant, not nodulose on the angles; radicles numerous, jointed, diverging.

This is a very delicate species, approaching in form and general appearance to the first species; but the plates of the body are so far destroyed that their arrangement cannot be determined. The angles of the column are not nodulose, as in that species, and this is almost the only obvious mark of distinction.

Fig. 3 *a.* The specimen of the natural size. 3 *b.* The same magnified.

Position and locality. This species occurs in the soft olive shale at Snakehill, Saratoga lake. (*State Collection.*)

Genus GLYPTOCRINUS.

[Greek, γλυπτος, sculptured, and κρινος, a lily; in allusion to the deeply carved or sculptured plates of the body.]

Character. Column round; pelvis composed of five plates; costals in two series, with a single regular intercostal plate; scapulars five, with two interscapular plates; scapulars supporting a pair of arm-plates, which are succeeded by the hands and fingers.

340. 1. GLYPTOCRINUS DECADACTYLUS.

Pl. LXXVII. Figs. 1 *a*–*f*; and Pl. LXXVIII. Figs. 1 *a*–*u*.

Body cupshaped, with ten arms, which support twenty tentaculated fingers; plates all marked by strong elevated radiating ridges; pelvic plates five, pentagonal, supporting upon their upper oblique edges five heptagonal costal plates, which are succeeded by five hexagonal second costals in a direct line; scapular plates heptagonal, resting directly upon the straight upper side of the second costals, and supporting on their two upper oblique edges two hexagonal arm-joints, which in turn support a second arm-joint, and this one two hexagonal hand-joints, the latter sustaining the fingers; fingers composed of a column of fimbriated joints, which are quadrangular below and cuneiform above; column round or obtusely pentagonal, varying in its character at different distances from the body.

In addition to the regular series of plates supporting the arms and fingers, there are numerous intermediate ones, of which a hexagonal intercostal plate, a first pair of hexagonal interscapular plates, and a second pair of heptagonal interscapular plates, the latter truncated above, are always regular and uniform. Between these last interscapular plates, there is usually an irregular interscapular joint, and several pectoral plates. The number and arrangement of the latter does not appear to be always uniform; but I have not been able to find specimens where every part could be satisfactorily examined. Between each pair of arms there are three or more plates, and between each pair of fingers one or more plates at the base. The capital plates, and their arrangement, are shown in the enlarged figure of the crown, fig. 1 *d*, pl. 77. The mouth is depressed and obscure.

The body of this species is readily recognized by the strong radiating ridges which mark the surface of all the plates below the tentaculated fingers. The surface is also marked by five more prominent ridges, which, proceeding from the first costal plates, bifurcate on the scapular plate, the divisions extending to the base of each pair of fingers. In these characters of the surface, and in its general structure, it resembles some species of the Genus Actinocrinus, from which it differs in having five instead of three pelvic plates.*

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* The first notice of this fossil was given by Mr. J. G. Anthony of Cincinnati, in Silliman's *American Journal of Science*, 1838, Vol. xxxv, p. 405. Mr. A. gives a very good figure of this beautiful species, but proposes no name,

There is some difficulty in making out the entire structure, since the plates usually adhere very closely, and some of the pectoral and interbrachial plates are very small. The important parts, however, and the plates proceeding to the arms, are readily and clearly determined.

This fossil is usually found destitute of the column; and I have not been able to decide satisfactorily whether all the fragments found with it are parts of the same, or belong to two species. The first, which evidently belong to this species, and form the upper part of the column, consist of joints, having a small base resting upon the broader disc of the next one below, giving more freedom of motion. Other portions have the upper surface of the disc excavated, and the column appears to be composed of a series of cups, alternating in size and placed one within the other, having the upper edges either smooth or fimbriated (figs. 1 *a* and 1 *b*, pl. 78). These columns have usually a distinct round alimentary canal, with the upper and lower surface marked by fine rays, more deeply impressed near the edge. In other parts of the column, where the plates are more nearly equal in size, the upper and lower surfaces have a pentapetalous impression or elevation radiating from the alimentary canal. This character, in fine, becomes the prominent and characteristic one of the greater proportion of the fragments of columns which we find; and they present all the variety of broad equal smooth joints with even surfaces, or of similar joints with a thin plate interposed, and of columns composed of moniliform joints with smaller ones between; or of distant rounded joints, sometimes deviating slightly from a cylindrical form. All the important varieties are illustrated by figures.

Plate LXXVII.

Fig. 1 *a*. A fragment of stone with two small specimens, preserving the tentaculated fingers.

Fig. 1 *b*. Figure of a larger specimen, showing the character of the plates and their arrangement more distinctly. The bases of the fingers, with about five or six joints, are preserved in this specimen.

Fig. 1 *c*. The upper extremity or crown of the last specimen, showing the capital plates.

Fig. 1 *d*. The same enlarged.

Fig. 1 *e*. A portion of the surface enlarged, showing the form and character of the plates, and the strong radiating ridges.

Fig. 1 *f*. An enlarged figure, showing the structure and arrangement of the plates as described. A small portion only of the plates of the fingers are represented, but there are no subdivisions beyond this point.

Plate LXXVIII.

Fig. 1 *a*. A figure of a specimen, preserving a small portion of the column and the entire length of the fingers.

Fig. 1 *b*. Fragments of columns, composed of alternating larger and smaller discs with angular edges.

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suggesting that it may be an *Apiocrinite*, which proves otherwise on examination. From his account, it would appear that the first specimen was found at Cincinnati, in 1837. This species is probably one of those named in Dr. Owen's Catalogue; but I have never seen a description of the same, nor received a specimen with the name attached.

Fig. 1 *c*. Section of the same.

Fig. 1 *d*. Section and figure of a similar fragment of a column enclosed in a coral.

Fig. 1 *e*. Fragment and section of a column where the discs are excavated on their upper side, and have plain rounded edges with a pentapetalous impression on the extremities.

Fig. 1 *f*. Fragment of similar character, having the upper edges of the plates fimbriated.

Fig. 1 *g*. Section of the same, enlarged.

Fig. 1 *h*. A magnified portion of 1 *f*, showing the fimbriated edges of the discs.

Fig. 1 *i*. Separate plates or discs of a similar column, showing the variable character of the marginal crenulations, one specimen being marked by six prominent angles.

Fig. 1 *k*. Two figures, showing the proportionate size of the larger and smaller discs in the columns, composed of plain alternating joints.

Fig. 1 *l*. A fragment of slate, with impressions of various discs of columns.

Fig. 1 *m*. Several of the same enlarged, showing their analogy with the preceding and following forms.

Fig. 1 *n*. Fragment of a column, with the edges of the discs rounded and slightly nodulose; intermediate plates thin.

Fig. 1 *o*. Edges of the discs rounded and subnodulose; intermediate ones thin, nodulose.

Fig. 1 *p*. Edges of the discs rounded and smooth, the intermediate ones thin.

Fig. 1 *r*. Edges of the discs flat and broad, the intermediate ones thin.

Fig. 1 *s*. A fragment of slate with moniliform columns; the intermediate plates often being scarcely distinct, while in others they are half as thick as the larger ones.

Fig. 1 *t*. Large fragments of columns in the compact slaty rocks of the Hudson-river group, with the discs thick, the intermediate ones being scarcely visible.

Fig. 1 *u*. A similar fragment of a column, with a section of the end, showing its identity with the preceding figures.

These figures illustrate nearly all the varieties of form usually seen in the columns of this species. There are some others presenting deviations greater than those figured, of which I have some doubt as to their specific identity, and therefore do not give them in this place. I have also entertained some doubt as to the propriety of uniting the figures from 1 *n*, pl. 78, onwards with the preceding, since I have not been able to trace a positive connection between the remote forms, though fig. 1 *e*, which is clearly identical with the preceding figures of columns, presents the pentapetalous impression on the extremity of the discs.

Position and locality. This one is the most common species of this family in the western extension of the formation, occurring at Cincinnati (O.), Maysville (Ky.), and Madison (Indiana). In numerous localities in New-York, fragments of the columns are abundant, but I have never been able to find the body. Fragments of columns, well preserved, are abundant in western localities. Those figured are from Cincinnati (Ohio), Maysville (Kentucky), Pulaski, Turin, Loraine, Boonville, and other places in New-York.

(*State Collection.*)

I am indebted to Mr. Joseph Clarke, to Mr. Anthony, and to Mr. Carly of Cincinnati, for beautiful specimens of this species.

129. 1. TENTACULITES FLEXUOSA.

PL. LXXVIII. Figs. 2 *a*, *b*.

Reference pag. 92, pl. 39, fig. 6 of this report.
Tentaculites. EMMONS, Geol. Report, 1842, pag. 404, fig. 6.
Compare *Cornulites serpularius*, SCHLOTHEIM. MURCHISON, Sil. System, pag. 627, pl. 26, figs. 5 – 8.

This species is equally as abundant in the rocks of the Hudson-river group as in the Trenton limestone. In the latter it often attains a greater length, and is nearly straight or simply curved. The flexuous character, therefore, may not be constant or essential in distinguishing the species, though I have not seen perfectly straight specimens. In the shales and ferruginous shaly sandstones of the Hudson-river group, the moulds only of this species are found, and the fine longitudinal striæ are rarely well preserved. It is distinct from either of the species described by Mr. MURCHISON, from the Caradoc sandstone.*

Fig. 2 *a*. Fragment of the stone with several specimens *a*, *a*, *a*, associated with corals, shells, etc.
Fig. 2 *b*. A specimen enlarged, showing the longitudinal striæ.

Position and locality. In the middle and higher parts of the Hudson-river group at Turin, Boonville, Loraine, Pulaski, and other places in New-York; at Cincinnati (Ohio), Maysville (Kentucky), and Madison (Indiana).

NOTE TO THE CRINOIDEA.

Since this volume will be published without the elementary portion, which is in preparation, and will form a part of the next volume, the following explanations are given of the signs used in designating the structural arrangement of these animals. Those only are given which are used in the plates of this volume.

B. Base of attachment.
E. Pelvis.
F. Costal plate or joint.
G. Intercostal plate or joint.
H. Scapular plate.
I. Interscapular plate.
J. Irregular interscapular plate.
K. Arms.
L. Cuneiform joint.
M. The hand.
N. The fingers.
Q. Pectoral plates.
R. Capital plates.
$\frac{K}{L}$ Cuneiform arm-joint.
a. First.
b. Second.
d. Joint, as $\frac{F}{a}$, first costal; $\frac{F}{b}$, second costal, etc. $\frac{K}{d}$, arm-joints.

* In the description of this species, I had overlooked the analogy in its mode of growth to that of the *Cornulites serpularius*, so fully illustrated by Mr. MURCHISON. The structure, however, is quite different, being annulated by sharp equal ridges, and not composed of sections of different sizes, one proceeding from the other. The apparently septate character, shown in a single large individual in the Trenton limestone, may indicate a structure incompatible with the true TENTACULITES. Its geological position is below that of the *Cornulites serpularius*; and should further examination and comparison prove it to be generically allied to that one, it will form a distinct species.

BRACHIOPODA OF THE UTICA SLATE AND HUDSON-RIVER GROUP.

Plate LXXIX.

Few species of this class are known in the Utica slate, and the individuals rarely found are specifically identical with those of the Trenton limestone. As the shales become less carbonaceous and lighter colored, with an admixture of arenaceous and calcareous matter, some of the species so abundant in the Trenton limestone again make their appearance in great force, and characterize the strata in almost all localities. Although, from the nature of the mass, they are in a different condition, they nevertheless preserve all the peculiarities of the same species in a lower position; while the absence of the shell, and the abundance of moulds of the interior and exterior surface, have induced an opinion that there are several distinct species. This remark is peculiarly applicable to the *Leptæna alternata*, which is rarely found preserving its shell entire, while the impressions of the outer and inner surface are abundant. This species has already (pages 102, 103 and 104, Pl. 31 and 31 A of this volume) been fully illustrated, and a few figures presenting its appearance and character in this group are given in the present connection.

It should be borne in mind, however, that comparatively few of the Trenton limestone species of Brachiopoda are found in the strata of this group, the larger portion ceasing their existence with that rock. The forms given on Plate lxxix are nearly all that usually occur; the *Leptæna alternata*, *L. sericea* and *Orthis testudinaria* being quite abundant, while the *Atrypa* and *Lingula* are rare. At the same time we find two other species of *Orthis*, which have not been observed in the limestone below. The same horizon, in the western extension of the formation, gives us not only the Trenton limestone species, but also several others not known within New-York. The few species occurring in this position in New-York, differing from those known in the Trenton limestone, are not therefore to be regarded as offering any important distinction between the two portions of the group; for we shall doubtless yet find many more in the lower limestones than we now know.

133. 7. LINGULA QUADRATA.

Pl. LXXIX. Figs. 1 *a*, *b*.

Reference pag. 96, pl. 30, fig. 4, of this volume.
Lingula rectilateris, Conrad, MS. Emmons, Geol. Report, 1842, pag. 399, fig. 6.

I am unable to perceive any essential difference between this shell and the *L. quadrata* of the Trenton limestone. The figure given by Prof. Emmons has the sides straighter and the upper extremity more pointed than the original specimen. In two specimens examined there is a slight difference in the form, owing in part to compression; but there is no more deviation than is often observed in the same shell in the limestone. The surface is marked by concentric lamellose striæ, and the centre by nearly equal longitudinal striæ; the sides are more or less straight, the base rounded with the upper extremity often subcuneate, having the slopes nearly direct. The base is sometimes nearly straight, and the shell resembles *L. lewisii.*

Figs. 1 *a*, *b*. Figures of two specimens, showing the difference ordinarily seen in the form of this fossil.
Fig. 1 *c*. A portion of the surface magnified.

Position and locality. In the soft argillaceous shales in the lower part of the group at Loraine, Turin, and other places. (*State Collection.*)

141. 4. LEPTÆNA ALTERNATA.

PL. LXXIX. Figs 2 *a* – *l*.

Reference pag. 102, pl. 31 and 31 A, of this volume.
Strophomena nasuta. CONRAD, Jour. Acad. Nat. Sciences, Vol. viii, p. 160.
— — EMMONS, Geol. Report, 1842, pag. 403, fig. 3.
Strophomena. ID. Ib. pag. 403, fig. 2.

This species occurs under a variety of conditions, and often presents a different aspect from the same in the Trenton limestone; but a comparison of several hundred specimens has convinced me that it is identical. The casts of the interior are striato-punctate, as in all the LEPTÆNA; and the alternating character of the striæ is not well preserved, or even at all visible. The circumstance of having one or two of the central lines larger than the others is often observed, and we have the same, already noticed, in those of the limestone. This character, therefore, which has been regarded as reliable for distinguishing it from *L. alternata* and *L. deltoidea*, is of no importance. It presents in these rocks, as in the limestone below, all the varieties from forms acutely nasute in front, to those of regularly curved outline, and entire absence of this character.

The impression of the outer surface of the shell, so often preserved in these rocks, shows, in a very perfect manner, the beautiful fascicles of striæ, separated by larger ones. This character, however, is not always evident; neither does it exist equally in all specimens. In a few localities we find this species with the shell perfect, showing in all its variety the same character which the species every where exhibits, and which is even more strongly marked and better preserved than is usual in the limestone. The most interesting parts of the shell, however, are the moulds of the interior of the valves, which are never found in the Trenton limestone. These reveal important characters of the species, on which we may rely in distinguishing it from others.

Fig. 2 *a*. Mould of the interior of the convex valve of this species, showing the form of the visceral impression, the oblique teeth, etc. The nasute character is well preserved.
Fig. 2 *b*. Figure of a similar specimen, where the nasute character is less conspicuous.
Fig. 2 *c*. A smaller specimen of the same character, showing a slight contraction in front.
The entire surface in such specimens, when well preserved, is striato-punctate.

Fig. 2 *d.* A portion of the surface of one of these enlarged, showing the striato-punctate character.

Fig. 2 *e.* A cast of a large symmetrical specimen, showing the same characters of the surface, form of visceral impression, etc.

Fig. 2 *f.* The impression made by the outside of the convex valve of this species, showing the fascicles of striæ in a perfect manner. Specimens like this and the preceding are often found in connection, giving the impressions made by the two sides of the valve.

Fig. 2 *g.* A small specimen, preserving the shell, and showing the striæ in interrupted fascicles.

Fig. 2 *g*†. A portion of the surface enlarged.

Figs. 2 *h, i.* Figures of specimens which still preserve a part of the shell, having the striæ in broad fascicles of small ones separated by larger ones.

Fig. 2 *k.* Interior of the concave valve, showing the two small teeth on the hinge line, with three diverging callosities.

Fig. 2 *l.* Mould of the interior of the flat valve, showing the two cavities made by the teeth, and the impressions of the radiating callosities.

The general aspect of this species, as it occurs in the shaly and arenaceous strata of this group, is more nearly like the same in the Blue limestone of Ohio and other western localities, where there is a considerable admixture of argillaceous matter in the mass. In both the Hudson-river group of New-York, and the western extension of the same strata, where there are frequent alternations of shaly, arenaceous and calcareous matter, there is a greater variety in form and appearance of the fossils. This species, therefore, in the numerous localities within this State, presents much diversity of appearance, depending upon the character of the rock, or upon the partial preservation of the shell.

Position and locality. The most prolific localities of this species in this group are Pulaski, and Washingtonville, in Oswego county; near Rome, Oneida county; near Boonville, Turin, and Martinsburgh, in Lewis county. It is equally abundant in numerous localities on the north side of Lake Ontario. (*State Collection.*)

146. 9. LEPTÆNA SERICEA.

PL. LXXIX. Figs. 3 *a, b.*

Reference pag. 110, pl. 31 B, of this volume.

This species is often quite abundant in the rocks of this group, extending almost to its highest limit. The shell is usually removed, and specimens are found mostly in the form of moulds or impressions of the shell. In some localities, when well preserved, the alternating stronger striæ are more distinct than in those of the Trenton limestone.

Fig. 3 *a.* A mould of the interior of the shell.

Fig. 3 *b.* An enlarged portion, showing the striato-punctate character of the surface.

Position and locality. This species is found in all the localities with the preceding, and rarely in the Utica slate. (*State Collection.*)

155. 2. ORTHIS TESTUDINARIA.

PL. LXXIX. Figs. 4 *a, b, c, d, e.*

Reference pag. 117, pl. 32, of this volume.

In the shales of this group, this species is rarely preserved with the shell entire; casts of the interior, or impressions of the exterior of one or both valves, being the usual form in which it is found. In some situations, it is almost equally as abundant as in the Trenton limestone, and often attains a larger size than in that rock.

Figs. 4 *a, b.* Casts of the interior of the dorsal valve.
Fig. 4 *c.* Cast of the interior of the ventral valve.
Fig. 4 *d.* A similar cast, more strongly impressed by the striæ.
Fig. 4 *e.* A fragment of the impression of the outer side of the ventral valve, showing the fine concentric striæ, which crenulate the diverging striæ.

These forms are the common ones in the shales and shaly sandstones of this group. It is rarely that we find casts in the Trenton limestone, and almost equally rare to find the shell preserved in this group. In this condition, it presents some slight differences from the same shell in the limestone below; but it is by no means a distinct species, as has been represented.

Position and locality. This species rarely, or never, appears in the Utica slate, but reappears near the middle of the Hudson-river shales, and continues nearly to their termination; being abundant at Turin, Loraine, Pulaski, and other places. It is more rarely found in the vicinity of the Hudson river, and in the Mohawk valley.

(*State Collection.*)

341. 19. ORTHIS? ERRATICA (*n. sp.*).

PL. LXXIX. Figs. 5 *a, b, c, d, e, f.*

Subhemispherical, orbicular; dorsal valve very convex, with the mesial portion abruptly elevated, flat above; ventral valve convex at the sides, depressed in the middle, and considerably elevated in front; surface marked by fine simple uniform striæ.

This species is usually found in great numbers, in erratic masses of the sandstones of this formation, associated with *Orthis testudinaria*, *Cyrtolites ornatus*, and other fossils of the group. It has rarely been found in the rocks in place. It is distinguished from *Orthis testudinaria*, which it most resembles, by its more rotund form, and broader mesial elevation and depression; the striæ are also more simple and straight, scarcely curving towards the cardinal margin. It is unknown in the Trenton limestone.

Figs. 5 *a, b.* Dorsal and ventral views of the cast of a large specimen.
Fig. 5 *c.* Ventral view of a small specimen.
Fig. 5 *d.* Front view of a larger specimen.
Fig. 5 *e.* Cardinal view of a large specimen.
Fig. 5 *f.* Profile view of a moderately convex specimen.

Position and locality. Near Washingtonville, Oswego county, in the central part of the group, and in transported fragments in all the southern counties of the State; often abundant. (*State Collection.*)

342. 20. ORTHIS CENTRILINEATA (*n. sp.*).

PL. LXXIX. Figs. 5 *a*, *b*, *c*.

Semioval; length and breadth nearly equal; dorsal valve moderately convex; striæ about thirty, bifid or trifid towards the margin; cast of the visceral impression bilobate, small, narrow, sublinear, with a depressed line extending from the centre towards the base of the shell.

The specimens of this species yet seen are casts, with a small portion of the shell remaining. It approaches more nearly to *O. dichotoma* of the Trenton limestone, than to any other species known to me; but the striæ are more numerous and often trifid, and the dorsal valve less convex. It is readily distinguished from *O. testudinaria*, with which it is associated, by the slightly elevated convex valve, and the stronger radiating striæ, which show no evidence of concentric striæ. It bears some resemblance to *Orthis vespertilio* of MURCHISON, but is uniformly smaller, and evidently distinct.

Fig. 5 *a*. A specimen of the natural size.
Fig. 5 *b*. A magnified portion of the cardinal line, and visceral impression.
Fig. 5 *c*. Several striæ enlarged, showing the bifid and trifid character.

Position and locality. This species is found associated with *Orthis testudinaria*, *Trinucleus*, and crinoidal columns, in the higher part of the group, at Loraine, Jefferson county, and at Turin in Lewis county. (*State Collection.*)

186. 19. ATRYPA INCREBESCENS.

PL. LXXIX. Fig. 6.

Reference pag. 146, pl. 33, figs. 13 *a* – *y*, of this volume.

This species is of frequent occurrence in the lower part of the Hudson-river group, rarely attaining a larger size than the figure given. It is always crushed, and is not readily recognized as identical with that of the Trenton limestone.

Position and locality. In the Utica slate, at Turin, Lewis county, and in the shales of the Hudson-river group at the same place, and at Loraine. (*State Collection.*)

In addition to the preceding forms, the *Atrypa modesta* (see page 141) occurs in the upper part of the Utica slate; and very rarely fragments or casts of some other Trenton limestone species are found, either in this slate or in the Hudson-river group. They are, however, by no means characteristic of the rocks of this formation.

343. 5. ORBICULA? SUBTRUNCATA (*n. sp.*).

PL. LXXIX. Figs. 7 *a, b*.

Ovate-orbicular, depressed, marked by fine concentric striæ; apex small, excentric; the broader extremity often subtruncate, having an appearance like METOPTOMA.

This species is abundant in some localities, covering large surfaces of the shaly sandstones, or distributed through the mass. In the latter condition it is obscure and not readily detected.

Fig. 7 *a*. A small fragment, with several individuals of this species upon the surface.
Fig. 7 *b*. A single specimen, enlarged.

Position and locality. In the central and upper part of the group, at Loraine and Turin, and probably at other places. (*State Collection.*)

344. 6. ORBICULA? CRASSA (*n. sp.*).

PL. LXXIX. Figs. 8 *a, b*.

Ovate-orbicular, with the apex near the narrower extremity; apex obtuse; surface marked by strong concentric wrinkles, and fine radiating striæ.

These characters are preserved in the cast, a small portion only of the shell remaining upon the specimen.

Fig. 8 *a*. The specimen of the natural size.
Fig. 8 *b*. A part of the surface enlarged, showing the concentric and radiating lines.

Position and locality. This species was found in the intercalated calcareous strata, among the shales of the Hudson-river group, two miles northeast of Troy.

345. 7. ORBICULA CÆLATA (*n. sp.*).

PL. LXXIX. Figs. 9 *a, b, c*.

Orbicular, small; apex excentric, depressed along the centre, and subplicated near the margins; surface marked by fine concentric lines and minute elevated points, giving it the appearance of being covered by a poriferous coral.

This species is readily distinguished by the fine papillose markings, which sometimes appear as if depressed at the tip, resembling in some degree the surface of the *O. punctata* of MURCHISON.

Fig. 9 *a*. A fragment of this species.
Fig. 9 *b*. The fragment enlarged, to show the central depression and lateral plications.
Fig. 9 *c*. A portion of the surface still farther enlarged, showing the character and arrangement of the papillæ.

Position and locality. The fragment figured is from the limestone intercalated with the Hudson-river shales, near Troy (from Dr. SKILTON). I have a similar perfect specimen, which occurs in the shales of the Blue limestone of Ohio, from Mr. CLARKE, of Cincinnati.

ACEPHALA OF THE UTICA SLATE AND HUDSON-RIVER GROUP.

Plates LXXX., LXXXI. & LXXXII.

Among the Acephala, not more than three species are known in the Utica slate; and these, with one exception, are continued into the higher shales. In the shales, and argillaceous and calcareous sandstones succeeding the black slate, we find a considerable accession of species, which are unknown in the limestone below. At the same time, several species are common to the limestones and the succeeding shales and sandstones. The Genus Avicula, of which the species in the limestone are somewhat equivocal, becomes well characterized in two species. The Genus Ambonychia is represented by two species quite distinct from those in the lower strata; and the Genus Modiolopsis presents very characteristic forms, which are much more numerously developed than in the inferior limestone. In addition to these, there are two or three other forms, presenting generic characters not observed in those previously described. Two of these (Orthonota and Cleidophorus) become more distinctly developed in succeeding formations.

The comparative abundance of species and individuals of the Brachiopoda and Acephala in these strata may be readily appreciated by reference to the plates (79, 80, 81 and 82), where the species of each are represented.

346. 3. AVICULA INSUETA.

Pl. LXXX. Figs. 1 *a*, *b*.

Avicula insueta. Conrad in MS.
— — Emmons, Geol. Report, 1842, pag. 399, fig. 5.

Shell obliquely subrhomboidal, depressed convex ; hinge line extended ; anterior wing short, obtuse or rounded ; posterior wing triangular, acute, extending a little beyond the margin of the shell ; surface marked by unequal concentric striæ and stronger wrinkles, and longitudinally, along the middle of the shell, by obscure radii.

This fossil bears some resemblance to other species of the genus in the higher strata, but differs essentially on a careful comparison.

Fig. 1 *a*. A specimen, natural size. 1 *b*. A portion of the surface enlarged.

Position and locality. This species occurs in the lower black shale, or Utica slate, at Canajoharie, and is not known in the higher part of the group. (*State Collection.*)

347. 4. AVICULA DEMISSA.

PL. LXXX. Figs. 2 *a*, *b*.

Avicula demissa. CONRAD, Jour. Acad. Nat. Sciences, 1842, Vol. viii, pag. 243, pl. 13, fig. 3.
— — EMMONS, Geol. Report, 1842, pag. 404, fig. 2.

Obliquely subovate, compressed, extended posteriorly into a broad triangular wing; anterior wing short, obtuse; surface marked by close, sharp, imbricating, lamellose striæ; posterior wing extending beyond the line of the posterior extremity of the shell; anterior and posterior margins nearly parallel, and but slightly oblique.

This species is characterized by the sharp elevated concentric striæ, which are crowded together on the posterior wing, and at its junction with the body of the shell. The shell presents some variations in form, but preserves the sharp striæ in all the specimens seen.

Fig. 2 *a*. A large perfect specimen, which is more elevated than usual.
Fig. 2 *b*. The impression of a smaller specimen in sandstone.

Position and locality. This species is found in the higher part of the Hudson-river group, near Rome, Oneida county, and at Pulaski. It likewise occurs in the same position in Ohio. Rolled fragments of the calcareous portions of the group, containing this shell, are frequently found on the south shore of Lake Ontario. (*State Collection*)

348. 5. AVICULA? DESQUAMATA.

PL. LXXX. Figs. 3 *a*, *b*.

Suborbicular, convex in the middle; beak nearly central; hinge line slightly extended on each side; surface scaly, or with elevated imbricating lamellæ, which desquamate, giving the surface a rough scaly appearance.

The characters of this species are not clearly decided, though it appears referable to the Genus AVICULA.

Fig. 3 *a*. A specimen, natural size. 3 *b*. An enlarged portion of the surface.

Position and locality. This species has been found only in the calcareous beds associated with the shales of the Hudson-river group, near Troy.

349. 7. AMBONYCHIA RADIATA.

PL. LXXX. Figs. 4 *a* – *l*.

Pterinea carinata. CONRAD, Ann. Geol. Report, 1838, p. 114; 1839, p. 63.
— — VANUXEM, Geol. Report, pag. 65, fig. 1.
— — EMMONS, Geol. Report, pag. 402, fig. 1.
Compare *Pterinea carinata*, GOLDFUSS, Vol. ii, pag. 136, tab. 119, fig. 8.

Equivalve, obliquely obovate, extending into acute curving beaks; anterior slope nearly straight above, and rounded below; posterior slope oblique, scarcely alate; surface marked by twenty-five to forty strong simple radii, which are crossed by fine concentric striæ; radii flattened upon the top; the intermediate spaces are regularly concave grooves, narrower than the radii, and marked by the concentric striæ.

This species has usually been referred to *Pterinea carinata* of GOLDFUSS, but it appears to me specifically distinct. The figure of that author, which is larger than figs. 4 *a*, *b* of our plate, represents the shell as having twenty-three or twenty-four radii, which are proportionally stronger than in this shell, while specimens of equal size with the figure of GOLDFUSS have from thirty-five to forty radii upon each valve. On this account, principally, I am disposed to consider the succeeding species as identical with that of GOLDFUSS.

I regard both this and the following species as differing sufficiently from PTERINEA of GOLDFUSS to be separated from that genus, and to constitute species under the Genus AMBONYCHIA, which is destitute of an anterior wing, while the posterior side is expanded, though scarcely alate, never showing the distinct wing which marks the AVICULA and nearly all the species of PTERINEA.

Fig. 4 *a*, *b*. The right and left valves of different specimens of this species.
Fig. 4 *c*. A smaller individual, with the radii distinctly marked, and more than thirty in number.
Fig. 4 *d*. A young specimen, with the radii finely marked.
Fig. 4 *e*. A portion of the surface, enlarged.
Fig. 4 *f*. A cast of the interior of the right valve. The posterior slope shows a straight well defined impressed line.
Fig. 4 *h*. Profile view of a specimen preserving both valves.
Fig. 4 *i*. Lateral view of the same. The difference in form between this and the preceding specimens is due to pressure.
Fig. 4 *k*. Enlarged portion of the surface, showing the same structure as 4 *e*.
Fig. 4 *j*. A large specimen, incrusted at its base with a coral, of which an enlarged portion is given in the fig. 4 *g*.
Fig. 4 *l*. An impression of a part of the valve of a very large and strongly ribbed specimen.

These specimens, though from different and widely distant localities, have all the same essential characters, and the radii are always smaller and more numerous than the one cited. It differs from the *A. bellistriata* and *A. orbicularis* of the Trenton limestone, both of which have finer radii and are of different form.

Position and locality. This is one of the most common fossils of the Hudson-river group, being found throughout the greater part of its thickness, but is unknown in the Trenton limestone or Utica slate. It is abundant at Boonville and Turin, in Lewis county; at Loraine, Jefferson county; at Pulaski, Washingtonville and Mexico, Oswego county; near Rome in Oneida county; and I have seen a single specimen from the altered slates near Waterford, Saratoga county. This species is likewise common in many western localities, and I have specimens from Cincinnati and Oxford (Ohio), Madison (Indiana), and Maysville (Kentucky).

350. 8. AMBONYCHIA CARINATA.

PL. LXXX. Figs. 5 *a*, *b*.

Pterinea carinata. GOLDFUSS, Petrefacta, Vol. ii, pag. 136, pl. 119, fig. 8.
Not *Pterinea carinata* of CONRAD, VANUXEM and EMMONS, loc. cit.

Shell ovate, oblique, ventricose; anterior margin abruptly declining from the beaks, and rounded below; posterior margin oblique, expanded, scarcely alate; beaks acute; cardinal margin short; surface marked by about twenty-four equal rounded radii, which are slightly oblique, in a direction from the posterior margin above, to the anterior margin below; radii equal to the interspaces.

The specimen figured and described has the shell nearly or entirely removed, so that the finer concentric striæ, which doubtless existed, cannot be discovered. This species is more ventricose than the preceding, the radii stronger and fewer in number, and they have an oblique direction, which is not noticed in that species. I have seen one or two other similar specimens, leaving no doubt of the permanency of the characters which clearly distinguish it from the last. This is probably identical with the one described by GOLDFUSS, who cites "Lewistown in Oneida country," as its locality; and the rock, "the Graywacke," is doubtless the argillaceous sandstone of the Hudson-river group. There has heretofore existed some doubt whether the common species of this group was the one described by GOLDFUSS; and since the discovery of another more nearly resembling the figure of that author, we may reasonably conclude the latter to be the true *Pterinea carinata.*

Fig. 5 *a.* Left valve of this species.
Fig. 5 *b.* Profile view, showing both valves. The apparent inequality of the beaks is produced by a slight displacement from pressure.

Position and locality. All the specimens of this species which have fallen under my observation are from loose masses of the rock; but its association with *Cyrtolites ornatus*, and other well known fossils of the group, leaves no doubt of its true position.

351. 11. MODIOLOPSIS MODIOLARIS.

PL. LXXXI. Figs. 1 *a* – *g*; PL. LXXXII. Fig. 1.

Pterinea modiolaris. CONRAD, Ann. Geol. Report, 1838, p. 118; 1839, p. 63.
Cypricardites modiolaris, and *C. angustifrons.* CONRAD, Ann. Geol. Report, 1841, p. 52.
— *ovata.* CONRAD, Ann. Geol. Rep. New-York, 1841, p. 52.
— *ovata.* EMMONS, Geol. Report, 1842, pag. 405, fig. 2.
— *angustifrons.* ID. Ib. pag. 405, fig. 1.
Not *Cypricardites modiolaris*, EMMONS, Geol. Report, 1842, pag. 403, fig. 4.
Compare *Modiola expansa*, PORTLOCK, Geol. Rep. Londonderry, pag. 425, pl. 33, fig. 6.

Somewhat obliquely oblong-ovate, narrowed before, expanded and obliquely truncated posteriorly; basal margin usually contracted, or slightly arched upwards; cardinal line extended, straight or slightly curved; beaks moderately prominent, near the anterior extremity; an oblique scarcely defined ridge, extending to the posterior basal margin;

surface marked by concentric undulations; muscular impression distinct, close to the anterior extremity.

This fossil presents considerable variation in form, which has given rise to the establishment of several species, founded either upon natural or accidental characters. The name of *Pterinea modiolaris* has priority; and since the species possesses all the essential characters of the Genus Modiolopsis, I have adopted it under that name, giving the others as synonymes, with illustrations of the forms on which they are founded. The more extreme forms might be regarded as distinct, did we not find numerous intermediate ones, showing a gradation from one to the other. The shell is more or less convex, depending on pressure, which sometimes obliterates the prominent oblique elevation extending backwards from the beak. Owing to the same cause, also, the beak is more or less prominent; and pressure in different directions changes the form of the shell.

Fig. 1 *a*. A specimen preserving the two valves in connection, showing the hinge line, and the muscular impression, which produces an elevation upon the outer surface of the shell. This is one of the most perfect forms, and the one to which Mr. Conrad applied the name of *modiolaris*.

Fig. 1 *b*. Another specimen preserving the two valves, which are laterally compressed. The anterior extremities are narrowed, and somewhat obtusely pointed. This is the original of *C. angustifrons* of Conrad; but since there are several intermediate forms allying it to the previous figure, I have no hesitation in uniting the two as identical.

Fig. 1 *c*. A single valve, with the posterior extremity more regularly rounded, and the hinge line curved. The shell is less compressed than fig. 1 *a*, though in other respects similar.

Fig. 1 *d*. A smaller and shorter specimen, having a form similar to 1 *a*, with the base not contracted or arched. There are other forms intermediate between this one and fig. 1 *a*.

Fig. 1 *e*. A small specimen, contracted at the anterior, and expanded towards the posterior extremity. The base is arched, and the hinge line apparently curved. This is the form of *C. ovata* of Mr. Conrad, the original remaining in the State Collection. It is not difficult to trace this form through intermediate grades till it becomes the unequivocal *M. modiolaris*.

Fig. 1 *f*. A specimen from the shales at Madison (Indiana), preserving both valves. The one shown in the figure is intermediate in form between fig. 1 *a* and 1 *c*, while the other valve is more contracted anteriorly than fig. 1 *b*. This figure represents the shell contracted below the beak, leaving the anterior extremity as an obscure lobe. This character is frequently observed in western specimens, while it is less frequent in those of New-York.

Fig. 1 *g*. The anterior extremity of a cast of this species, showing the prominence of the muscular impression.

Plate lxxxii, fig. 1. A young specimen of the same species.

Numerous other forms might be given, showing the variable character of the species, but those figured are the prevailing varieties. Several hundred specimens have been examined in order to determine the unity of the several species cited.

Position and locality. This fossil is everywhere found in the central and higher part of the group, varying its form as it occurs in arenaceous or argillaceous strata, or from compression. It occurs at Turin, Boonville and Martinsburgh, Lewis county; Loraine, Jefferson county; Pulaski, Washingtonville and other places in Oswego county; and near

Rome, Oneida county. I have collected the same species from Cincinnati (Ohio), and Madison (Indiana). In the latter it place it is associated with *Favistella stellata* and *Ambonychia radiata*. (*State Collection.*)

203. 4. MODIOLOPSIS NASUTUS.

Pl. LXXXI. Fig. 2.

Cypricardites nasuta. Conrad, Ann. Geol. Report, 1841.
— *modiolaris*. Emmons, Geol. Report, 1842, pag. 403, fig. 4.
Reference pag. 159, pl. 35, fig. 7, of this volume.

Narrow, subelliptical; base straight; cardinal line nearly direct; anterior extremity produced into a narrow extended nasute form; posterior extremity obliquely truncated, or more or less rounded; surface scarcely marked by concentric lines of growth.

This shell is distinguished from the preceding species, in being uniformly narrower; all that part behind the beak is of nearly equal width, and the beak more central, being distant from the anterior extremity one third the length of the shell. The muscular impression is scarcely distinct in any specimen which I have examined. The characters represented in the figure are constant in several specimens examined, and there appears to be no varieties intermediate between this one and the *M. modiolaris*, which is a far more abundant fossil.

Position and locality. This species occurs in the arenaceous strata of the higher part of the Hudson-river group, and I have never seen it in the softer shales. The principal localities are near Rome, Oneida county, and Loraine, Jefferson county. (*State Collection.*)

352. 12. MODIOLOPSIS TRUNCATUS (*n. sp.*).

Pl. LXXXI. Figs. 3 *a*, *b*.

Compare *Cypricardia Deshayesiana*, de Verneuil, Pal. Russia and the Ural Mountains, pag. 304, pl. 20, fig. 1.

Oblique, transverse, sub-trapezoidal; the cardinal and basal margins diverging from the anterior extremity, convex; beaks near the anterior extremity, with an obscure elevated ridge extending obliquely to the base; posterior extremity obliquely truncate; muscular impression very distinct, a little in advance of the beaks, and at the anterior extremity, in the cast projecting beyond the margin (see figure).

This shell differs but little from some of the varieties of *M. modiolaris;* but it is proportionally broader, and the beaks are closer to the anterior extremity, while the muscular impression seems to be placed upon the very margin of the shell. It is much less common than the *M. modiolaris*, and the few specimens examined appear to be constant in the characters given. It bears a close resemblance to the figure of de Verneuil cited above, but it is less ventricose, our specimen being crushed and destitute of the shell.

Fig. 3 *a*. View of the right valve of this species.
Fig. 3 *b*. Profile view, one valve being more compressed than the other.

Position and locality. This species occurs near Rome, Oneida county, and at Cincinnati (Ohio).

353. 13. MODIOLOPSIS CURTA (*n. sp.*).

PL. LXXXI. Fig. 4; PL. LXXXII. Figs. 2 *a* – *d*.

Compare *Cypricardites curta*. CONRAD, Ann. Geol. Report, 1841, p. 53.

Suborbicular, compressed, oblique; cardinal margin short; anterior extremity rounded, posterior obliquely truncated; base curving; beak distant from the anterior extremity nearly one third the length of the shell; surface marked by concentric undulations and finer striæ.

In specimens not compressed, there is an obtuse oblique carina, extending from the beak to the posterior margin above the base; but when the shell is compressed, this feature is obliterated. The concentric fine striæ are usually obliterated when the matrix is arenaceous, and they are only indistinctly preserved in specimens from the shale. This one is quite unlike either of the preceding forms, and deviates widely from typical forms of the genus. A single specimen preserves the mark of the anterior muscular impression.

PLATE LXXXI.

Fig. 4. A large individual of this species, from near Grimsby, Canada West.

PLATE LXXXII.

Fig. 2 *a*. A specimen from Loraine, Jefferson county, New-York.
Fig. 2 *b*. A small specimen in shale, from Rodman, Jefferson county.
Fig. 2 *c*. Figure of a small specimen from Mineral Point, Wisconsin.
Fig. 2 *d*. Cardinal view of the same.

Position and locality. This species occurs at Loraine, in the higher shaly part of the group; in the lower part of the same in the town of Rodman; and in a similar position near Rome, Oneida county. It is found in the same group in Canada, and in a similar position at Mineral Point (Wisconsin), and several other western localities.

354. 14. MODIOLOPSIS (*Species undetermined*).

PL. LXXXI. Figs. 5 *a*, *b*.

Subcylindrical, elongated, very gradually expanding from the anterior extremity; beaks subacute, near the anterior extremity; surface smooth or with fine concentric striæ.

The specimen is imperfect at both extremities, but sufficient is preserved to show that it is a distinct species. In the perfect shell the beaks extend nearly or quite as far as the line of the anterior margin.

Fig. 5 *a*. Left valve of the fragment. 5 *b*. Dorsal view of the same.

Position and locality. This species is known to me only in the soft shales of Cincinnati (Ohio).

355. 15. MODIOLOPSIS ANODONTOIDES.

Pl. LXXXII. Figs. 3 *a*, *b*, *c*.

Cypricardites anodontoides. Conrad.
— *sinuata.* Emmons, Geol. Report, 1842, pag. 399, fig. 3.

General figure subelliptical, very convex; beak elevated, with a strong angular ridge extending to the posterior basal margin; cardinal margin nearly straight; posterior extremity obliquely truncated; base contracted just below or a little posterior to the beak; surface marked by strong concentric striæ; length a little more than twice the height.

This species is readily recognized by its great umbonical elevation, and the prominent oblique carina extending from the beak to the posterior basal extremity. Its form and proportions are quite different from either of the preceding, showing that it is a distinct species. It is exceedingly rare, but few individuals being known, and these, with one exception, are confined to the arenaceous portions of the group.

I have united the *Cypricardites sinuata* of Emmons, *id. cit.*, with this species, regarding them as identical, the difference in form being due to pressure, and the occurrence of the former in soft shale, which has preserved the external markings more perfectly than in the specimens from sandstone.

Fig. 3 *a*. A specimen in sandstone, preserving the original form of the shell. This specimen is the original of *C. anodontoides*.

Fig. 3 *b*. A specimen in soft shale, more compressed than the preceding, and consequently rounded at the posterior extremity. This one is the original of *C. sinuata*.

Fig. 3 *c*. A specimen in shale, where both valves are still adhering. This is associated with the last, having the same surface markings, but is less compressed, and in form like fig. 3 *a*.

Position and locality. This species occurs in the lower shaly part of the group, in Rodman, and in the upper arenaceous part, at Loraine, Jefferson county. (*State Collection.*)

202. 3. MODIOLOPSIS FABA.

Pl. LXXXII. Fig. 4.

Reference pag. 158, pl. 35 of this volume.

This species, which is abundant in the Trenton limestone, appears more rarely in the Hudson-river group. It is nevertheless often found associated with the preceding and following species, both in the shaly and arenaceous portions of the group.

356. 16. MODIOLOPSIS? NUCULIFORMIS (*n. sp.*)

Pl. LXXXII. Figs. 5 *a*, *b*.

Subelliptical, length nearly once and a half the width; beaks elevated; cardinal margin a little declining posteriorly; front rounded; a shallow sinus extending obliquely backwards from the beak to the base, producing an indentation in the basal margin; surface marked by concentric folds, which are undulated on the sinus.

This species is very distinctly characterized by the oblique impression or sinus, which produces an indentation in the basal margin, and often leaves the posterior extremity acute.

Fig. 5 *a*. A specimen preserving both valves.
Fig. 5 *b*. The right valve, which is less compressed than the preceding.

Position and locality. This species occurs in the Utica slate, at Turin, associated with the Graptolites; in the same position in Montgomery county; and in the black, glazed, and partially metamorphic slates of Waterford, Saratoga county.

357. 1. ORTHONOTA PHOLADIS.

PL. LXXXII. Fig. 6.

Pterinea pholadis. CONRAD, Ann. Geol. Report, 1838, p. 118.
Orthonota pholadis. ID. Ib. 1841, p. 51.

"Shell profoundly elongated, ventricose; dorsal and basal margins parallel; posterior side rugose, or with short undulations near the dorsal margin. Length $1\frac{3}{4}$ inches."

The preceding description is cited from Mr. CONRAD, and the figure is also by him, having never seen the shell myself. It resembles the following species, but is much more elongated and proportionally narrower.

Position and locality. In the shales of this group at Pulaski, Oswego county.

358. 2. ORTHONOTA PARALLELA (*n. sp.*).

PL. LXXXII. Figs. 7 *a*, *b*, *c*, *d*.

Shell extremely elongated and very narrow; anterior extremity rounded, and contracted just forward of the beaks; cardinal margin straight or gently arched; posterior extremity rounded, broader than the anterior; basal margin slightly arcuate; beaks near the anterior extremity having an obscure carina, extending obliquely towards, but not reaching, the posterior basal margin; surface marked by fine concentric striæ, and a few oblique strong wrinkles along the dorsal margin.

This shell bears considerable resemblance to the *O. pholadis*; but is less extended, and has a greater width. The width in this species is fully one third the length, while in the figure of *O. pholadis* the width is less than one fourth the length. In specimens which are imbedded in shale and much compressed, the surface is regularly convex, and the oblique elevated carina becomes obsolete. The cast is smooth, with scarcely any evidence of the oblique folds on the cardinal margin.

Fig. 7 *a*. The left valve, preserving the shell, which is finely striated concentrically, and shows the folds upon the cardinal line.
Fig. 7 *b*. Dorsal view of a cast in coarse sandstone, where the folds are visible on the dorsal margin.
Fig. 7 *c*. The left side of a cast scarcely retaining any markings.
Fig. 7 *d*. Dorsal view of the same. The anterior extremity is partially eroded.

Position and locality. This species occurs in the soft shaly portions of the group, at Pulaski, Loraine, and other places. I have obtained casts of the same from the ferruginous sandstones in the higher part of the group. It occurs likewise at Cincinnati, and several other western localities.

359. 3. ORTHONOTA CONTRACTA (*n. sp.*)

Pl. LXXXII. Figs. 8 *a*, *b*.

Subcylindrical, slightly arcuated; beaks distinct, acute, with a prominent oblique carina extending towards the posterior basal margin, which is arcuated, and the shell much contracted below and posterior to the beaks; dorsal margin broad, rounded, the valves strongly marked by oblique folds.

The extremities of the shell are wanting in the two specimens which I have. It differs from the last, in having more acute and distinct beaks, with the cardinal margin broader. The base is arcuate, and distinctly contracted, or sinuate, a little behind the beaks. It is possible that this may prove identical with the last, since I have been unable to examine perfect specimens.

Fig. 8 *a*. The left valve, showing the distinct carina and concentric striæ of the surface.
Fig. 8 *b*. Dorsal view of the same, showing the oblique wrinkles on the posterior cardinal margins of the shell.

Position and locality. This species occurs in the soft marls at Cincinnati, Ohio. I have not seen it from other localities.

360. 1. CLEIDOPHORUS PLANULATUS.*

Pl. LXXXII. Figs. 9 *a*, *b*, *c*, *d*, *e*.

Nuculites planulata. Conrad, Ann. Report, 1841, p. 48.
— *scitula.* Conrad in MS. Emmons, Geol. Report, pag. 399, fig. 2.

Subelliptical, with the anterior extremity narrowed, regularly rounded; posterior side broader; beak scarcely elevated; a distinct impressed line extending from before the beak,

* All the specimens of this species which I have examined, show no crenulations upon the cardinal margin, which is nearly direct and subalate posteriorly. There is no visible muscular impression as in *Modiolopsis*; and the strong linear depressed line in the casts indicates the existence of a rib, or clavicle, as in *Solecurtus*. This character, which is very conspicuous in several species in the higher strata, pertains to shells having a similarity of form, which is nearly like the one figured. For shells of this character, I propose the following generic name:

Genus CLEIDOPHORUS.

[Greek, κλειδος, clavicle, and φερο, to bear; in allusion to the clavicle in each valve, anterior to the beak.]

The shells of this genus may be characterized as, equivalved, inequilateral; hinge without teeth or crenulations; surface (particularly in casts) marked by an oblique linear depression, extending from the anterior cardinal margin towards the base, indicating the place of the clavicle; surface concentrically striated.

half way to the base; hinge line straight; posterior extremity obliquely truncated; shell uniformly convex; a round elevated ridge extending from the beak to the posterior basal margin, between which and the cardinal line a narrow portion of the shell is closely compressed.

This species is very abundant in the green shales just above the black shale, and is also often found in the higher arenaceous parts of the group. The thin compressed portion on the posterior dorsal margin is often covered, so that the form is the same as fig. 9 *a*, which shows only the convex part of the shell. Sometimes the impressed line before the hinge is not distinctly visible, particularly in the folded and glazed slates of this group along the Hudson river; but in most instances it is a reliable character. In the decomposing arenaceous portions of the group, this is one of the most abundant fossils, associated with crinoidal joints, fragments of *Trinucleus*, and other fossils.

Fig. 9 *a*. A specimen of the arenaceous slate, with several individuals of this species, associated with crinoidal columns, etc.

Figs 9 *b*, *c*, *d*. Other individuals from different localities, showing a slight difference in form.

Fig. 9 *e*. A specimen from the altered slates, preserving both valves.

In its geographical distribution, this species is coextensive with the group, and is unknown below the Utica slate, or above the terminal sandstone of the Hudson-river group.

Position and locality. This species occurs in all parts of the group, in the following localities: Turin and Martinsburgh, Lewis county; Loraine, Jefferson county; Pulaski and Washingtonville, Oswego county; near Rome, Oneida county; Waterford, Saratoga county, and other places.

190. 2. NUCULA? POSTSTRIATA.

PL. LXXXII. Figs. 10 *a*, *b*.

Reference pag. 151, pl. 34 of this volume.

This species has already been given under the Trenton limestone, where it first occurs. In the Hudson-river group it acquires a greater development, and is both larger and more numerous. It rarely preserves the shell, however, and we are forced to depend on casts of the interior for our examinations. The strong diverging striæ upon the posterior slope are usually marked upon the cast, which, with the subtriangular form of the shell, is sufficient to distinguish it from others of the group. The broader or more quadrangular form of the specimen in the Trenton limestone is due to the preservation of the shell, which gives the posterior slope a greater elevation.

Fig. 10 *a*. A small specimen in the ferruginous sandstone.

Fig. 10 *b*. A larger specimen, preserving very distinctly the striæ on the posterior slope.

Position and locality. This species occurs both in the shaly and arenaceous part of the group, at Loraine and Pulaski, though it is a comparatively rare form. (*State Collection.*)

Genus LYRODESMA (Conrad).

Character. "Equivalved, inequilateral; hinge with about eight diverging prominent cardinal teeth, transversely striated."

If this description, cited from Mr. Conrad, were so altered as to include shells with a greater number of cardinal teeth, it would include a species which appears closely allied to the one described as the typical form. The form of this shell, and character of the diverging cardinal teeth, or crenulations, are different from Nucula, and more nearly like Pectunculus. I prefer, however, to place it under the Genus Lyrodesma, provisionally; though a better knowledge of *L. plana*, the typical species of the genus, may hereafter render it necessary to separate them.

361. 1. LYRODESMA PLANA.

Pl. LXXXII. Figs. 11 *a*, *b*.

Lyrodesma plana. Conrad, Ann. Geol. Report, 1841, p. 51.

"Subrhomboidal, compressed; posterior margin widely and obtusely truncated; posterior basal margin rectilinear; extremity rounded."

I have copied the figures and description of Mr. Conrad, not having seen the shell. It is described in the Annual Report cited above, and also figured on a plate partially prepared for his report on palæontology.

Fig. 11 *a*. The right valve. 11 *b*. Interior of the right valve, showing the cardinal teeth.

Position and locality. In the shaly sandstones of the Hudson-river group near Rome, Oneida county.

362. 2. LYRODESMA PULCHELLA.

Pl. LXXXII. Figs. 12 *a*, *b*, *c*, *d*.

Slightly inequilateral, broadly oval; beaks moderately elevated; anterior extremity rounded; posterior extremity scarcely truncated; hinge line gently arched, marked by about eight diverging teeth on the posterior side of the beak, and apparently fewer (five or six) on the anterior side; surface marked by fine equal concentric striæ.

This is the most beautiful shell among the bivalves of this group; its nearly symmetrical form, finely striated surface, and crenulated hinge line, are sufficient to distinguish it from any other species. It is usually compressed, and but slightly convex; but when found in a perfect condition it is very convex, and even ventricose towards the umbones.

Fig. 12 *a*. A specimen of the natural size, from the black slate near Watertown, Jefferson county.
Fig. 12 *b*. The same enlarged, showing the character of the crenulations.
Fig. 12 *c*. A smaller specimen, from the partially altered slates near Waterford, on the Hudson river.
Fig. 12 *d*. The cardinal line enlarged.

Position and locality. This species occurs in the lower part of the group at Turin, and near Watertown, in the unaltered slates; and near Waterford, in the black glazed slates of the same group.

GASTEROPODA OF THE HUDSON-RIVER GROUP.

Plates LXXXIII. & LXXXIV.

Among the Gasteropoda of the Utica slate and the succeeding shales and sandstones, there are few forms with which we are not already familiar in the Trenton limestone. In the lower black slate we rarely find specimens of this order, a single species being all that I have observed. In the succeeding strata we find a single well marked species of Bellerophon, differing from those of the Trenton limestone; and that peculiar form, the *Cyrtolites ornatus*, which is unknown in any other position. A very small proportion of the species known in the limestone reappear in this position, and in nearly all instances the specimens are but poorly preserved. I have introduced a single well marked and characteristic species from the western extension of the group, though it has not been distinctly recognized in New-York.

Almost all the specimens occur in the form of casts of the interior, the shell being rarely preserved; in consequence of which, there is some difficulty in identifying them.

236. 13. MURCHISONIA GRACILIS.

Pl. LXXXIII. Figs. 1 *a*, *b*.

Reference *Murchisonia gracilis*, pag. 181, pl. 39, figs. 4 *a*, *b*, *c*, of this volume.

I am unable to find any marks of distinction between the slender forms so common in the Trenton limestone, and those in the shales of the Hudson-river group, which will enable me to refer them to distinct species. There are some slight variations observable even in specimens from the same rock; but these appear to be due to accidental causes, or the different character of the enclosing material. This species is abundant in the shales and calcareous portions of the sandstones of this group, but I have never been able to obtain one where the shell is preserved.

Fig. 1 *a*. A specimen (a cast) from the calcareous sandstone.
Fig. 1 *b*. A similar cast from the soft shales, at Loraine.

Position and locality. This species occurs throughout the group, and is one of the most common forms at Turin, Loraine, Washingtonville, Pulaski, and Rome. It is also found in the altered slates of the group, on the Hudson river, near Waterford.

(*State Collection.*)

363. 14. MURCHISONIA UNIANGULATA, *var.* ABBREVIATA.

PL. LXXXIII. Figs. 2 *a, b, c, d.*

Compare *Murchisonia uniangulata*, pag. 179, pl. 38, fig. 8, of this volume.

Conical or subfusiform ; volutions about four or five, rapidly diminishing from the apex ; last whorl angular on the middle ; centre of the whorls marked by a double depressed spiral band, separated by a narrow space, which is not marked by the striæ ; surface marked by fine striæ, which form a deep retral bend on the body of the whorl where they meet the spiral band.

This species resembles, in form, the *M. bicarinata* of the Trenton limestone ; but it differs essentially in having the volutions angulated only on the centre. The specimens of this species which occur in the Hudson-river group, are all shorter than the *M. uniangulata* of the Trenton limestone. The carinal band in that species is obscure, and I cannot decide whether it be double, as in the specimens under consideration.

Figs. 2 *a, b.* Two specimens which preserve a part of the shell.
Fig. 2 *c.* A portion of the surface of the last volution magnified, showing the double spiral band.
Fig. 2 *d.* A specimen with the volutions more acutely angulated, but apparently identical.

Position and locality. In the calcareous higher portions of the group at Turin, Lewis county, and in a similar situation near Rome, Oneida county. (*State Collection.*)

225. 13. PLEUROTOMARIA SUBCONICA.

PL. LXXXIII. Figs. 3 *a, b, c, d, e.*

Reference *Pleurotomaria subconica*, pag. 174, pl. 37, figs. 8 *a, b, c, d*, of this volume.

This species is not unfrequently found in the shales of the Hudson-river group, but usually in such a condition as not to be readily recognized. All the specimens yet seen are casts, preserving in one or two instances some remains of the vertical striæ and the carina, upon the centre of the last volution, It can be recognized by its almost uninterrupted conical form and broad volutions, with a prominent carina on the last one, which is preserved in the casts, while the higher volutions are obtusely angulated near their base.

I have received specimens of the same species from the northwestern part of Wisconsin, collected by the late Mr. NICOLLET.

Fig. 3 *a.* A specimen preserving the vertical striæ.
Fig. 3 *b.* A portion of the same enlarged.
Figs. 3 *c, d.* Imperfect casts, from the shales of the Hudson-river group.
Fig. 3 *e.* A more perfect cast of the same species, from Wisconsin.

Position and locality. This fossil occurs in the central portions of the Hudson-river group at Turin, Pulaski, and other places in the State of New-York. The western specimens are in limestone, associated with other fossils known as belonging to the Trenton limestone. (*State Collection.*)

364. 17. PLEUROTOMARIA [?] BILIX.

PL. LXXXIII. Figs. 4 *a*, *b*, *c*, *d*, *e*.

Pleurotomaria bilix. CONRAD, Jour. Acad. Nat. Sci. Philadelphia, 1842, Vol. viii, pag. 271, pl. 16, fig. 10.
Compare *Pleurotomaria percarinata*, pag. 177, pl. 38, fig. 4, of this volume.

Obliquely conical; spire short, composed of four or more volutions, which are somewhat appressed above and ventricose below; last volution somewhat flattened on the lower side; aperture rounded, or slightly transverse; surface marked by numerous strong spiral carinæ, which frequently alternate with finer ones; these are crossed by fine striæ, which, commencing at the top of the volution, pass obliquely backwards to the base, or into the umbilicus, suffering no alteration of their direction upon the carinæ.

This beautiful species seems scarcely appropriately placed under PLEUROTOMARIA, since there is no distinct spiral band interrupting the striæ, nor a slit in the margin of the aperture. For the same reason, also, it cannot fall under the Genus MURCHISONIA. This one, with some other species, when better known, may constitute a distinct genus; or the Genus HOLOPEA, proposed for some Pleurotomaria-like shells of the Trenton limestone, may perhaps include this one also.

This shell is readily recognized by the numerous sharp spiral carinæ which conspicuously mark the surface. Between these more elevated ones, there are often regularly alternating smaller ones; but these are not always developed. Some individuals, showing but the stronger carinæ, have a very different aspect from others where they are regularly alternated. The oblique finer striæ which cross the carinæ are often nearly obliterated, and scarcely visible to the naked eye.

Fig. 4 *a*. A small specimen of this species, showing the back of the spire, and the expansion of the last volution towards the aperture.
Fig. 4 *b*. A portion of the surface enlarged, showing the alternating larger and smaller carinæ, which are crossed by the oblique fine striæ.
Fig. 4 *c*. A larger specimen — a view from the outside obliquely into the aperture.
Fig. 4 *d*. Another specimen, showing the form of the aperture, which is entire on the outer margin.
Fig. 4 *e*. The base, viewed in the direction of the spire.

Position and locality. This species has not been distinctly recognized in the rocks of New-York, but it is abundant in the western extension of the same group, associated with MODIOLOPSIS, AMBONYCHIA, and other species, at Madison (Indiana), Cincinnati and Oxford (Ohio), Maysville (Kentucky), and near Prairie du Chien (Wisconsin).

365. 18. PLEUROTOMARIA (*Species undetermined*).

PL. LXXXIII. Figs. 5 *a*, *b*.

This species has the form of *P. lenticularis;* but it is only preserved as casts, which are too indistinct to be determined.

Figs. 5 *a*, *b*. Views of the apex and base of two small casts.

Position and locality. This species occurs in the Utica slate in the Mohawk valley, and in the lower shales of the Hudson-river group at Turin and Pulaski. (*State Collection.*)

366. 2. METOPTOMA? RUGOSA (*n. sp.*).

PL. LXXXIII. Figs. 6 *a*, *b*, *c*.

Elliptical, with the sides straight; apex elevated, and slightly bent forwards; posterior extremity broader than the anterior; surface marked by strong concentric undulations, which increase in number on the posterior side.

Fig. 6 *a*. View of the upper surface of the shell. 6 *b*. Lateral view of the same.
Fig. 6 *c*. An enlarged portion of the surface.

Position and locality. In the subcrystalline calcareous beds, associated with the Hudson-river shales, near Troy.

239. 2. CARINAROPSIS PATELLIFORMIS.

PL. LXXXIII. Figs. 7 *a*, *b*.

Reference *Carinaropsis patelliformis*, pag. 183, pl. 40, figs. 2 *a*, *b*, of this volume.

This species is perhaps more abundant in the Hudson-river group than in the Trenton limestone, and sometimes attains to a greater size. The smaller specimens appear like an ORBICULA; but the shell is of a different texture, and the constant absence of a second, flatter valve, both here and in the Trenton limestone, confirms me in the opinion already given.

Fig. 7 *a*. A large individual of this species.
Fig. 7 *b*. Profile view of the same. The elevation of the shell is less than usual, from compression.

Position and locality. This species occurs in the argillaceous and calcareous parts of the group at Turin and Pulaski, and in the semi-altered shales near Waterford.

(*State Collection.*)

367. 3. CARINAROPSIS ORBICULATUS (*n. sp.*).

PL. LXXXIII. Figs. 8 *a*, *b*, *c*.

Suborbicular; apex subcentral, small, slightly inclined; surface finely striated.

This species has the form of ORBICULA, but the apex is remarkably elevated, and no flat valve has been observed. It is also different in texture from the known species of ORBICULA in the same rock.

Fig. 8 *a*. View of a specimen, looking upon the apex.
Fig. 8 *b*. Lateral view of specimen partially distorted.
Fig. 8 *c*. A portion of the surface enlarged.

Position and locality. In the slates of the Hudson-river group, near Waterford.

(*State Collection.*)

210. 1. BELLEROPHON BILOBATUS.

PL. LXXXIII. Figs. 9 *a*, *b*, *c*.

Reference pag. 181, pl. 40, figs. 3 *a*, *b*, *c*, *d*, of this volume.

This fossil is far less abundant in the Hudson-river group than in the Trenton limestone, but still it is seen in nearly every locality where the rocks are well exposed. The shell is rarely preserved, and the casts show the small umbilicus very distinctly. This fossil often attains a greater size in this group than in the Trenton limestone. The specimens found are usually compressed, and it rarely presents the rotundity so common in the limestone.

Fig. 9 *a*. A large imperfect specimen.
Fig. 9 *b*, *c*. Lateral and profile view of a smaller specimen, showing the volutions compressed, as in some of the varieties from the Trenton limestone.

Position and locality. This species is rarely seen in the lower shaly part of the group, but in the central semicalcareous strata it is of frequent occurrence. Specimens have been obtained from Turin, Pulaski, Loraine, and several other localities.

(*State Collection.*)

368. 4. BELLEROPHON CANCELLATUS (*n. sp.*).

PL. LXXXIII. Figs. 10 *a*, *b*, *c*.

Involute, subglobose; aperture expanded, bilobate; dorsal line subcarinated?; surface cancellated by fine concentric and longitudinal striæ; concentric striæ arching on the side, and meeting at a sharp angle upon the dorsal line; aperture with a sinus in the dorsal margin.

The concentric striæ are usually the more conspicuous, the others being scarcely visible, except under a magnifier. The only entire specimen seen is crushed, so that the original form cannot be clearly defined; but the marking of the surface is sufficient to distinguish it from any other species in the lower strata.

Fig. 10 *a*. Lateral view of an entire individual.
Fig. 10 *b*. A portion of the surface enlarged, showing the cancellated striæ.
Fig. 10 *c*. A fragment of a shell, apparently of the same species.

Position and locality. The perfect specimen, with one or two fragments of the same species, was found at Loraine; and the small fragment figured, in the partially altered shales near Waterford, these being the only localities where it is known to occur.

(*State Collection.*)

369. 4. CYRTOLITES ORNATUS.

PL. LXXXIV. Figs. 1 *a*, *b*, *c*, *d*, *e*, *f*, *g*.

Cyrtolites ornatus. CONRAD, Ann. Geol. Rep. New-York, 1838, p. 118; 1839, p. 63; 1841, p. 37.
— — VANUXEM, Geol. Report, 1842, pag. 65, fig. 2.
— — EMMONS, Geol. Report, pag. 402, fig. 2.

Convolute; spire equally depressed on either side; volutions two or three (rarely more than two visible), rapidly enlarging towards the aperture; shell sharply and strongly carinated upon the back, and obtusely angulated upon the sides; ventral side obtusely angulated, with a narrow deep groove on the summit, for the reception of the dorsal carina; aperture but slightly expanded, quadrangular; section quadrangular; dorsal slopes marked by strong obliquely transverse ridges, which extend to the angle on the side of the volution; entire surface marked by fine transverse striæ, the spaces between which are crossed by finer curving ones, giving the surface a cancellated or pitted appearance.

This fossil usually occurs in the form of casts of the interior, which preserve the form of the shell, the dorsal carina, and the transverse ridges, but not the finer sculpture of the surface. In the perfect shell the volutions are contiguous, there being a narrow groove on the ventral line for the admission of the dorsal carina. In casts of the shell, the volutions are often not contiguous, owing chiefly to the dorsal carina being broken off; for when the cast of this part is preserved, it usually reaches to the ventral side of the contiguous volution. This fossil is one of the most remarkable and characteristic of the group, and so peculiar in its form and markings as to render it easily identified.

This species is the type of the Genus CYRTOLITES, proposed by Mr. CONRAD.

Fig. 1 *a*. Lateral view of a cast of this species.
Fig. 1 *b*. Profile of the same, looking into the aperture.
Fig. 1 *c*. Another specimen (a cast), where the volutions are contiguous.
Fig. 1 *d*. A specimen preserving the shell, from which the finer striæ are removed. This fossil, though still preserving the shell, has the exterior often exfoliated, destroying the beautifully sculptured surface.
Fig. 1 *e*. A portion of the surface of the shell, showing the sculpture.
Fig. 1 *f*. A portion of the same magnified.
Fig. 1 *g*. A transverse section of the shell.

Position and locality. This species is unknown in the Trenton limestone, or Utica slate, but is abundant in the central and higher part of the Hudson-river group. It is found at Turin, Boonville, Rome, Pulaski, Washingtonville, Loraine, Rodman, and numerous other localities, in New-York. It occurs in the same position in Canada, and in several western localities. (*State Collection.*)

CEPHALOPODA OF THE UTICA SLATE AND HUDSON-RIVER GROUP.

PLATES LXXXV., LXXXVI. & LXXXVII.

The rocks of this group furnish few species of CEPHALOPODA in addition to those already described. The ORTHOCERATA are usually found in fragments, entirely denuded of the shell, and so much compressed as to render it difficult to identify them. Several species, apparently identical with those previously described, are found ranging through the group. Among these, the young shells of *Endoceras proteiforme* are the most abundant, particularly in the Utica slate. Two or three previously unknown forms appear in the higher part of the group, where some of the strata are calcareous; but these are often obscure, and their determination unsatisfactory.

In the western extension of the group, in Ohio and Indiana, I have observed several species of ORTHOCERAS, but have not yet determined whether they are identical with those here described or not.

249. 1. TROCHOLITES AMMONIUS.

PL. LXXXIV. Figs. 2 *a*, *b*, *c*.

Reference pag. 192, pl. 40, figs. 4 *a* – *k*, of this volume.
Trocholites rugosus. CONRAD in MS. State Collection.
Trocholites, Utica trocholite. VANUXEM, Geol. Report, 1842, pag. 57, fig. 3.

This fossil is clearly identical with *T. ammonius* of the Trenton limestone, the difference observable in some specimens being due to the character of the enclosing shale, or to the partial exfoliation of the shell. Its appearance in this position shows that it continued to exist in considerable numbers after the cessation of the calcareous deposits below; and, on this account, we may look for its occurrence in the shales of the Hudson-river group.

Fig. 2 *a*. A small specimen, partially preserving the shell in some parts, and showing the septa in others.

Fig. 2 *b*. An enlarged portion of the surface, which is partially exfoliated, and slightly different from similar magnified parts of those in the Trenton limestone, where the shell is well preserved.

Fig. 2 *c*. Mould of a large specimen, in the black slate.

Position and locality. This species occurs in the Utica slate on East-Canada creek, at Canajoharie; Cold-spring, on the Erie canal; and in other places, associated with *Calymene beckii*.

370. 2. TROCHOLITES PLANORBIFORMIS.

PL. LXXXIV. Figs. 3 *a, b, c, d, e, f.*

Trocholites planorbiformis. CONRAD, Jour. Acad. Nat. Sciences, 1842, Vol. viii, pag. 274, pl. 17, fig. 1.

Depressed, orbicular, or planorbiform; volutions about four or five, wider than deep; apex profoundly and equally depressed on both sides; aperture lunate; section elliptical, with the inner side concave from the junction of the next volution; surface marked by obliquely transverse ridges, which bend backwards, forming a broad curve on the dorsal line, longitudinally striated with rounded lines.

In all the specimens examined, the outer lamina of the shell is exfoliated, and the fine striæ of the surface are destroyed. The character of the shell is much like that of *T. ammonius*, and I have been disposed to regard it as a variety of the same. But in specimens of that species from the Trenton limestone, I have rarely found the transverse and longitudinal ridges so strongly marked as in this specimen. The shell is always larger than the specimens of the Trenton limestone, but in other respects there are few important differences; and it presents no greater variety than is represented in the *Lituites cornuarietis*, by MURCHISON and DE VERNEUIL.

Fig. 3 *a*. Figure of a specimen nearly entire.
This figure is given from an imperfect specimen, the parts wanting being supplied from the figure of Mr. CONRAD, the original of which I have examined in the cabinet of the Academy of Natural Sciences, at Philadelphia.

Fig. 3 *b*. Dorsal view of the same.

Fig. 3 *c*. Ventral view of a fragment, preserving part of the two outer volutions, showing the concave ventral side, and the position of the siphuncle.

Fig. 3 *d*. A portion of the surface magnified.

Fig. 3 *e*. A specimen crushed in a vertical direction; a part of the outer volution retaining its form in a sufficient degree to identify the species.

Fig. 3 *f*. Dorsal view of the same, showing the slightly arching septa upon the dorsal line, and a part of the outer chamber.

Nearly all the specimens found in the Hudson-river group, in New-York, are crushed and distorted. The single perfect specimen known to me, with another less perfect, were obtained near Grimsby, Canada West, by Mr. ASHMEAD of Philadelphia.

Position and locality. This species occurs in the central part of the group at Turin in Lewis county, Pulaski in Oswego county, and several other localities. The specimens from Canada are associated with other fossils peculiar to this group, leaving no doubt of their position. (*State Collection.*)

371. 18. ENDOCERAS PROTEIFORME?

PL. LXXXV. Figs. 1 *a* – *f*.

Reference pag. 208 – 216, pl. 45 – 50, of this volume.

This species, which is apparently identical with *E. proteiforme* of the Trenton limestone, is abundant in the Utica slate in many localities. It presents some deviations from the prevailing varieties in the Trenton limestone, but not greater than is observed in some specimens in that rock. In the small specimens, which are more common than any others, the distance of the septa is from one fourth to one third of the diameter, and the siphuncle is small and slightly excentric. I have never found them in this rock enclosed in larger tubes or embryo sheaths. The specimens are usually casts in sulphuret of iron, and very perfectly preserved; they are often compressed, and the section is elliptical: but this feature is always due to pressure. The siphuncle likewise shows slight deviations from its prevailing position, and it is often so nearly central that the difference escapes observation.

Fig. 1 *a*. A specimen preserving a large part of the outer chamber. The longitudinal groove is due to pressure which has broken the shell, the broken edges curving inwards.

Figs. 1 *b*, *c*. Specimens of the smaller extremity of the fossil.

The septa in fig. 1 *b*, show a slight arching upwards, but this is not a usual character.

Fig. 1 *d*. A fragment and sections of the two extremities, showing an elliptical form, which is due to pressure.

Fig. 1 *e*. A similar smaller fragment of the same form.

Fig. 1 *f*. A smaller fragment, with sections circular.

The elliptical forms are variable in their degree of eccentricity, and the apparent position of the siphuncle is often influenced by the same cause.

Position and locality. This species is abundant in the black slate at Turin, in Lewis county; it is likewise found at Canajoharie; on the Oxtungo creek, above Fort-Plain, and in other places in the Mohawk valley. (*State Collection.*)

372. 26. ORTHOCERAS (*Species undetermined*).

PL. LXXXV. Fig. 2.

This is a crushed specimen, slightly folded inwards along the centre, and preserving the shell along this line. The original shell is preserved on other parts of the specimen, but all the surface markings are obliterated. The proportional distance of the septa is much greater than in the preceding species, and the character of the specimen is otherwise unlike that of the previous one.

Position and locality. In the Utica slate at Turin, Lewis county.

373. 27. ORTHOCERAS CORALLIFERUM (*n. sp.*).

Pl. LXXXV. Fig. 3; and Pl. LXXXVI. Figs. 1 *a*, *b*, *c*, *d*.

I have collected numerous fragments of Orthocerata, which, from being compressed and denuded of the shell, or partially preserving the shell with its markings obliterated, cannot be characterized with precision. Many of these are partially covered by some incrusting coral, and as this circumstance is characteristic of specimens from widely separated localities, it may be useful in identifying the species.

The septa are closely arranged; the tubes very gradually tapering and often attaining a large size. The distance of the septa, as compared with the diameter of the shell, appears to be variable, from the greater or less degree of pressure which it has suffered.

Plate LXXXV.

Fig. 3. A large specimen, extremely compressed, from the Utica slate.

Plate LXXXVI.

Fig. 1 *a*. A small fragment, from the altered shales near Waterford, Saratoga county. The septa are represented too distant in the figure. A portion of the coral covering the surface is magnified in fig. 1 *b*.

Fig. 1 *c*. A fragment, from the green shales of Lewis county.

Fig. 1 *d*. A fragment from the sandstone of the Hudson-river group.

Position and locality. This species occurs in the Utica slate at Turin, and in the shales and sandstones of the Hudson-river group at Turin, Boonville, Pulaski, Rome, and other places. (*State Collection.*)

374. 28. ORTHOCERAS LAMELLOSUM (*n. sp.*).

Pl. LXXXVI. Figs. 2 *a*, *b*, *c*, *d*.

Slender, very gradually tapering to an acute point; septa distant from one fifth to one fourth of an inch, having a convexity about equal to their distance from each other; siphuncle slightly excentric; surface apparently lamellose or subimbricate.

This species is of frequent occurrence in the calcareous portions of the Hudson-river group. It differs but little from *Endoceras proteiforme*, in the distance of septa and position of siphuncle; but the character of the shell appears to be quite distinct.

Fig. 2 *b*, *c*. Fragments near the smaller extremity; the septa being indistinctly preserved.

Fig. 2 *d*. A fragment, showing the comparative distance of the septa, in which it varies slightly from fig. 2 *c*.

Fig. 2 *e*. Section of the last, showing the position of the siphuncle.

Position and locality. This species occurs at Turin, Loraine, Pulaski, and near Rome. (*State Collection.*)

375. 2. ORMOCERAS CREBRISEPTUM.

PL. LXXXVI. Fig. 2 *a*; PL. LXXXVII. Figs. 2 *a*, *b*, *c*, *d*, *e*.

Elongated, conical, somewhat rapidly tapering to an acute apex; septa numerous, approximate, deeply arched, distant about one seventh the diameter; siphuncle excentric, enlarging in each cell and contracting at its passage through the septum; section circular; surface marked by longitudinal lines, which are visible in the cast.

This species is readily recognized by its very approximate septa, which are highly arched, differing in this respect from the *Orthoceras multicameratum* of the Birdseye limestone; the siphuncle is also proportionally larger, and more excentric.

PLATE LXXXVII.

Fig. 2 *a*. A part of the outer chamber of this species.

Fig. 2 *b*. A fragment still preserving a portion of the shell, which shows some strong longitudinal striæ, and the dorsal line or ridge, a character rarely observed in the ORTHOCERATA.

Fig. 2 *c*. A fragment, showing the position of the siphuncle on the highly arched septum at the upper extremity of the figure.

Fig. 2 *d*. A fragment of stone, with numerous small specimens of this species, associated with crinoidal joints.

Fig. 2 *e*. A longitudinal section of a fragment, showing the deeply arched septa, and the alternate enlargement and contraction of the siphuncle.

Plate lxxxvi, fig. 2 *a*. A fragment of the same species, the siphuncle being distinctly moniliform.

Position and locality. In the shaly calcareous strata of the Hudson-river group at Turin, Pulaski, Washingtonville, and other places. (*State Collection.*)

376. 1. THECA? TRIANGULARIS.

PL. LXXXVII. Figs. 1 *a*, *b*, *c*, *d*.

Bodies of a slender pyramidal form, flat behind and rounded at the larger extremity, angular in front; small extremity pointed; section (aperture?) triangular. The surface shows no defined markings, though the outer covering is not preserved in the specimens which I have seen.

These bodies are of frequent occurrence in the shales of the Hudson-river group, but I have been unable to satisfy myself of their relation to other organic forms, or their independent nature. Capt. PORTLOCK (*Geol. Rep. Londonderry*, pag. 470, pl. 29 A, figs. 6, 7 *a*, 7 *b*) has given some figures of similar bodies, which he refers, with some hesitation, to the internal bone of a cephalopod. Our species presents the general characters of others of this genus, which Prof. G. FORBES has shown to belong to the pteropodous mollusca.

Fig. 1 *a*. A portion of a large specimen, with the smaller extremity broken off.
Fig. 1 *b*. Section of the last.
Fig. 1 *c*. A smaller specimen, very perfectly terminated at both extremities.
Fig. 1 *d*. A minute specimen of the same species.

Position and locality. These specimens (1 *c* and *d*) are from the semi-altered slates near Waterford. The other specimen is from the calcareous beds associated with the same slate, near Troy.

ADDITIONS AND CORRECTIONS.

The two species of Turbo, page 12, probably do not strictly belong to this genus, but are congeners of those in the Trenton limestone, which I have termed *Holopea*. They are not *Pleurotomariæ* nor *Murchisoniæ*; the perfect specimens never exhibiting any spiral band, carina or marginal indentation.

377. 8. AMBONYCHIA MYTILOIDES.

Pl. XXXIII*. Fig. 2.

Obliquely ovate, narrowing and acute at the beak; posterior slope obtusely subcarinated; anterior margin straight above and rounded below; surface (in the cast) presenting some obscure concentric lines.

The specimen is a cast, and the surface markings are unknown. It is quite distinct in form from either of the other species of the genus, being more acute at the beaks than any of them, and it is not as strongly marked by radii as the species of the Hudson-river group. It is an interesting fact to show that this generic type commenced its existence almost with the dawn of organic life; continuing, in the several forms already given, to the termination of the Hudson-river group.

Position and locality. In the lower crystalline strata of the Chazy limestone at Chazy.

63. 7. ORTHOCERAS MONILIFORME (p. 35).

This species should be placed under the Genus Ormoceras, from the character of the siphuncle.

Genus PHYTOPSIS, and species (pag. 38, pl. 8 & 9).

A further examination of these peculiar fossils has convinced me that they belong rather to the Zoophyta than to Plants; though it is impossible, with our present knowledge, to decide their true relations or associates. The examination of a large number of specimens, with the best glasses in my possession, has shown no pores upon the surface; and the internal structure, though similar to plants, is the kind of structure which plants exhibit under a high magnifying power, and not to the naked eye as in these fossils.

378. 2. SCHIZOCRINUS STRIATUS (*n. sp.*)

PL. XXVIII. Figs. 4 *a, b, c*.

Body very gradually enlarging upwards; plates narrow, elongated; costal plates consisting of a regular single series of five, supporting a series of scapular plates; a single range of intercostal plates, which are succeeded by a double range of interscapulars, one of the oblique lower sides of each plate resting upon the upper oblique edge of the intercostal, and the other upon the costal plate; arms unknown; column near the pelvis, composed of thin joints, alternating at distant intervals with a thicker one; edges of the plates of the column with slight longitudinal ridges or striæ.

This species has the same structure as the *S. nodosus*, but the form of the body and plates is quite different; the joints of the column are not nodulose, but longitudinally striated, differing in an essential manner from the other species with which it is generically identical.

This specimen was discovered after the descriptions of the above species had been printed, but is added to the plate, which had not been completed.

Fig. 4 *a*. The body of this species, with a small part of the column attached.
Fig. 4 *b*. A portion of the column enlarged.
Fig. 4 *c*. An enlarged figure, showing the structure and arrangement of the plates.

Position and locality. In the intercalated shaly layers in the Trenton limestone at Middleville.

121. 1. GRAPTOLITES AMPLEXICAULE (p. 79).

It is quite possible that this species will prove identical with *G. pristis*, or some other one of the higher slates; though in the limestone, when not compressed, it presents a different aspect.

123. 1. POTERIOCRINUS ALTERNATUS (pag. 83, pl. 28, figs. 1 *a – f*).

This species may perhaps be a *Cyathocrinus;* but the form of the plates is the same as in *P. gracilis*, which presents all the generic characters given by MILLER. It may be doubtful even whether the distinction between *Poteriocrinus* and *Cyathocrinus* is always conspicuous or readily decided.

379. 3. NUCULA? DONACIFORMIS.

PL. XXXIII*. Figs. 3 *a, b*.

Ovate-cuneate, the anterior side short and rounded, the posterior side extended, narrowing and compressed laterally, inflated towards the umbones, which are prominent and distinctly elevated above the cardinal line; base nearly straight; surface marking obliterated.

This species approaches in form to the larger varieties of *N. levata*, but is more extended posteriorly, and the anterior side proportionally shorter.

It is not improbable but there may be two species among those given as *N. levata*, though I have not yet been able to distinguish them by decided characters.

Fig. 3 *a*. Right valve of this species. 3 *b*. Cardinal view of the same.

208. 9. MODIOLOPSIS AVICULOIDES (pag. 161, pl. 36, fig. 1 *a*).

The transverse striæ shown in this figure are due to pressure in the shaly matrix, which produces markings similar to the "slickensides," or striæ made by the sliding of one surface over another. Many fossils in the Trenton limestone are thus marked.

380. 6. BUCANIA INTEXTA (*n. sp.*)

Pl. XXXIII*. Fig. 4 *a*, *b*, *c*, *d*.

Convolute, discoidal; volutions three or more, contiguous, gradually expanding, the last one continuing in a somewhat direct line to the aperture; umbilicus broad and deep; back of the volutions broadly rounded; sides obtusely angular; dorsal line marked by a sharp elevated carina; surface of the shell ornamented by strong elevated longitudinal striæ, which are interrupted by distant oblique transverse lines, and crossed by finer striæ.

This species, of which only a single fragment has been seen, was obtained by Dr. Emmons, near Watertown, Jefferson county, in what he supposed to be the Trenton limestone; but from its close analogy with the *B. sulcatina* of the Chazy limestone, I have hesitated to place it with the Trenton species of the genus, fearing some error in regard to its geological position. It differs from *B. sulcatina*, in having the longitudinal grooves equal to the striæ; while in that one the elevated bands, which are often composed of two or three smaller ones, are twice as wide as the spaces between. In addition to the fine obliquely transverse striæ, there are, at regular intervals, stronger ones which partially displace or derange the longitudinal striæ, so that they are not continuous. This character is less conspicuous in *B. sulcatina*. In that species, also, the dorsal line is depressed; while in this one it appears to have been carinated, a portion of the carina remaining. A comparison of the figures of the surface of the two individuals will show the distinctions here indicated.

Fig. 4 *a*. Dorsal view of the fragment.
Fig. 4 *b*. Lateral view of the same.
Fig. 4 *c*. A portion of the surface magnified.
Fig. 4 *d*. A portion of the surface of *B. sulcatina* magnified.

175. 8. ATRYPA CUSPIDATA (pag. 138, pl. 33*).

This species, though differing from the original of *A. extans*, I am inclined to regard as identical with it, the differences indicated depending partly upon the accidental condition of the specimens. I have never been able to obtain perfect specimens, preserving the characters of *A. extans* represented in the single valves from which Mr. CONRAD described the species.

127. 1. ECHINO-ENCRINITES ANATIFORMIS (pag. 89, pl. 29).

The structure cannot be entirely made out from the specimens in my possession. The pelvic plates are four, two of them truncated above, and one or both the others are pentagonal. A large part of the column is preserved in the specimens 4 *a* and 4 *b*. The specimen 4 *d* is crushed, and the column flattened, and appears wider than its proper proportion. In the specimen fig. 4 *d'*, the natural proportions are preserved. The lower part of the column, which is very small, and composed of joints twice or thrice as long as wide, is magnified in fig. 4 *a*+. This part of the column is not preserved in any of the specimens except fig. 4 *a*.

128. 2. ASTERIAS MATUTINA (pag. 91, pl. 29).

Prof. AGASSIZ has shown me that this species, though having the form of an *Asterias*, presents a generic difference, requiring another designation.

This species, with several other species of asteroid-crinoids in the palæozoic strata, will constitute a distinct genus, whenever their characters shall have been sufficiently studied.

313. 1. THALEOPS (ILLÆNUS) OVATUS (p. 259).

PL. LXVII. Figs. 6 *a*, *b*, *c* (fig. 6 *c* added).

Since this description was written, I have had an opportunity of examining a specimen from the collection of Mr. W. H. PEASE, which is more perfect in some respects than the one previously described and figured. This individual is provided with a strong angular spine, projecting from each posterior angle of the buckler, nearly at right angles to the axis of the body. Spines of this character have sometimes been seen in the Trenton limestone, and in the Blue limestone of Cincinnati. The specimen described is from the southern part of Indiana, the precise locality unknown.

354. 14. MODIOLOPSIS TERMINALIS (*n. sp.*).

PL. XXXIII*. Fig. 5.

Reference *Modiolopsis* (species undetermined), p. 297.

Since the description and figure of this species were completed, I have obtained a very perfect cast of the same, which is figured as above. The beaks appear to be terminal, or extending quite as far as the anterior margin of the shell. The form of the shell is similar to *M. nasutus*, but the position of the beaks readily distinguishes it from that species.

ORGANIC REMAINS OF THE TACONIC SYSTEM.

Dr. Emmons, in his paper on the Taconic System, and in his Agricultural Report, has given several plates of fossils of the Taconic system, with descriptions of the same. The larger number of these are from the State of Maine; and since the relative position of the rocks containing them has not been shown upon geological evidence, nor any fossils from them identified with those of rocks of the [presumed] same age in New-York, I have thought it better to omit any notice of them in this volume. Of those found within the State of New-York, several are unequivocally identical with well known species in the Hudson-river group, while a single species is yet unknown in that position.

The *Trilobites* are figured on Plate LXVII, and described at pages 252 and 256 of this Report. One of these is new, while the other is unquestionably the *Calymene beckii.*

The *Nemapodia* has since been shown, by Dr. Fitch, to be the track or discoloration on the surface, produced by some existing animal.

The *Gordia marina* presents no evidence of organic structure, having more the appearance of the cast of a furrow made by some mollusk upon a soft bottom, which was afterwards filled with sediment, producing the form under consideration.

The *Nereites* and *Myrianites*, figured on Plates III and IV, *Tac. System* (Plates XV and XVI, *Agr. Report*), are, as before observed, from the slates of Waterville in Maine, the age and relative position of which has not been shown upon other evidence.

The *Fucoides simplex* is undoubtedly a *Graptolite*, allied to *G. foliaceus*, and apparently identical with a species in the unaltered slates of the Hudson-river group.

The *Fucoides rigida* and *F. flexuosa* are one and the same species; but their locality leaves no doubt that the rocks in which they occur are a part of the Hudson-river group. A species, undistinguishable from this one, occurs in the unaltered shales of the Hudson-river group at Turin in Lewis county, though such variable forms are not to be regarded as of cardinal importance. Even if this prove a distinct species, it is generically identical with others from authentic localities of the Hudson-river group, and is therefore of little value as typifying rocks of a distinct system. Such an argument, however, if available in this case, may be used in another; for the two species of *Sphenothallus* (Pl. LXVIII) are not associated with other known fossils, but are clearly in strata of the Utica slate and Hudson-river group. The only difference in the case of those in Washington county, is that the rocks have suffered a few undulations and plications, with scarcely any visible change in their lithological character.

For these reasons, and because a careful examination of the structure of this part of the country has shown a clear connexion of the rocks on the east and west side of the Hudson-river valley, I have considered it my duty to unite these fossils with those found in other localities of the Hudson-river group. Whatever future investigations may develope, we have at present no sufficient evidence for regarding the rocks on the east side of the Hudson river as distinct from those on the west side; since they are visibly connected, and the undulated and plicated structure and partial alteration commences on the west side of the river, while the fossils still retain their form and unequivocal character. Those who investigate the subject should remember, also, that the discovery of a few species in the altered shales on the east side of the river is not decisive of a different age of the strata, while so many unequivocal forms of the unaltered rocks on the west side appear in the same connexion. A careful search conducted in any part of these strata, both in the disturbed and undisturbed regions, will lead to the discovery of many new species, which is likewise true in other formations.

I conceive, however, that it is unnecessary, in this place, to enter into detail regarding the geological structure of this part of the country. This will appear in an introduction to the work, with sections showing the continuation of the formations eastward, and their gradual metamorphism which increases with their greater disturbance.

TABULAR LIST OF THE SPECIES DESCRIBED IN THIS VOLUME,

SHOWING THEIR VERTICAL RANGE AS FAR AS HAS BEEN OBSERVED IN THE PROGRESS OF THE WORK.

In comparing the species of this table, and the range given, it should be borne in mind, that all the groups here mentioned are subordinate parts of the lower division of the palæozoic series, constituting the equivalents of the Lower Silurian rocks of England and Wales, and other parts of Europe. These subdivisions are not, therefore, to be regarded as of the same importance as the greater groups or divisions, which are more definitely marked at their termination and commencement; still it is interesting to observe the important changes taking place at the termination of each one, and how few are the species which pass from one to the other. From the Trenton limestone upwards, the zoological affinities of the strata are much greater than between this rock and those below; for, in fact, although it is almost impossible to define the line of separation between the Black-river limestone and the Trenton limestone, yet the few species common to the two rocks impresses one as remarkable, and as indicating a greater and more decided change in the organic products of this period than the similar lithological nature of the rocks would lead us to believe.

The zoological relations between the five lower members of this division are by no means intimate; the difference in the organic remains amounting almost to an entire change between the termination of one, and the commencement of the next in succession. The small number of species in the two lower members, however, give scarcely a fair opportunity of comparison with the succeeding ones where the species are more numerous; and we find no considerable number of species, till we arrive at the Chazy limestone. The greater proportion of these, however, are peculiar to this rock, the few exceptions being barely sufficient to link it with the succeeding strata by its organic affinities. By this arrangement, and by carefully presenting the results of investigations among the organic remains of very subordinate groups, geologists will be able to decide what value is to be attached to this kind of evidence, even where, usually, there has not been made any important distinction of age or character of strata.

I should observe, however, in this place, that the organic affinities of these rocks may be increased by further research; as doubtless a greater number of species will be found common to two or more of them, while there are only two or three instances where there is a probability that those at present regarded as identical may prove distinct species. Among these are the *Illænus* and *Isotelus* of the Chazy limestone, which are apparently identical with those of the Trenton limestone.

The Utica slate has been continued as a separate formation in this table, though the species peculiar to it are few. Its relative value and importance will be readily apprehended by an inspection of the table.

	GENERA AND SPECIES.	Plate and figure.	Page.	Rocks & Groups.							
				Potsdam sandstone.	Calciferous sandstone.	Chazy limestone.	Birdseye limestone.	Black-river limestone.	Trenton limestone.	Utica slate.	Hudson-river group.
	PLANTÆ.										
1	Scolithus linearis, *Haldeman*	i, 1 *a* – *c*	2	+							
1	Palæophycus tubularis, *Hall*	ii, 1, 2, 4, 5	7		+						
2	— irregularis, "	ii, 3	8		+						
3	— rugosus, "	xxi, 2	63						+		
4	— simplex, "	xxii, 1 *a* – *d*	63						+		
5	— virgatus, "	lxx, 1	263								+
6	— *sp. indet.*	lxx, 2	264								+
1	Buthotrephis antiquata, *Hall*	ii, 6	8		+						
2	— gracilis, "	xxi, 1	62						+		
3	— succulens, "	xxii, 2 *a*, *b*	62						+		
4	— subnodosa, "	lxviii, 3 *a*, *b*	262								+
5	— flexuosa, *Emmons*	lxix, 1 *a* – *c*	263								+
1	Sphenothallus angustifolius, *Hall*	lxviii, 1	261							+	
2	— latifolius, *Hall*	lxviii, 2 *a* – *f*	262								+
	INCERTÆ SEDES.										
1	Gordia marina, *Emmons*	lxxi, 1. 2	264								+
1	Phytopsis tubulosum, *Hall*	viii, 1 *a* – *e*	38				+				
2	— cellulosum, "	ix, 1 *a* – *d*	39				+				
1	Tentaculites flexuosa, "	xxix, 6	92						+		
		lxxviii, 2	284								+
	ZOOPHYTA.										
1	Graptolithus amplexicaule? *Hall*	xxvi, 11 *a*, *b*	79						+		
2	— pristis, *Hisinger*	lxxii, 1 *a* – *s*	265							+	+
3	— secalinus, *Eaton*	lxxii, 2 *a*, *b*	267							?	+
4	— mucronatus, *Hall*	lxxiii, 1 *a* – *d*	268								+
5	— bicornis, "	lxxiii, 2 *a* – *s*	268								+
6	— ramosus, "	lxxiii, 3 *a* – *h*	270								+
7	— scalaris, *Linne*	lxxiii, 4 *a* – *g*	271							+	+
8	— sagittarius, *Hisinger*	lxxiv, 1 *a*, *b*	272								+
9	— tenuis, *Portlock*	lxxiv, 2 *a* – *d*	272								+
10	— sextans, *Hall*	lxxiv, 3 *a* – *e*	273								+
11	— furcatus, "	lxxiv, 4 *a* – *f*	273								+
12	— serratulus, "	lxxiv, 5 *a*, *b*	274								+
13	— gracilis, "	lxxiv, 6 *a* – *d*	274								+
14	— lævis, "	lxxiv, 7	274							+	
1	Intricaria? reticulata, "	xxvi, 8 *a* – *c*	77						+		
1	Gorgonia? aspera, "	iv, 3 *a*, *b*	16			+					
2	— perantiqua, "	xxvi, 5 *a*, *b*	76						+		
1	Retepora incepta, "	iv, 1 *a*, *b*	15			+					
2	— gracilis, "	iv, 2, 2 *a*	15			+					
3	—? foliacea, "	xxvi, 9 *a*, *b*	78						+		
1	Stictopora fenestrata, "	iv, 4 *a* – *e*	16			+					
2	— glomerata, "	iv, 5	17			+					
3	— labyrinthica, "	xii, 8 *a*, *b*	50				+				
4	— ramosa, "	xii, 6, 7, 7 *a*	51					+			
5	—? acuta, "	xxvi, 3 *a*, *b*	74						+		
6	— elegantula, "	xxvi, 4 *a* – *g*	75						+		
1	Escharopora recta, "	xxvi, 1 *a* – *g*	73						+		
2	— — *var.* nodosa, *Hall*	xxvi, 2	73						+		
	Several of the preceding genera require a different place in a strict zoological arrangement; but since they are usually known as fossil corals, no advantage could result from separating them in a work of this kind.										
1	Aulopora arachnoidea, *Hall*	xxvi, 6 *a*, *b*, *c*	76						+		

	GENERA AND SPECIES.	Plate and figure.	Page.	Potsdam sandstone.	Calciferous sandstone.	Chazy limestone.	Birdseye limestone.	Black-river limestone.	Trenton limestone.	Utica slate.	Hudson-river group.
				Rocks & Groups.							
1	Alecto inflata, *Hall*	xxvi, 7 *a, b*	77						+		
1	Chætetes, *sp. indet.*	iv, 7 *a – d*	18			+					
2	— lycoperdon? *Say*	xii, 3, 5	48				+	+			
2	— lycoperdon, *Say*	xxiii, 1, 2, 3; xxiv, 1	64						+		
		lxxv, 2 *a – f*	276								+
3	— rugosus, *Hall*	xxiv, 2 *a, b*	67						+		
4	— columnaris, "	xxiii, 4, 4 *a*	68						+		
1	Stromatocerium rugosum, *Hall*	xii, 2, 2 *a, b*	48				+	+			
1	Porites? vetusta, "	xxv, 5 *a, b*	71					?	+		
1	Favistella stellata, "	lxxv, 1 *a, b, c*	275								+
1	Columnaria alveolata, *Goldfuss*	xii, 1 *a, b, c*	47					+			
1	Streptoplasma expansa, *Hall*	iv, 6 *a, b*	17			+					
2	— profunda, "	xii, 4 *a – d*	49					+			
3	— corniculum, "	xxv, 1 *a – e*	69						+		
4	— crassa, "	xxv, 2 *a, b, c*	70						+		
5	— multilamellosa, "	xxv, 3 *a, b, c*	70						+		
6	— parvula, "	xxv, 4 *a, b, c*	71						+		
1	Discophyllum peltatum, "	lxxv, 3	277								+
1	Stellipora antheloidea, "	xxvi, 10 *a, b, c*	79						+		
1	Receptaculites neptunii? *Defrance*	xxiv, 3 *a – d*	68						+		
1	(Genus?) cyathiformis, *Hall*	xxv, 6 *a, b, c*	72						+		
1	(Undetermined)	lxxv, 4	277								+
	CRINOIDEA.										
1	Actinocrinus tenuiradiatus, *Hall*	iv, 8, 9	18			+					
2	— *sp. indet.*	iv, 10	18			+					
1	Schizocrinus nodosus, *Hall*	xxvii, 1 *a – p*	81						+		
2	— striatus, "	xxviii, 4 *a, b, c*	316						+		
3	— *sp. indet.*	xxix, 1	86						+		
1	Poteriocrinus alternatus, *Hall*	xxviii, 1 *a – f*	83						+		
2	— gracilis, "	xxviii, 2 *a – f*	84						+		
1	Scyphocrinus heterocostalis, "	xxviii, 3 *a – f*	85						+		
1	Heterocrinus heterodactylus, "	lxxvi, 1 *a – o*	279						+		+
2	— simplex, "	lxxvi, 2 *a – d*	280								+
3	—? gracilis, "	lxxvi, 3 *a, b*	280								+
1	Glyptocrinus decadactylus, "	lxxvii, 1; lxxviii, 1	281								+
1	Echino-encrinites anatiformis, "	xxix, 4 *a – f*	89						+		
1	Asterias? (*sp. indet*)	iv, 11 *a, b*	18			+					
2	— matutina, *Hall*	xxix, 5 *a, b*	91						+		?
	BRACHIOPODA.										
1	Lingula prima, *Conrad*	i, 2 *a, b*	3	+							
2	— antiqua, *Hall*	i, 3 *a – e*	3	+							
3	— acuminata, *Conrad*	.....	9		+						
4	— attenuata? *Sowerby*	xxx, 1 *a, b*	94						+		
5	— riciniformis, *Hall*	xxx, 2 *a, b, c*	95						+		
6	— æqualis, "	xxx, 3 *a, b*	95						+		
7	— quadrata, *Eichwald*	xxx, 4; lxxix, 1	96, 185						+		+
8	— elongata, *Hall*	xxx, 5	97						+		
9	— curta, *Conrad*	xxx, 6 *a, b*	97						+	+	
10	— obtusa, *Hall*	xxx, 7 *a, b, c*	98						+		
11	— crassa, "	xxx, 8 *a – e*	98						+		?
1	Orbicula? deformata, *Hall*	iv bis, 10	23			+					
2	— filosa, "	xxx, 9 *a – d*	99						+		
3	— lamellosa, "	xxx, 10 *a, b*	99						+		
4	— terminalis, *Conrad*	xxx, 11 *a – d*	100						+		

	GENERA AND SPECIES.	Plate and figure.	Page.	Rocks & Groups. Potsdam sandstone.	Calciferous sandstone	Chazy limestone.	Birdseye limestone.	Black-river limestone.	Trenton limestone.	Utica slate.	Hudson-river group.
5	Orbicula ? subtruncata, *Hall*	lxxix, 7 *a*, *b*	290								+
6	— ? crassa, "	lxxix, 8 *a*, *b*	290								+
7	— cælata, "	lxxix, 9 *a*, *b*, *c*	290								+
1	Leptæna plicifera, "	iv bis, 1 *a*, *b*	19			+					
2	— incrassata, "	iv bis, 2 *a*, *b*, *c*	19			+					
3	— fasciata, "	iv bis, 3 *a*, *b*, *c*	20			+					
4	— alternata, *Conrad*	xxxi, 1; xxxi A, 1	102						+		
		lxxix, 2 *a* – *l*	286								+
5	— camerata, "	xxxi A, 2 *a*, *b*	106						+		
6	— deltoidea, "	xxxi A, 3 *a* – *e*	106						+		
7	— tenuistriata, *Sowerby*	xxxi A, 4 *a* – *f*	108						+		
8	— alternistriata, *Hall*	xxxi B, 1 *a*, *b*, *c*	109						+		
9	— sericea, *Sowerby*	xxxi B, 2 *a* – *h*	110						+		
		lxxix, 3 *a*, *b*	287							+	+
10	— filitexta, *Hall*	xxxi B, 3 *a* – *f*	111						+		
11	— planumbona, "	xxxi B, 4 *a* – *f*	112						+		
12	— deflecta, *Conrad*	xxxi B, 5 *a*, *b*	113						+		
13	— recta, "	xxxi B, 6 *a*, *b*	113						+		
14	— planoconvexa, *Hall*	xxxi B, 7 *a* – *d*	114						+		
15	— tenuilineata, *Conrad*	xxxi B, 8	115						+		
16	— subtenta, "	xxxi B, 9 *a*, *b*	115						+		
17	— (*sp. indet.*)	xxxi B, 10 *a*, *b*, *c*	116						+		
1	Orthis costalis, *Hall*	iv bis, 4 *a*, *b*	20			+					
2	— testudinaria, *Dalman*	xxxii, 1 *a* – *l*	117						+		
		lxxix, 4 *a* – *e*	288								+
3	— subæquata, *Conrad*	xxxii, 2 *a* – *f*	118						+		
4	— bella-rugosa, "	xxxii, 3 *a*, *b*, *c*	118						+		
5	— disparilis, "	xxxii, 4 *a*, *b*, *c*	119						+		
6	— perveta, "	xxxii, 5 *a*, *b*, *c*	120						+		
7	— equivalvis, *Hall*	xxxii, 6 *a*, *b*, *c*	120						+		
8	— fissicosta, "	xxxii, 7 *a*, *b*	121						+		
9	— tricenaria, *Conrad*	xxxii, 8 *a* – *e*	121						+		
10	— plicatella, *Hall*	xxxii, 9 *a* – *g*	122						+		
11	— pectinella, *Conrad*	xxxii, 10 *a* – *e*	123						+		
12	— — *var.* semiovalis, *Hall*,	xxxii, 11 *a*, *b*, *c*	124						+		
13	— insculpta, *Hall*	xxxii, 12 *a*, *b*, *c*	125						+		
14	— dichotoma, "	xxxii, 13 *a*, *b*	125						+		
15	— subquadrata, "	xxxii A, 1 *a* – *o*	126						+		
16	— occidentalis, "	xxxii A, 2 *a* – *q*	127						+		
		xxxii B, 1 *a* – *e*	128						+		
17	— sinuata, "	xxxii B, 2 *a* – *s*	128						+		
18	— subjugata, "	xxxii C, 1 *a* – *m*	129						+		
19	— erratica, "	lxxix, 5 *a* – *f*	288								+
20	— centrilineata, "	lxxix, 6* *a*, *b*, *c*	289								+
1	Delthyris biforatus, *var.* lynx, *Eich.*	xxxii D, 1 *a* – *u*	133						+		
1	Atrypa dubia, *Hall*	iv bis, 5	21			+					
2	— acutirostra, "	iv bis, 6	21			+					
3	— plena, "	iv bis, 7 *a* – *e*	21			+					
4	— plicifera, "	iv bis, 8 *a* – *d*	22			+					
5	— altilis, "	iv bis, 9 *a* – *d*	23			+					
6	— extans, *Conrad*	xxxiii, 1 *a*, *b*	137						+		
7	— nucleus, *Hall*	xxxiii, 2 *a*, *b*, *c*	138						+		
8	— cuspidata,† "	xxxiii*, 1 *a* – *h*	138						+		

* Erroneously referred to fig. 5 on page 289.

† *A. cuspidata* figured on supplementary plate xxxiii*.

	GENERA AND SPECIES.	Plate and figure.	Page.	Rocks & Groups. Potsdam sandstone.	Calciferous sandstone.	Chazy limestone.	Birdseye limestone.	Black-river limestone.	Trenton limestone.	Utica slate.	Hudson-river group.
9	Atrypa bisulcata, *Emmons*	xxxiii, 3 *a* – *c*	139	..	..	..	..	..	+	..	..
10	— deflecta, *Hall*	xxxiii, 4 *a*, *b*	140	..	..	..	..	..	+	..	..
11	— recurvirostra, "	xxxiii, 5 *a* – *d*	140	..	..	..	..	..	+	..	..
12	— exigua, "	xxxiii, 6 *a* – *d*	141	..	..	..	..	..	+	..	..
13	— modesta, *Say*..............	xxxiii, 15	141	..	..	..	..	.	+	+	+
14	— circulus, *Hall*..........	xxxiii, 7 *a* – *c*	142	..	..	..	..	..	+	..	..
15	— ambigua, "	xxxiii, 8 *a* – *c*, 9 *a* *b*	143	..	..	..	..	..	+	..	..
16	— hemiplicata, "	xxxiii, 10 *a* – *f*	144	..	..	..	..	..	+	..	..
17	— *sp. indet.*	xxxiii, 11 *a* – *c*	145	..	..	..	..	..	+	..	..
18	— subtrigonalis, *Hall*	xxxiii, 12 *a* – *c*	145	..	..	..	..	..	+	..	..
19	— increbescens.* "	xxxiii, 13 *a* – *y*	146	..	..	..	..	..	+	..	..
		lxxix, 6	289	..	.	..	..	..	..	+	+
20	— dentata, "	xxxiii, 11 *a* – *c*	148	..	..	..	..	..	+	..	..
21	— sordida, "	xxxiii, 16	148	..	..	..	..	..	+	..	..
	ACEPHALA.										
1	Ambonychia mytiloides, *Hall*	xxxiii*, 2	315	..	..	+	..	..	..	..	..
2	— bellastriata, "	xxxvi, 4 *a* – *c*	163	..	..	..	..	..	+	..	..
3	— orbicularis, *Conrad*	xxxvi, 5 *a* – *d*	164	..	..	..	..	..	+	..	..
4	— amygdalina, *Hall*	xxxvi, 6 *a* – *c*	165	..	..	..	..	..	+	..	..
5	— undata, *Conrad*............	xxxvi, 7 *a*, *b*	165	..	..	..	..	..	+	..	..
6	— obtusa, *Hall*	xxxvi, 8 *a*, *b*	167	..	..	..	..	..	+	..	..
7	—? *sp. indet*	xxxvi, 9 *a*, *b*	167	..	..	..	..	..	+	..	..
8	— radiata, *Hall*	lxxx, 4 *a* – *m*	292	..	..	..	..	.	..	..	+
9	— carinata, *Goldfuss*	lxxx, 5 *a*, *b*	294	..	..	..	..	..	..	..	+
1	Avicula trentonensis, *Conrad*	xxxvi, 2 *a* – *d*	161	..	..	..	..	..	+	..	..
2	— elliptica, *Hall*	xxxvi, 3	162	..	..	..	..	..	+	..	..
3	— insueta, *Conrad*	lxxx, 1 *a*, *b*	291	..	..	..	..	..	..	+	..
4	— demissa, "	lxxx, 2 *a*, *b*	292	..	..	..	..	..	..	..	+
5	—? desquamata, *Hall*	lxxx, 3 *a*, *b*	292	..	..	..	..	..	..	..	+
1	Modiolopsis mytiloides, *Hall*	xxxv, 4 *a*, *b*	157	..	..	..	..	..	+	..	..
2	— parallela, *Conrad*....	xxxv, 5	158	..	..	..	..	..	+	..	..
3	— faba, "	xxxv, 6 *a* – *d*	158	..	..	..	..	..	+	..	..
		lxxxii, 4	298	..	..	..	..	..	..	..	+
4	— nasutus, "	xxxv, 7	159	..	..	..	..	..	+	..	..
		lxxxi, 2	296	..	..	..	..	..	..	..	+
5	— arcuatus, *Hall*..........	xxxv, 8	159	..	..	..	..	..	+	..	..
6	— subspatulatus, "	xxxv, 9 *a*, *b*	159	..	..	..	..	..	+	..	..
7	— latus, "	xxxv, 10 *a*, *b*	160	..	..	..	..	..	+	..	..
8	— carinatus, "	xxxv, 11 *a* – *c*	160	..	..	..	..	..	+	..	..
9	— aviculoides, "	xxxvi, 1 *a*, *b*	161	..	..	..	..	..	+	..	..
10	— trentonensis, *Conrad*	xxxiv, 10	161	..	..	..	..	..	+	..	..
11	— modiolaris, "	lxxxi, 1 ; lxxxii, 1	294	..	.	..	..	..	..	..	+
12	— truncatus, *Hall*	lxxxi, 3 *a*, *b*	296	..	.	..	..	..	..	..	+
13	— curta, *Conrad*	lxxxi, 4 ; lxxxii, 2	297	..	..	..	..	..	..	..	+
14	— *sp. indet.*. .... }	lxxxi, 5 *a*, *b*	297 }	..	..	..	..	..	?	..	+
"	— terminalis, *Hall*.... ..... }	xxxiii*, 5	318 }								
15	— anodontoides, *Conrad*	lxxxii, 3 *a* – *c*	298	..	..	..	..	..	..	..	+
16	—? nuculiformis, *Hall*	lxxxii, 5 *a*, *b*	295	..	..	..	..	..	..	..	+
1	Modiola ? obtusa, "	x, 1	40	..	..	..	+	..	..	..	..
1	Tellinomya nasuta, *Hall*.......	xxxiv, 3 *a* – *c*	152	..	..	..	..	..	+	..	..
2	— sanguinolaroidea, "	xxxiv, 4 *a*, *b*	152	..	..	..	..	..	+	..	..
3	— gibbosa, "	xxxiv, 5 *a*, *b*	153	..	..	..	..	..	+	..	..

* Compare *A. capax*, CONRAD, Jour. Acad. Nat. Sciences, Vol. viii, pag. 264, pl. 14, fig. 21.

	GENERA AND SPECIES.	Plate and figure.	Page.	Rocks & Groups.							
				Potsdam sandstone.	Calciferous sandstone	Chazy limestone.	Birdseye limestone.	Black-river limestone.	Trenton limestone.	Utica slate.	Hudson-river group.
4	Tellinomya dubia, *Hall*	xxxiv, 6 *a – f*	153						+		
5	— anatiniformis, "	xxxiv, 7	154						+		
1	Orthonota pholadis, *Conrad*	lxxxii, 6	299								+
2	— parallela, *Hall*	lxxxii, 7 *a – d*	299								+
3	— contracta, "	lxxxii, 8 *a, b*	300								+
1	Cleidophorus planulatus, *Conrad*	lxxxii, 9 *a – e*	300							?	+
1	Nucula levata, *Hall*	xxxiv, 1 *a – i*	150						+		+
2	— [?] poststriata, *Conrad*	xxxiv, 2 *a, b*; lxxxii, 10 *a, b*	151; 301						+		+
3	—? donaciformis, *Hall*	xxxiii*, 3 *a, b*	316						+		
1	Lyrodesma plana, *Conrad*	lxxxii, 11 *a, b*	302								+
2	— pulchella, *Hall*	lxxxii, 12 *a – d*	302							?	+
1	Cardiomorpha vetusta, "	xxxiv, 8	154						+		
1	Edmondia ventricosa, "	xxxv, 1 *a – f*	155						+		
2	— subtruncata, "	xxxiv, 9; xxxv, 3	156						+		
3	—? subangulata, "	xxxv, 2 *a, b*	156						+		
	GASTEROPODA.										
1	Euomphalus uniangulatus, *Hall*	iii, 1, 1 *a*	9		+						
1	Ophileta levata, *Vanuxem*	iii, 4, 5	11		+						
2	— complanata, "	iii, 6	11		+						
1	Maclurea sordida, *Hall*	iii, 2, 2 *a*	10		+						
2	— matutina, "	iii, 3	10		+						
3	— magna, *Leseuer*	v, 1 *a – d*; v bis, 1	26			+		+			
1	Raphistoma striata, *Emmons*	vi, 2 *a, b*	28			+					
2	— staminea, *Hall*	vi, 4, 5, 5 *a*	29			+					
3	— planistria, "	vi, 3 *a, b*	30			+					
4	— — *var.* parva, *Hall*	vi, 3 *c, d, e*	30			+					
1	Scalites angulatus, *Conrad*	vi, 1 *a, b*	27			+					
1	Capulus auriformis, *Hall*	vi, 9 *a, b*	31			+					
1	Natica? (*sp. indet.*)	x, 5	42				+				
1	Turbo dilucula, *Hall*	iii, 7	12		+						
2	—? obscura, "	iii, 8	12		+						
1	Holopea symmetrica, *Hall*	xxxvii, 1	170						+		
2	— obliqua, "	xxxvii, 2 *a – d*	170						+		
3	— paludiniformis, "	xxxvii, 3 *a, b*	171						+		
4	— ventricosa, "	xxxvii, 4 *a, b*	171						+		
1	Pleurotomaria? turgida, "	iii, 9, 10	12		+						
2	— biangulata, "	vi, 6	31			+					
3	— (*sp. indet.*)	vi, 8	31			+					
4	— antiquata, *Hall*	vii, 1	31			+					
5	—? nucleolata, "	x, 6	42				+				
6	— quadricarinata, "	x, 8	43				+				
7	— umbilicata, "	x, 9; xxxviii, 1	43, 175				+		+		
8	—? nodulosa, "	x, 10	44				+				
9	—? obsoleta, "	x, 11	44				+				
10	— subtilistriata, "	xxxvii, 5 *a – d*	172						+		
11	— lenticularis, *Sowerby*	xxxvii, 6 *a – d*	172						+		
12	— rotuloides, *Hall*	xxxvii, 7 *a – c*	173						+		
13	— subconica, "	xxxvii, 8 *a – c*; lxxxiii, 3 *a – e*	174; 304						+		+
14	— indenta, "	xxxviii, 2	176						+		
15	— ambigua, "	xxxviii, 3 *a, b*	176						+		
16	— percarinata, "	xxxviii, 4	177						+		
17	— [?] bilix, *Conrad*	lxxxiii, 4 *a – e*	305						?		+
18	— (*sp. indet.*)	lxxxiii, 5 *a, b*	305								+

	GENERA AND SPECIES.	Plate and figure.	Page.	Potsdam sandstone.	Calciferous sandstone.	Chazy limestone.	Birdseye limestone.	Black-river limestone.	Trenton limestone.	Utica slate.	Hudson-river group.
				Rocks & Groups.							
1	Murchisonia abbreviata, *Hall*	vi, 7	32	..	..	+	..	..	..	..	..
2	—? angustata, "	x, 2 *a*, *b*	41	..	..	..	+	..	..	..	..
3	— ventricosa, "	x, 3	41	..	..	..	+	..	..	..	..
4	— perangulata, "	x, 4	41	..	..	..	+	..	..	..	..
5	—? varicosa, "	x, 7 *a*, *b*	42	..	..	..	+	..	..	..	..
6	— bicincta, "	xxxviii, 5 *a* – *h*	177	..	..	..	..	..	+	..	..
7	— tricarinata, "	xxxviii, 6 *a* – *e*	178	..	..	..	..	..	+	..	..
8	— perangulata, *var.* A., *Hall* ..	xxxviii, 7 *a*, *b*	179	..	..	..	..	..	+	..	..
9	— uniangulata, *Hall*	xxxviii, 8	179	..	..	..	..	..	+	..	..
10	— bellacincta, "	xxxix, 1 *a* – *e*	179	..	..	..	..	..	+	..	..
11	— subfusiformis, "	xxxix, 2 *a*, *b*	180	..	..	..	..	..	+	..	..
12	— vittata, "	xxxix, 3 *a*, *b*	181	..	..	..	..	..	+	..	..
13	— gracilis, "	xxxix, 4 *a* – *c* lxxxiii, 1 *a*, *b*	181 303	..	..	..	..	..	+	..	+
14	— uniangulata, *var.* abbreviata,	lxxxiii, 2 *a* – *d*	304	..	..	..	..	..	..	..	+
1	Subulites elongata, *Conrad*..........	xxxix, 5 *a* – *c*	182	..	..	..	..	..	+	..	..
1	Metoptoma? dubia, *Hall*	iv bis, 11	23	..	..	+	..	..	..	..	..
2	—? rugosa, "	lxxxiii, 6 *a* – *c*	306	..	..	..	..	..	..	..	+
1	Carinaropsis carinata, "	xl, 1 *a* – *c*	183	..	..	..	..	..	+	..	..
2	— patelliformis, "	xl, 2 *a*, *b* lxxxiii, 7	183 306	..	..	..	..	..	+	..	+
3	— orbiculatus, "	lxxxiii, 8 *a* – *c*	306	..	..	..	..	..	..	..	+
1	Bellerophon bilobatus, *Sowerby*	xl, 3 *a* – *d* lxxxiii, 9 *a* – *c*	184 307	..	..	..	..	..	+	..	+
2	— — *var.* acutus, *Hall*..	xl, 4 *a*, *b*	185	..	..	..	..	..	+	..	..
3	— — *var.* corrugatus, "	xl, 6 *a*, *b*	185	..	..	..	..	..	+	..	..
4	— cancellatus, *Hall*	lxxxiii, 10 *a* – *c*	307	..	..	..	..	..	..	..	+
1	Bucania sulcatina, *Emmons*	vi, 10, 10 *a*	32	..	..	+	..	..	..	..	..
2	— rotundata, *Hall*	vi, 11 *a* – *c*	33	..	..	+	..	..	..	..	..
3	— expansa, "	xl, 7 *a* – *d*	186	..	..	..	..	..	+	..	..
4	— bidorsata, "	xl, 8 *a* – *g*	186	..	..	..	..	..	+	..	..
5	— punctifrons, *Conrad*, *Emm*..	xl A, 1 *a* – *e*	187	..	..	..	..	..	+	..	..
6	— intexta, *Hall*	xxxiii*, 4 *a* – *d*	317	..	..	..	..	..	+	..	..
1	Cyrtolites compressus, *Conrad*	xl A, 2 *a* – *f*	188	..	..	..	..	..	+	..	..
2	— trentonensis, "	xl A, 3; xli, 1	189	..	..	..	..	..	+	..	..
3	— filosum, "	xli, 3 *a*, *b*	190	..	..	..	..	..	+	..	..
4	— ornatus, "	lxxxiv, 1 *a* – *g*	308	..	..	..	..	..	..	..	+
	CEPHALOPODA.										
1	Lituites undatus, *Conrad*	xiii, 1, 3; xiii bis, 1	52	..	..	..	..	+	..	..	..
2	— convolvans? *Hisinger*	xiii, 2, 2 *a*	53	..	..	..	..	+	..	..	..
1	Trocholites ammonius, *Conrad*	xl A, 4 *a* – *k* lxxxiv, 2 *a* – *c*	192 309	..	..	..	..	..	+	..	+
2	— planorbiformis, "	lxxxiv, 3 *a* – *f*	310	..	..	..	..	..	..	..	+
	ORTHOCERATA.										
1	Oncoceras constrictum, *Hall*	xli, 6 *a* – *f*, 7 *a* – *d*	197	..	..	..	..	..	+	..	..
1	Cyrtoceras lamellosum, "	xli, 2 *a* – *c*	193	..	..	..	..	..	+	..	..
2	— annulatum, "	xli, 4 *a* – *d*, 5	194	..	..	..	..	..	+	..	..
3	— macrostomum, "	xlii, 1 *a* – *c*, 3 *a*, *b*	194	..	..	..	..	..	+	..	..
4	— constrictostriatum, "	xlii, 2 *a*, *b*; 3 *c*, *d*	195	..	..	..	..	..	+	..	..
5	— multicameratum, "	xlii, 4	195	..	..	..	..	..	+	..	..
6	— arcuatum, "	xlii, 5 *a* – *c*	196	..	..	..	..	..	+	..	..
7	— camurum, "	xlii, 6	196	..	..	..	..	..	+	..	..
1	Orthoceras primigenium, *Vanuxem*..	iii, 11, 11 *a*	13	..	+	..	..	..	..	..	..
2	— laqueatum, *Hall*	iii, 12; lvi, 2 *a* – *c*	13, 206	..	+	..	..	..	+	..	..

No.	GENERA AND SPECIES.	Plate and figure.	Page.	Potsdam sandstone.	Calciferous sandstone.	Chazy limestone.	Birdseye limestone.	Black-river limestone.	Trenton limestone.	Utica slate.	Hudson-river group.
				Rocks & Groups.							
3	Orthoceras rectiannulatum, *Hall*	vii, 2, 2 *a*	34			+					
4	— subarcuatum, "	vii, 3	34			+					
5	— tenuiseptum, "	vii, 6	35			+					
6	— (Ormoceras) moniliforme, "	vii, 5	35			+					
7	— multicameratum, *Conrad* ...	xi, 1 *a, b, c*	45				+				
8	— recticameratum, *Hall*	xi, 1 *d*	46				+				
9	— fusiforme, "	xx, 1	60					+			
10	— arcuoliratum, "	xlii, 7 *a* – *c*	198						+		
11	— teretiforme, "	xlii, 8 *a, b*	198						+		
12	— textile, "	xliii, 1 *a, b*	199						+		
13	— bilineatum, "	xliii, 2 *a* – *d*	199						+		
14	— — var. *a*. "	xliii, 3 *a* – *d*	200						+		
15	— clathratum, "	xliii, 4 *a* – *c*	201						+		
16	— vertebrale, "	xliii, 5 *a* – *c*	201						+		
17	— anellum, *Conrad*	xliii, 6 *a* – *f*	202						+		
18	— undulostriatum, *Hall*	xliii, 7 *a* – *k*	202						+		
19	— (*sp. indet.*)	xliii, 8	203						+		
20	— latiannulatum, *Hall*	liv, 1 *a, b*	204						+		
21	— junceum, "	xlvii, 3 *a* – *f*	204						+		
22	— amplicameratum, "	li, 1 *a* – *g*	205						+		
23	— strigatum, "	lvi, 1 *a* – *d*	205						+		
24	— laqueatum, var. *a*. "	lvi, 3	206						+		
25	— (*sp. indet.*)	lxxxv, 2	311							+	
26	— coralliferum, "	lxxxv, 3; lxxxvi, 1	312								+
27	— lamellosum, "	lxxxvi, 2 *a* – *d*	312								+
1	Ormoceras tenuifilum, "	xv, 1; xvi, 1: xvii, 1 lviii, 2 *a, b*	55 222					+	?		
2	— — *var.* distans, "	xvii, 2	58					+			
3	—? gracile, "	xvii, 3	58					+			
4	— crebriseptum, "	lxxxvi, 2; lxxxvii, 2	313								+
1	Endoceras subcentrale, "	xvii, 4	59					+			
2	— longissimum, "	xviii, 1, 1 *a*	59					+			
3	— multitubulatum, "	xviii, 2 *a, b*	59					+			
4	— gemelliparum, "	xix, 1 *a, b*	60					+			
5	— annulatum, "	xlv, 1 *a, b*	207						+		
6	— proteiforme, *var.* tenuistriatum, *Hall*	xlv, 1 *a, b* xlvii, 1, & 2 *a* – *e*	209						+		
7	— *var.* tenuitextum, "	xlv, 2, 3, & 5 *a* – *c* xlviii, 2 *a* – *c*	210						+		
8	— *var.* lineolatum, "	xlv, 4 *a* – *e* xlvi, 1, 2, 3 xlvii, 4 *a* – *e*	211						+		
9	— *var.* strangulatum, "	xlvi, 4 *a* – *e*	212						+		
10	— *var.* elongatum, "	lii, 1 *a, b*	216						+		
11	— arctiventrum, *Hall*	li, 2 *a, b*	217						+		
12	— angusticameratum, "	li, 3	218						+		
13	— magniventrum, "	liii, 1 *a* – *e*	218						+		
14	— — *var.* "	liv, 2 *b*	218						+		
15	— approximatum, "	liv, 2 *a*	219						+		
16	— duplicatum, "	lv, 1	219						+		
17	— distans, "	lvii, 1 *a, b*	220						+		
18	— proteiforme? "	lxxxv, 1 *a* – *f*	311							+	
1	Cameroceras trentonense, *Conrad*	lvi, 4 *a* – *c*	221						+		
1	Gonioceras anceps, *Hall*	xiv, 1, 1 *a* – *d*	54					+			

	GENERA AND SPECIES.	Plate and figure.	Page.	Rocks & Groups. Potsdam sandstone.	Calciferous sandstone.	Chazy limestone.	Birdseye limestone.	Black-river limestone.	Trenton limestone.	Utica slate.	Hudson-river group.
1	Conularia trentonensis, *Hall*	lix, 4 *a* – *f*	222	..	..	..	..	..	+	..	?
2	— granulata, "	lix, 5 *a*, *b*	223	..	..	..	..	..	+	..	..
3	— papillata, "	lix, 6 *a*, *b*	223	..	..	..	..	..	+	..	..
4	— gracilis, "	lix, 7 *a*, *b*	224	..	..	..	..	..	+	..	..
1	Theca triangularis, "	lxxxvii, 1 *a* – *d*	313	..	..	..	..	..	..	..	+
	CRUSTACEA.										
1	Illænus arcturus, "	iv (bis), 12	23	..	..	+	..	..	..	..	..
2	— crassicauda? *Wahlenberg* ..	iv (bis), 13	24	..	..	+	..	..	..	..	..
3	— crassicauda, "	lx, 4 *a* – *d*	220	..	..	..	..	..	+	..	..
4	— trentonensis, *Emmons*	lx, 5	230	..	..	..	..	..	+	..	..
5	— latidorsata, *Hall*	lx, 6 *a*, *b*	230	..	..	..	..	..	+	..	..
1	Thaleops (Illænus) ovatus, *Conrad* ..	lxvii, 6 *a* – *c*	259	..	..	..	..	..	+	..	..
1	Asaphus? obtusus, *Hall*	iv (bis), 14	24	..	..	+	..	..	..	..	..
2	— marginalis, "	iv (bis), 15	24	..	..	+	..	..	..	..	..
3	—? extans, "	lx, 2, 2 *a*	228	..	..	..	+	..	..	..	..
4	—? nodostriatus, "	lxi, 1 *a*, *b*	248	..	..	..	..	..	+	..	..
5	—? latimarginata, "	lxvi, 4 *a*, *b*	253	..	..	..	..	..	..	+	?
1	Isotelus canalis, *Conrad*	iv (bis), 17, 18, 19	25	..	..	+	..	..	..	..	..
2	— gigas? *Dekay*.............	iv (bis), 16	25	..	..	+	..	..	..	..	..
"	— gigas, "	lx, 7; lxi, 3, 4 lxii, 1, 2; lxiii lxvi, 5	231 254	..	..	..	..	..	+	+	+
1	Ogygia? vetusta, *Hall*	lx, 1	227	..	..	..	+	..	..	..	..
1	Acidaspis trentonensis, "	lxiv, 4 *a* – *f*	240	..	..	..	..	..	+	..	..
2	— spiniger, "	lxiv, 5	241	..	..	..	..	..	+	..	..
1	Platynotus trentonensis, *Conrad*	lxiv, 1 *a* – *e*	235	..	..	..	..	..	+	..	..
1	Ceraurus? *sp. indet.*	iv (bis), 20	25	..	..	+	..	..	..	..	..
2	— pleurexanthemus, *Green*....	lxv, 1 *a* – *m* lxvi, 1 *a* – *h*	242	..	..	..	..	..	+	..	..
3	— vigilans, *Hall*	lxv, 2 *a* – *h*	245	..	..	..	..	..	+	..	..
4	— pustulosus, "	lxi, 2 *a*, *b*	246	..	..	..	..	..	+	..	..
1	Calymene multicosta, "	lx, 3	228	..	..	..	+	..	..	..	..
2	— beckii, *Green*	lxiv, 2 *a* – *e* lxvi, 2 *a* – *k* lxvii, 4 *a* – *e*	237 250	..	..	..	..	..	+	+	+
3	— senaria, *Conrad*.	lxiv, 3 *a* – *m*	238	..	..	..	..	..	+	+	+
4	— (*sp. indet*)	lxvi, 3 *a*, *b*	253	..	..	..	..	..	..	+	..
1	Phacops callicephalus, *Hall*	lxv, 3 *a* – *i*	247	..	..	..	..	..	+	..	..
2	—? laticaudus, "	lxiv, 3	248	..	..	..	..	..	+	..	..
1	Trinucleus concentricus, *Eaton*	lxv, 4 *a* – *e* lxvii, 1 *a* – *h*	249 255	..	..	..	..	..	+	..	+
1	Olenus asaphoides, *Emmons*.........	lxvii, 2 *a* – *c*	256	..	..	..	..	..	..	..	+
2	— undulostriatus, *Hall*........	lxvii, 3 *a*, *b*	258	..	..	..	..	..	..	..	+
1	Agnostus lobatus, "	lxvii, 5 *a* – *f*	258	..	..	..	..	..	..	..	+
1	Cytherina (*sp. indet*)	x, 12	44	..	..	..	+	..	..	..	..

Note. Several species of Graptolithus are marked as occurring in the shales of the Hudson-river group only. These are unknown to me in any situations, except where the strata are so much disturbed as to render it difficult to identify the Utica slate, in the absence of other fossils; and it is quite possible that the black slate containing them is that rock, interplicated and folded with the green slates and shaly sandstones, which latter, in undisturbed regions, constitute the Hudson-river group proper.

Several species of fossils from western localities (particularly of the genus Orthis) have been referred to the period of the Trenton limestone, though it is quite probable they may be found to range through the entire series, and to have existed as late as the period of the Hudson-river group of New-York; while others, peculiar to the latter, are found only near the termination of the "Blue limestone formation" in western localities.

RECAPITULATION OF THE PRECEDING TABLE,

SHOWING THE NUMBER OF SPECIES PECULIAR TO EACH FORMATION, AND ALSO THE NUMBER COMMON TO SEVERAL FORMATIONS.

CLASS OR ORDER.	GENERA.	SPECIES.	*RESTRICTED TO THE*								*COMMON TO THE*									
			Potsdam sandstone.	Calciferous sandstone.	Chazy limestone.	Birdseye limestone.	Black-river limestone.	Trenton limestone.	Utica slate.	Hudson-river group.	Potsdam and succeeding strata.	Calciferous and succeeding strata.	Chazy and Black-river limestones.	Birdseye, Black-river and Trenton limestones, & Hudson-river group.	Birdseye & Black-river limestones.	Black-river & Trenton limestones.	Trenton, U. slate & Hudson-river.	Trenton limestone & Utica slate.	Trenton and Hudson-river group.	Utica slate & Hudson-river group.
PLANTÆ	4	14	1	3	..	..	..	4	1	5	..	..	..	..	..	..	..	..	..	..
INCERTÆ SEDES,	3	4	..	..	..	2	..	..	..	1	..	..	..	..	..	..	..	.	1	..
ZOOPHYTA	19	50	..	..	7	1	3	19	3	13	..	..	..	1	1	1 ?	..	..	1	..
CRINOIDEA	8	15	..	..	3	..	..	7	..	3	..	..	..	..	..	..	..	..	1†1 ?	..
BRACHIOPODA ..	7	77	2	1	10	..	..	51	..	5	..	.	..	..	..	..	3	1	3†1 ?	..
ACEPHALA	12	49	..	..	1	1	..	26	1	13	..	..	..	..	..	..	..	..	4†1 ?	2
GASTEROPODA ..	17	71	..	8	13	9	..	28	..	6	..	..	1	..	..	1	..	..	4†1 ?	..
CEPHALOPODA ..	11	68	..	1	4	2	10	40	2	5	..	1 ?	..	..	..	1 ?	..	1	1 ?	..
CRUSTACEA ...	14	33	..	..	7	4	..	13	1	3	..	..	..	..	..	..	3	..	1	1
TOTAL......	95	381	3	13	45	19	13	188	8	51	0	1	1	1	1	3	6	2	20	3

INDEX TO THE GENERA AND SPECIES DESCRIBED IN THIS VOLUME.

LIST OF PLATES.

*** The numbers on the left hand indicate the figures on the plates, and those on the right refer to the pages containing the detailed descriptions of the several specimens.

ERRATA.

Page 9, second line of first paragraph, for "*Atrypa*," read "*Orthis*."

15, last line of page, for "*Maclurea gigantea*," read "*Maclurea magna*."

19, 7th line from bottom, for "*L. interstrialis*," read "*L. alternata*."

20, first and last line of second paragraph, for "*L. interstrialis*," read "*L. alternata*."

26, description of plate v, for "1," read "1 *a* ;" for "1 *a*," read "1 *b* ;" and for "1 *b*," read "1 *e*."

31, under *Capulus auriformis*, plate vi, for "fig. 6," read "fig. 9."

49, second line from top, for "fig. 4," read "fig. 5."

64, 3d line from top, for "of which there about eighteen," read "of which there are about eighteen."

79, for "Compare *Graptolites foliaceus*, PORTLOCK, etc.," read "Compare *Graptolites foliaceus*, MURCHISON, Sil. System, pl. 26, fig. 3.

103, 16th line from the bottom, for "species," read "specimen."

104, 10th line from the top, for "lower," read "upper."

105, 5th line from the top, for "longer," read "larger."

108, description of fig. 4 *f*, for "the same species," read "the same specimen."

114, description of *Leptæna planoconvexa*, fourth line, insert "rounded" between "coarse" and "radiating."

129, after the 9th line from the top, insert "Plate XXXII C."

136, 6th line from the top, for "$\frac{5}{4}$," read "$\frac{4}{3}$."

159, for "Compare *Cypricardites nasutus*, EMMONS," read "Compare *Cypricardites modiolaris*, EMMONS."

" 3d line from the bottom, for "fig. 1 *a*," read "fig. 9 *a*."

160, 3d, 4th and5th lines from the bottom, for "fig. 9," read "fig. 11."

161, under *Modiolopsis trentonensis*, for "plate xxxv," read "plate xxxiv."

162, 10th, 12th, 13th and 14th lines, for "fig. 1," read "fig. 2."

216, for "plate lviii," read "plate lvii ;" and in the third line below, for "this," read "there."

220, for "plate lvii," read "plate lviii."

222, for "plate lviii, figs. 1 *a*, &c.," read "plate lix, figs. 4 *a*, &c."

223, explanation of plate, for "fig. 1," read "fig. 4."

" under *Conularia granulata*, for "fig. 2," read "fig 5."

223 & 224, under *Conularia papillata*, for "fig. 3," read "fig. 6."

224, under *Conularia gracile*, for "fig. 4," read "fig. 7."

237, *Calymene beckii*, no. of species, for "1," read "2 ;" and "3" for "2," in *C. senaria*.

248, under *Phacops? laticaudus*, for "fig. 3," read "fig. 6."

284, under *Tentaculites flexuosa*, reference page 92, for "pl. 39," read "pl. 29."

288, for "*Orthis? erratica*," read "*Orthis erratica*."

289, for "*Orthis centrilineata*," read "*Orthis? centrilineata*."

289, under *Orthis centrilineata*, reference to pl. 79, for "fig. 5," read "fig. 5*."

297, under *Modiolopsis* (sp. indet.), the reference is to fig. 5, but some of the plates are printed "fig. 4."

312, under *Orthoceras lamellosum*, for "plate lxxxvi, fig. 2 *a*, *b*, *c*, *d*, *e*," read "2 *b*, *c*, *d*, *e*."

327, under "CEPHALOPODA," insert "*Lituacea*."

PLATE 1.

Fig. 1. 1. 1. SCOLITHUS LINEARIS. (Pag. 2.)

1 *a.* A vertical or longitudinal view of a specimen of the rock containing these bodies.

1 *b.* A similar view of a specimen of partially altered and laminated sandstone from Pennsylvania, the tubes somewhat flattened.

1 *c.* Weathered surface of a specimen of the altered sandstono (crystalline or granular quartz), from Adams, Massachusetts.

Fig. 2. 2. 1. LINGULA PRIMA. (Pag. 3.)

Fig. 3. 3. 2. LINGULA ANTIQUA. (Pag. 3.)

3 *a.* The usual form of this fossil.

3 *b.* A broader specimen, with apex wanting.

3 *c.* A very broad somewhat rounded specimen, a view of the interior of the shell, the inner laminæ wanting, and the concentric elevated lines showing in relief.

3 *d.* An elongated specimen, somewhat compressed laterally.

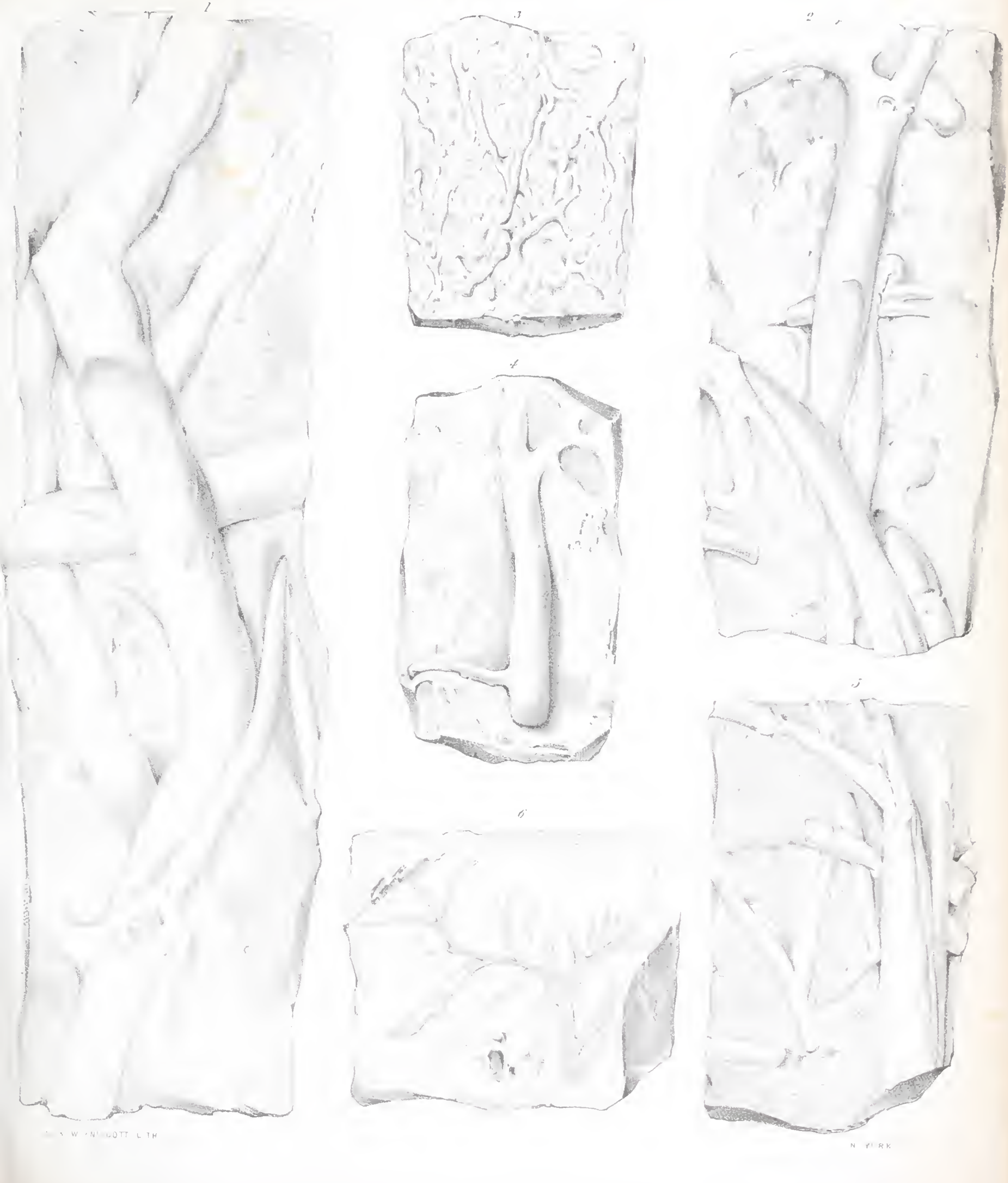
3 *e.* An enlarged portion of 3 *c.*

PLANTS & SHELLS

PLATE 2.

Fig. 1, 2, 4, 5.	4. 1.	PALÆOPHYCUS TUBULARIS.	(Pag. 7.)
Fig. 3.	5. 2.	PALÆOPHYCUS IRREGULARIS.	(Pag. 8.)
Fig. 6.	6. 1.	BUTHOTREPHIS ANTIQUATA.	(Pag. 8.)

PLANTS



W. ENDICOTT LITH

N. YORK

PLATE 3.

Fig. 1.	8.	1.	EUOMPHALUS UNIANGULATUS.	(Pag. 9.)

1. View of the upper side of a large specimen.
1 *a* The lower side of a smaller specimen, showing the broad umbilicus

Fig. 2, 2 *a*.	9.	1.	MACLUREA SORDIDA.	(Pag. 10.)
Fig. 3.	10.	2.	MACLUREA MATUTINA.	(Pag. 10.)
Fig. 4, 5.	11.	1.	OPHILETA LEVATA.	(Pag. 11.)
Fig. 6.	12.	2.	OPHILETA COMPLANATA.	(Pag. 11.)
Fig. 7.	13.	1.	TURBO DILUCULA.	(Pag. 12.)
Fig. 8.	14.	2.	TURBO? OBSCURA.	(Pag. 12.)
Fig. 9, 10.	15.	1.	PLEUROTOMARIA? TURGIDA.	(Pag. 12.)
Fig. 11, 11 *a*.	16.	1.	ORTHOCERAS PRIMIGENIUM.	(Pag. 13.)
Fig. 12.	17.	2.	ORTHOCERAS LAQUEATUM.	(Pag. 13.)

CALCIFEROUS SANDSTONE — PLATE 3

SHELLS

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PLATE 4.

Fig. 1. 18. 1. Retepora incepta. (Pag. 15.)

1 *a*. Specimen of the natural size. 1 *b*. An enlarged portion of the same.

Fig. 2. 19. 2. Retepora gracilis. (Pag. 15.)

2 *a*. Natural size of the fragment. 2 *b*. Enlarged portion, showing the form of the fenestrules.

Fig. 3. 20. 1. Gorgonia? aspera. (Pag. 16.)

3 *a*. Natural size of specimen.
3 *b*. Portion enlarged, showing the rough surface of the coral, and the form of the fenestrules.

Fig. 4. 21. 1. Stictopora fenestrata. (Pag. 16.)

4 *a*. Natural size of the branches of this coral.
4 *b*. A portion magnified.
4 *c*. A fragment of another specimen from a different locality.
4 *d*. Portion of the same magnified.
4 *e*. A part of the axis of a specimen, denuded of the outer crust, and presenting a series of concentric lines corresponding to the lines of progressive growth.

Fig. 5. 22. 2. Stictopora glomerata. (Pag. 17.)

Fig. 6 *a*, *b*. 23. 1. Streptelasma expansa. (Pag. 17.)

Fig. 7. 24. 1. Chætetes ———. (Pag. 18.)

7 *a*, *b*, *c*. The specimens considerably magnified. 7 *d*. The ends of the tubes magnified.

Fig. 8, 9. 25. 1. Actinocrinus tenuiradiatus. (Pag. 18.)

Fig. 10. 26. 2. Actinocrinus ———. (Pag. 18.)

Fig. 11. 27. 1. Asterias? ———. (Pag. 18.)

11 *a*. Natural size. 11 *b*. Magnified view


8
9
11 a

PLATE 4 (bis).

Fig. 1. 28. 1. LEPTÆNA PLICIFERA. (Pag. 19.)

1 *a*. Figure of the convex valve.
1 *b*. Cast of convex valve, with a portion of the shell remaining : cast of visceral cavities magnified.

Fig. 2. 29. 2. LEPTÆNA INCRASSATA. (Pag. 19.)

2 *a*, *b*. Convex valves of this species. 2 *c*. Ventral valves.
2 *d*. Cast of the interior of the convex valve, and the same enlarged.

Fig. 3. 30. 3. LEPTÆNA FASCIATA. (Pag. 20.)

3 *a*, *b*. Convex valves of two individuals. 3 *c*. A larger specimen of the same.

Fig. 4. 31. 1. ORTHIS COSTALIS. (Pag. 20.)

4 *a* An imperfect shell, showing the radii towards the margin.
4 *b*. A cast showing the visceral marking, and casts of radii near the base of the shell.
4 *c*. An impression of the convex valve, smaller than the other specimens. Such impressions are abundant.

Fig. 5. 32. 1. ATRYPA DUBIA. (Pag. 21.)

Fig. 6. 33. 2. ATRYPA ACUTIROSTRA. (Pag. 21.)

The two lower figures are of the natural size ; the upper one is enlarged.

Fig. 7. 34. 3. ATRYPA PLENA. (Pag. 21.)

7 *a*. View of the ventral valve, showing the beak of the dorsal valve closely incurved over the beak of the former. 7 *b*. Lateral view of the same individual.
7 *c*. Dorsal valve of a small specimen.
7 *d*. Front view of a large specimen. 7 *e*. Dorsal valve of the same.

Fig. 8. 35. 4. ATRYPA PLICIFERA. (Pag. 22.)

8 *a*, *b*. View of ventral valve, and front of same individual.
8 *c*, *d*. Ventral valve and front view of another individual.

Fig. 9. 36. 5. ATRYPA ALTILIS. (Pag. 23.)

9 *a*. View of the ventral valve, showing the beak of the dorsal valve. 9 *b*. View of the dorsal valve.
9 *c*. Lateral view of the same shell. 9 *d*. Front view, showing the elevation of the mesial radii.

Fig. 10. 37. 1. ORBICULA ? DEFORMIS. (Pag. 23.)

Fig. 11. 38. 1. METOPTOMA ? DUBIA. (Pag. 23.)

Fig. 12. 39. 1. ILLÆNUS ARCTURUS. (Pag. 23.)

Fig. 13. 40. 2. ILLÆNUS CRASSICAUDA ? (Pag. 24.)

Fig. 14. 41. 1. ASAPHUS ? OBTUSUS. (Pag. 24.)

Fig. 15. 42. 2. ASAPHUS MARGINALIS. (Pag. 24.)

Fig. 16. 43. 1. ISOTELUS GIGAS ? (Pag. 25.)

Fig. 17, 18, 19. 44. 2. ISOTELUS CANALIS. (Pag. 25.)

18 & 19 Labrum or epistoma of an *Isotelus*, perhaps of *I. canalis*

Fig. 20. 45. 1. CERAURUS ? (*Species undetermined*). (Pag. 25.)

Fig. 21. A fragment of the crust of an unknown trilobite.

PLATE 5.

Fig. 1. 46. 3. Maclurea magna. (Pag. 26.)

1 *a*. The upper surface partially denuded of the shell, showing the striæ with the smooth cast beneath. This is a perfect representation of the shell, except that the minute terminal volution is not shown.

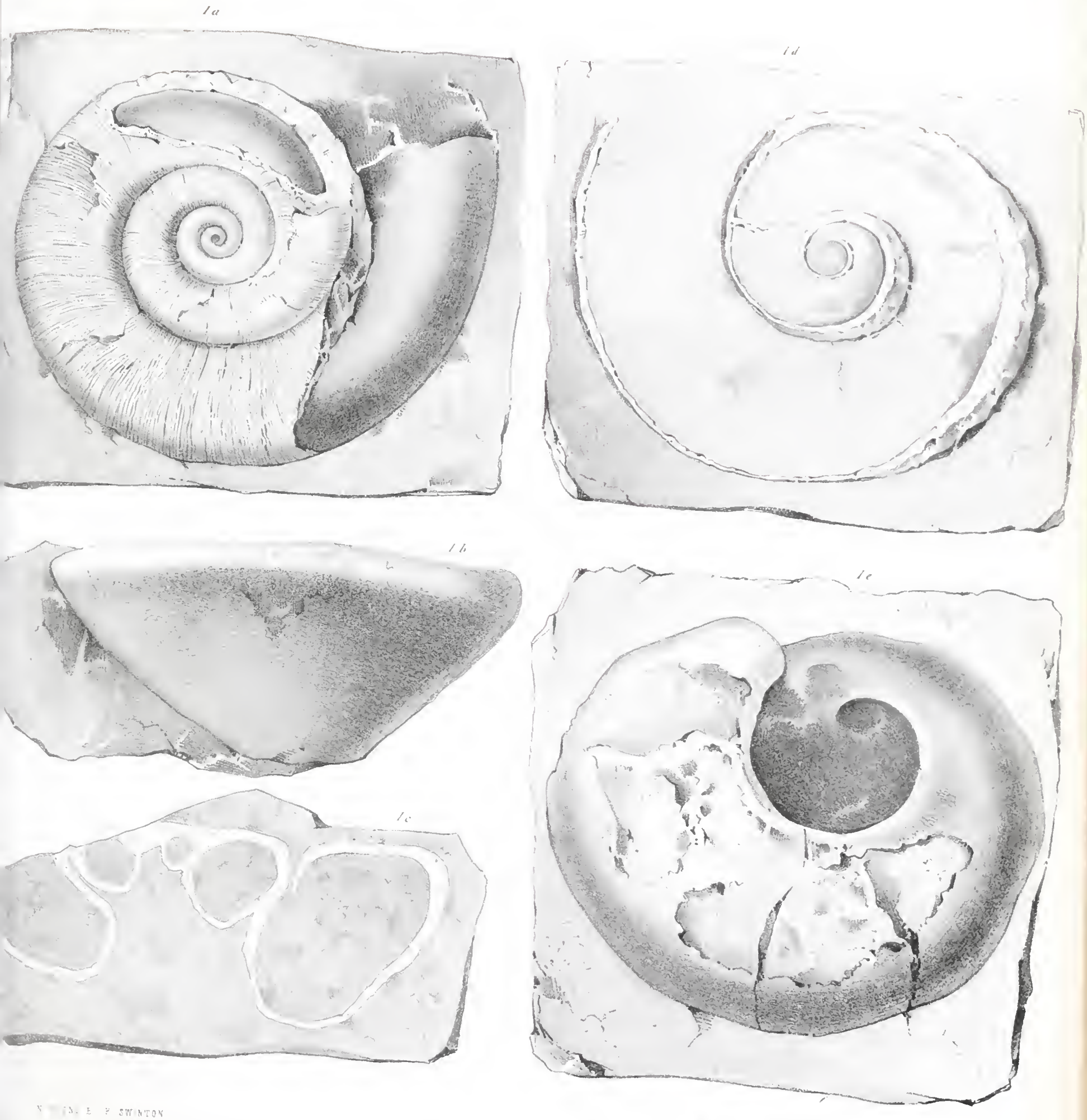
1 *b*. Side view of a cast of the shell, showing the depressed turbinate form and flat spire.

1 *c*. View of the lower surface, somewhat worn; showing the large umbilicus, which is partially filled with stony matter.

1 *d*. A vertical section of the shell, near, but not directly through the centre of the spire; showing several volutions, and the deep umbilicus. Such sections of the shell are not unusual in the rock, and they are generally vertical to the lines of deposition.

1 *e*. A view of the shell worn down from the lower side, as it very commonly appears upon the weathered surfaces of the rock at Chazy.

(SHELLS) PL 5



N. ... E. F. SWINTON

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PLATE 5 bis.

Fig. 1. 46. 3. Maclurea magna. (Pag. 26.)

1 a. An obliquely vertical section of the fossil, passing nearly through the centre of the spire above, but more on one side below, so as to escape the umbilicus.

1 b. A vertical section of the outer volution: a common appearance upon the weathered surface of the rock at Chazy.

1 c. An unusually large specimen of the same species; the surface worn so as to obliterate the striæ, and obscure the first volutions.

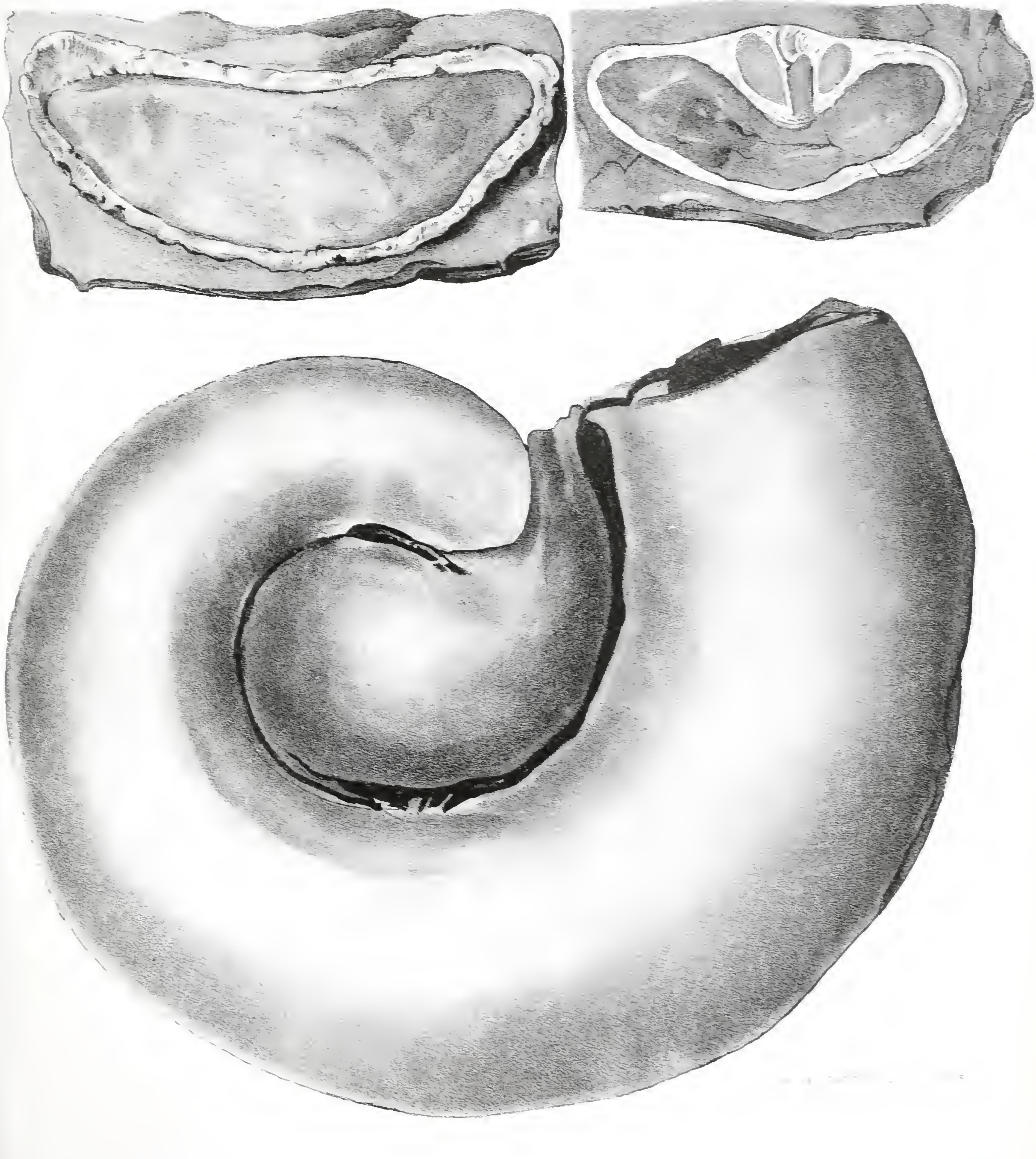

PLATE 6.

Fig. 1 *a*, *b*.	47.	1.	SCALITES ANGULATUS.	(Pag. 27.)

Fig. 2.	48.	1.	RAPHISTOMA STRIATA.	(Pag. 28.)

2 *a*. An obliquely lateral view of the specimen, showing the spire, with the striæ upon the surface of the shell.
2 *b*. View of the spire denuded of the shell.

Fig. 3.	50.	3.	RAPHISTOMA PLANISTRIA.	(Pag. 30.)

3 *a*. View of the spire; the striæ flat and broad. The figure does not show the interruption.
3 *b*. View from beneath, showing the umbilicus. The height of the shell is not shown here. (See the figures at the foot of page 30.)

Fig. 3.	51.	4.	RAPHISTOMA PLANISTRIA, *var.* PARVA.	(Pag. 30.)

3 *c*. View of the spire. 3 *d*. Lateral view. 3 *e*. View of the aperture.

Fig. 4, 5.	49.	2.	RAPHISTOMA STAMINEA.	(Pag. 29.)

5. View of the spire; the inner volutions partially denuded of the shell.
5 *a*. A lateral view, showing the aperture, which is distorted by crushing from above. The denuded spire is shown to rise considerably above the outer volution. The striæ upon the side do not bend forward as much as in the original.

Fig. 6.	52.	2.	PLEUROTOMARIA BIANGULATA.	(Pag. 31.)
Fig. 7.	56.	1.	MURCHISONIA ABBREVIATA.	(Pag. 32.)
Fig. 8.	53.	3.	PLEUROTOMARIA (*Species undetermined*).	(Pag. 31.)
Fig. 9 *a*, *b*.	55.	1.	CAPULUS AURIFORMIS.	(Pag. 31.)
Fig. 10.	57.	1.	BUCANIA SULCATINA.	(Pag. 32.)

10. Dorsal view, looking into the aperture, which is filled with stony matter, so that the form can not well be shown. The shell is denuded from a large portion of the last volution, but is well preserved on the part exhibited in the figure.
10 *a*. Lateral view of the fossil denuded of the shell; the cast smooth.

Fig. 11.	58.	2.	BUCANIA ROTUNDATA.	(Pag. 33.)

11 *a*. Dorsal view, looking into the aperture, which is partially filled with stony matter, and broken at the sides. In this view, it presents the aspect of a *Bellerophon*.
11 *b*. Side view; the volutions not all visible, from the umbilicus being filled with stony matter.
11 *c*. Longitudinal section, showing the form and relation of the volutions to each other: the dotted line is the margin of the outer volution near the aperture.

SHELLS

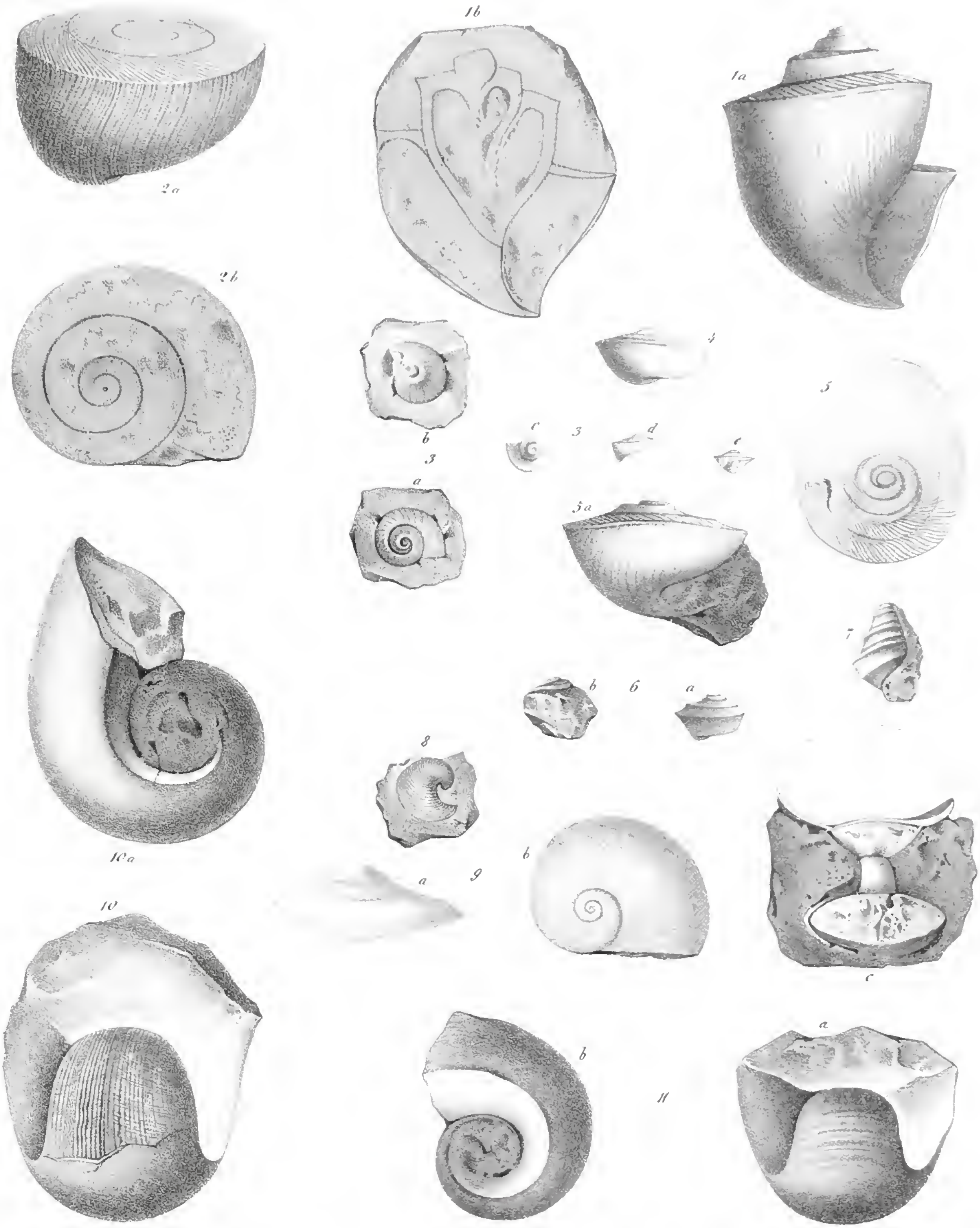

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PLATE 7.

Fig. 1.	54.	4.	Pleurotomaria antiquata.	(Pag. 31.)
Fig. 2.	59.	3.	Orthoceras rectiannulatum.	(Pag. 34.)

2. A portion of the fossil, nearly two inches long, exhibiting eight annulations.
2 *a*. Transverse section, showing the position of the siphon.

Fig. 3.	60.	4.	Orthoceras subarcuatum..	(Pag. 34.)
Fig. 4, 4 *a*.	62.	6.	Orthoceras bilineatum.	(Pag. 35.)
Fig. 5.	63.	7.	Orthoceras moniliforme.	(Pag. 35.)
Fig. 6.	61.	5.	Orthoceras tenuiseptum.	(Pag. 35.)

ORTHOCERATA &c.

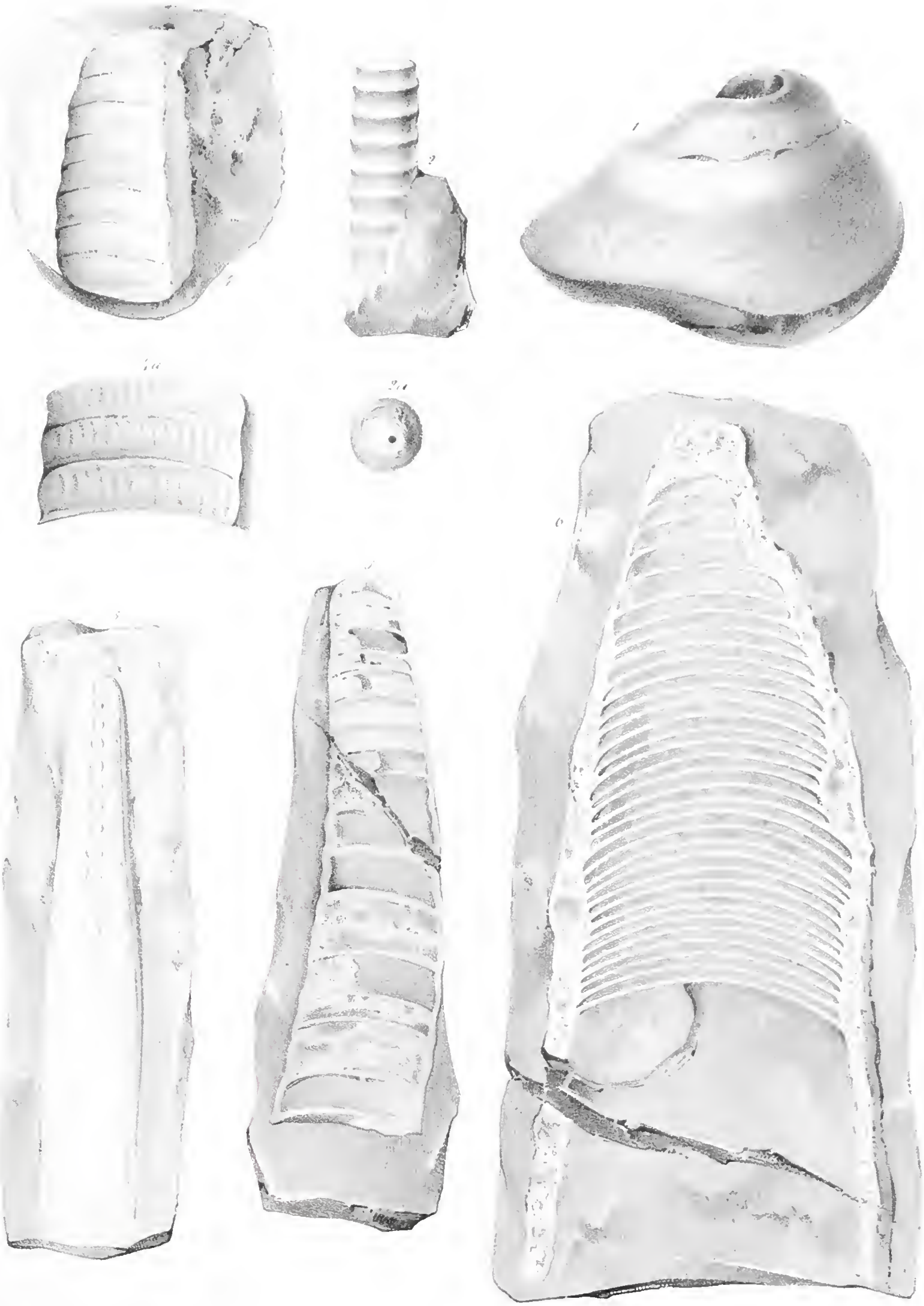


PLATE 8.

Fig. 1. 64. 1. PHYTOPSIS TUBULOSUM. (Pag. 38.)

1. A fragment of rock, showing several stems of this fossil, with their anastomosing branches.

1 *a*. A similar vertical section, where the stems have been divided, showing that they were originally hollow.

1 *b*. A bulb of stony matter, embraced by the stems or rootlets of this fossil. The stems apparently proceed from such a bulb or root; as the radicles converge below and diverge above, as represented in the figure.

1 *c*. A horizontal section, presenting the ends of several stems, most of which are less than the ordinary size. The rock is discolored for some distance around these stems, as if deprived of its coloring matter by the carbonaceous character of the fossil.

1 *d*. A horizontal section of stems larger than the usual size: these stems are cellular, with apparent longitudinal dissepiments in two of the four presented in the figure.

1 *e*. A horizontal or transverse section of the stems, showing a concretionary arrangement of the calcareous matter around them, which, on weathering, presents the appearance here represented.

PLANTS ?

PLATE 9.

Fig. 1. 65. 2. PHYTOPSIS CELLULOSUM. (Pag. 39.)

1. Base or root of one of these fossils, with its diverging and slightly ascending branches. The surface, not being worn, presents no marks of structure.

1 *a.* A part of the specimen presents the longitudinal fibres, with very distant transverse fibres.

1 *b.* A longitudinal section, passing nearly through the centre of the stem, showing the longitudinal and transverse fibres.

1 *c.* Portion of two stems with the cuticle removed, showing the structure.

1 *d.* Oblique sections near the termination of branches, presenting stellate or cruciform cells.

1 *a* (in part), presents quadrangular cells, arranged diagonally to the direction of the stems. These forms may arise from weathering, or solution of cellular partitions in forms like 1 *d*.

BIRDSEYE LIMESTONE

(PLANTS?

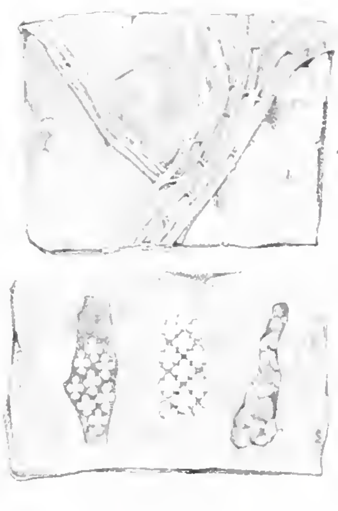
PLATE 9

1

1a

1b

1d



1c

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N. YORK

PLATE 10.

Fig. 1.	66.	1.	MODIOLA OBTUSA.	(Pag. 40.)
Fig. 2 *a*, *b*.	67.	2.	MURCHISONIA? ANGUSTATA.	(Pag. 41.)
Fig. 3.	68.	3.	MURCHISONIA VENTRICOSA.	(Pag. 41.)
Fig. 4.	69.	4.	MURCHISONIA PERANGULATA.	(Pag. 41.)
Fig. 5.	71.	1.	NATICA? (*Species undetermined*).	(Pag. 42.)
Fig. 6.	72.	5.	PLEUROTOMARIA? NUCLEOLATA.	(Pag. 42.)

6 *a*. Natural size of specimen. 6 *b*. Enlarged view of the same.

Fig. 7.	70.	5.	MURCHISONIA? VARICOSA.	(Pag. 42.)

7 *a*. A specimen having the surface much worn and weathered : the markings are but partially visible.
7 *b*. Longitudinal section of a specimen of the same shell.

Fig. 8.	73.	6.	PLEUROTOMARIA QUADRICARINATA.	(Pag. 43.)
Fig. 9.	74.	7.	PLEUROTOMARIA UMBILICATA.	(Pag. 43.)

9 *a*. Lateral view of a cast of this species, the spire partially obliterated.
9 *b*. View of a larger specimen, showing but a single angle upon the cast, the upper one having been obliterated.
9 *c*. View of the upper side of a smaller specimen.
9 *d*. Lateral view of a specimen much compressed. 9 *e*. Lower surface of the same, showing the umbilicus and the striæ upon the shell, which is partially preserved.
9 *g*. View of the upper side of a crushed specimen. 9 *h*. Lower side of a small specimen.

Fig. 10.	75.	8.	PLEUROTOMARIA? NODULOSA.	(Pag. 44.)
Fig. 11.	76.	9.	PLEUROTOMARIA? OBSOLETA.	(Pag. 44.)
Fig. 12.	77.	1.	CYTHERINA (*Species undetermined*).	(Pag. 44.)

GASTROPODA &c.

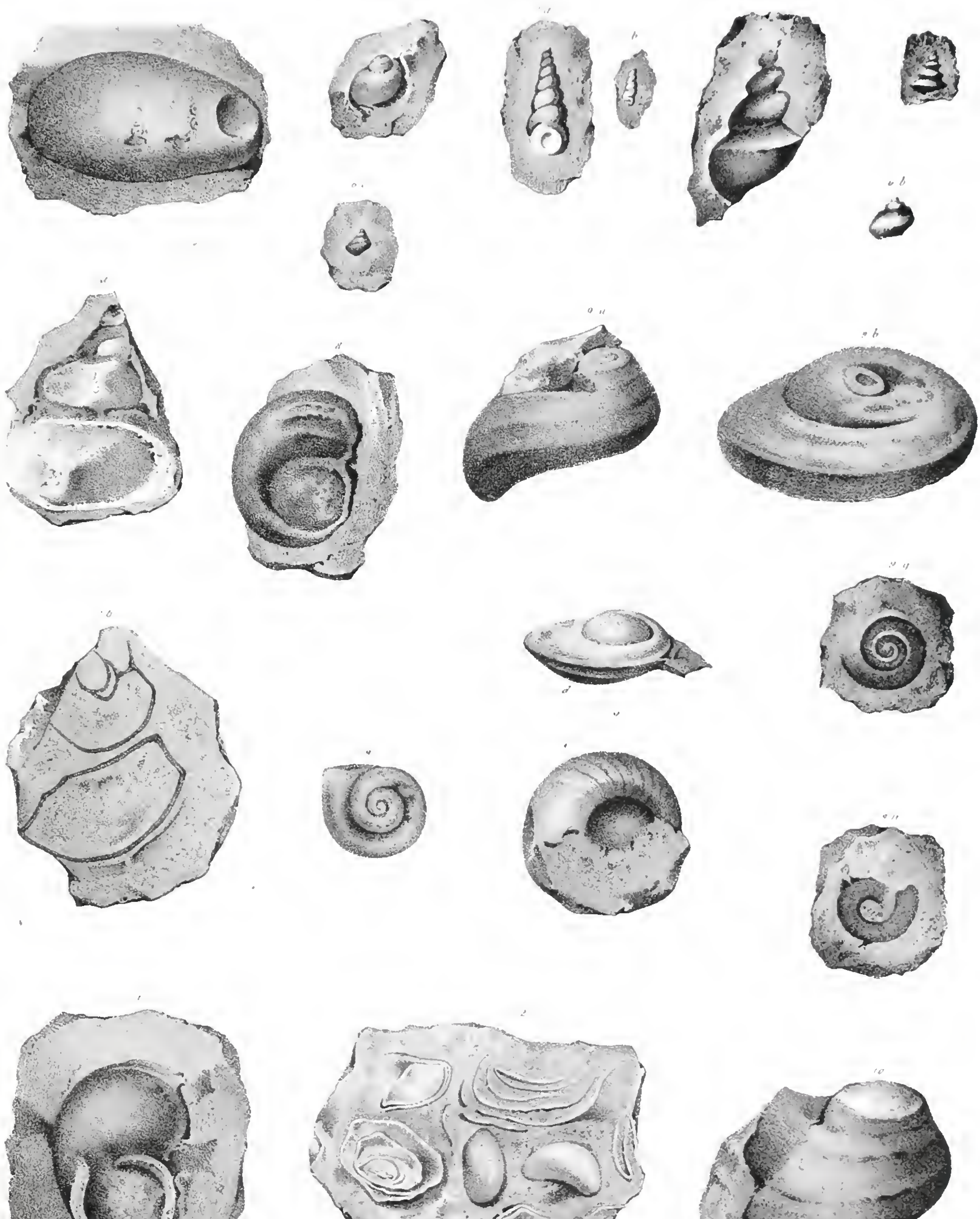

PLATE 12.

Fig. 1. 80. 1. Columnaria alveolata. (Pag. 47.)

1. A vertical section of a compact specimen, showing the striated walls of the cells.
1 *a*. A vertical section, showing the transverse dissepiments, with the vertical lamellæ obliterated.
1 *b*. A transverse section (weathered surface), showing the radiating lamellæ. 1 *c*. The same enlarged.

Fig. 2. 81. 1. Stromatocerium rugosum. (Pag. 48.)

2. A specimen, natural size, showing the concentric lamination of the coral. The masses are often several times as large as this one.
2 *a*. A fragment magnified, showing less contortion of the laminæ, with some indistinct indication of vertical tubes or cells.
2 *b*. A small portion of a specimen of the natural size, showing the rugose or contorted direction of the laminæ.

Fig. 3, 5. 82. 2. Chætetes lycoperdon? (Pag. 48.)

3. Specimen natural size.
5. Probably the same species, very minute, occurring in some thin shaly layers at the upper part of the Birdseye limestone, or at its junction with the Black-river limestone.

Fig. 4. 83. 2. Streptelasma profunda. (Pag. 49.)

4. Lateral view of a specimen where the edge of the cup is worn down, shortening the entire length about one-third.
4 *a*. Section of a specimen near the base, showing the contortion of the lamellæ at the centre : the section is slightly oblique.
4 *b*. Transverse section above the base, showing the alternation of larger and smaller lamellæ, which do not reach the centre.
4 *c*. Transverse section near the termination of the cup. I have some doubt whether this section is of the same species, the lamellæ being much stronger and less in number than in the other individuals, which all occur in one specimen of the stone.
4 *d*. A longitudinal section, slightly oblique to the axis, and coming out on one side of the centre below; showing some of the lamellæ vertically, and others obliquely.
4 *e*. An oblique section, being nearly transverse to the lower part of the fossil on one side.

Fig. 6, 7. 85. 4. Stictopora ramosa. (Pag. 51.)

6. A small fragment of limestone, the surface covered with pieces of the coral.
7. A small portion, showing the base of the cells when separated from the internal axis.
7 *a*. The same magnified.

Fig. 8. 84. 3. Stictopora labyrinthica. (Pag. 50.)

8. The weathered surface of a fragment of the limestone, showing the transverse sections of this coral of the natural size.
8 *a*, *b*. Enlarged portions as seen upon the specimen above, showing sections of two rows of cells rising obliquely from the axis

Fig. 9. Fragment of a crinoidal column. (Pag. 51.)

BLACK RIVER AND BIRDSEYE LIMESTONE PLATE 12

(CORALS)

PLATE 13.

Fig. 1. 86. 1. LITUITES UNDATUS. (Pag. 52.)

1. Lateral view of a specimen. A part of the last volution, near the aperture, is broken off.

1 *a* Lateral view of the cast of a smaller specimen 1 *b*. Dorsal view of the same.

Fig. 2. 87. 1. LITUITES CONVOLVANS? (Pag. 53.)

2. A portion of a cast, showing the septa and part of the outer chamber.

2 *a*. A vertical section of another individual as seen on the weathered surface of the limestone, showing the septa, which are removed from the smaller extremity by weathering. The cast is worn down below the siphuncle, which has not been observed in any specimen yet seen.

Fig. 3. 86. 1. LITUITES UNDATUS. (Pag. 52.)

A section apparently of this fossil, though the surface markings are not preserved. The septa are distinctly shown in a portion of the shell, and the dorsal siphon at two points *a*, *a*.

Pl. 15

PLATE 13 (bis).

Fig. 1. 86. 1. LITUITES UNDATUS. (Pag. 52.)

A large specimen, showing a part of the fossil denuded of the shell, the direction and distance of the septa, and a portion of the deep outer chamber; the extremity being broken off.

PLATE 14.

Fig. 1. SS. 1. Gonioceras anceps. (Pag. 54.)

1. Natural longitudinal section of a *Gonioceras*, showing a portion of the siphuncle, which is greatly expanded laterally between the septa, and contracted at their junction with it. In this specimen, the sides are worn down below the angles of the shell; so that the septa do not appear to turn backwards or towards the apex, as shown in 1 *a*, where the section is more directly through the angles.

1 *a*. A longitudinal section, showing a small portion of the siphuncle at one extremity, and a more perfect exhibition of the curving septa towards the exterior of the fossil.

1 *b*. A transverse section, showing the position of the siphuncle. The specimen, on the upper side of the figure, has been slightly worn, so as to present a straight line. The siphuncle is nearer to the upper edge than is represented in the figure.

1 *c*. A transverse section near the smaller extremity of the shell, showing the position of the siphuncle.

1 *d*. A small portion of the exterior denuded of the shell, showing only the central portion of the septa.

ORTHOCERATA

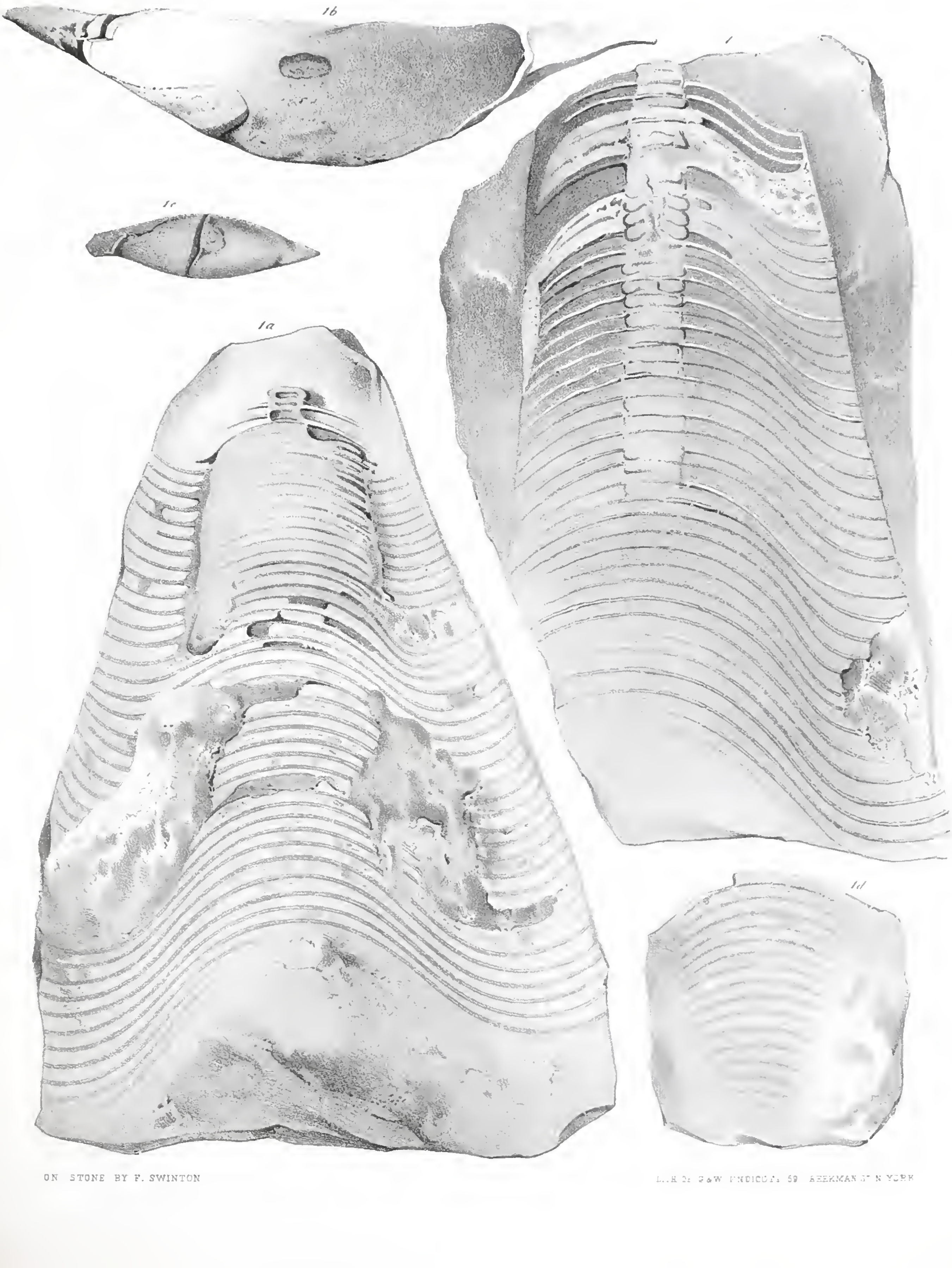

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PLATE 15.

Fig. 1. 89. 1. ORMOCERAS TENUIFILUM. (Pag. 55.)

1. A fragment of this species, partially covered with the delicate thin outer shell, presenting in the lower part of the figure some obscure markings of the septa; and above, showing the moderate convexity of a septum.

1 *a*. Transverse section of the same specimen, broken through the annulations of the siphon.

1 *b*. A portion of the outer shell magnified, showing the fine undulating threadlike lines upon the surface.

1 *c*. A longitudinal section of a portion of a large individual, showing the septa, which are composed of double plates reaching only to the inner lamina of the exterior shell. The distance between the laminæ is unusually great in the upper part of this specimen, the spaces between them being nearly as great as between the septa.

ORTHOCERATA

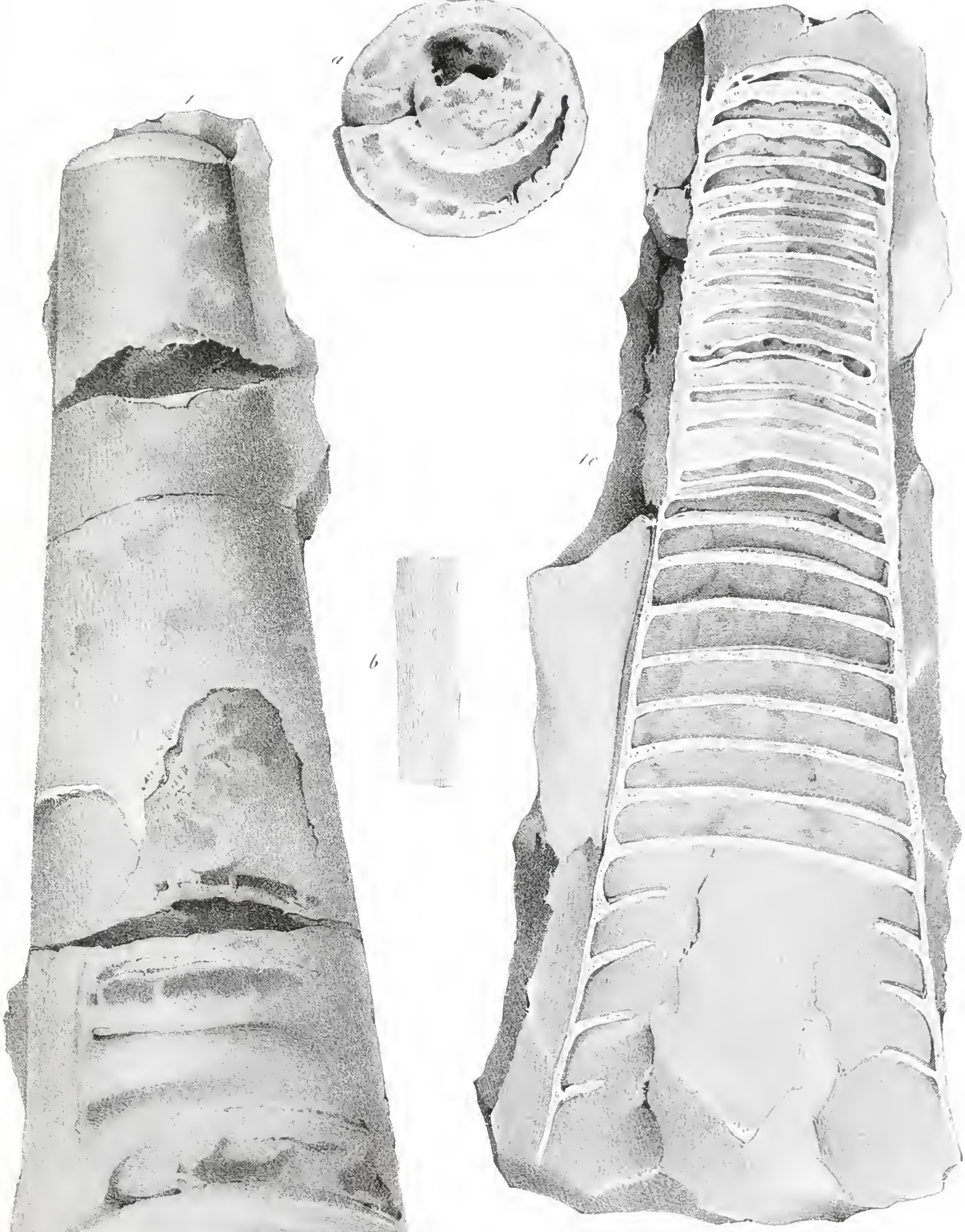

PLATE 16.

Fig. 1. 89. 1. Ormoceras tenuifilum. (Pag. 55.)

1. A transverse section, showing the edge of an annulation of the siphon, and the proportionate size of this part of the fossil. (By a mistake of the artist, the upper edge of this ring is far too nearly central to be true.)

1 *a*. An artificial longitudinal section of a portion of fig. 1, pl. 15, showing the siphon and septa.

1 *b*. A longitudinal section in a direction from the ventral to the dorsal side, showing very clearly the position of the siphuncle. The specimen appears contracted at both extremities, which is due to its having been slightly bent; so that in wearing down, the two extremities are worn beyond the centre; while the middle portion is central, showing the siphuncle almost in contact with the external shell.

1 *c*. A longitudinal section similar to the last, but the shell not bent: the direction of the section is nearly in the ventral and dorsal lines. Septa and outer shell showing double laminæ.

1 *d*. A longitudinal section, showing the siphuncle apparently central, which is due to a wearing down from the ventral side, and consequently leaving the siphon equidistant from the two lateral margins of the shell.

1 *e*. A similar section to the last, both of which exhibit more or less distinctly the double laminæ of the outer shell and septa.

In figures 1 *b*, *c*, *e*, the double laminæ of the outer shell and septa are not so clearly distinguishable, the interspaces in the fossil being filled up by calcareous matter, so that both shell and septa appear thickened. In 1 *a* and 1 *d*, particularly the latter, the double laminæ of the septa are quite distinctly preserved, the interspaces being empty.

ORTHOCERATA

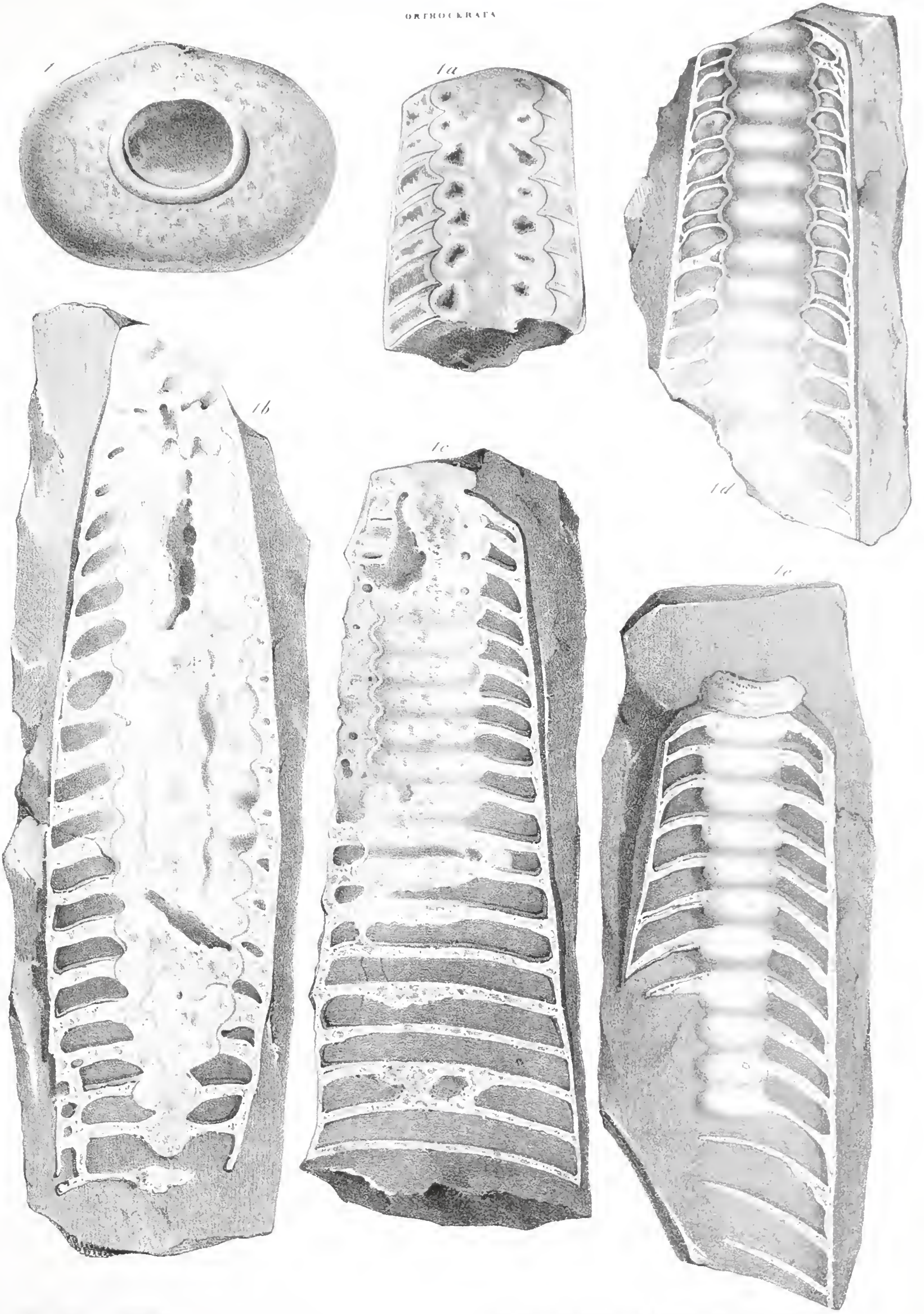

PLATE 17.

Fig. 1. 89. 1. ORMOCERAS TENUIFILUM. (Pag. 55.)

1. A fragment of this species, showing the siphon directly in contact with the ventral side of the shell, a portion of which remains on the lower part of the specimen. There is also a slight irregularity in the size of the annulations, which is a common occurrence.

1 *a*. Transverse section of the last, showing the wrinkled inner surface of the siphon at the points of contraction.

1 *b*. A longitudinal section passing through the siphuncle. The interior is here filled with stony matter; but in other specimens, the inner surface of the tube presents the same wrinkled appearance along the contracted portions as is represented in 1 *a*.

Fig. 2. 90. 2. ORMOCERAS TENUIFILUM? *var.* DISTANS. (Pag. 58.)

Fig. 3. 91. 3. ORMOCERAS? GRACILE. (Pag. 58.)

Fig. 4. 92. 1. ENDOCERAS SUBCENTRALE. (Pag. 59.)

ORTHOCERATA.

Pl 17.

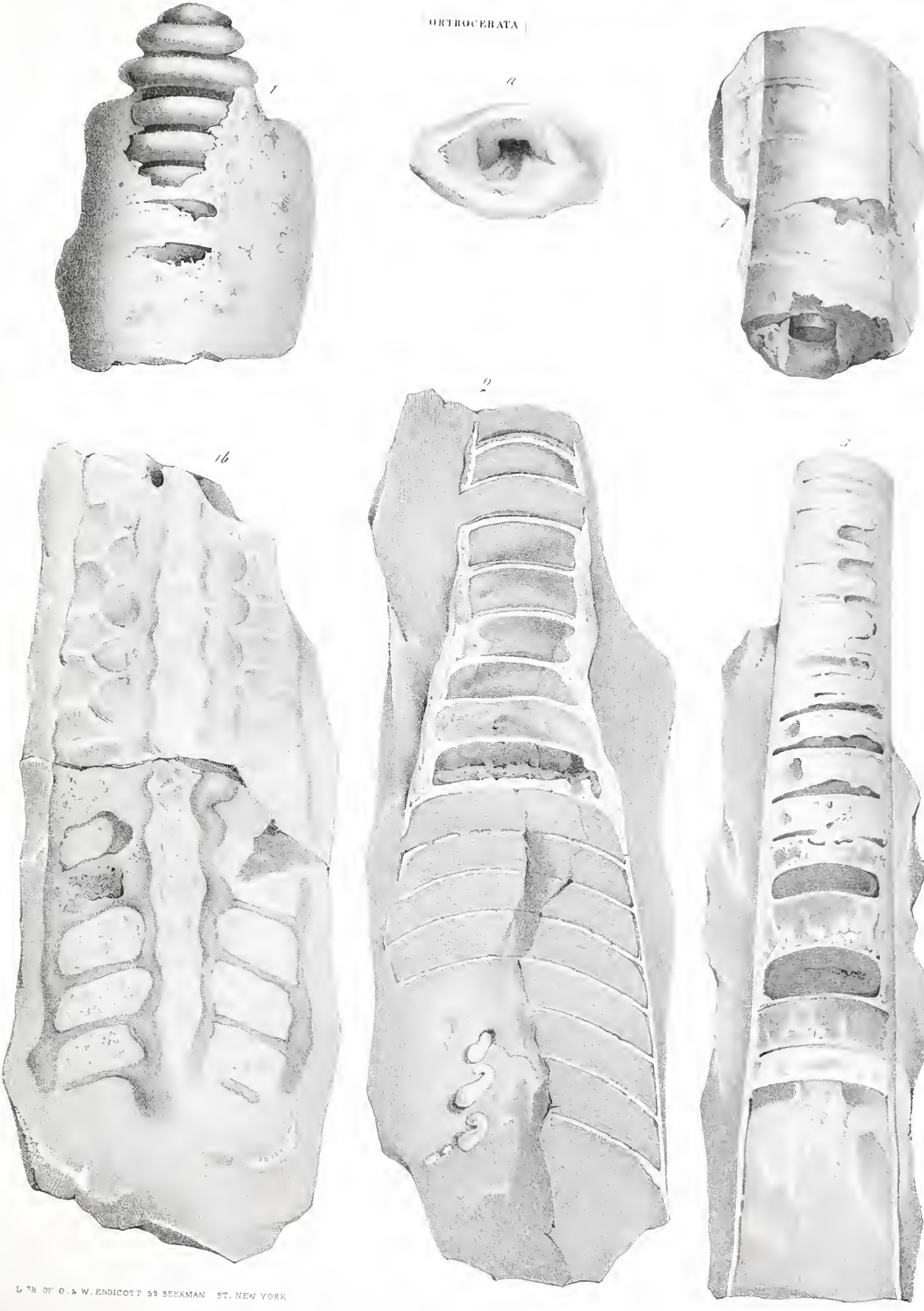

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PLATE 18.

Fig. 1, 1 *a*. 93. 2. Endoceras longissimum. (Pag. 59.)

Fig. 2 *a*, *b*. 94. 3. Endoceras multitubulatum. (Pag. 59.)

(ORTHOCERATA)

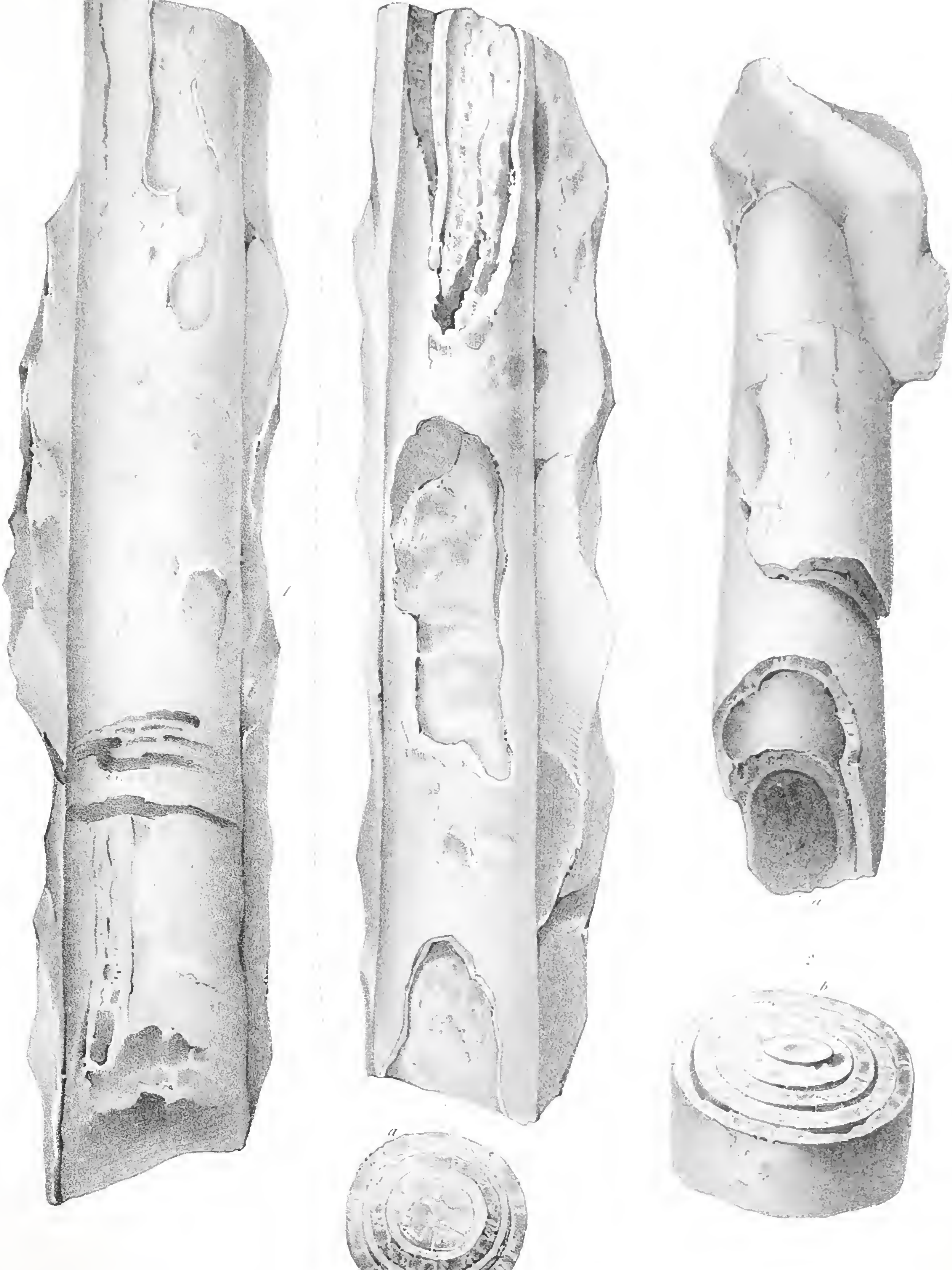

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PLATE 19.

Fig. 1. 95. 4. ENDOCERAS GEMELLIPARUM. (Pag. 60.)

1 *a*. External view of the fragment.

1 *b*. Transverse section of the smaller extremity, showing the siphuncle tube which joins the external margin; within which are shown sections of the two embryo tubes.

1 *c*. Longitudinal section of the specimen, *d* and *e* being the two enclosed tubes, one of them partially covered with stony matter.

(ORTHOCERATA)

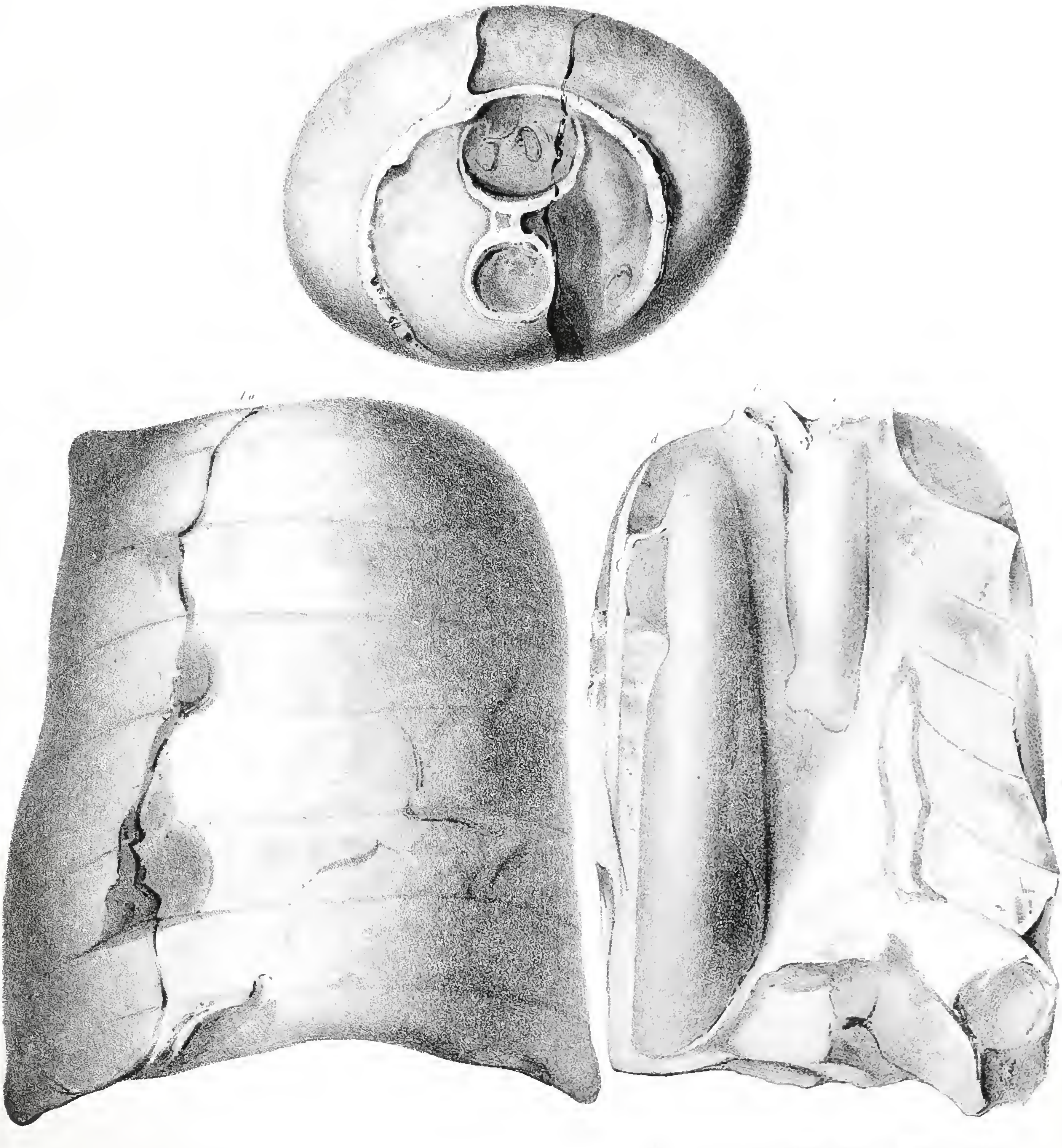

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PLATE 21.

Fig. 1. 97. 2. BUTHOTREPHIS GRACILIS. (Pag. 62.)

Fig. 2. 99. 3. PALÆOPHYCUS RUGOSUS. (Pag. 63.)

Fig. 3. An undetermined species of PALÆOPHYCUS.

PLANTS

PLATE 22.

Fig. 1. 100. 4. PALÆOPHYCUS SIMPLEX. (Pag. 63.)

1 *a*. A portion of a large stem, and section.
1 *b*. A fragment compressed and bent. 1 *c*. Section of the same.
1 *d*. A small fragment, showing the groove along the side of the stem.

Fig. 2. 98. 3. BUTHOTREPHIS SUCCULENS. (Pag. 62.)

2 *a*. A portion of a large specimen, the branches scarcely compressed.
2 *b*. A single stem with branches, from another plant.

PLANTS

PLATE 23.

Fig. 1, 2, 3. 101. 2. CHÆTETES LYCOPERDON. (Pag. 64.)

1. Portion of a vertical section of a hemispherical form of large size, showing the radiating structure from increase of tubes by subdivision, and also the increase by development of marginal tubes. The tubes are filled, and have become solid columns, which are easily separable by a slight blow of the hammer.

1 *a*. A portion magnified, showing only the enlarged columns; the diaphragms not visible.

1 *b*. Transverse section of a small conical or hemispheric form, showing the radiating arrangement of the tubes.

1 *c*. A portion of the same enlarged, showing the diaphragms at regular intervals in some of the tubes which are divided longitudinally.

1 *d*, *e*, *f*. Different external forms of the coral: 1 *d* and *f*, with more depressed forms, being the more usual; while 1 *e* shows a tendency to branching, which, if continued, would produce a coral with a massive centre and numerous branches.

1 *g*. A large irregular mass with numerous diverging branches, some of which are broken off, showing the radiating arrangement of the tubes from a central axis. This specimen exhibits the same tendency as in 1 *e*, carried forward to a greater extent, showing how the same form may produce the ramose varieties.

1 *h*. A fragment from a larger mass, where the tubes are not filled with calcareous matter, showing the regularity of the diaphragms, which are distant a little less than the width of the tubes.

1 *i*. The same enlarged. The mass is light and spongy like recent coral, and appears to be composed of numerous smaller ones which were drifted together, and afterwards recommenced their growth, forming a very irregular mass.

2, var. *ramosus*. A fragment of limestone, with numerous worn fragments of a coral upon its surface. The structure of this coral is apparently identical with those just noticed, though it has assumed a perfectly ramose form.

2 *a*. A fragment enlarged, showing the columnar structure upon the worn surface. The tubes terminate at unequal heights, from having been worn and broken off in this manner.

3. A cylindrical specimen having the bases of three branches above, which appear to have been suddenly contracted and discontinued; as also the central shaft, which has been broken off, and partially healed before the death of the animal. The form of the openings of the tube is not correctly given in this figure. It is not unusual, in the branching forms, to find specimens in which the branches have been broken off; and the polyps adjoining the fracture, by the addition of lateral tubes, commence covering up the part, and terminate it abruptly, as the branches of this specimen and the upper branches of 1 *g*.

Fig. 4. 103. 4. CHÆTETES COLUMNARIS. (Pag. 68.)

4. A fragment of the natural size. 4 *a*. An enlarged portion, showing the general form of the tubes.

TRENTON LIMESTONE

(CORALS)

PLATE 23

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PLATE 24.

Fig. 1. 101. 2. CHÆTETES LYCOPERDON. (Pag. 64.)

1 *a*. Section of a small hemispherical mass, showing the tubes nearly vertical to the base.

1 *b*. A portion of the same magnified.

1 *c*. The base of one of the hemispherical forms, where the polyps have just commenced their operations; the tubes, though distinctly formed, have scarcely a perceptible elevation. The polyps here commenced their operations by attaching themselves to a valve of the *Orthis testudinaria*, and thence extended laterally on all sides.

1 *d*. A small membranous envelope of this coral, from which, in some parts, the tubes have just commenced rising: this substance is thin, and concentrically wrinkled on both sides.

1 *e*. A portion of an irregular massive specimen, showing a tendency to branching more distinctly than the specimens represented on Plate 23.

1 *f*. A few tubes of the same enlarged, showing the structure before exhibited in the hemispheric masses.

1 *g*. A cylindrical branched specimen.

1 *h*. A portion enlarged, showing the radiated tubes.

1 *i*. Enlarged ends of the tubes on the surface of 1 *g*.

1 *m* & 1 *k*. Smaller branched and cylindrical specimens. In these the direction of the tubes is more nearly in the direction of the axis of the coral, as shown in 1 *o*: they are, otherwise, similar to the previously noticed forms. The opening of the tubes upon the surface being likewise more oblique to the axis, they present a different form as represented in 1 *n*.

Fig. 2. 102. 3. CHÆTETES RUGOSUS. (Pag. 67.)

2 *a*. The specimen of the natural size.

2 *b*. An enlarged portion, showing the form of the tubes and the rugose interior.

Fig. 3. 104. 1. RECEPTACULITES NEPTUNII? (Pag. 68.)

3 *a*. The upper surface of the specimen, showing the quadrangular or rhomboidal openings upon the outside.

3 *b*. A portion of the same enlarged, with a few of the openings, showing the aperture of the cylindrical tube within. The opening above is not entirely circular.

3 *c*. Vertical section of the cylindrical tubes through the centre of the mass, as they appear on a weathered surface. As these converge towards the base, the ends only are seen as shown in the figure.

3 *d*. Three of these tubes enlarged, showing a contraction or stricture near their upper termination, and the same below.

PLATE 25.

Fig. 1. 105. 3. STREPTELASMA CORNICULUM. (Pag. 69.)

1 *a*. A small nearly perfect individual. 1 *b*. A larger specimen.
1 *c*. A short and less curved specimen, with the surface distinctly marked.
1 *d*. A portion of the surface of the last enlarged.

Fig. 2. 106. 4. STREPTELASMA CRASSA. (Pag. 70.)

2 *a*. Lateral view of a specimen, the edges somewhat broken.
2 *b*. Longitudinal section, showing the internal arrangement of the lamellæ.
2 *c*. View of the cup, showing imperfectly the meeting of the lamellæ in the centre.

Fig. 3. 107. 5. STREPTELASMA MULTILAMELLOSA. (Pag. 70.)

3 *a*. Lateral view of a specimen, somewhat shortened from wearing off of the smaller extremity.
3 *b*. Transverse section, showing the thin lamellæ.
3 *c*. An enlarged portion of the denuded outer surface.

Fig. 4. 108. 6. STREPTELASMA PARVULA. (Pag. 71.)

4 *a*. The lower part of a specimen of ordinary size, with the margin of the cup broken off, showing the lamellæ within.
4 *b*. Transverse section of the same, showing the simple radiating lamellæ.
4 *c*. A group of the same. Three of the specimens lie upon the surface of the stone, with their bases nearly in contact.

Fig. 5. 109. 1. PORITES? VETUSTA. (Pag. 71.)

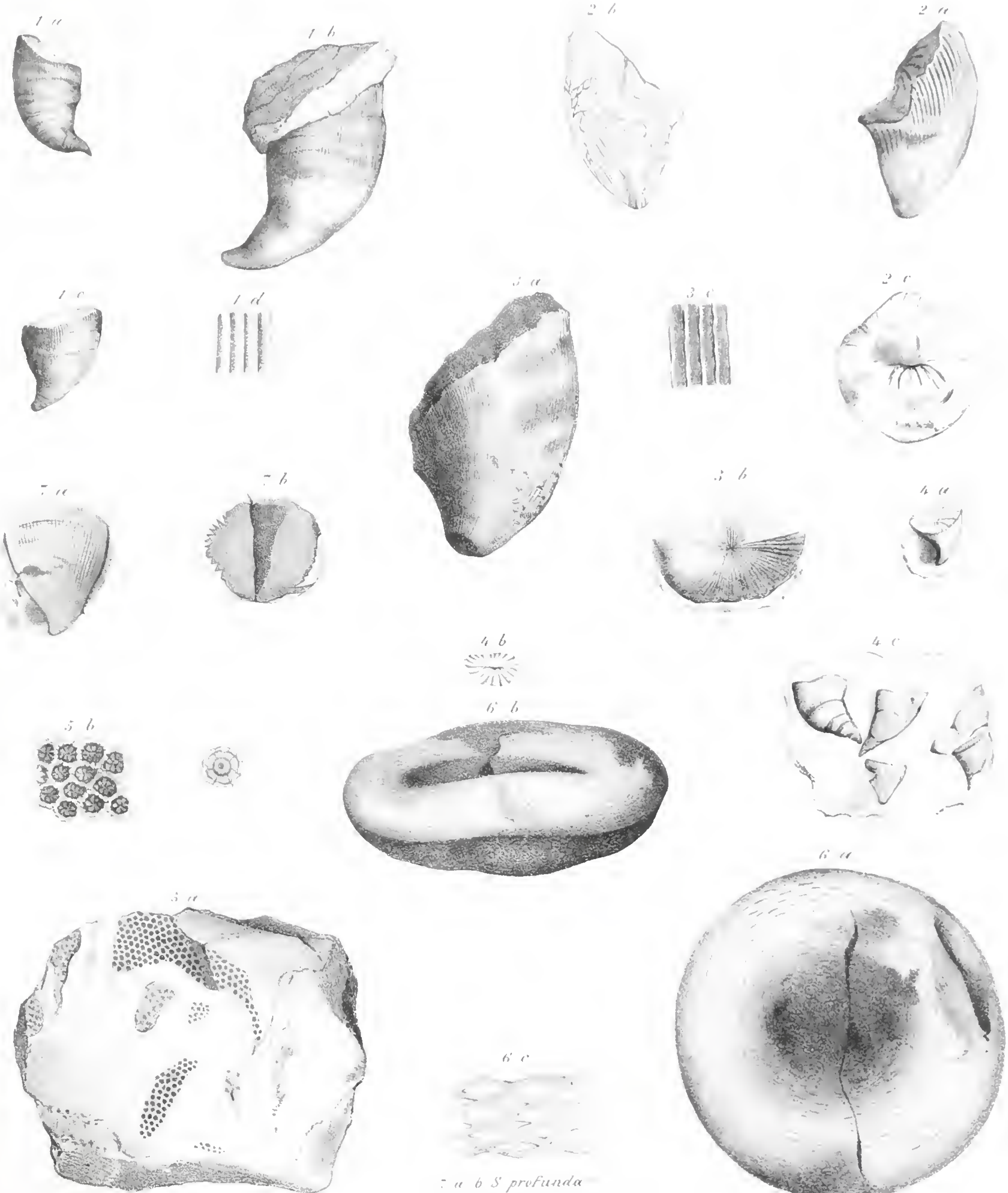
5 *a*. Surface of the specimen, a part only showing the cells.
5 *b*. A portion magnified. The figure on the right hand is one of the cells more distinctly enlarged.

Fig. 6. 110. 1. ——— CYATHIFORMIS (*Genus undetermined*). (Pag. 72.)

6 *a*. View of specimen, looking upon the upper or inner surface. 6 *b*. Lateral view.
6 *c*. Enlarged portion of the inner surface, showing the structure and arrangement of the cells.

TRENTON LIMESTONE. PL. 25

(CORALS.)



7 a b S. profunda
Black River Limestone.

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PLATE 26.

Fig. 1. 111. 1. ESCHAROPORA RECTA. (Pag. 73.)

1 *a*. Specimen natural size; the lower extremity expanding to form the rootlike processes, and terminating abruptly above.

1 *b*. An enlarged portion, showing the arrangement of cells, which are apparently in ascending spiral lines around the axis.

1 *c*. A small specimen, entirely cylindrical, tapering above to an acute point.

1 *d*. An enlarged portion, showing the oblique elevated lines crossing the surface, in the spaces between which are the openings of the cellules. These lines are partially obliterated in worn specimens.

1 *e*. The root or attaching part of this coral: the branches embrace a portion of stony matter. Upon the base of the broken shaft of the coral, a portion of the surface is marked as the specimen 1 *a*.

1 *g*. A longitudinal section of one of these corals, a little on one side of the centre, showing a few ranges of the apertures of the cells, and the diverging and ascending tubes on either side.

Fig. 2. 112. 2. ESCHAROPORA RECTA, *var.* NODOSA. (Pag. 73.)

Fig. 3. 113. 5. STICTOPORA? ACUTA. (Pag. 74.)

3 *a*. A small fragment of limestone, with several branches of the coral upon its surface.

3 *b*. An enlarged portion of one of the branches.

3 *c*. Transverse section of two branches of the coral, just above the bifurcation.

Fig. 4. 114. 6. STICTOPORA ELEGANTULA. Fig. 75.)

4 *a*. A small fragment of the natural size, showing the form of branches and arrangement of cells.

4 *b*. A small part of the same enlarged. The form of the cells is more rounded than appears in this figure.

4 *c*. The entire specimen 4 *a* enlarged, to show more distinctly the arrangement of the cells, the striated margin, etc.

4 *d*. A small specimen, bifurcating above, with the celluliferous crust nearly removed, a few of the cells only remaining near the base. The longitudinal and concentrically transverse striæ are clearly shown.

4 *e*. A small portion of the same enlarged.

4 *f*. A more elongated specimen; the branches narrow, and bifurcating more nearly like the last species. The celluliferous crust is removed, leaving the central striated axis.

4 *g*. A small portion of the last enlarged.

Fig. 5. 115. 2. GORGONIA? PERANTIQUA. (Pag. 76.)

5 *a*. The specimen, natural size.

5 *b*. A portion of a branch enlarged, showing the openings upon the two sides of the axis.

⁂ This species proves, on farther examination, not to be a *Gorgonia*.

Fig. 6. 116. 1. AULOPORA ARACHNOIDEA. (Pag. 76.)

6 *a*. The dorsal valve of *Delthyris lynx*, having the inner side of the shell spread over with a fine web of this little coral.

6 *b*. A magnified portion, showing the form of the cells, openings, etc.

6 *c*. Two of the cells still farther magnified.

Fig. 7. 117. 1. ALECTO INFLATA. (Pag. 77.)

7 *a*. Dorsal valve of *Leptæna alternata*, on the outer surface of which this coral is affixed.

7 *b*. Two of the tubes magnified, to show their form.

Fig. 8. 118. 1. INTRICARIA? RETICULATA. (Pag. 77.)

8 *a*. A small fragment of the rock covered by this coral, and fragments of one or two other species (nat. size).

8 *b*. A portion magnified, showing the apertures of the cells, and the mode of branching and anastomosing. A small fragment of another coral lies across the specimen.

8 *c*. A small portion of a branch still more enlarged, showing the apertures of the cells.

Fig. 9. 119. 3. RETEPORA? FOLIACEA. (Pag. 88.)

9 *a*. The specimen (nat. size), upon the surface of limestone. 9 *b*. Surface of the same enlarged.

Fig. 10. 120. 1. STELLIPORA ANTHELOIDEA. (Pag. 79.)

10 *a*. Fragment, exhibiting the prominent star-form cells of the natural size.

10 *b*. Three of these stars enlarged, showing points or pores upon their upper surface. One of these stars has a slightly irregular form in the centre, as if composed of parts of two: this is true of several others.

Fig. 11. 121. 1. GRAPTOLITHUS AMPLEXICAULE. (Pag. 79.)

11 *a*. A group of these fossils; all the stipes, except one, having been broken off by a fracture of the stone.

11 *b*. An enlarged portion, showing the edges of the sheathing scales.

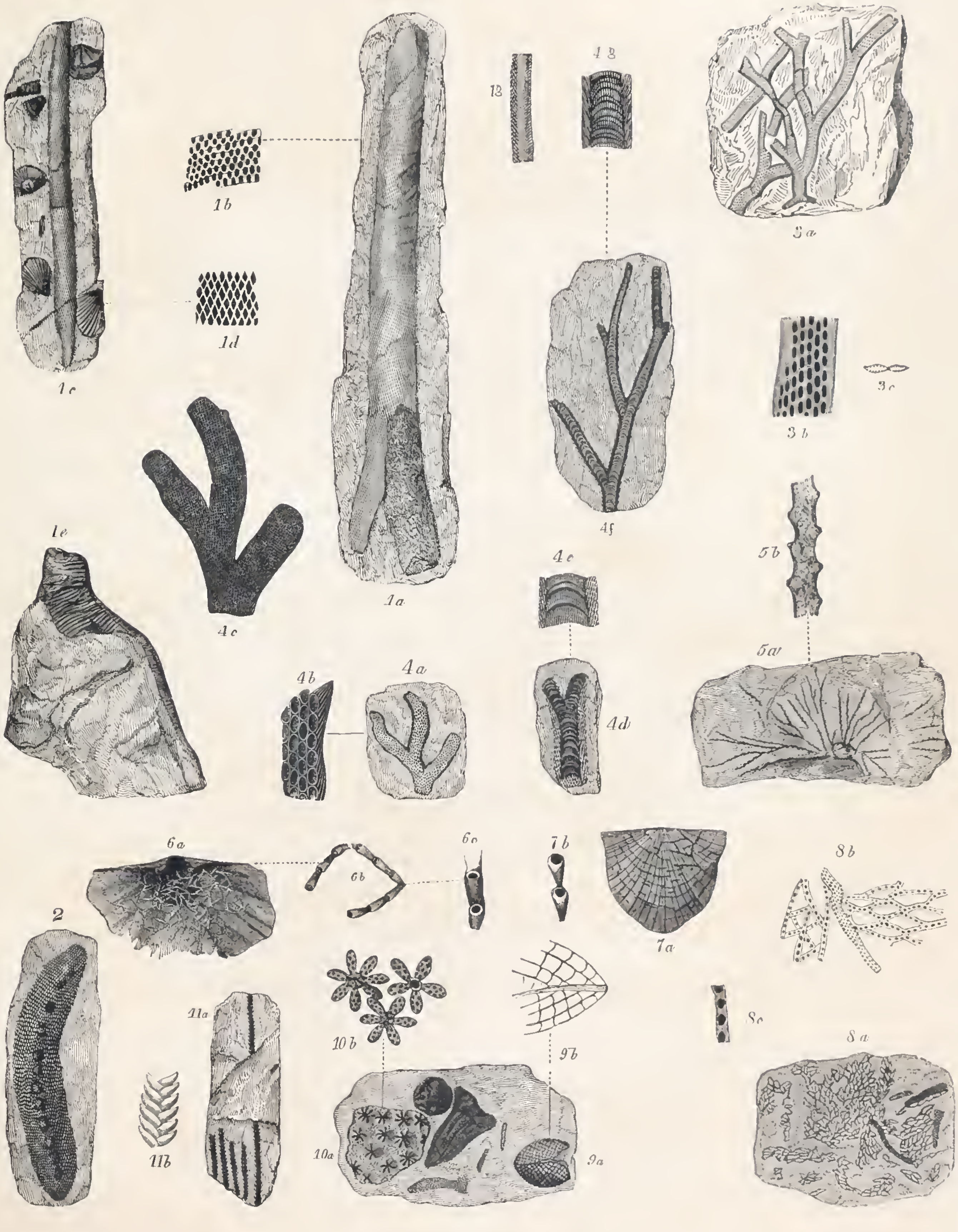
1c
1b
1d
1a
1e
4c
13
4f
3a
3b
3c
5b
5a
4e
4d
4b
4a
6a
6b
6c
7b
7a
8b
2
11a
11b
10b
9b
8c
8a
10a
9a

PLATE 27.

Fig. 1. 122. 1. SCHIZOCRINUS NODOSUS. (Pag. 81.)

1 *a*. A nearly perfect individual of this species, with portions of the fingers and several inches of the column attached. The body is composed of plates arranged as follows :

1 *b*. E. Pelvis, composed of five small pentagonal plates.

$\frac{F}{a}$. First costal plates five, heptagonal, resting upon the upper and inner edges of the pelvic plates.

$\frac{F}{b}$. Second costal plates five, hexagonal, resting upon the upper edges of the first costal plates.

H. Scapulars five, hexagonal, and resting directly upon the last.

G. Intercostal plate.

I. Double interscapular plates. The intercostal plate supports upon its upper lateral edges a pair of interscapular plates, which are in turn succeeded by two other pairs of similar plates ; the last pair truncated on their upper angles, and more deeply excavated between, supporting on the upper and inner lateral edges a small quadrangular plate, and upon the truncated upper edges a pair of larger quadrangular plates.

K. Brachial plates. Each of the scapulars is surmounted by a hexagonal brachial or arm-plate, which supports a double cuneiform arm-joint $\frac{L}{K}$, from which proceed the hands and fingers M, N.

1 *c*. Part of one of the tentaculated fingers of this species : the tentacula are long, and not jointed ; the joints of the fingers are cuneiform, the tentacula being attached to the broader side of each joint.

1 *d*. A part of one of the fingers magnified, showing the tetacula attached to the broader side of the plate.

1 *e*. A fragment of a small column.

1 *f*. The same enlarged, showing characters precisely similar to the fragments of larger columns.

1 *g*. A column of large size ; the upper part showing the larger thick plates, which are nodulose on their margins, alternating with three thinner plates : lower down the number of intermediate plates becomes four, and below this five, when the central one becomes thicker and broader, the edges projecting beyond the others.

1 *h*. A fragment of a small column ; the surface worn nearly smooth, and presenting only the points of attachment of the side-arms on the thicker joints.

1 *i*. A small column ; the larger joints unusually projecting, and their edges elevated.

1 *k*, *l*, *m*. Fragments of columns from different parts, showing the alternation of larger and smaller plates, the points of attachment for side-arms, and the weathered surface exhibiting the serrated appearance of the edges of the plates.

1 *n*, *o*. Specimens showing the character and aspect of fragments of different parts of the column. In some portions there are six, seven, and eight intermediate plates ; the central ones usually extending a little beyond the others, and showing a nodulose margin.

1 *p*. Ends of the plates of the columns, showing a striated surface. 1 *p* *. The same enlarged.

1h
1d
1k
1g
1f
1a
1m
1n
1p

PLATE 28.

Fig. 1. 123. 1. POTERIOCRINUS ALTERNATUS. (Pag. 83.)

1 *a*. A specimen upon the weathered surface of the limestone, showing imperfectly the structure and arrangement of the plates, with the tentacula and a portion of the column below.

1 *b*. Shows the arrangement of the plates around the column, and the attachment of the fingers to the upper part of the brachial plate.

1 *c*. A brachial plate separated. 1 *d*. A costal plate separated. 1 *e*. A pelvic plate.

1 *f*. A portion of the column of this species, showing the alternating width and rounded edges of the plates.

Fig. 2. 124. 2. POTERIOCRINUS GRACILIS. (Pag. 84.)

2 *a*. A specimen of the natural size, broken off just below the last joint of the column, which adheres closely to the pelvis. The tentacula are broken off above, before reaching their termination.

2 *b*. The same enlarged, showing more clearly the arrangement of the plates, and the situation of the intercostal plate.

E. Pelvis.
F. Costal plates.
J. Irregular intercostal plate.
H. Scapular plate.

2 *c*. The body of another specimen, with a few of the last joints of the column attached.

2 *d*. The same enlarged, showing the intercostal plate and the structure of the column.

Fig. 3. 125. 1. SCYPHOCRINUS HETEROCOSTALIS. (Pag. 85.)

3 *a*. A specimen (natural size), with the fingers and column broken off; the form otherwise well preserved.

3 *b*. The structure and arrangement of the plates, the letters indicating the parts as explained in the previous figures. The plates are slightly enlarged beyond their natural size.

3 *c*. The base of the specimen magnified, to show the fimbriated plate adhering to the base of the pelvis.

3 *d*. Lateral view of a smaller specimen of the same species, with portions of the fingers remaining.

3 *e*. The same, showing the base, with a fragment of the column broken off and lying at the side.

3 *f*. A portion of this column magnified, to show the character of the plates.

Fig. 4. 378. 2. SCHIZOCRINUS STRIATUS. (Pag. 316.)

4 *a*. The body of this species, with a small part of the column attached.

4 *b*. A portion of the column enlarged.

4 *c*. An enlarged figure, showing the structure and arrangement of the plates.

(CRINOIDEA.)

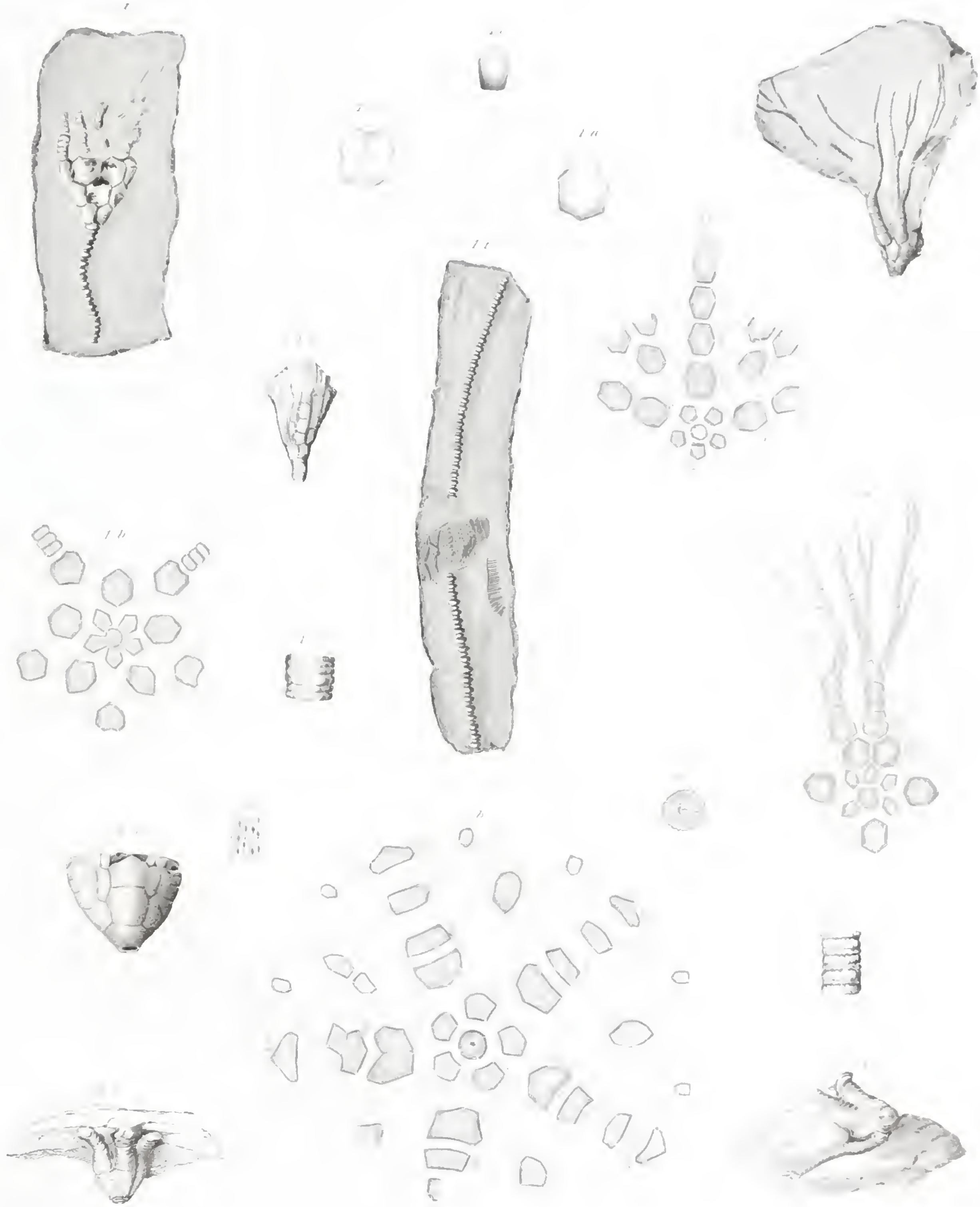

PLATE 29.

Fig. 1. 126. 2. SCHIZOCRINUS? (Pag. 86.)

Fig. 2 *a*, *b*. Bases of attachment of CRINOIDEA. (Pag. 86.)

Fig. 3 *a*, *b*, *c*. Columns of CRINOIDEA. (Pag. 86.)

Fig. 4. 127. 1. ECHINO-ENCRINITES ANATIFORMIS. (Pag. 89.)

4 *a*. The column, with a single detached plate near its upper termination. The long narrow joints of the column, which gradually become shorter and broader until they form broad thin rings in the upper part, are clearly shown. The plate belongs to the second range, and is hexagonal, with three prominent ridges upon its surface. A curved depression on one side shows that it formed a part of the lateral aperture.

4 *b*. Part of a similar column, with the plates of a crushed cup lying at its upper termination. There are, at the summit of this specimen, one or two free nearly circular discs, and one apparently attached, as if forming the base of the tentacula at one point.

4 *c*. One of these plates enlarged. The surface is worn smooth, with the exception of the ridges on the plate.

4 *d*. A larger and more perfect specimen; the plates near the base showing the strong striæ upon their surface, which are at right angles to the edges.

4 *e*. The structure, as far as can be ascertained from our specimens.

4 *f* The surface of one of the plates, magnified, to show the striæ.

Fig. 5. 128. 2. ASTERIAS MATUTINA. (Pag. 91.)

5 *a*. The specimen, natural size.

5 *b*. A portion enlarged, showing the form of the plates and the punctate surface.

Fig. 6. 129. 1. TENTACULITES? FLEXUOSA. (Pag. 92.)

6 *a*. A single specimen of this species, with a portion of the same magnified, showing the transverse septa.

6 *b*. A group of the same species, adhering by their smaller extremities to the dorsal valve of *Orthis testudinaria*. At *c*, there is the base of several cells of the *Chætetes lycoperdon*, adhering to the same shell.

6 *d*. A single tube magnified, showing more distinctly the striæ upon the surface, and, also, in some degree, the irregularity of the annulations.


4 b
4 d
7 b
7 a
6 b
6 a
6 d

PLATE 30.

Fig. 1. 130. 4. LINGULA ATTENUATA? (Pag. 94.)

1 *a*, is the largest individual of this species yet seen. 1 *b*. A specimen of the ordinary size.

Fig. 2 *a*, *b*, *c*. 131. 5. LINGULA RICINIFORMIS. (Pag. 95.)

Fig. 3 *a*, *b*. 132. 6. LINGULA ÆQUALIS (*a variety of the last species?*). (Pag. 95.)

Fig. 4. 133. 7. LINGULA QUADRATA. (Pag. 96.)

4 *a*. A specimen of the ordinary size; the shell partially exfoliated, and presenting the strong radiating striæ along the centre.
4 *b*. View of the edge of the shell, with the two valves closed. It appears slightly inequivalve from compression.
4 *c*. A specimen of larger dimensions, from which the shell is partially exfoliated.

Fig. 5. 134. 8. LINGULA ELONGATA. (Pag. 97.)

Fig. 6. 135. 9. LINGULA CURTA. (Pag. 97.)

6 *a*. Specimen from the Utica slate. 6 *b*. Specimen from the Trenton limestone.

Fig. 7. 136. 10. LINGULA OBTUSA. (Pag. 98.)

7 *a*. A very perfect specimen of large size, giving the exact form of the shell: radiating striæ scarcely visible.
7 *b*. Another specimen, the form not quite so perfect as the last, but the radiating striæ more distinctly visible.
7 *c*. A smaller individual of the same species.

Fig. 8. 137. 11. LINGULA CRASSA. (Pag. 98.)

8 *a*, *b*. View of both valves of this species.
8 *c*. View of the edge of both valves, closed; one being more convex than the other, and slightly arched.
8 *d*. A larger specimen, somewhat crushed. 8 *e*. A smaller specimen.

Fig. 9. 138. 2. ORBICULA? FILOSA. (Pag. 99.)

9 *a*. A young shell, very convex or obtusely conical in form.
9 *b*. A larger shell, less convex than the last: this portion is magnified.
9 *c* & *d*. Two apparently full grown shells of this species; the form is much depressed, nearly flat, and the surface completely covered by fine striæ.

Fig. 10. 139. 3. ORBICULA LAMELLOSA. (Pag. 99.)

10 *a*. Ventral view. 10 *b*. Lateral view.

Fig. 11. 140. 4. ORBICULA TERMINALIS. (Pag. 100.)

11 *a*. Dorsal valve, showing the central apex and lateral depression, which extends to the margin.
11 *b*. Ventral valve with marginal apex. 11 *c*. Lateral view of a perfect specimen.
11 *d*. Ventral valve, marked with strong concentric lamellæ; apex marginal.

(BRACHIOPODA.)

Pl. 30.

PLATE 31.

Fig. 1. 141. 4. LEPTÆNA ALTERNATA. (Pag. 102.)

1 *a*. A specimen of medium size, with the elevated striæ very distinctly marked, and the gradual enlarging of one of the intermediate smaller striæ is shown as they recede from the apex.

1 *b*. A smaller specimen, presenting the characters of the species in a very perfect manner.

1 *b**. Enlarged portion of the surface.

1 *c*. Inside of the dorsal valve of this species, showing imperfectly the visceral impression near the beak, and the papillose surface of the shell. The alternation of larger striæ with fascicles of smaller ones is quite distinct.

1 *d*. An individual of larger size, having the essential features of the species well preserved. This specimen is much more convex in the centre, and more abruptly curved in front, than either of the preceding.

1 *e*. Dorsal valve of another specimen, in which the length and breadth of the shell are about equal; and in this respect only does it differ from the preceding specimens, in which the width considerably exceeds the height. The larger and more elevated striæ alternate precisely in the same manner with four to six smaller ones, the whole being crossed by fine concentric slightly undulating lines.

1 *f*. A specimen having almost precisely the same form as 1 *e*; but the larger striæ are not so prominent, and the intermediate smaller ones not as regular as in the last specimen.

1 *g*. The dorsal valve of this species, from the shaly blue limestone of Ohio. The surface is well preserved, and the striæ very strongly marked : a few imbricating lines of growth are visible near where the curvature of the shell becomes abrupt.

1 *h*. Ventral valve of another specimen : the radiating striæ are nearly equal; the larger elevated ones, dividing the fascicles of small rays, being scarcely distinct, while on the dorsal valve they present the same distinction as in the last figure. The hinge view shows the deltoid foramen nearly closed, with the small perforation in the beak, which is enlarged in the upper figure.

1 *i*. This shell is a representative of that known as *L. ponderosa* in Ohio. In form it resembles the two preceding, except that it is more deflected on the margin, with more distinct imbricating and squamose lines of growth; the space between the two valves is also much greater, and the shell more massive. The lower figure is of the dorsal valve, the two upper representing cardinal and lateral views.

1 *i**. Magnified view of a coral upon the shell.

1 *k*. An elongated form of this species; the dorsal valve showing the margin abruptly curved upwards from a little below the hinge line. The alternating striæ are very perfectly represented; and the foramen is scarcely closed, while the minute perforation in the beak is very conspicuous.

1 *m*. Interior of the dorsal valve, showing the visceral impression.

1 *m**. Enlarged portion of a coral which partially covers the interior of the shell, while the upper and left-hand margin is covered with *Chætetes lycoperdon*.

1 *n*. The convex valve of this species, with the shell partially exfoliated. The stronger radiating striæ are very prominent, but the intermediate ones are obsolete except towards the hinge; the concentric elevated lines are, at the same time, very prominent. The shell is partially removed, so as to reveal somewhat of the internal structure.

(BRACHIOPODA)

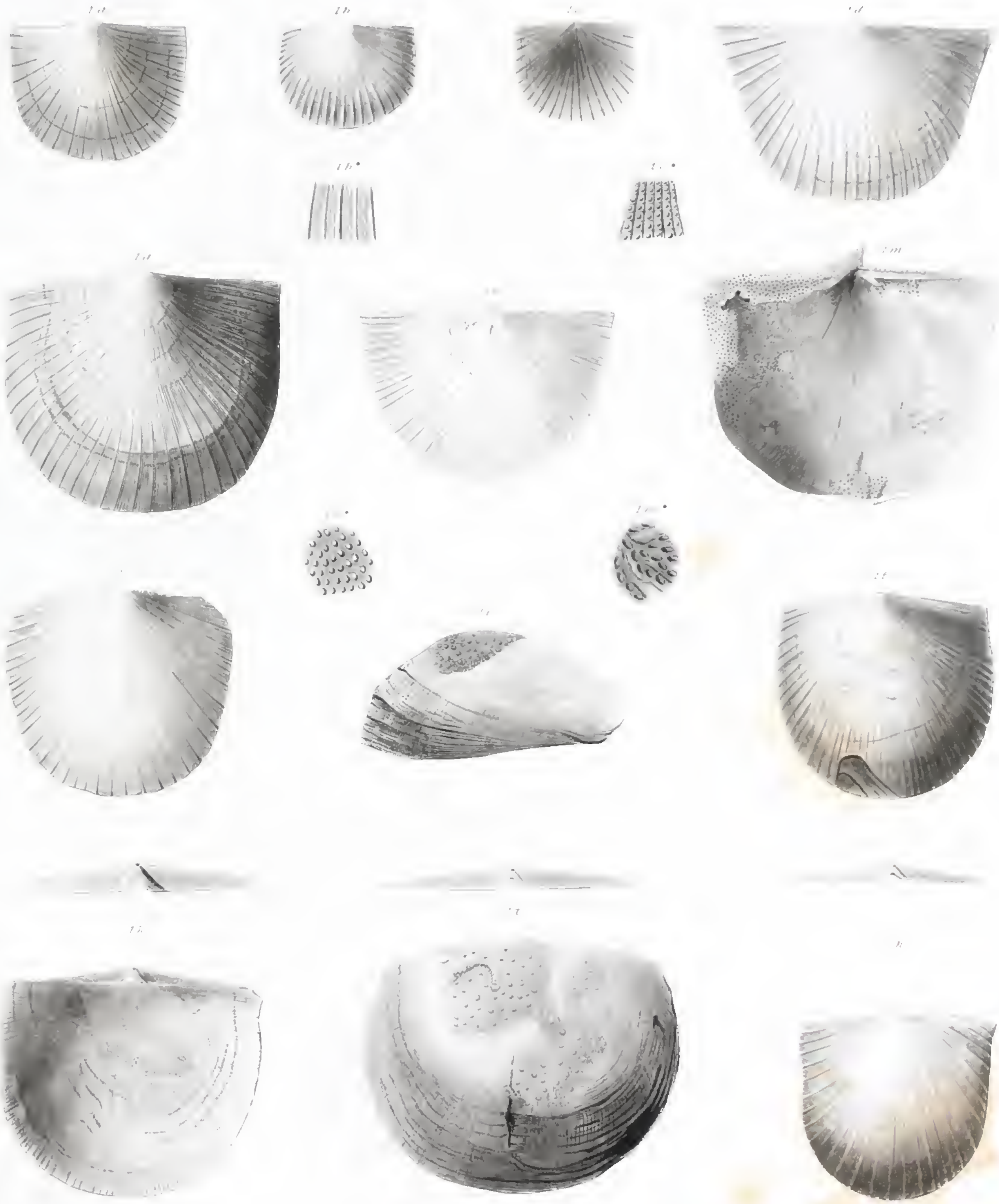

PLATE 31 A.

Fig. 1. 141. 4. LEPTÆNA ALTERNATA. (Pag. 102.)

1 *a*. A specimen which is contracted just below the ears and bent abruptly upwards, having towards the front several folds, and a more prominent one directly in front.

1 *b*. A lateral view of the same specimen, showing the abrupt and extreme deflection of the shell.

1 *c*. A specimen having the same general form as the last, but contracted and folded in front so as to present precisely the same form as the *Strophomena nasuta* of CONRAD.

In both the preceding specimens the beak is perforated, as is exhibited in the enlarged view of the hinge in 1 *a*, which at the same time shows the foramen not quite closed.

The nasute feature above indicated is often connected with a single elevated ridge, or more prominent stria, much larger than the others, and extending from the base to the beak of the shell. This appears very distinctly in the two preceding specimens; but to prove that this character is common to the species, the specimen 1 *d* is represented, showing a prominent line down the centre, while the shell is totally destitute of the other characters of *S. nasuta*, being scarcely convex and very regularly semioval.

1 *e*, *f*, *g* & *h*. These figures represent a series of the younger shells of this species, as they occur in the compact limestone of Middleville, Little-Falls, Trenton-Falls, and other places.

1 *i*. A very convex specimen, much contracted below the cardinal line, with the alternating striæ less distinct.

Fig. 2. 142. 5. LEPTÆNA CAMERATA. (Pag. 106.)

2 *a*. Lateral view of the specimen, showing the extreme concavity of the shell in the centre, and the nearly flat disc.

2 *b*. Front view, showing the great deflection; the surface is puncto-striate, from being denuded of the shell.

Fig. 3. 143. 6. LEPTÆNA DELTOIDEA. (Pag. 106.)

3 *a*. A specimen showing but a slight difference from the last described species. It is marked by distinct concentric wrinkles upon the disc; is finely striated, with more prominent elevated ones alternating with every four, five or six of the smaller ones. In this respect it partakes of the characters of specimen 1 *i*.

3 *b*. A specimen presenting the same form as the last, except that it is more produced in front. The concentric wrinkles on the front are perhaps more distinct, and the shell is contracted more abruptly just below the extremities of the cardinal line, producing small acute ears.

3 *c*. Lateral view, showing the elevation of the shell.

3 *d*. A specimen of nearly the same form as the last. The concentric wrinkles are more distinct, and the radiating striæ are equal, except on the central part of the shell, where they are stronger.

3 *e*. A larger specimen, with the disc distinctly wrinkled and marked by nearly equal radiating striæ; scarcely produced in front. The striæ on the centre are more distinct than at the sides.

3 *f*. A very perfect specimen in form and markings, from a drawing by MR. CONRAD.

Fig. 4. 144. 7. LEPTÆNA TENUISTRIATA. (Pag. 108.)

4 *a*. A small specimen, the dorsal valve having about four or five strong undulations upon the surface: the cardinal extremities are strongly deflected.

4 *b*. Cardinal line, showing imperfectly the deltoid foramen.

4 *c*. A small specimen, having about six distinct undulations on the disc, and three less distinct ones towards the beak: the shell bends abruptly upwards, nearly at right angles to the disc.

4 *d*. A small shell, exhibiting very indistinct undulations upon the surface, being very abruptly deflected near the margin, and extremely extended on the cardinal line.

4 *e*. A larger specimen, showing about four or five distinct undulations on the dorsal valve, and the same number on the ventral valve. The cardinal line is more extended than is usual in this species.

4 *f*. Ventral valve and cardinal line of the same specimen, showing the narrow almost linear area; the latter enlarged, exhibiting the perforation in the beak.

4 *g*. Lateral view of the same specimen, showing the abrupt deflection and elevation in front.

BRACHIOPODA

PLATE 31 B.

Fig. 1. 145. 8. LEPTÆNA ALTERNISTRIATA. (Pag. 109.)

1 *a*. Dorsal valve of a large specimen, showing a very regular alternation in the size of the striæ.

1 *b*. Ventral valve of the same specimen, the striæ being regular and uniform in size.

1 *c*. A smaller specimen, presenting a greater extension of the cardinal extremities, and an irregular alternation of the striæ upon the surface.

Fig. 2. 146. 9. LEPTÆNA SERICEA. (Pag. 110.)

2 *a*, *b*. The form and surface of the shell are perfectly preserved in this specimen, both valves of which have distinct larger striæ alternating with several smaller ones.

2 *c*, *d*. The opposite valves of another specimen, showing the equal striæ and a few concentric lines of growth.

2 *e*. Interior of the ventral valve, showing two winglike papillose callosities for the visceral attachment.

2 *f*, shows a variation from the preceding internal structure.

2 *g*. Interior of the convex valve, showing the visceral impression, margined by a sharp elevated ridge.

2 *h*. View of the cardinal area of the convex valve, showing the deltoid aperture which is partially closed.

Fig. 3. 147. 10. LEPTÆNA FILITEXTA. (Pag. 111.)

3 *a*. Ventral valve of a large specimen. 3 *b*. Cardinal area. 3 *c*. Interior of the dorsal valve.

3 *d*. Dorsal valve of a smaller specimen. 3 *e*. Cardinal view of the same.

3 *f*. An enlarged portion of the surface, showing the textile character.

Fig. 4. 148. 11. LEPTÆNA PLANUMBONA. (Pag. 112.)

4 *a* & *b*. Views of the two valves; the ventral one *b* showing some strong imbricating lines of growth.

4 *c*. Cardinal view, showing the nearly linear area and closed foramen.

4 *d*. Interior of the concave valve. 4 *e*. Lateral view of the shell.

Fig. 5. 149. 12. LEPTÆNA DEFLECTA. (Pag. 113.)

5 *a*. Dorsal valve of the specimen. 5 *b*. Cardinal area of the same.

Fig. 6. 150. 13. LEPTÆNA RECTA. (Pag. 113.)

6 *a*. View of the ventral valve. 6 *b*. Cardinal view of the same shell.

Fig. 7. 151. 14. LEPTÆNA PLANOCONVEXA. (Pag. 114.)

7 *a*. View of the dorsal valve, with one of the cardinal extremities produced beyond the other.

7 *b*. A smaller specimen. 7 *c*. Profile view of the shell. 7 *d*. Cardinal view of the first specimen.

Fig. 8. 152. 15. LEPTÆNA TENUILINEATA. (Pag. 115.)

Fig. 9. 153. 16. LEPTÆNA SUBTENTA. (Pag. 115.)

9 *a*. View of the dorsal valve. 9 *b*. Interior of the hinge margin.

Fig. 10. 154. 17. LEPTÆNA (*Species undetermined*). (Pag. 116.)

10 *a*. Ventral valve, showing the equal radiating striæ. 10 *b*. Dorsal valve, with unequal striæ.

10 *c*. Cardinal area, and the same enlarged, showing the open foramen and imperforate beak.

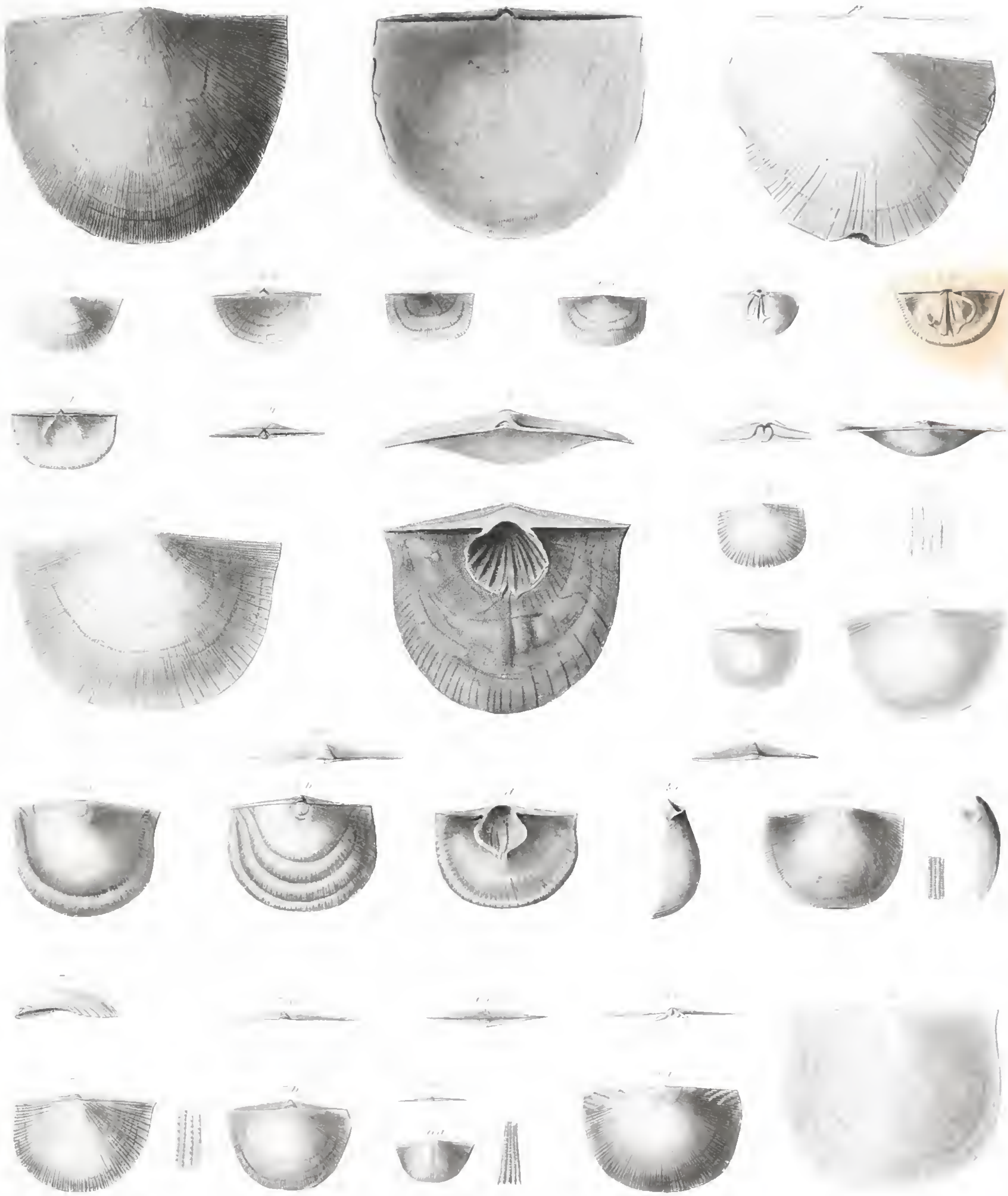

PLATE 32.

Fig. 1. 155. 2. ORTHIS TESTUDINARIA. (Pag. 117.)

1 *a.* Ventral valve. 1 *b.* Profile view of the shell. 1 *c.* Dorsal valve. 1 *d.* Cardinal view of shell. 1 *e.* A smaller specimen. 1 *f.* Interior of the dorsal valve. 1 *g.* Interior of the ventral valve. 1 *h.* Cast of the dorsal valve. 1 *i*, *k*, *l.* The same species from the Blue limestone of Ohio.

Fig. 2. 156. 3. ORTHIS SUBÆQUATA. (Pag. 118.)

2 *a.* Ventral valve. 2 *b.* Dorsal valve. 2 *c.* Profile view. 2 *d.* Cardinal view. 2 *e*, *f.* Figures of a smaller specimen; the ventral valve being less convex than in the older specimen.

Fig. 3. 157. 4. ORTHIS BELLARUGOSA. (Pag. 118.)

3 *a.* Ventral valve. 3 *b.* Dorsal valve. 3 *c.* Profile view. 3 *d.* Cardinal view. 3 *e.* An enlarged portion of the surface, showing the imbricating squamose lamellæ.

Fig. 4. 158. 5. ORTHIS DISPARILIS. (Pag. 119.)

4 *a.* Ventral valve. 4 *b.* Dorsal valve. 4 *c.* Profile view. 4 *d.* Cardinal area and foramen.

Fig. 5. 159. 6. ORTHIS PERVETA. (Pag. 120.)

5 *a.* Ventral valve. 5 *b.* Cardinal view. 5 *c.* Profile view. 5 *d.* Cardinal view magnified.

Fig. 6. 160. 7. ORTHIS ÆQUIVALVIS. (Pag. 120.)

6 *a.* Ventral valve. 6 *b.* Dorsal valve. 6 *c.* Cardinal view, showing the equality of the valves.

Fig. 7. 161. 8. ORTHIS FISSICOSTA. (Pag. 121.)

7 *a.* Ventral valve. 7 *b.* Profile view, showing the projecting beak of the dorsal valve.

Fig. 8. 162. 9. ORTHIS TRICENARIA. (Pag. 121.)

8 *a.* Ventral valve and area. 8 *b.* Interior of the dorsal valve. 8 *c.* Exterior of the dorsal valve. 8 *d.* Interior of the ventral valve. 8 *e.* Profile view of a perfect specimen.

Fig. 9. 163. 10. ORTHIS PLICATELLA. (Pag. 122.)

9 *a*, *b*, *c.* Ventral valves. 9 *d.* Profile view of the last. 9 *e.* Cardinal view of the same. 9 *f.* Ventral valve of a large specimen. 9 *g.* Profile view of the same.

Fig. 10. 164. 11. ORTHIS PECTINELLA. (Pag. 123.)

10. A small individual. 10 *a.* Ventral or convex valve. 10 *b.* Dorsal valve of the same specimen. 10 *c.* Cardinal view of another specimen. 10 *d.* Ventral valve. 10 *e.* Interior of the ventral valve.

Fig. 11. 165. 12. ORTHIS PECTINELLA, *var.* SEMIOVALIS. (Pag. 124.)

11. A large specimen, somewhat imperfect. 11 *a*, *b.* Dorsal and ventral valve of a smaller individual.

Fig. 12. 166. 13. ORTHIS INSCULPTA. (Pag. 125.)

12 *a.* Dorsal valve, the beak imperfect. 12 *b.* Interior of the dorsal valve. 12 *c.* Dorsal area.

Fig. 13. 167. 14. ORTHIS DICHOTOMA. (Pag. 125.)

13 *a.* Ventral valve, showing the projecting dorsal beak. 13 *b.* Profile view of the same.

BRACHIOPODA.

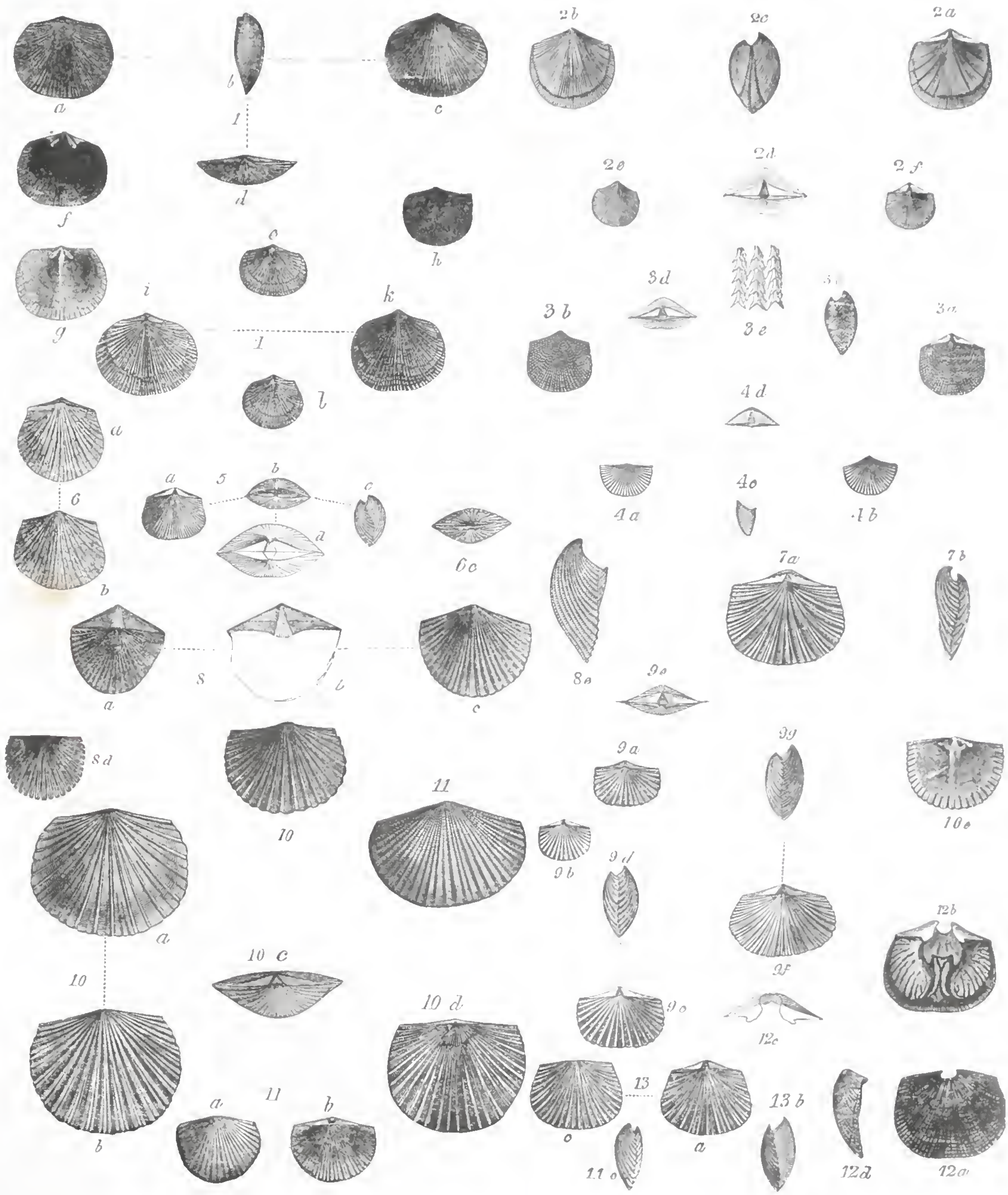

PLATE 32 A.

Fig. 1. 168. 15. ORTHIS SUBQUADRATA. (Pag. 126.)

1 *a*, *b*, *c*. Three views of the dorsal valve, showing gradation in the size of the shell.

1 *d*, *e*. Profile views, showing the nearly equal elevation of the beaks.

1 *f*, *g*. Front views, showing the slight elevation produced by the sinus in the ventral valve.

1 *h*, *i*. Ventral valves, showing the slight depression along the centre of the shell.

1 *k*. Cardinal view, showing the area, foramen, etc.

1 *l*. Exterior of a large dorsal valve somewhat flattened from compression.

1 *m*. Interior of the same, showing the form of the visceral impression and the marks of the external radii, which terminate near the margin.

1 *n*. Dorsal area and foramen.

1 *o*. Interior of the ventral valve, showing the narrow area and foramen, with the projecting medial tooth, which is enlarged in the upper figure. The impressions of the external radii are visible but a short distance from the margin on the inside of the shell.

Fig. 2. 169. 16. ORTHIS OCCIDENTALIS. (Pag. 127.)

2 *a* – *f*, are illustrations of a series of this species, beginning with the smallest recognized specimens, and passing through the several grades, till the increasing rotundity of the ventral valve towards the umbo rises above the beak of the dorsal valve.

2 *g*, *h*. Profile views of several specimens as above.

2 *i*, *k*, *l*, *m*. Front views, showing the increasing sinus of the dorsal valve as the shell becomes older.

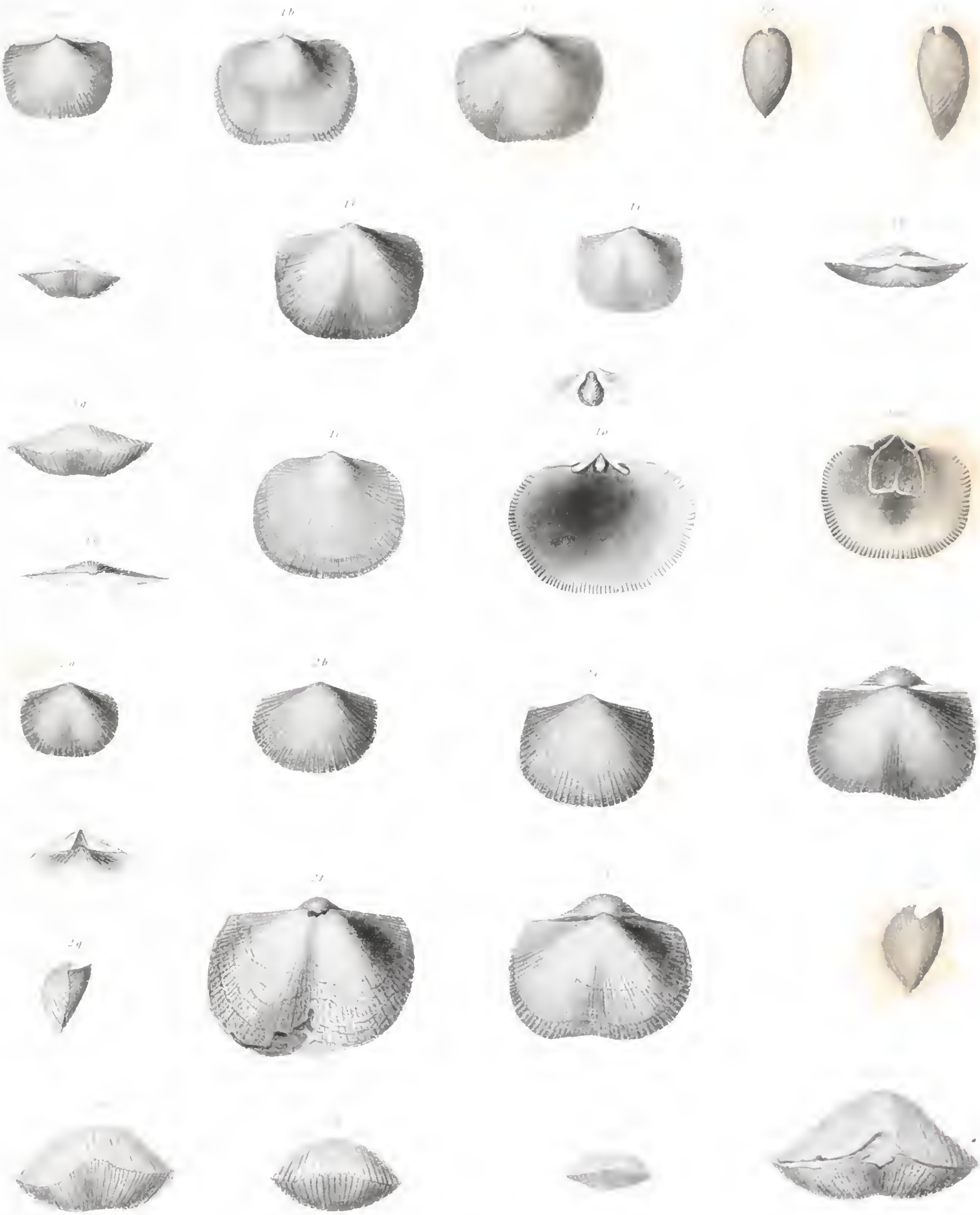

PLATE 32 B.

Fig. 1. 169. 16. Orthis occidentalis. (Pag. 127.)

1 *a*, *b*. Cardinal views of a young and old specimen of this species.

1 *c*. Ventral valve of an imperfect specimen, partially showing the interior of the dorsal valve, which is strongly marked by the external radii.

1 *d*. Profile view of a large specimen. 1 *e*, *f*, *g*. Views of ventral valves.

1 *h*, *i*. Interior of ventral valves, showing the medial tooth and the marks of the external radii.

Fig. 2. 170. 17. Orthis sinuata. (Pag. 128.)

2 *a*, *b*, *c*, *d*, *e*. A series of specimens, illustrating the variations produced by age.

2 *f*, *g*, *h*. Profile views of specimens of different ages, showing the gradual increasing rotundity of the ventral valve, and also the more acute beak of the dorsal valve as compared to the last.

2 *i*, *k*. Front views of young and old specimens.

(BRACHIOPODA.)

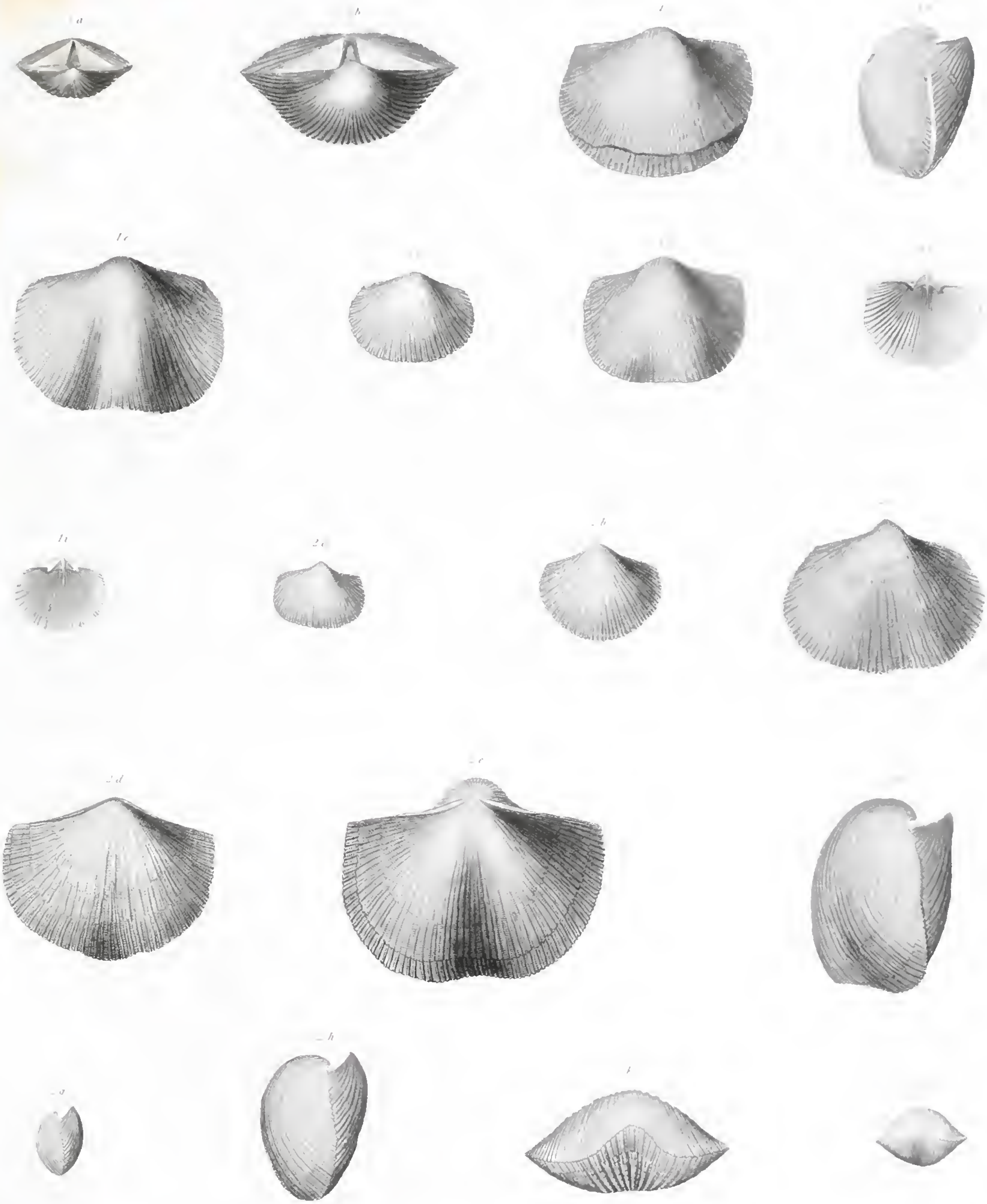

PLATE 32 C.

Fig. 1. 171. 18. Orthis subjugata. (Pag. 129.)

1 *a*. Ventral valve of a young specimen. 1 *b*. Profile view of the same. 1 *c*. Front view of the same.

1 *d*. Dorsal valve of another specimen, with a deep sinus. 1 *e*. Front view of the same.

1 *f*. Dorsal valve of an older specimen, showing the gibbous ventral valve projecting beyond the cardinal line.

1 *g*. Front view of the same.

1 *h*. Dorsal valve of an old individual.

1 *i*. Front view of the same, showing the deep sinus of the dorsal valve, and the corresponding elevation on the opposite valve.

1 *k*, *m*. Cardinal views of young and old individuals. 1 *n*. View of the ventral valve.

Fig. 2. 170. 17. Orthis sinuata. (Pag. 128.)

2 *l*, *m*. Cardinal views of young and old specimens.

2 *n*, *o*. Ventral valves of a young and old specimen.

2 *p*. Interior of the dorsal valve, showing the form of the visceral impression, and the radii near the margin.

2 *q*, *r*. The two lower figures show a slight difference in the character of the visceral impression.

2 *s*. Interior of the ventral valve, showing the medial tooth, which is thicker and stronger than in the last species, and is connected with a strong medial ridge which is trifid below.

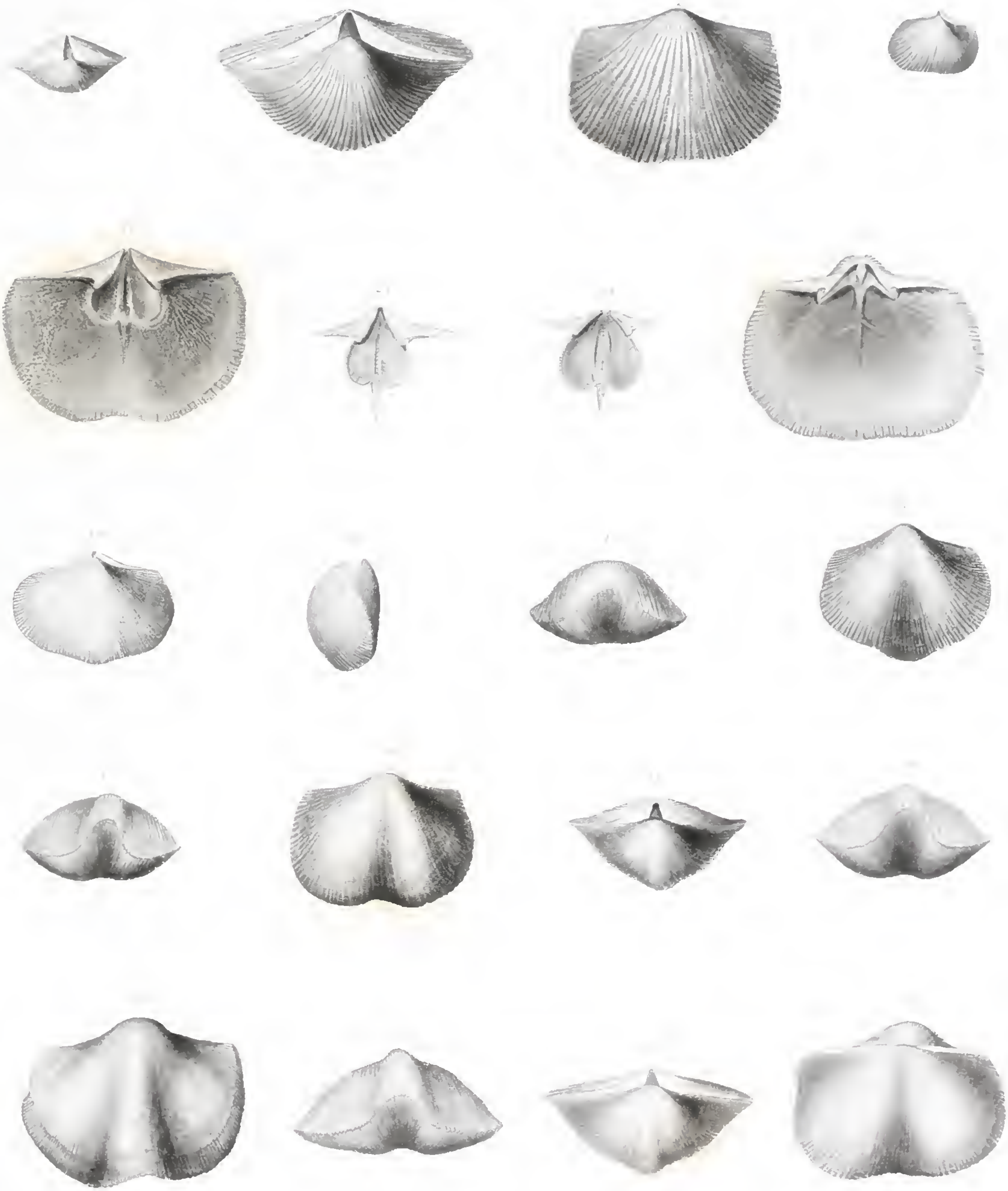

PLATE 32 D.

Fig. 1. 172. 1. DELTHYRIS LYNX. (Pag. 133.)

1 *a*, *b*, *c*, *d*. A series of specimens, showing the gradations in size, and the increase in number of plications as the shell becomes older. The smaller specimen 1 *a* has three plaits in the sinus and four on the mesial lobe, with seven on each side, thus : $7\ \frac{4}{3}\ 7$. In 1 *b*, there is the partial development of a fourth plication in the sinus, and a fifth on the mesial lobe, though there is no increase in the number of lateral ones. In *c* and *d*, there is a full development of the $\frac{6}{5}$ medial plications, and 10 lateral ones.

1 *e* and *f*, are front views of *a* and *d*. 1 *g*. Profile view of *d*.

1 *h*. Ventral valve of another form, showing extended beaks. Medial plications $\frac{4}{3}$; lateral ones 13 on each side.

1 *i*. Front view of the same.

1 *k*, *l*, *m*, *o*, *q*, *s*, *u*. A series of western specimens, with the mesial and lateral plications ($7\ \frac{4}{3}\ 7$); showing no tendency to increase of either number, though the size of the shell increases as in the previous series. Figures 1 *m*, *q* and *s*, show the cardinal extremities more extended and acute than in the other forms ; while the specimens *o* and *u* have the cardinal extremities shorter, scarcely equalling the width of the shell.

1 *n*, *p*, *r*, *t*, are front views of 1 *m*, *o*, *q*, *u*, respectively.

1 A, B. Cardinal and profile views of an extremely globose specimen, having the cardinal line much less than the width of the shell, and the extremities rounded : the area is broad, and very well defined. The plications are $7\ \frac{}{3}\ 7$.

1 C. Dorsal valve of a specimen, having the cardinal line extended beyond the width of the shell, and terminating in short acute ears.

1 D. Front view of the last, showing the plications, which are $10\ \frac{5}{4}\ 10$.

1 E. Profile view of the same.

1 F. Cardinal view of another specimen, with the extremities extending beyond the greatest width of the shell below.

1 G & H. Front view and profile of a specimen similar in form to 1 B, but having the plications $10\ \frac{4}{2}\ 10$. The cardinal line is less than the width of the shell.

1 I, K. Front view and ventral valve of a cuboidal specimen, showing some irregularity in the development of the plications ; a single one on the sinus and two on the medial lobe being fully developed, with smaller ones on each side, while the lateral plications are six and seven.

The following present some deviations from the prevailing forms, and approach to the *Spirifer dentatus* of DE VERNEUIL :

1 L, M, N. Ventral, dorsal, and profile view of a small specimen, with the plications arranged thus : $5\ \frac{4}{3}\ 5$.

1 O, P, Q. Ventral, front, and profile view, having the same form and proportions as the last, but having an additional plication upon each side.

1 R, S, T, U. Ventral valve, front, cardinal, and profile views of the same specimen, which is remarkably extended on the hinge. This specimen has a single fully developed plication in the sinus and two on the mesial lobe, with the rudiment of another on each side of the sinus and of the mesial lobe, while the lateral plications are ten on each side.

BRACHIOPODA

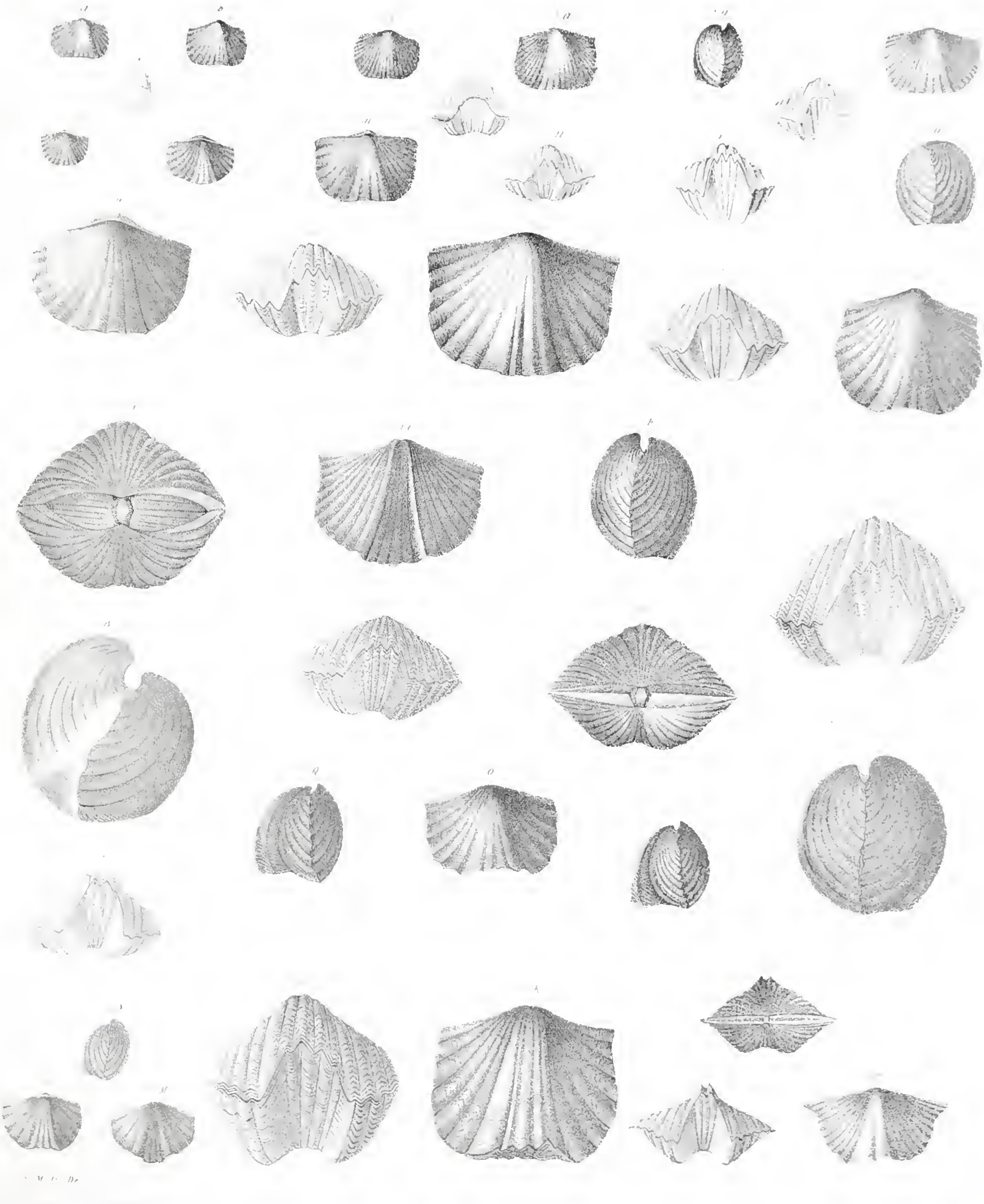

PLATE 33.

Fig. 1. 173. 6. Atrypa extans. (Pag. 137.)
1 *a.* Dorsal valve. 1 *b.* Ventral valve.

Fig. 2. 174. 7. Atrypa nucleus. (Pag. 138.)
2 *a.* Ventral valve. 2 *b.* Dorsal valve. 2 *c.* Profile view.

Fig. 3. 176. 9. Atrypa bisulcata. (Pag. 139.)
3 *a.* Dorsal valve. 3 *b.* Ventral valve. 3 *c.* Cardinal view. 3 *d.* Enlarged profile view. 3 *e.* Front view.

Fig. 4. 177. 10. Atrypa deflecta. (Pag. 140.)
4 *a.* View of dorsal valve. 4 *b.* Front view, showing the form of the two valves.

Fig. 5. 178. 11. Atrypa recurvirostra. (Pag. 140.)
5 *a.* Dorsal valve. 5 *b.* Profile view. 5 *c.* Cardinal view. 5 *d.* Ventral valve separated from the dorsal.

Fig. 6. 179. 12. Atrypa exigua. (Pag. 141.)
6 *a.* Ventral valve. 6 *b.* Dorsal valve. 6 *c.* Cardinal view. 6 *d.* Dorsal valve of a small and large individual.

Fig. 7. 181. 14. Atrypa circulus. (Pag. 142.)
7 *a.* Dorsal valve. 7 *b.* Cardinal view. 7 *c.* Profile view.

Fig. 8, 9. 182. 15. Atrypa ambigua. (Pag. 143.)
8 *a* & *b.* Usual form of the shell. 8 *c.* Front view in outline, showing two incipient plications in the sinus.
9. Four valves represented precisely as they occur on the surface of a slab of limestone.

Fig. 10. 183. 16. Atrypa hemiplicata. (Pag. 144.)
10 *a.* Dorsal valve of a specimen of the ordinary size. 10 *b.* Profile view. 10 *c.* Front view.
10 *d.* Dorsal valve and front view of a young specimen.
10 *e.* Ventral valve of a large specimen. 10 *f.* Front view of the same.

Fig. 11. 184. 17. Atrypa (perhaps the young of *A. extans*). (Pag. 145.)
11 *a*, *b.* Ventral and dorsal valves. 11 *c.* Front view, the dorsal valve below. 11 *d.* Profile view.

Fig. 12. 185. 18. Atrypa subtrigonalis. (Pag. 145.)
12 *a.* Ventral valve. 12 *b.* Profile view. 12 *c.* Front, with the dorsal valve below.

Fig. 13. 186. 19. Atrypa increbescens. (Pag. 146.)
13 *a*, *b.* Ventral valve and front view.
13 *c*, *d.* Ventral valve and profile view.
13 *e*, *f.* Ventral valve and profile view of a more gibbous form.
13 *g*, *h*, *i.* Front, profile, and ventral valve of a larger and more rotund specimen.
13 *k.* A small specimen of the western type.
13 *l*, *m*, *n*, *o.* Ventral valves and front views of two larger individuals.
13 *p*, *r*, *s.* Ventral valve, profile and front view of a larger specimen.
13 *t*, *u.* Profile and front view of a gibbous specimen.
13 *w.* Profile view of a very gibbous specimen.
13 *x*, *y.* Front and cardinal view of the same.

Fig. 14. 187. 20. Atrypa dentata. (Pag. 148.)
14 *a.* Dorsal valve. 14 *b.* Front view of the same, the dorsal valve below. 14 *c.* Profile view.

Fig. 15. 180. 13. Atrypa modesta. (Pag. 141.)
The two upper figures are of the dorsal and ventral valve of a specimen above the common size; the lower figure is of a small specimen, having the same characters.

Fig. 16. 188. 21. Atrypa sordida. (Pag. 148.)

TRENTON LIMESTONE.

(BRACHIOPODA.)

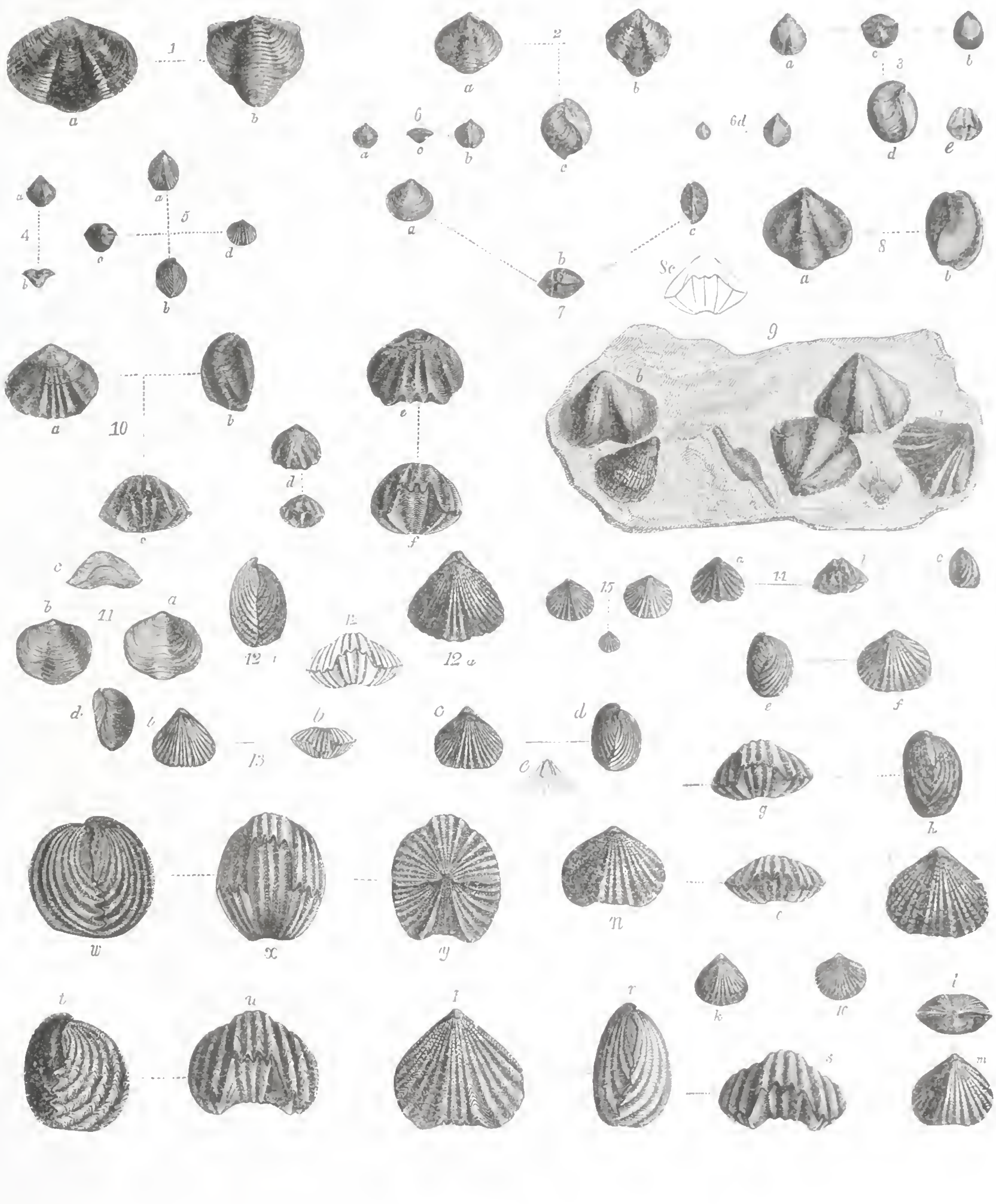

PLATE 34.

Fig. 1. 189. 1. NUCULA LEVATA. (Pag. 150.)

1 *a*, *b*. Left valve and posterior view of a specimen of the prevailing form in New-York. The muscular impressions † † are distinctly visible.

1 *c*, *d*. Similar views of a large shell, slightly varying in its proportions.

1 *e*. Left valve of a very gibbous specimen, in which the posterior side is less extended.

1 *f*. A specimen less elevated, and approaching the western forms.

1 *g*. Cast of a western specimen, showing more distinctly the muscular impressions † †.

1 *h*. Cardinal view of the same, showing the crenulations of the hinge, and the same enlarged.

1 *i*. A small specimen of the same, with the shell showing faint concentric lines.

1 *k*. Cardinal view of a gibbous specimen.

Fig. 2. 190. 2. NUCULA POSTSTRIATA. (Pag. 151.)

2 *a*. Right valve of this species. 2 *b*. Cardinal view of the same specimen.

Fig. 3. 191. 1. TELLINOMYA NASUTA. (Pag. 152.)

3 *a*. Right valve of a specimen on which the shell is preserved.

3 *b*. Similar view of a cast, showing the muscular impression *a*. 3 *c*. Dorsal view of the same.

Fig. 4. 192. 2. TELLINOMYA SANGUINOLAROIDEA. (Pag. 152.)

4 *a*. Right valve, showing the posterior muscular impression *a*. 4 *b*. Cardinal view of the same specimen.

Fig. 5. 193. 3. TELLINOMYA GIBBOSA. (Pag. 153.)

5 *a*. Right valve of this species. 5 *b*. Dorsal valve.

Fig. 6. 194. 4. TELLINOMYA DUBIA. (Pag. 153.)

6 *a*. Cardinal view of the two valves in connection. 6 *b*. Left valve of the same, slightly contracted behind.

6 *c*. A separate valve, in which the posterior contraction is scarcely perceptible.

6 *d*. Left valve of a specimen, in which the posterior side is much contracted.

6 *e*, *f*. Separate valve of an old shell, with a view of the dorsal margin.

Fig. 7. 195. 5. TELLINOMYA ANATINIFORMIS. (Pag. 154.)

Fig. 8. 196. 1. CARDIOMORPHA VETUSTA. (Pag. 154.)

Fig. 9. 198. 2. EDMONDIA SUBTRUNCATA. (Pag. 156.)

Fig. 10. 209. 10. MODIOLOPSIS? TRENTONENSIS. (Pag. 161.)

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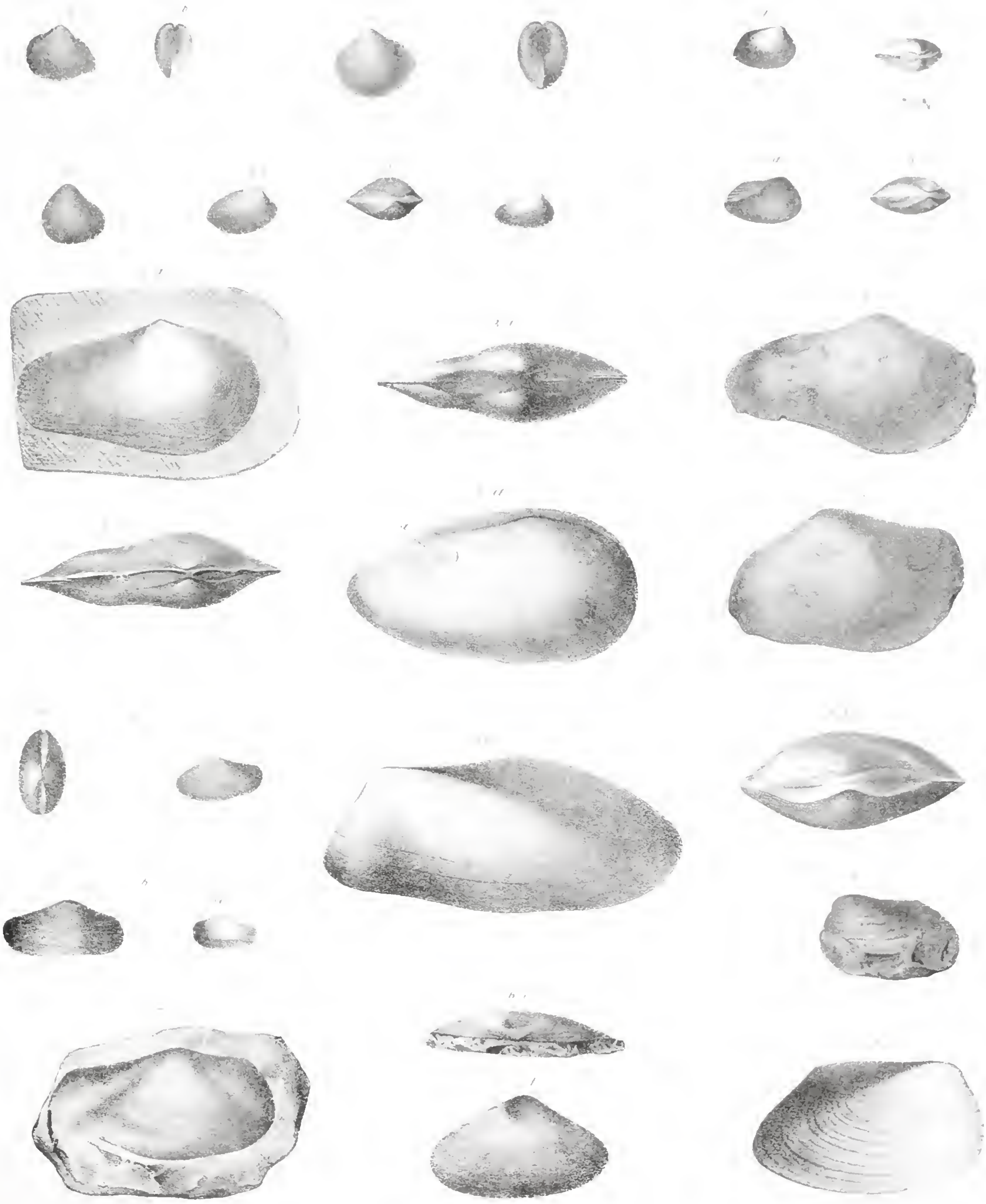

PLATE 35.

Fig. 1. 197. 1. EDMONDIA VENTRICOSA. (Pag. 155.)

1 *a*. Right valve of a large and perfect specimen. 1 *b*. Anterior extremity of the same. 1 *c*. Dorsal view.
1 *d*. Left valve of a smaller individual.
1 *e*. Left valve of a specimen which has been compressed vertically. 1 *f*. Dorsal view of the same.

Fig. 2. 199. 3. EDMONDIA? SUBANGULATA. (Pag. 156.)

2 *a*. Left valve of this species. 2 *b*. Dorsal view of a single valve.

Fig 3. 198. 2. EDMONDIA SUBTRUNCATA. (Pag. 156.)

3 *a*, *b*. Casts of this species, in the crystalline limestone at Watertown.
3 *c*. A cast, showing strong imbricating ridges towards the base.

Fig. 4. 200. 1. MODIOLOPSIS MYTILOIDES. (Pag. 157.)

4 *a*. Right valve of a specimen, showing the muscular impression. 4 *b*. Dorsal view.

Fig. 5. 201. 2. MODIOLOPSIS PARALLELA. (Pag. 158.)

Fig. 6. 202. 3. MODIOLOPSIS FABA. (Pag. 158.)

6 *a*. A large and characteristic form, the muscular impression visible at the anterior extremity.
6 *b*. A smaller specimen, less regularly rounded.
6 *c*. A specimen having a more oblique form, with the anterior lobe more compressed and extended.
6 *d*. A young specimen, having the umbones and sinus nearly central.

Fig. 7. 203. 4. MODIOLOPSIS NASUTUS. (Pag. 159.)

Fig. 8. 204. 5. MODIOLOPSIS ARCUATUS. (Pag. 159.)

Fig. 9. 205. 6. MODIOLOPSIS SUBSPATULATUS. (Pag. 159.)

9 *a*. View of the right valve of this species. 9 *b*. Dorsal view of the same.

Fig. 10. 206. 7. MODIOLOPSIS LATUS. (Pag. 160.)

10 *a*, *b*. The left valves of two specimens, showing a slight variation in form.

Fig. 11. 207. 8. MODIOLOPSIS CARINATUS. (Pag. 160.)

11 *a*. A large specimen, with prominent umbones.
11 *b*. A smaller specimen, showing the true form of the shell more distinctly than the last.
11 *c*. A smaller specimen, in which the posterior margin is less oblique.

ACEPHALA

PLATE 36.

Fig. 1. 208. 9. MODIOLOPSIS AVICULOIDES. (Pag. 161.)

1 *a*. A view of the left valve of this specimen. 1 *b*. Dorsal view of the same.

Fig. 2. 210. 1. AVICULA TRENTONENSIS. (Pag. 161.)

2 *a*. A worn specimen, showing only obscure traces of the radii, with strong concentric ridges.
2 *b*. A similar specimen, with obscure radii, having the anterior wing more extended.
2 *c*. The opposite valve of a specimen of similar form as the last.
2 *d*. A large specimen of the left valve, with strong radii.

Fig. 3. 211. 2. AVICULA ELLIPTICA. (Pag. 162.)

Fig. 4. 212. 1. AMBONYCHIA BELLISTRIATA. (Pag. 163.)

4 *a*. Left valve of a very symmetrical specimen.
4 *b*. Right valve of a larger specimen. 4 *c*. Profile view of the same. The specimen appears to be inequivalve, which is due to the sliding down of one valve below the other, as is clearly shown in the lower part of the figure, and in 4 *b*.
4 *d*. A portion of the surface enlarged, showing the fine undulating striæ, crossed by the concentric lines of growth.

Fig. 5. 213. 2. AMBONYCHIA ORBICULARIS. (Pag. 164.)

5 *a*. Right valve of a specimen, showing the muscular impression.
5 *b*. Left valve, retaining a portion of the shell, which is beautifully ornamented by radiating and concentric striæ.
5 *c*. Anterior profile view of a single valve. 6 *d*. A portion of the shell enlarged.

Fig. 6. 214. 3. AMBONYCHIA AMYGDALINA. (Pag. 165.)

6 *a*. Right valve of this specimen. 6 *b*. Profile from the posterior side.
6 *c*. Profile of the anterior extremity, showing a kind of lunule below the beaks.

Fig. 7. 215. 4. AMBONYCHIA UNDATA. (Pag. 165.)

7 *a*. Right valve of a specimen which is imperfect on the lower side.
7 *b*. Profile of the same, looking upon the posterior side.

Fig. 8. 216. 5. AMBONYCHIA OBTUSA. (Pag. 167.)

8 *a*. Right valve of this species. 8 *b*. Profile view from the posterior side.

Fig. 9. 217. 6. AMBONYCHIA? (Pag. 167.)

9 *a*, *b*. View of the single valve, and profile of the same.

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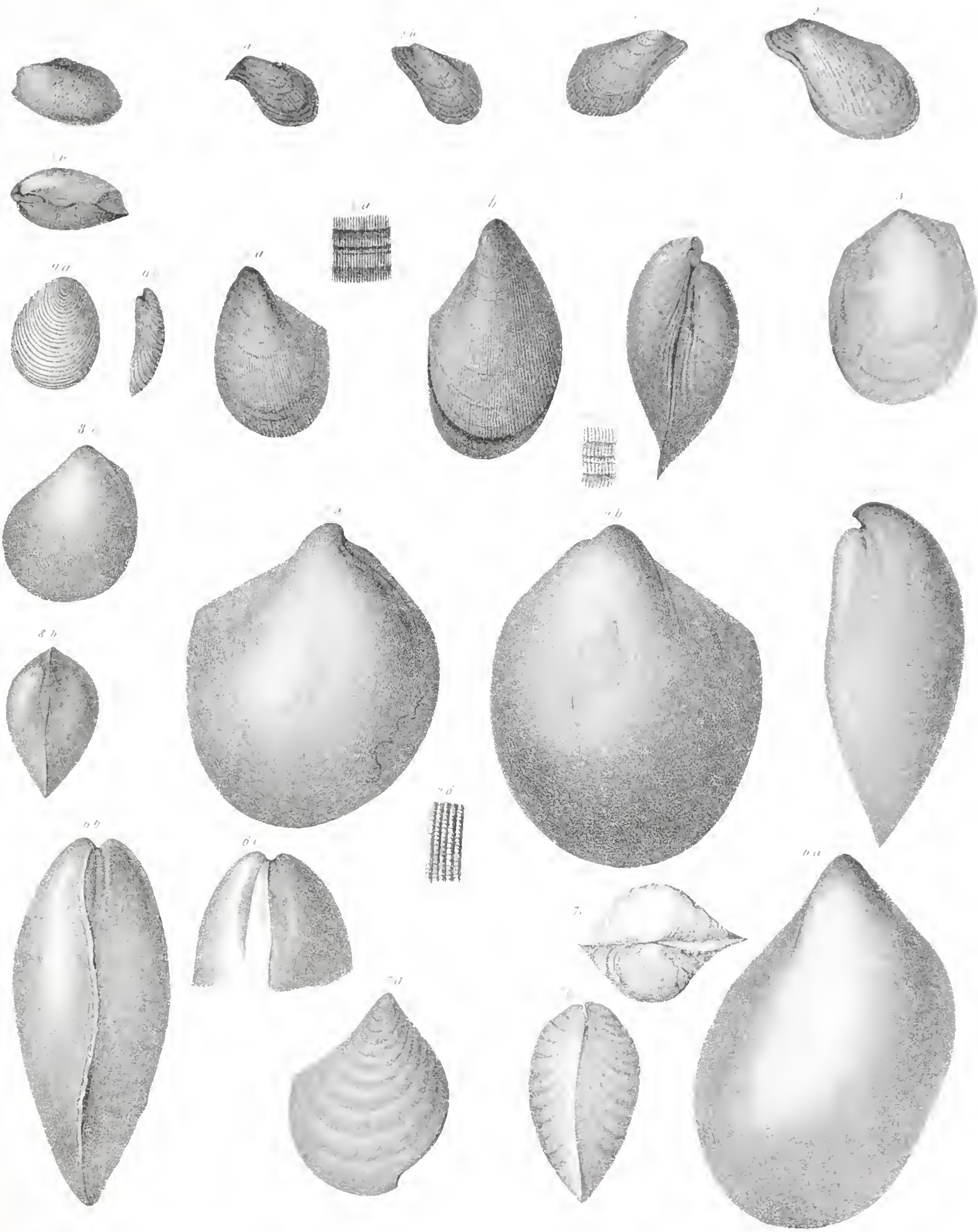


PLATE 37.

Fig. 1. 218. 1. Holopea symmetrica. (Pag. 170.)

Fig. 2. 219. 2. Holopea obliqua. (Pag. 170.)

2 *a*. View of the aperture of a small specimen. 2 *b*. View of the back of the shell. 2 *c*. Profile view.
2 *d*. Back of a larger specimen.

Fig. 3. 220. 3. Holopea paludiniformis. (Pag. 171.)

3 *a*. View of the back of the shell. 3 *b*. View of the aperture.

Fig. 4. 221. 4. Holopea ventricosa. (Pag. 171.)

4 *a*. View of the back of the spire. 4 *b*. View of the top of the spire.

Fig. 5. 222. 10. Pleurotomaria subtilistriata. (Pag. 172.)

5 *a*. View of the spire of a large specimen. 5 *b*. Profile of the same.
5 *c*, *d*. View of the spire and profile of the largest specimen seen.

Fig. 6. 223. 11. Pleurotomaria lenticularis. (Pag. 172.)

6 *a*. View of the spire (the specimen is a cast). 6 *b*. Lateral view, showing the elevation of the spire.
6 *c*. Base of a smaller specimen (a cast), showing the umbilicus. 6 *d*. Front view, showing the aperture.

Fig. 7. 224. 12. Pleurotomaria rotuloides. (Pag. 173.)

7 *a*. View of the aperture and front of the shell, showing the elevation of the spire.
7 *b*. View of the top of the spire. 7 *c*. View of the base, showing the umbilicus.

Fig. 8. 225. 13. Pleurotomaria subconica. (Pag. 174.)

8 *a*. Front view of a specimen preserving the shell in a very perfect manner; the aperture imperfect.
8 *b*. Base of the same, showing the small partially closed umbilicus.
8 *c*. An enlarged portion of the surface, showing the cancellated striæ which are scarcely visible to the naked eye.
8 *d*. Cast of another specimen. 8 *e*. Front view of the same, showing the form of the aperture.

PLATE 38.

Fig. 1. 74. 7. Pleurotomaria umbilicata. (Pag. 175.)

1 *a*. Back of the shell, showing an elevated spire. 1 *b*. Front view, showing the aperture. 1 *c*. Base.
1 *d*. Top of the spire of a larger specimen. 1 *e*. Front view, showing a depressed spire. 1 *f*. Base.
1 *g*. Specimen from Mineral Point, showing a greater elevation of the spire.

Fig. 2. 226. 14. Pleurotomaria indenta. (Pag. 176.)

Fig. 3. 227. 15. Pleurotomaria ambigua. (Pag. 176.)

3 *a*. View of the back of the spire. 3 *b*. Front of the same, showing the aperture.

Fig. 4. 228. 16. Pleurotomaria percarinata. (Pag. 177.)

Fig. 5. 229. 6. Murchisonia bicincta. (Pag. 177.)

5 *a*. Front view of a nearly perfect specimen, showing the form of the aperture. 5 *b*. Back view.
5 *c*. Front view of a specimen with the last volution broken off behind the aperture.
5 *d*. View of an imperfect specimen, showing the direction of the striæ. 5 *e*. Enlarged view of the same.
5 *f*. A smooth cast from crystalline limestone, scarcely preserving the upper carination in an obscure angle.
5 *g*. A large imperfect specimen, still preserving the striæ upon the surface.
5 *h*. A portion of the same enlarged.

Fig. 6. 230. 7. Murchisonia tricarinata. (Pag. 178.)

6 *a*. View of the back of the shell.
6 *b*. Front view, showing the aperture, which is imperfect on the outer side.
6 *c*. A fragment apparently belonging to the same species; but the striæ are much better preserved, and the carinæ sharply projecting.

Fig. 7. 231. 8. Murchisonia perangulata. (Pag. 179.)

7 *a*. Back of the spire, showing six volutions. 7 *b*. A portion of the surface, with the striæ enlarged.

Fig. 8. 232. 9. Murchisonia uniangulata. (Pag. 179.)

(GASTROPODA)

ON STONE BY SWINTON

PLATE 39.

Fig. 1. 233. 10. MURCHISONIA BELLICINCTA. (Pag. 179.)

1 *a*. A small imperfect specimen, preserving the striæ and mesial band in a very perfect manner.
1 *b*. A specimen with the striæ partially removed, showing the extension of the aperture below.
1 *c*. A cast, showing the form of the aperture, which is nearly entire.
1 *d*. A fragment of a larger specimen, preserving the striæ and mesial band.
1 *e*. Cast of a large specimen, the lower volution broken off.

Fig. 2. 234. 11. MURCHISONIA SUBFUSIFORMIS. (Pag. 180.)

2 *a*. View of the back of the spire; the apex imperfect.
2 *b*. View, showing, imperfectly, the form of the aperture.
2 *c*. A large imperfect individual of this species.

Fig. 3. 235. 12. MURCHISONIA VITTATA. (Pag. 181.)

3 *a*. View of the back of the spire. 3 *b*. Partial front view, showing a part of the aperture.

Fig. 4. 236. 13. MURCHISONIA GRACILIS. (Pag. 181.)

4 *a*. Fragment showing six volutions.
4 *b*. Another fragment, showing one of the lower volutions partially covered by the shell.
4 *c*. A small fragment, on which the shell is partially preserved.

Fig. 5. 237. 1. SUBULITES ELONGATA. (Pag. 182.)

5 *a*. Imperfect cast of a large specimen, showing a part of the aperture.
5 *b*. A specimen preserving a portion of the shell, and showing the great length of the last volution and aperture.
5 *c*. A fragment preserving the shell, and showing more distinctly the banded suture

GASTROPODA

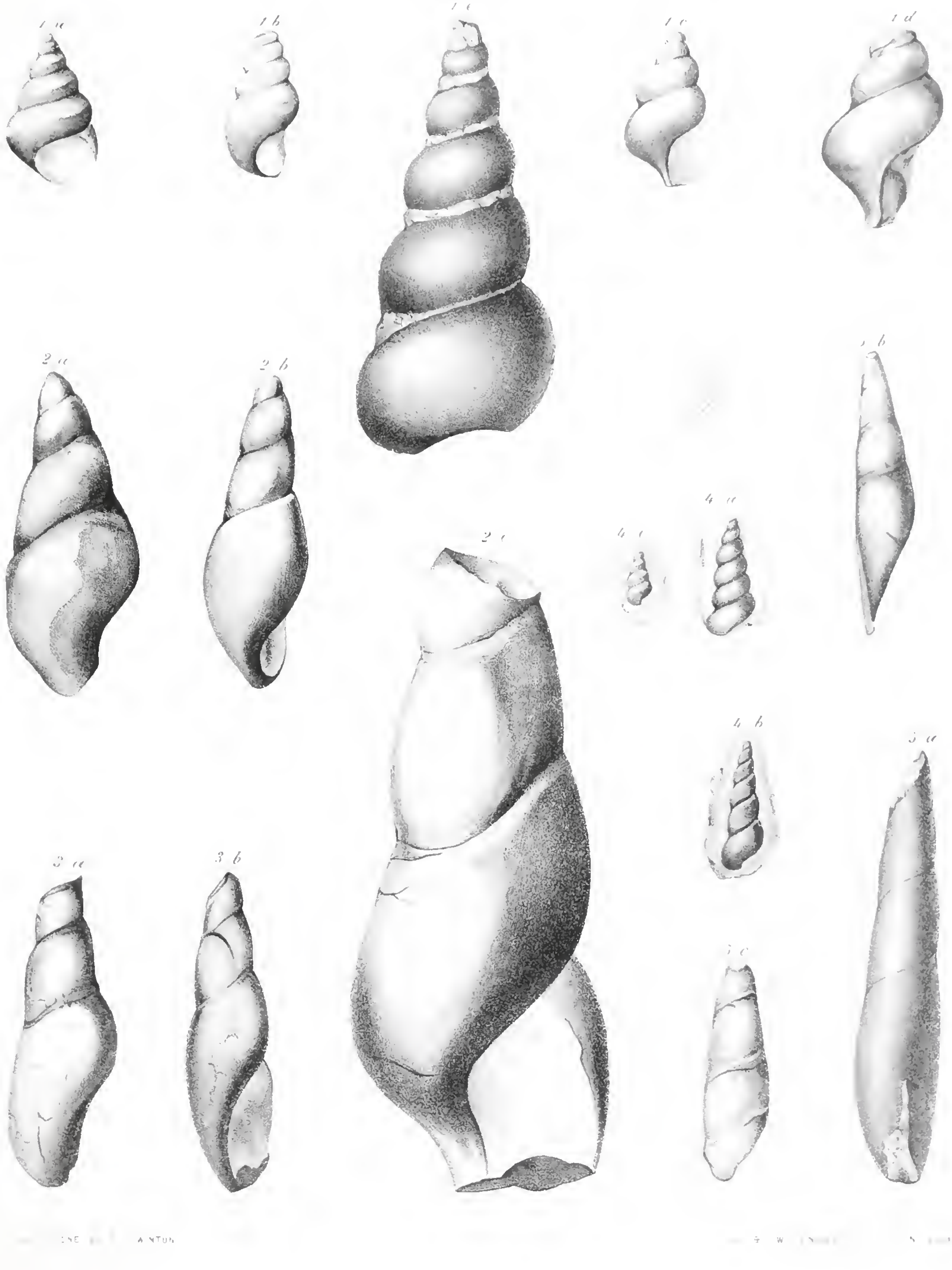


PLATE 40.

Fig. 1. 238. 1. CARINAROPSIS CARINATA. (Pag. 183.)

1 *a*, *b*. Lateral and dorsal views. 1 *c*. Lateral view of another specimen, showing a more elevated carina.

Fig. 2. 239. 2. CARINAROPSIS PATELLIFORMIS. (Pag. 183.)

2 *a*. Dorsal view. 2 *b*. Lateral view of the same specimen.

Fig. 3. 240. 1. BELLEROPHON BILOBATUS. (Pag. 184.)

3 *a*. Dorsal view, showing the sinus of the aperture.
3 *b*. Lateral view, showing the involution of the whorls.
3 *c*, *d*. Two views of a smaller specimen.

Fig. 4, 5. 241. 2. BELLEROPHON BILOBATUS, *var.* ACUTUS. (Pag. 185.)

4 *a*, *b*. Dorsal and lateral views of the specimen. 5 *a*, *b*. Another variety, apparently due to pressure.

Fig. 6. 242. 3. BELLEROPHON BILOBATUS, *var.* CORRUGATUS. (Pag. 185.)

6 *a*. A specimen which is in a stone with three others, only one of which shows a slight development of the dorsal folds. 6 *b*. A specimen less distinctly corrugated.

Fig. 7. 243. 3. BUCANIA EXPANSA. (Pag. 186.)

7 *a*. View of the back of the shell, showing the strong carina, expanded aperture, and sinus on the dorsal margin. 7 *b*. Lateral view of the same.
7 *c*. Transverse section of the last volution, below the aperture.
7 *d*, *e*. Lateral and front view of another specimen, from which the expanded portion of the aperture is broken off, and showing also a little deviation in form.

Fig. 8. 244. 4. BUCANIA BIDORSATA. (Pag. 186.)

8 *a*. Dorsal view of a small specimen, preserving a portion of the shell.
8 *b*. View of the aperture, which is very imperfect.
8 *c*. A fragment, showing the carinæ and dorsal band very distinctly. 8 *d*. The same enlarged.
8 *e*. Cast of a larger specimen, imperfect towards the aperture, and showing only the broad dorsal carina.
8 *f*. Lateral view of the same, showing the umbilicus.
8 *g*. Section of the last volution below the aperture.

GASTROPODA.

PLATE 40 A.

Fig. 1. 245. 5. Bucania punctifrons. (Pag. 187.)

1 *a*. Dorsal view of a small specimen. 1 *b*. Lateral view, showing the umbilicus.

1 *c*. Dorsal view of a larger specimen, showing the elevated carinal band, which does not rise above the surface on the lower part of the shell.

1 *d*. Lateral view of another specimen, showing the side of the shell, which is obtusely angular, with obscure longitudinal ridges.

1 *e*. A portion of the surface enlarged.

Fig. 2. 246. 1. Cyrtolites compressus. (Pag. 188.)

2 *a*. Lateral view of a specimen, having the sinuous lamellæ at the ordinary distance asunder.

2 *b*. Dorsal view of the same.

2 *c*. Lateral view of a specimen, where the elevated lamellæ are more distant.

2 *d*. Lateral view of another, showing the lamellæ closely arranged.

2 *e*. A cast, which is smooth, with the exception of the elevated carina.

2 *f*. A portion of the surface enlarged, showing the finer transverse and longitudinal striæ, and the subnodulose appearance of the surface.

Fig. 3. 247. 2. Cyrtolites trentonensis. (Pag. 189.)

3 *a*, *b*. View of the upper surface of two individuals. 3 *c*. Lower surface of the same. 3 *d*. Dorsal view.

Fig. 4. 249. 1. Trocholites ammonius. (Pag. 192.)

4 *a*. A small perfect specimen, showing the lamellose striæ in great perfection.

4 *b*. A large specimen, preserving the lamellose surface.

4 *c*. Dorsal view, showing the archings of the striæ upon the back.

4 *d*. A specimen denuded of the shell, showing the septa and deep outer chamber.

4 *e*. Section, showing the position of the siphuncle.

4 *f*, *g*. Lateral and dorsal view of a fragment of an inner volution, showing a slight undulation of the septa on the back.

4 *h*. Lateral view of a fragment partially denuded of the shell, showing only the oblique transverse ridges.

4 *i*. Dorsal view of the same, showing the arching of the striæ upon the back.

4 *k*. Section of the same, showing the position of the siphuncle.

PLATE 41.

Fig. 1. 247. 2. CYRTOLITES TRENTONENSIS. (Pag. 189.)

1 *a*. Lower surface of an imperfect specimen. 1 *b*. A portion of the surface striæ enlarged.

1 *c*. Section of the shell below the aperture; the upper surface of the figure being the dorsal margin.

Fig. 2. 250. 1. CYRTOCERAS LAMELLOSUM. (Pag. 193.)

2 *a*. Lateral view of the fragment. 2 *b*. Dorsal view of the same. 2 *c*. Magnified portion of the surface.

Fig. 3. 248. 3. CYRTOLITES FILOSUM. (Pag. 190.)

3 *a*. Lateral view of the specimen imbedded in stone, the apex being concealed.

3 *b*. View of the dorsal side of a small portion of the shell, showing the arched striæ.

Fig. 4, 5. 251. 2. CYRTOCERAS ANNULATUM. (Pag. 194.)

4 *a*. A large fragment (a cast), retaining the annulations.

4 *b*. A smaller fragment, retaining the shell and transverse striæ.

4 *c*. Section of the last, showing the siphuncle.

4 *d*. A portion of the surface magnified.

5. A fragment of the same species, nearer the aperture.

Fig. 6, 7. 257. 1. ONCOCERAS CONSTRICTUM. (Pag. 197.)

6 *a*. View of the ventral side of an imperfect specimen.

6 *b*. Lateral view of the same, showing the sudden contraction below the outer chamber : aperture imperfect

6 *c*. Section of the lower extremity, showing the small dorsal siphuncle.

6 *d*. A smaller specimen, of the same form as the last.

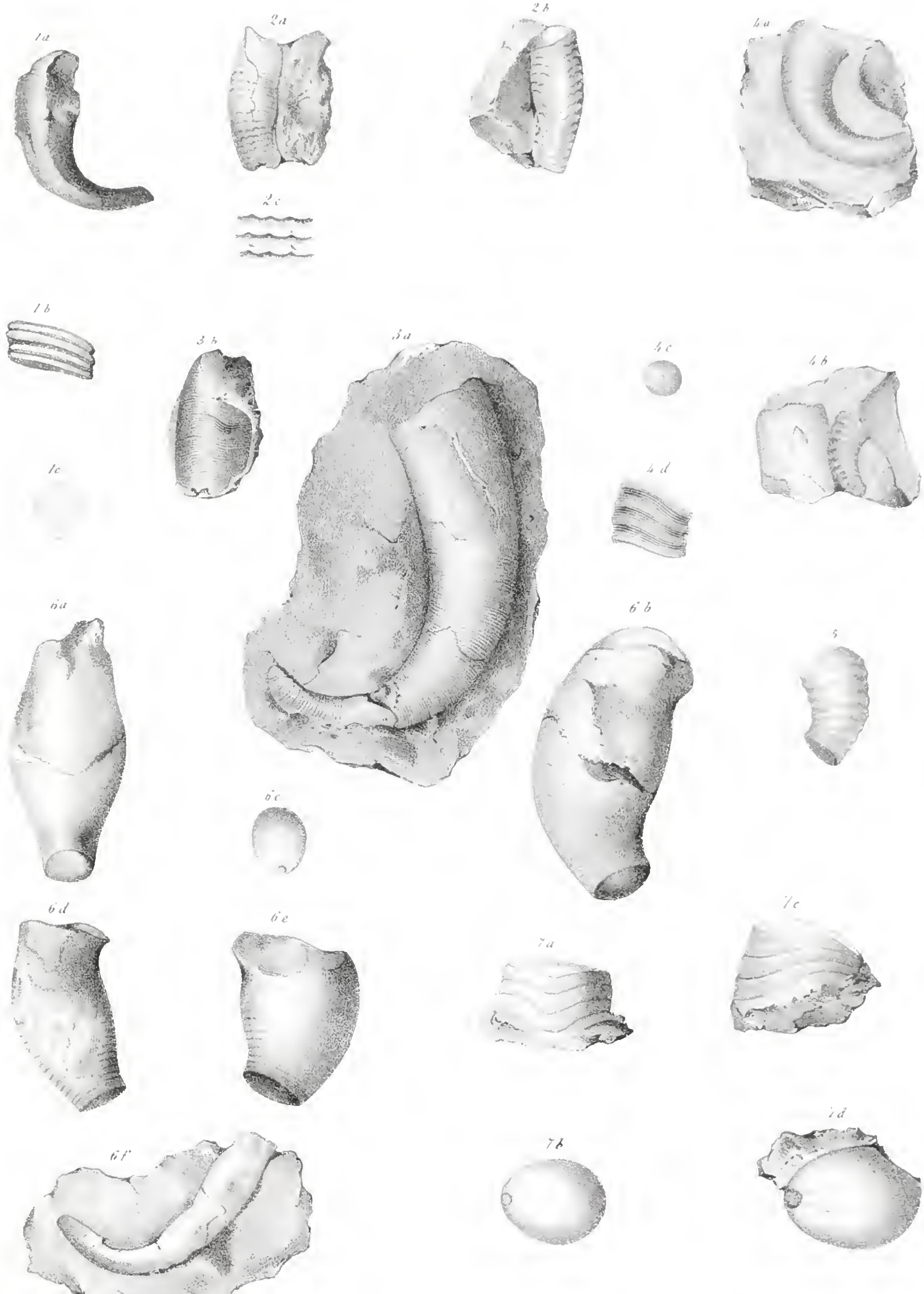
6 *e*. A shorter and more ventricose specimen. (The transverse lines on the upper half of the figure, indicating septa, are incorrect.)

6 *f*. The apicial extremity of the fossil.

7 *a*, *c*. Dorsal and lateral views of a fragment, showing the direction of the septa.

7 *b*, *d*. Sections of different specimens, showing the position of the siphuncle, and the narrowing of the dorsal side of the shell.

(CYRTOCERAS &c)



ON STONE BY F SWINTON

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PLATE 42.

Fig. 1, 3. 252. 3. CYRTOCERAS MACROSTOMUM. (Pag. 194.)

1 *a*. A fragment, showing a partial section.
1 *b*. A large fragment, showing the wide outer chamber.
1 *c*. Section of the smaller extremity of the last.
3 *a*. Dorsal view of a fragment probably identical : the striæ in the figure do not bend so abruptly as in the original. 3 *b*. Lateral view of the same.

Fig. 2, 3. 253. 4. CYRTOCERAS CONSTRICTOSTRIATUM. (Pag. 195.)

2 *a*. A fragment, showing several of the septa and a part of the outer chamber.
2 *b*. Transverse section, somewhat compressed, showing the position of the siphuncle.
3 *c*. A fragment, showing the surface markings.
3 *d*. Section of the same, which does not show the siphuncle.

Fig. 4. 254. 5. CYRTOCERAS MULTICAMERATUM. (Pag. 195.)

Fig. 5. 255. 6. CYRTOCERAS ARCUATUM. (Pag. 196.)

5 *a*. Lateral view of the specimen, which is crushed towards the lower extremity.
5 *b*. Section of the same.
5 *c*. The base of a parasitic coral, or of a crinoid, attached to the fossil.

Fig. 6. 256. 7. CYRTOCERAS CAMURUM. (Pag. 196.)

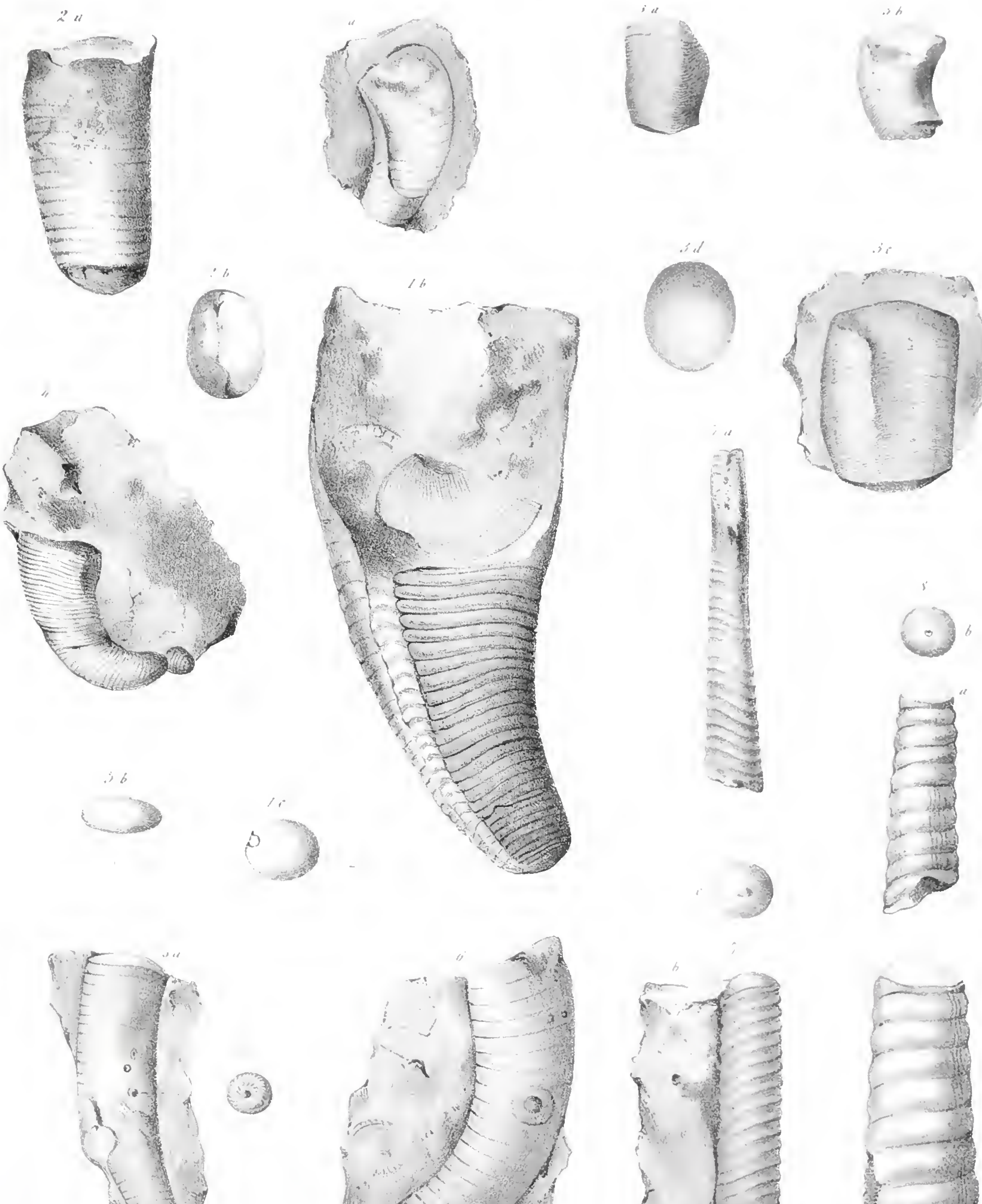
Fig. 7. 258. 11. ORTHOCERAS ARCUOLIRATUM. (Pag. 198.)

7 *a*. A fragment near the apex of the shell.
7 *b*. A fragment of larger diameter, showing the convexity of a septum.
7 *c*. Transverse section, showing the central position of the siphuncle.

Fig. 8. 259. 12. ORTHOCERAS TERETIFORME. (Pag. 198.)

8 *a*. Fragments of two specimens connected by the dotted lines. The annulations are represented too broad.
8 *b*. Section showing the position of the siphuncle.

(CYRTOCERAS &c.)



W. ENDICOTT

PLATE 43.

Fig. 1. 260. 13. ORTHOCERAS TEXTILE. (Pag. 199.)

1 *a*. A fragment of the natural size. 1 *b*. A portion of the surface enlarged, to show the striæ.

Fig. 2. 261. 14. ORTHOCERAS BILINEATUM. (Pag. 199.)

2 *a*, *b*. Views of two individuals, showing the annulations and longitudinal striæ.
2 *c*. Transverse section of *b*. 2 *d*. Portion of the surface enlarged.

Fig. 3. 262. 15. ORTHOCERAS BILINEATUM, *var. α*. (Pag. 200.)

3 *a*. A fragment of this variety. 3 *b*. Transverse section, slightly compressed, showing the siphon.
3 *c*. An enlarged portion of the surface.
3 *d*. A fragment denuded of the shell, showing the lines of septa which do not correspond to the annulations.

Fig. 4. 263. 16. ORTHOCERAS CLATHRATUM. (Pag. 201.)

4 *a*. The fragment, natural size. 4 *b*. Magnified portion of the surface. 4 *c*. Transverse section.

Fig. 5. 264. 17. ORTHOCERAS VERTEBRALE. (Pag. 201.)

5 *a*. Ventral side of the fragment. 5 *b*. Portion of the dorsal side. 5 *c*. Transverse section.

Fig. 6. 265. 18. ORTHOCERAS ANELLUM. (Pag. 202.)

6 *a*. A fragment of the septate portion of the shell. 6 *b*. Transverse section of the same.
6 *c*. Enlarged portion, showing the striæ, which, on a great part of the surface, are covered by a calcareous coating.
6 *d*. A smaller fragment. 6 *e*. Transverse section. 6 *f*. Portion of the surface enlarged.

Fig. 7. 266. 19. ORTHOCERAS UNDULOSTRIATUM. (Pag. 202.)

7 *a*. Ventral side of a fragment, showing the nearly transverse direction of the annulations.
7 *b*. Dorsal side of the same, the specimen cylindrical. 7 *c*. Transverse section of the same.
7 *d*, *e*. Two smaller fragments of the species, compressed in different degrees.
7 *f*, *g*. Transverse sections of the two last. 7 *h*. An enlarged portion of the surface.
7 *i*, *k*. Another fragment and section, showing the position of the siphuncle.

Fig. 8. 267. 20. ORTHOCERAS (*O. trochleare?*). (Pag. 203.)

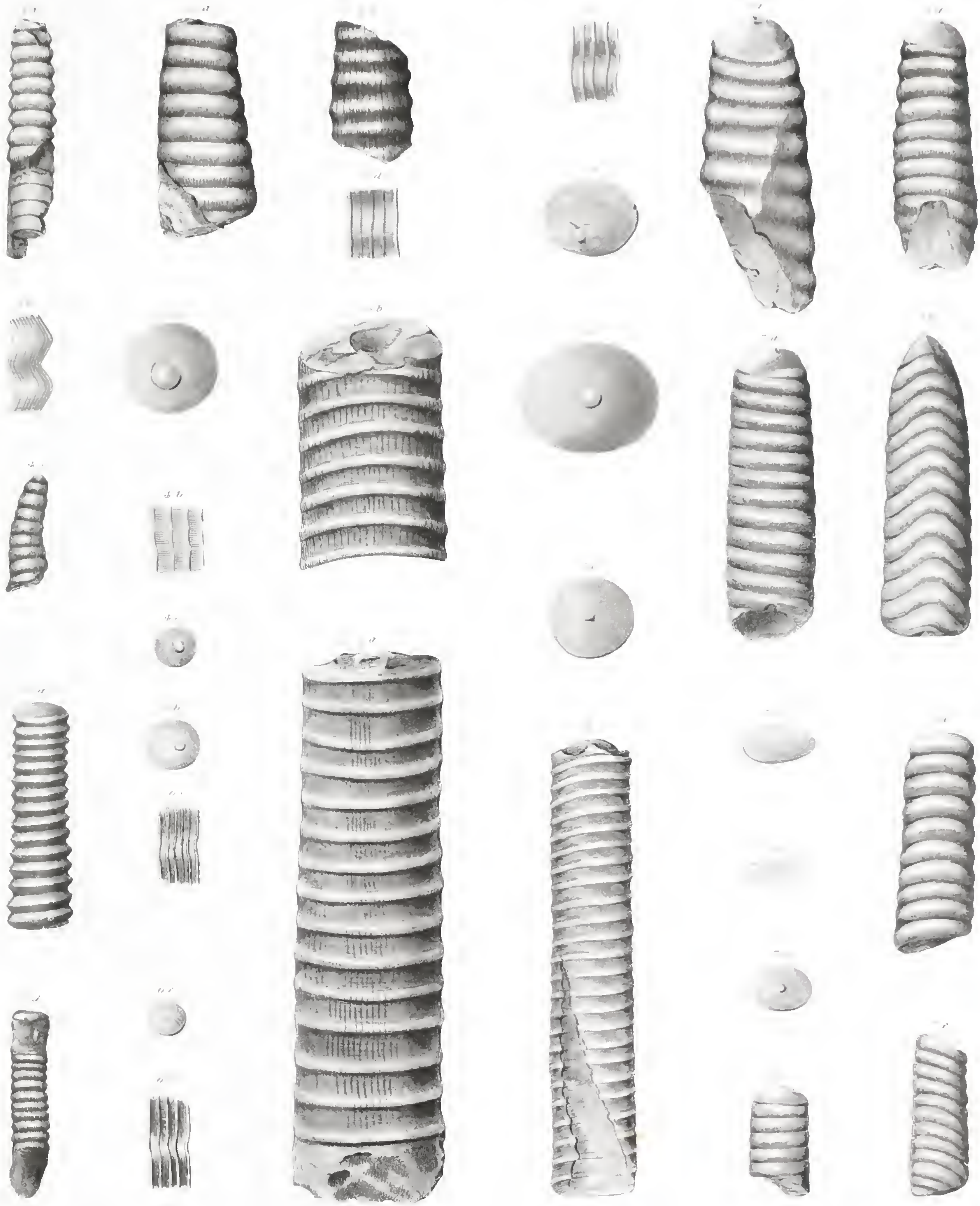


PLATE 44.

Fig. 1. 273. 5. Endoceras annulatum. (Pag. 207.)

1 *a*. Lateral view of a fragment, showing the arching of the annulations towards the left side. The fine dark transverse lines indicate the edges of the septa.

1 *b*. Longitudinal section, showing the position of the siphuncle, convexity of the septa, and internal tubes.

(ORTHOCERATA.)

1 a

1 b

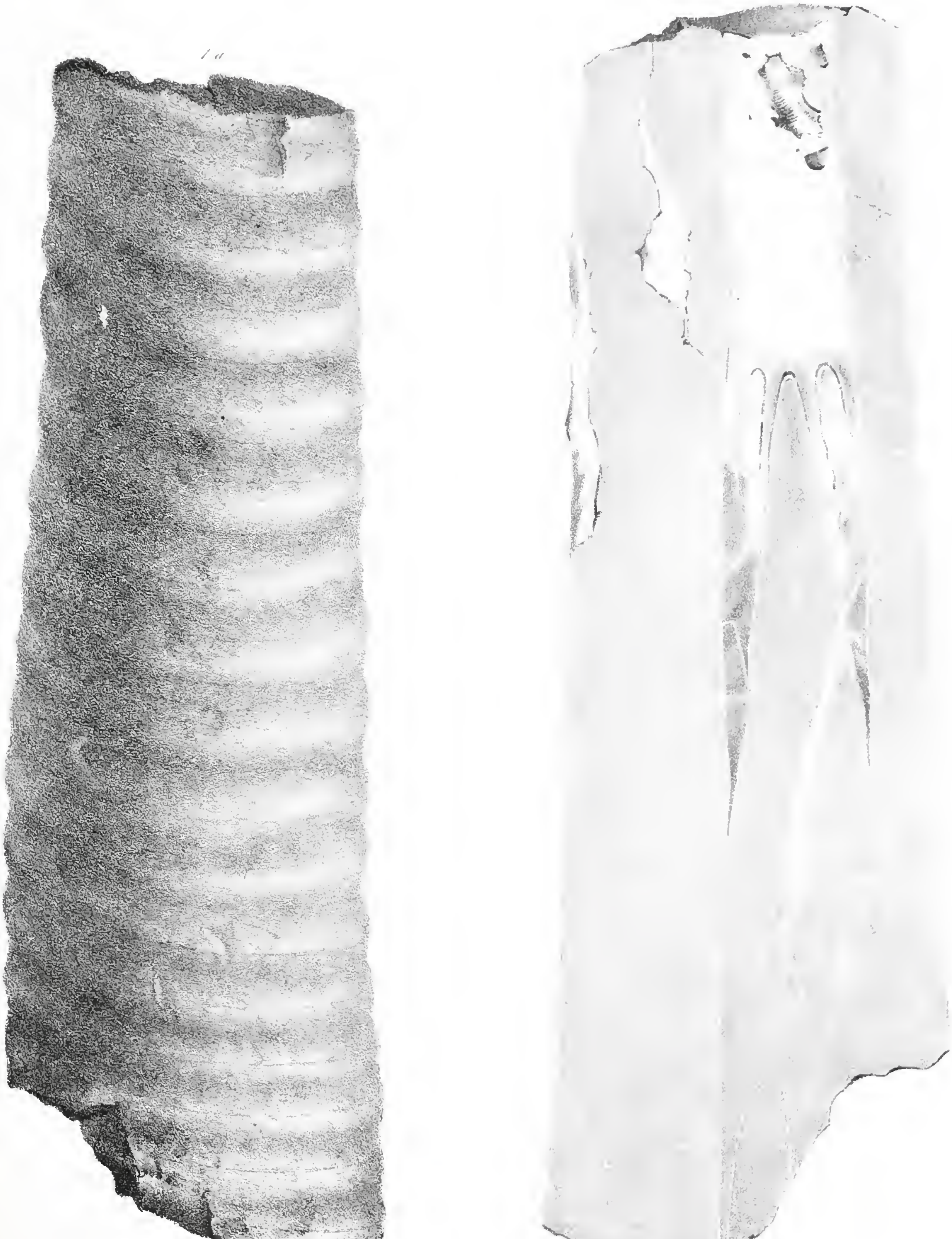


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PLATE 45.

Fig. 1. 274. 6. ENDOCERAS PROTEIFORME, *var.* TENUISTRIATUM. (Pag. 209.)

1 *a.* Fragment of the young shell, natural size, showing only the transverse striæ.
1 *b.* Enlarged portion, showing the longitudinal striæ.

Fig. 2, 3, 5. 275. 7. ENDOCERAS PROTEIFORME, *var.* TENUITEXTUM. (Pag. 210.)

2 *a.* A fragment of a tube destitute of septa, presenting strong transverse and longitudinal striæ.
2 *b.* A portion of the surface enlarged.
3 *a.* A specimen with finer striæ, showing the marks of septa. 3 *b.* Portion of the surface enlarged.
5 *a.* This specimen presents a double tube or sheath, the outer one (or embryo tube) being entirely smooth; while the inner one, which is but little smaller, is marked by longitudinal and transverse striæ as in the preceding figures.
5 *b.* A portion of the same enlarged to show the striæ.
5 *c.* A section of the same, showing no septa or siphuncle.

Fig. 4. 276. 8. ENDOCERAS PROTEIFORME, *var.* LINEOLATUM. (Pag. 211.)

4 *a.* A young shell, with the outer chamber and apex broken off.
4 *b.* Transverse section of the larger extremity, showing the position of the siphuncle.
4 *c.* A fragment of the smaller extremity of the shell, which is annulated by fine sharp ridges.
4 *d.* The same enlarged.
4 *e.* A fragment of another tube, marked like 4 *a*, showing at the lower extremity a septum and siphuncle.

(ORTHOCERATA.)

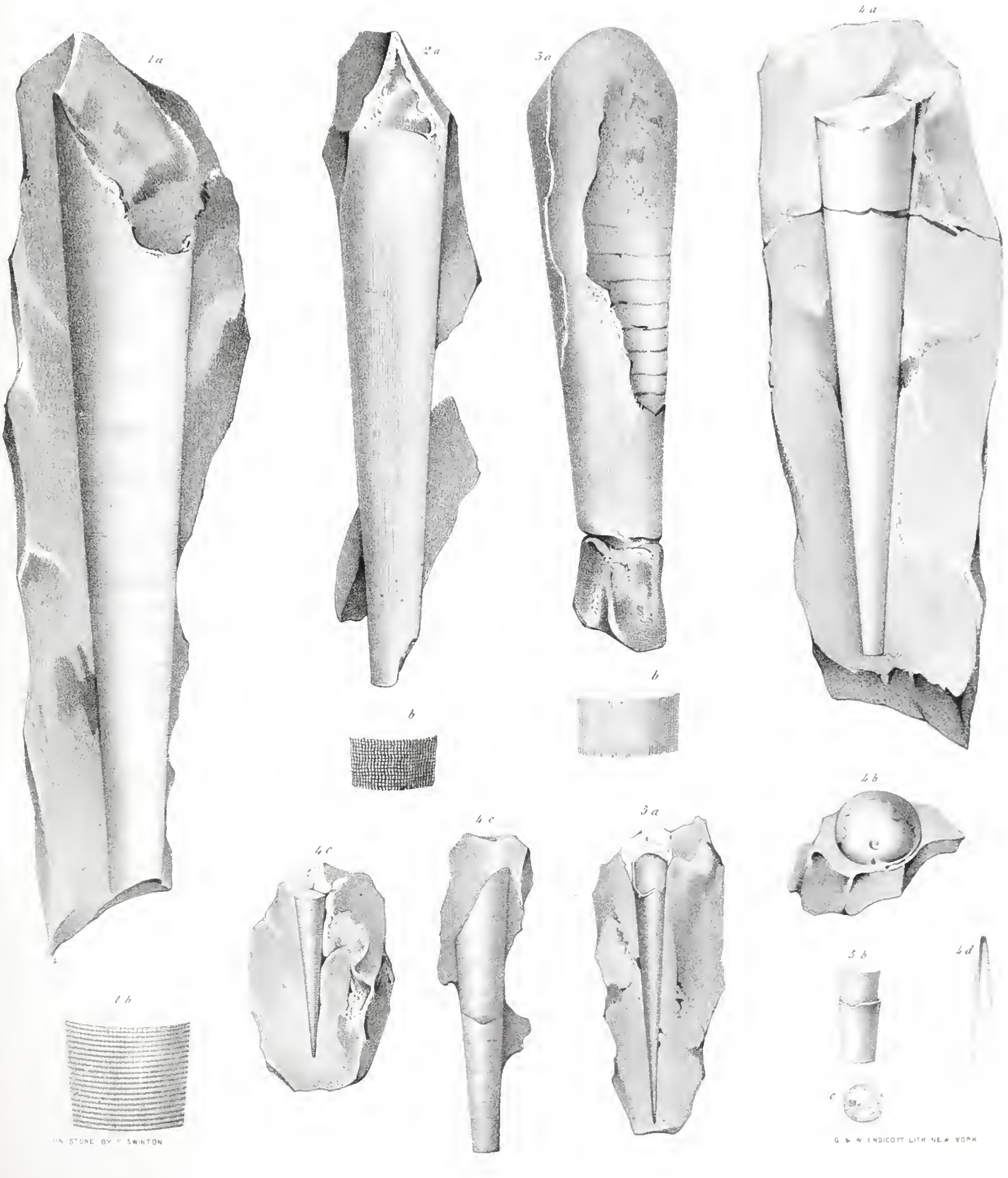

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PLATE 46.

Fig. 1, 2, 3. 276. 8. ENDOCERAS PROTEIFORME, *var.* LINEOLATUM. (Pag. 211.)

1 *a.* A fragment of the parent shell, enclosing an embryo tube within the siphuncle.

1 *b.* Transverse section of the last, showing the large lateral or excentric siphuncle of the old shell. The shell is crushed, as shown in the upper figure, so that a perfect section cannot be given.

1 *c.* The surface marking of the young shell, enlarged.

2 *a, b.* The external shell, and a longitudinal section of a young shell, which is destitute of septa.

3. This is marked upon the surface as other specimens of the var. *lineolatum.* The septa in the figure are erroneously represented by the engraver much more approximate than they are in the specimen.

Fig. 4. 277. 9. ENDOCERAS PROTEIFORME, *var.* STRANGULATUM. (Pag. 212.)

4 *a.* A fragment, showing the contraction below the aperture.

4 *b.* Transverse section, showing the nearly central position of the siphuncle.

4 *c.* A portion of the surface of a specimen enlarged.

4 *d, e.* Two specimens denuded of the shell, showing a uniform character in the contraction of the tube, with a slight difference in the distance of the septa.

(ORTHOCERATA.)

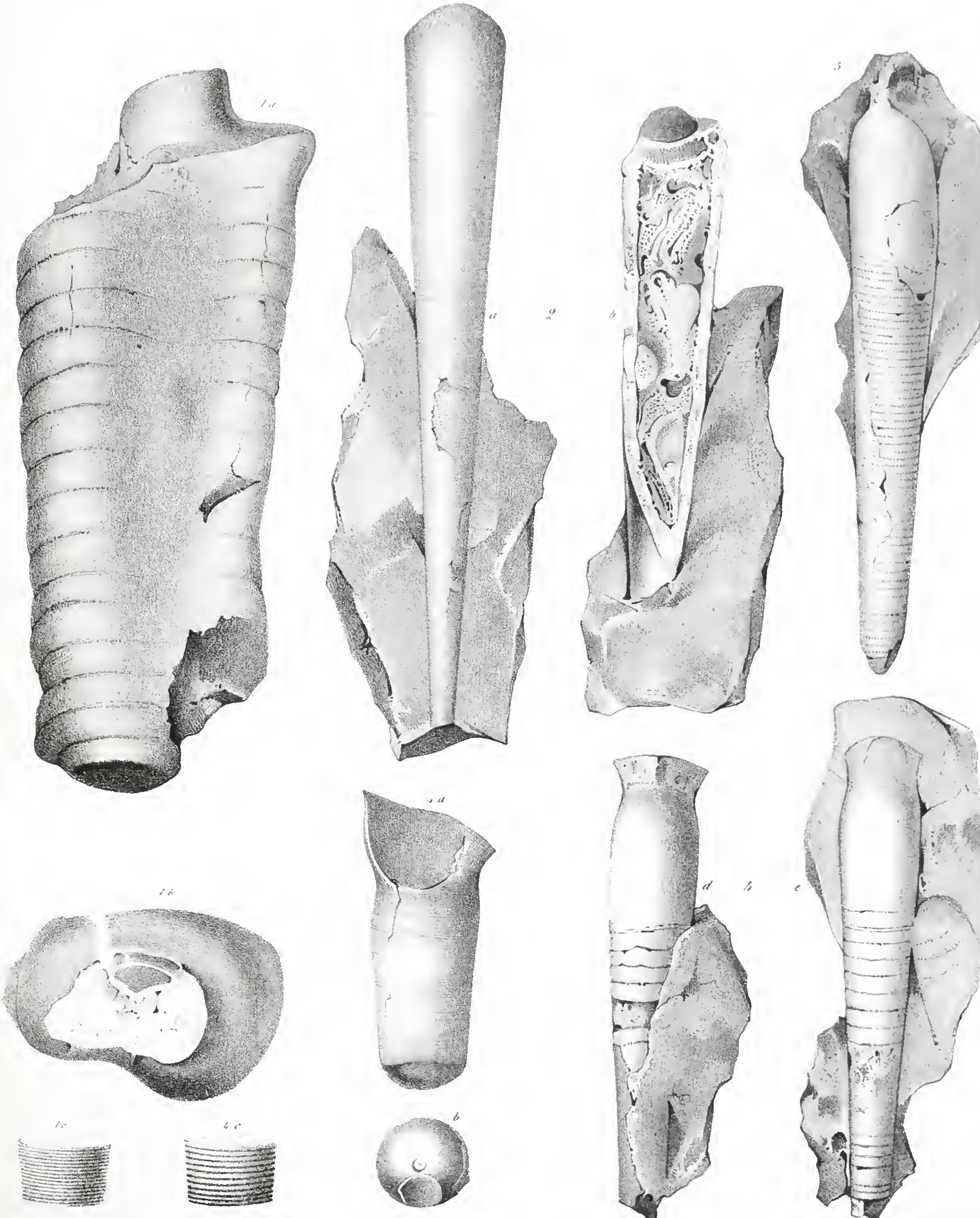

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PLATE 47.

Fig. 1, 2. 274. 6. ENDOCERAS PROTEIFORME, *var.* TENUISTRIATUM. (Pag. 209.)

1 *a*. A small and slender specimen of this species.

1 *b*. A portion of the surface enlarged, showing the cancellated lines.

2 *a*. This specimen presents very similar surface markings, and cannot be distinguished from the last, though the transverse striæ are less prominent. The specimen consists of a double or triple tube; the outer one 2 *b* showing externally marks of septa, which are distant about one-fourth the diameter. The shell is exfoliated, and the surface markings are unknown.

2 *c*. An enlarged portion of the surface: the longitudinal striæ are too strong in the figure.

2 *d*. A small portion still farther magnified, showing the proportionate size of the transverse and longitudinal striæ.

2 *e*. Transverse section of the specimen 2 *a*, showing the proportional diameters of the two, and the section of a still smaller tube within 2 *a*.

Fig. 3. 269. 22. ORTHOCERAS JUNCEUM. (Pag. 204.)

3 *a*. A fragment denuded of the shell, showing a part of the outer chamber, and septate portion of the tube.

3 *b*. A smaller specimen, showing the marks of septa which appear to be slightly oblique.

3 *c*. A small fragment, showing the convexity of a single septum.

3 *d*. A section of the last, showing the central position of the siphuncle.

3 *e*. A small fragment, showing the closer approximation of the septa near the outer chamber.

3 *f*. A small fragment, preserving the shell and the striated surface.

Fig. 4. 276. 8. ENDOCERAS PROTEIFORME, *var.* LINEOLATUM. (Pag. 211.)

4 *a*. A fragment from the apex of one of these tubes, which is septate as in the larger specimens.

4 *b*. A transverse section.

4 *c*. A fragment which is annulated near the apex, and septate to the extreme point.

4 *d*. Section near the apex.

4 *e*. A fragment of a similar young shell, where the lamellose striæ have become vesicular, giving a rough scaly appearance to the surface.

ORTHOCERATA

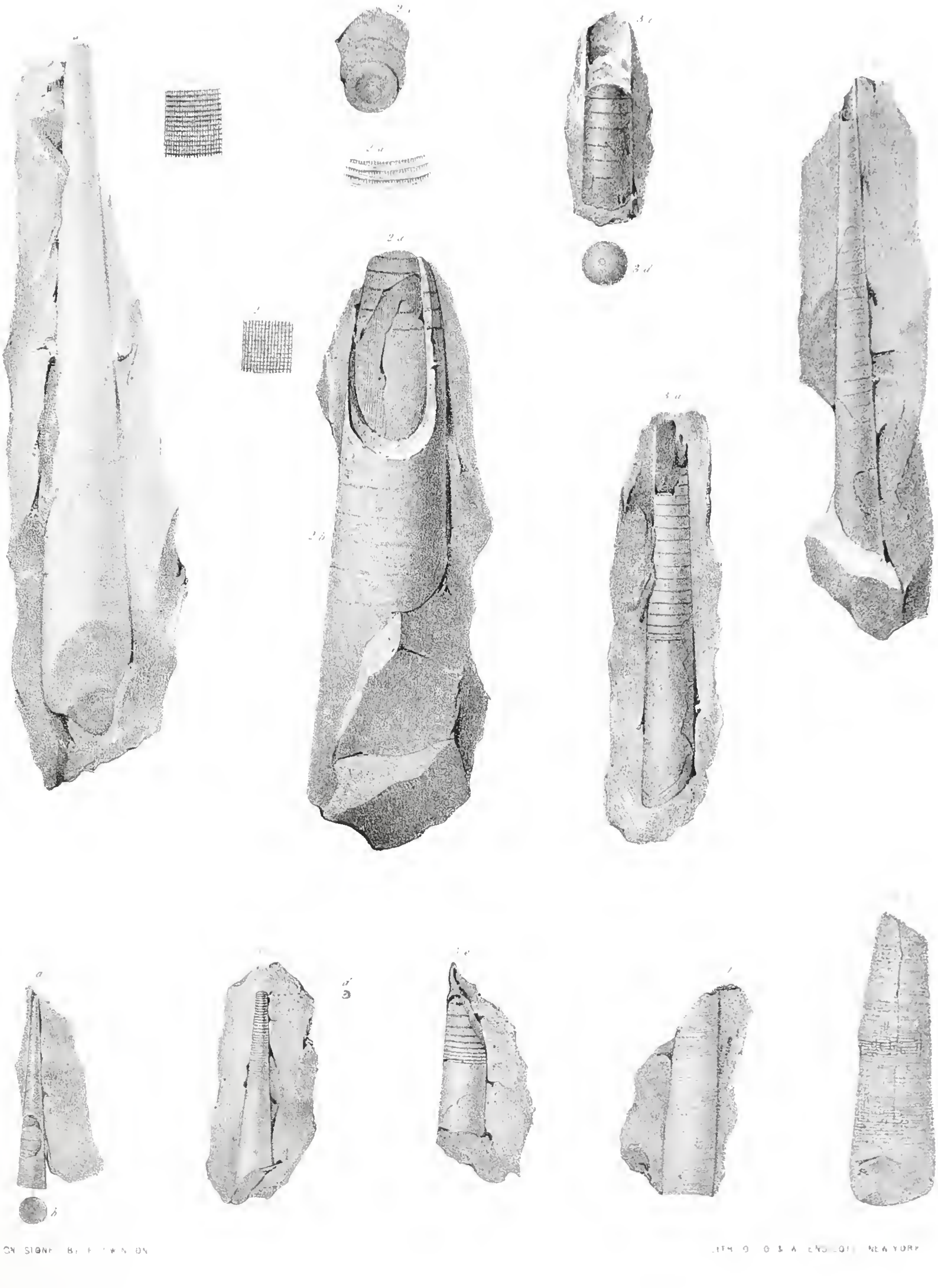

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PLATE 48.

Fig. 1, 2, 3, 4. ENDOCERAS PROTEIFORME. (Pag. 213.)

4. A fragment of a large specimen, composed of twenty or more chambers, one side of which is worn down, exposing the siphuncle, which contains the embryo tube, within which is a young shell *a*.

4 *b*, *b*. The larger or embryo tube, which is broken at the lower extremity.

4 *c*. The siphuncle, the space surrounding the tube being filled with calcareous spar. This specimen shows, in a very satisfactory manner, the position of these tubes within the parent shell. A small portion of the upper part only of the embryo tube is preserved.

3. An embryo tube with a longitudinal section on one side, showing a slender septate tube within, which is nearly destroyed by weathering.

2. A similar tube, free from striæ, and like the others. This tube has been broken at *a*, *b*, *c*; and the transverse sections *a*, *b*, *c*, at the bottom of the plate, represent its appearance. The outer tube contains an inner one, which is septate throughout its entire length, and furnished with an excentric siphuncle, which is distinctly represented in the section *a*.

1. A separate embryo tube, nearly perfect, and showing some inequalities near the base, apparently from contact with the inner side of the siphuncle.

(ORTHOCRATA.)

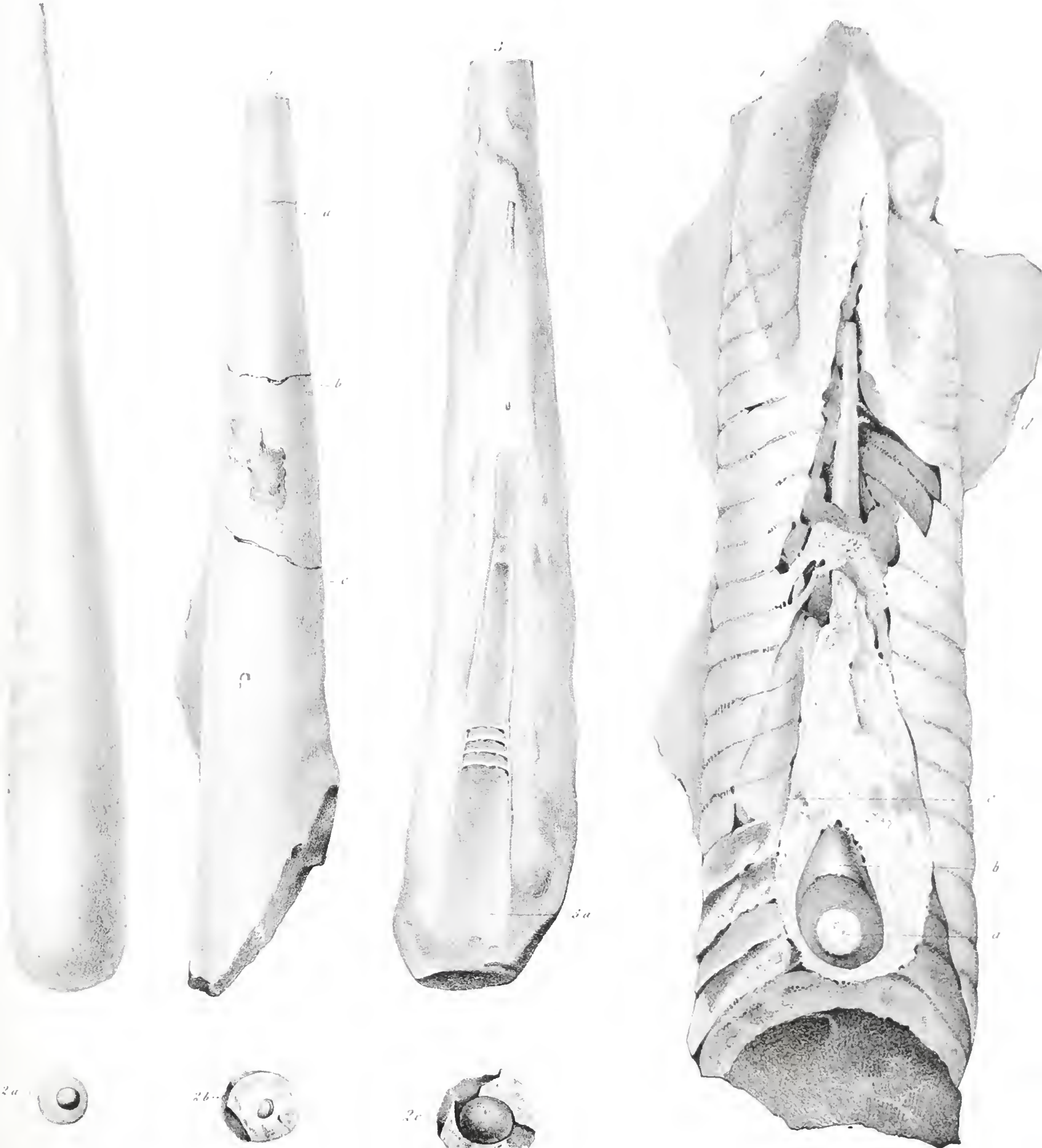

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PLATE 49.

Fig. 1. ENDOCERAS PROTEIFORME. (Pag. 213.)

1 *a*. Ventral side of a fragment, showing the siphuncle, which is worn through in the lower part, exhibiting the smooth embryo tube. This specimen shows the more abrupt arching of the septa as they approach the siphuncle.

1 *b*. A fragment, preserving the embryo tube.

1 *c*. Transverse section of the last, which is slightly elliptical from compression. The embryo tube is pressed against the upper side of the siphuncle, the outline of which is only faintly represented.

1 *d*. A similar fragment, embracing a portion of the embryo tube. In this one the septa are a little more approximate than in the other specimens, but it does not differ in other respects.

1 *e*. A nearly perfect embryo tube, with a few of the septa of the parent shell still attached.

In all these specimens, the septa are distant one-fourth to one-sixth the diameter of the outer shell.

ORTHOCERATA

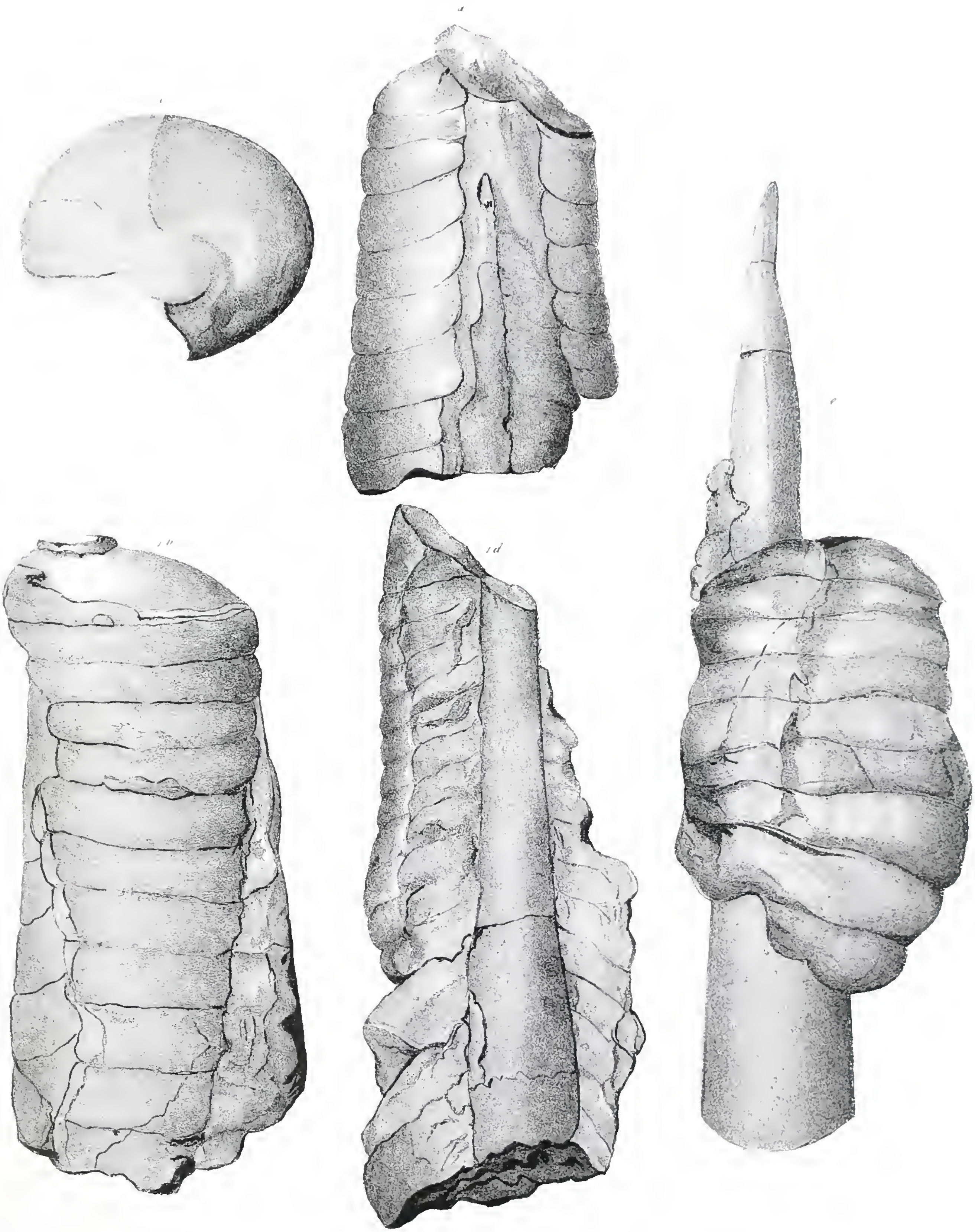

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PLATE 50.

Fig. 1, 2, 3. ENDOCERAS PROTEIFORME. (Pag. 213.)

1 *a.* An embryo tube containing a young shell. This specimen is more elongated, and less rapidly attenuating than the prevailing forms of the species : the outer tube is smooth, while the inner one is striated.

1 *b.* This tube is more slender than the usual forms, but does not differ in other respects.

2 *a*, *b*. Fragments of smooth embryo tubes, apparently of the same species, differing only in being more suddenly contracted and aculeate near the apex.

2 *c*, *d*. Parts of the siphuncle separated from larger shells, still retaining the embryo tube within. The siphuncle is marked by oblique or ascending annulations, indicating the junction of the septa; which direction of the annulations is due to the lateral or excentric position of the siphuncle.

3. An embryo tube, more conical than any of the others.

(ORTHOCERATA.)

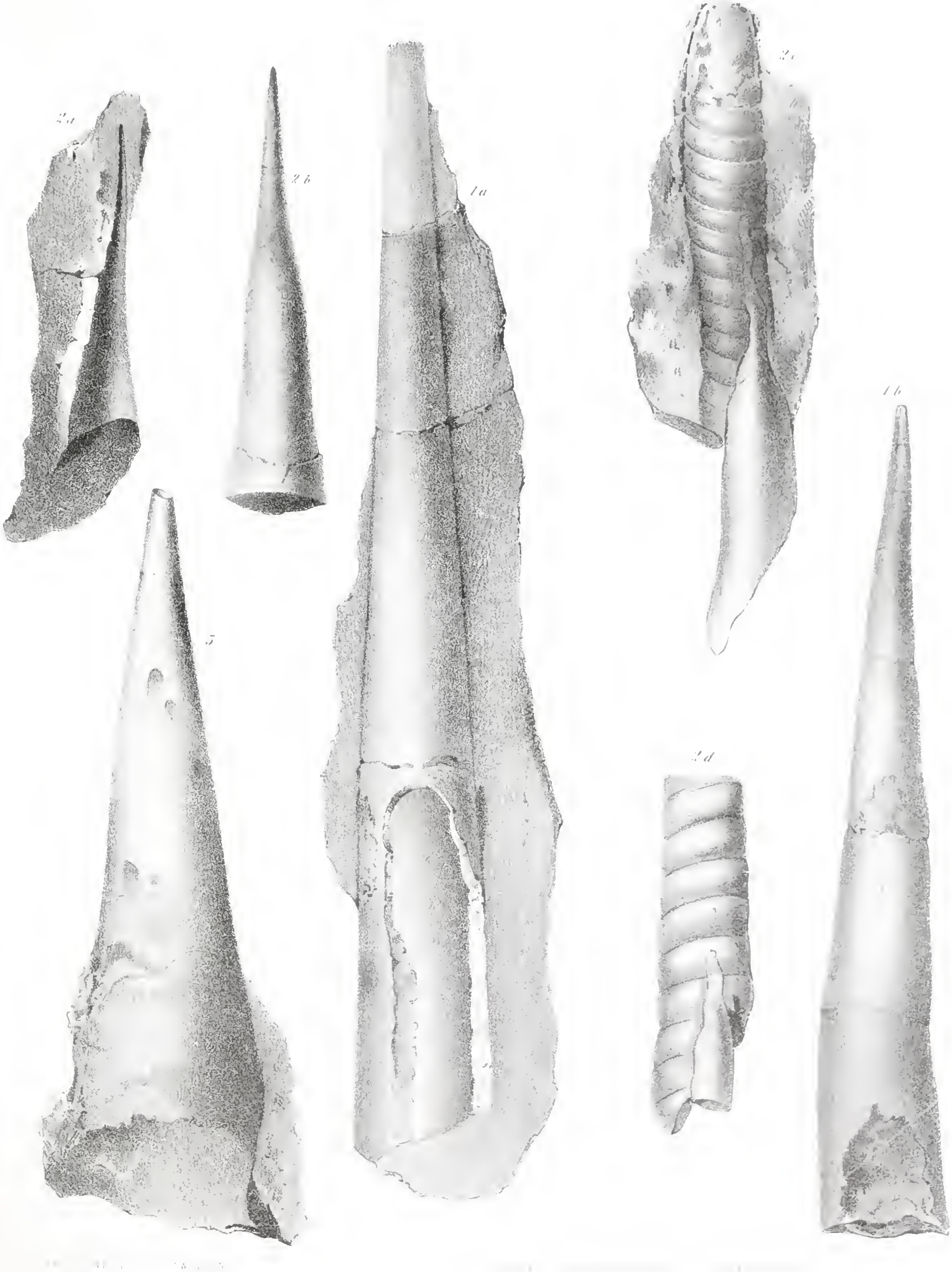

PLATE 51.

Fig. 1. 270. 23. ORTHOCERAS AMPLICAMERATUM. (Pag. 205.)

1 *a*, *b*. Parts of the same individual, preserving a large portion of the outer chamber, with an equal length of the septate part of the tube.

1 *c*. A transverse section of the specimen, at the upper extremity of 1 *a*, showing the excentric position of the siphuncle.

1 *d*, *e*. A fragment of another specimen, showing the same distance of the septa and excentric position of the siphuncle.

1 *f*. A fragment of the septate portion of a much larger specimen.

1 *g*. Transverse section of the same, showing the position of the siphuncle.

Fig. 2 *a*, *b*. 279. 11. ENDOCERAS ARCTIVENTRUM. (Pag. 217.)

Fig. 3. 280. 12. ENDOCERAS ANGUSTICAMERATUM. (Pag. 218.)

(ORTHOCERATA)

PLATE 54.

Fig. 1. 268. 21. ORTHOCERAS LATIANNULATUM. (Pag. 204.)

1 *a*. A fragment, showing four chambers. 1 *b*. Section and siphuncle.

Fig. 2 *a*. 283. 15. ENDOCERAS APPROXIMATUM. (Pag. 219.)

Fig. 2 *b*. 282. 14. ENDOCERAS MAGNIVENTRUM? *var*. (Pag. 218.)

ORTHOCERATA

PLATE 55.

Fig. 1. 284. 16. ENDOCERAS DUPLICATUM. (Pag. 219.)

PLATE 56.

Fig. 1. 271. 24. ORTHOCERAS STRIGATUM. (Pag. 205.)

1 *a*. A young specimen, with the shell partially exfoliated; a few of the septa being indistinctly visible.

1 *b*. A fragment, showing the shell in a considerable degree of preservation.

1 *c*. A portion of the surface of the last enlarged, showing the flexuous character of the striæ.

1 *d*. A large specimen, preserving but indistinctly the striæ. About twenty of the chambers are preserved, as well as a large part of the outer chamber. This specimen shows a small septate tube within the open extremity, but it is probably accidentally present.

1 *e*, *f*. A fragment, showing five chambers, with a section of the same.

Fig. 2. 17. 2. ORTHOCERAS LAQUEATUM. (Pag. 206.)

2 *a*. A fragment imbedded in compact limestone.

2 *b*. A small fragment, showing the intermediate finer striæ.

2 *c*. A portion of the surface enlarged.

Fig. 3. 272. 25. ORTHOCERAS LAQUEATUM? *var. a*. (Pag. 206.)

Fig. 4. 286. 1. CAMEROCERAS TRENTONENSE. (Pag. 221.)

4 *a*. A fragment of the shell, preserving about three of the chambers, beyond which the siphon is extended to an equal distance.

4 *b*. Another fragment, with the siphuncle still more extended.

4 *c*. Transverse section, showing the position of the siphuncle.

(ORTHOCERATA.)

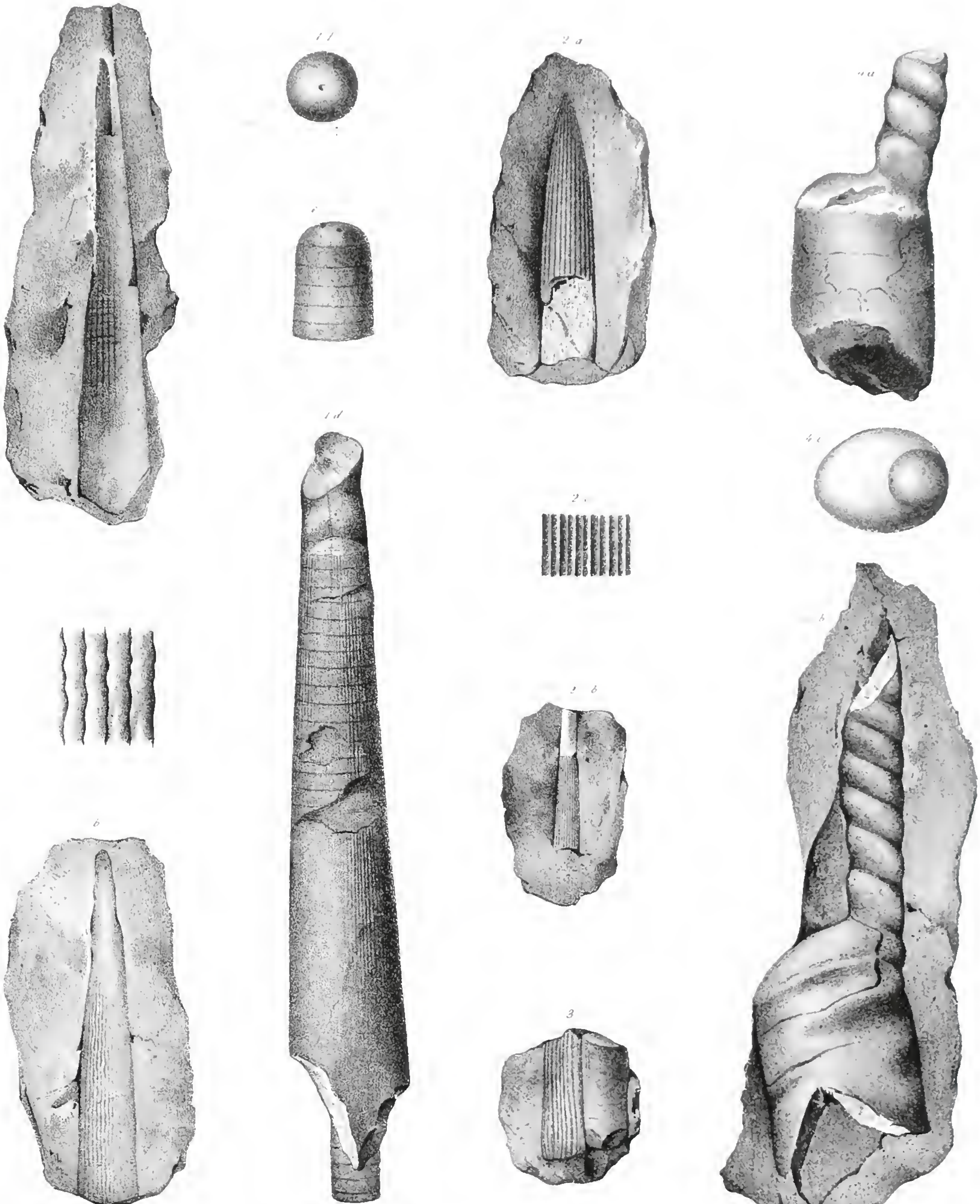

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PLATE 58.

Fig. 1. 285. 17. ENDOCERAS DISTANS. (Pag. 220.)

1 *a.* A weathered cast of a fragment of this species.
1 *b.* Transverse section of the smaller extremity of the same, showing the large siphuncle.

Fig. 2. 89. 1. ORMOCERAS TENUIFILUM? (Pag. 222.)

2 *a.* Part of a siphuncle, with a small portion of the shell adhering.
2 *b.* A fragment worn down on one side somewhat obliquely, showing the siphuncle in the lower part of the figure.
2 *c.* Section of the same.

ORTHOCERATA.

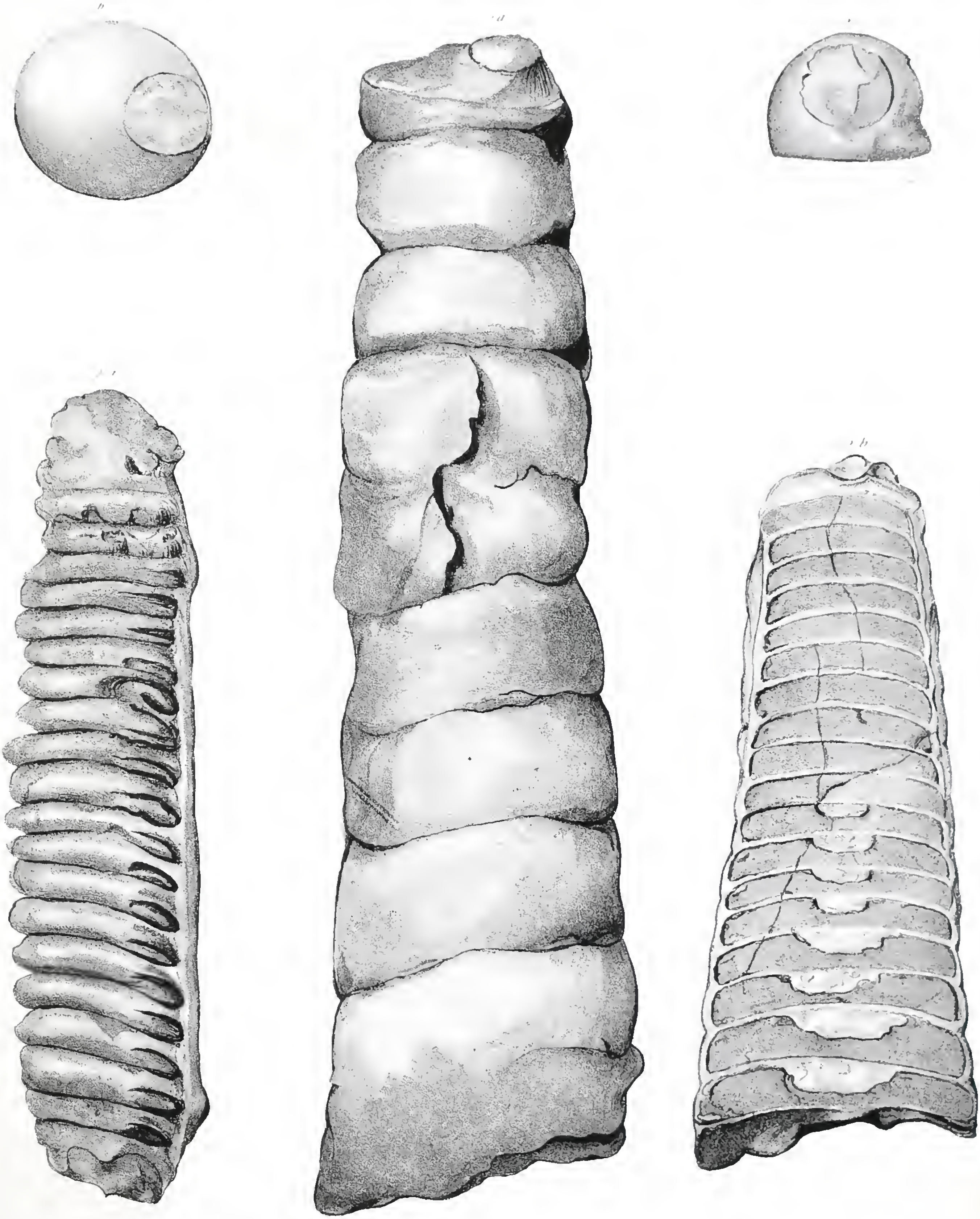

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PLATE 59.

Fig. 1, 2, 3. ENDOCERAS PROTEIFORME. (Pag. 216.)

1 *a, b*. Var. *tenuitextum*. The surface markings on two different specimens, somewhat enlarged beyond the natural size.

2 *a, b*. Var. *tenuistriatum*. The surface markings on two different specimens, both slightly magnified.

3 *a*. Var. *lineolatum*. This presents only transverse striæ; but some specimens show minute longitudinal ones, passing into the preceding variety.

3. Var. *lineolatum*. The surface is covered by fine spots or stigmata, as if some adhering softer substance had been separated from it. The same is observed in 2 *b*, in a less degree.

Fig. 4. 287. 1. CONULARIA TRENTONENSIS. (Pag. 222.)

4 *a*. A specimen (natural size), with the apex broken off.

4 *b*. Another specimen, more abruptly acute.

4 *c*. Transverse section of 4 *a*, near the apex, showing the septum and siphuncle.

4 *d, e*. Lateral and transverse view of a fragment, showing the convex septum.

4 *f*. A portion of the surface enlarged.

Fig. 5. 288. 2. CONULARIA GRANULATA. (Pag. 223.)

5 *a*. A specimen nearly entire, giving the general form of this species.

5 *b*. A portion of the surface enlarged.

Fig. 6. 289. 3. CONULARIA PAPILLATA. (Pag. 223.)

6 *a*. An imperfect specimen, of the natural size. 6 *b*. A portion magnified.

Fig. 7. 290. 4. CONULARIA GRACILE. (Pag. 224.)

7 *a*. A specimen (natural size), the apex broken off. 7 *b*. A portion of the surface enlarged.

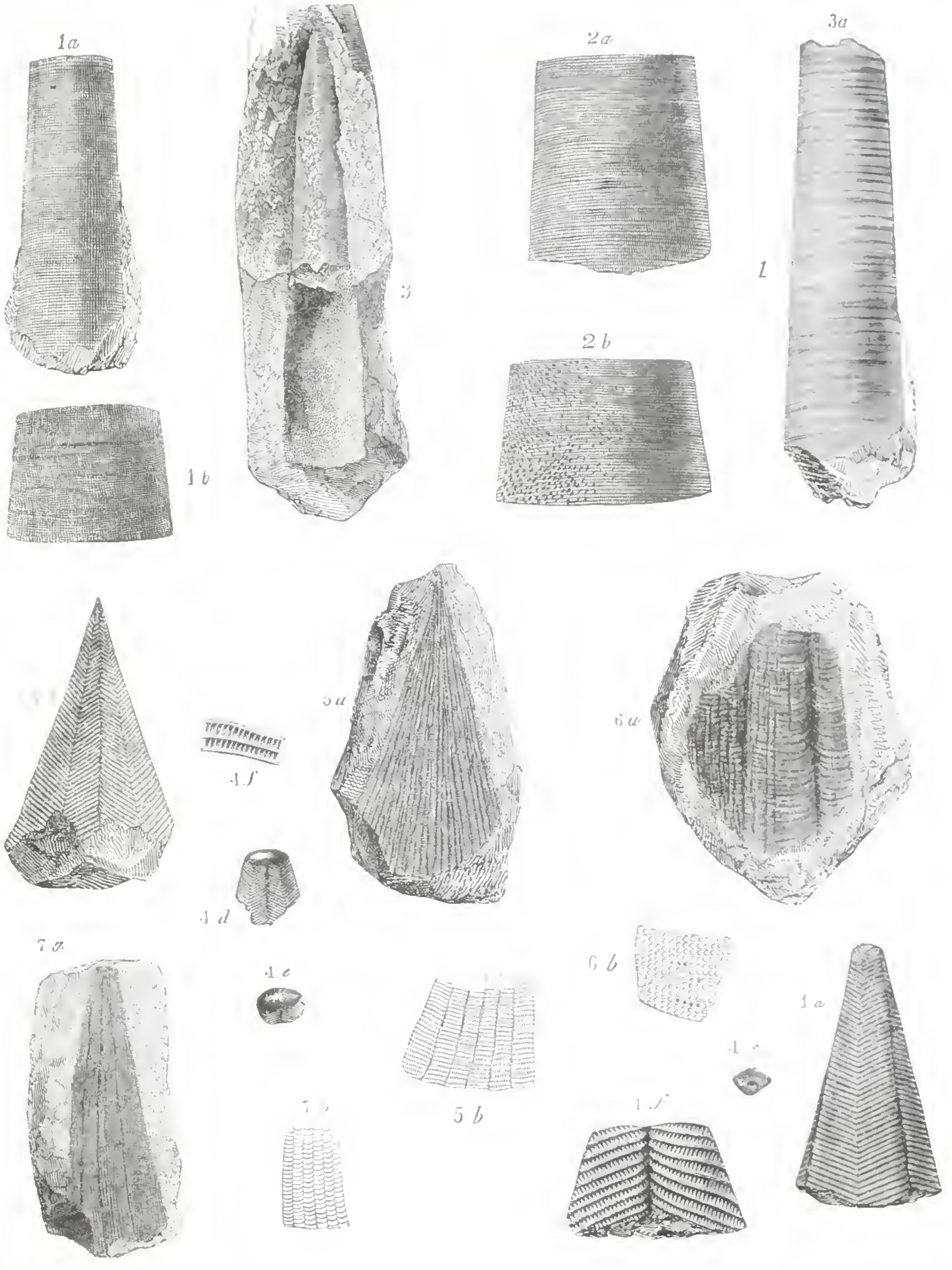

PLATE 60.

Fig. 1. 291. 1. OGYGIA? VETUSTA. (Pag. 227.)

Fig. 2. 292. 3. ASAPHUS? EXTANS. (Pag. 228.)

2 *a*. A caudal shield. 2 *b*. Lateral view of the same.
2 *c*. Another fragment, showing nine articulations of the thorax.

Fig. 3. 293. 1. CALYMENE MULTICOSTA. (Pag. 228.)

Fig. 4. 40. 2. ILLÆNUS CRASSICAUDA. (Pag. 229.)

4 *a*. The caudal shield of a large individual.
4 *b*. Middle lobe of the cephalic shield, the lateral portions being separated at the sutures.
4 *c*. Lateral view of a small entire specimen.
4 *d*. Dorsal view, showing the great width of the middle lobe, and abrupt incurving of the cephalic shield.

Fig. 5. 294. 3. ILLÆNUS TRENTONENSIS. (Pag. 230.)

Fig. 6. 295. 4. ILLÆNUS LATIDORSATA. (Pag. 230.)

6 *a*. The fragment, natural size. 6 *b*. Three of the articulations enlarged, showing the lamellose striæ.

Fig. 7. 43. 1. ISOTELUS GIGAS. (Pag. 231.)

7 *a*. A specimen preserving the thorax, caudal extremity, and central lobe of the buckler. (The base of the latter is too far extended in the engraving.) The caudal shield is denuded of the shell.
7 *b*, *c*. The maxillary portions or cheeks of the buckler. E, E. The eyes.
7 *d*. Inside of the lower crust of the cephalic shield, the upper part having been separated at the lateral suture.
7 *e*, *f*. Lower side of the cephalic shield, towards the extremities of which the upper and lower crusts are folded together, so as to present the appearance of projecting spines.
7 *g*. The epistoma or labrum, the place of which is indicated in the centre of the lower side of the previous figure. Two circular depressed spots are represented, which are always observed in well preserved specimens: these probably indicate the points for the attachment of muscles or tendons upon the inside
7 *h*. Central lobe of the cephalic shield. 7 *i*. Same part of a larger individual.

TRILOBITES

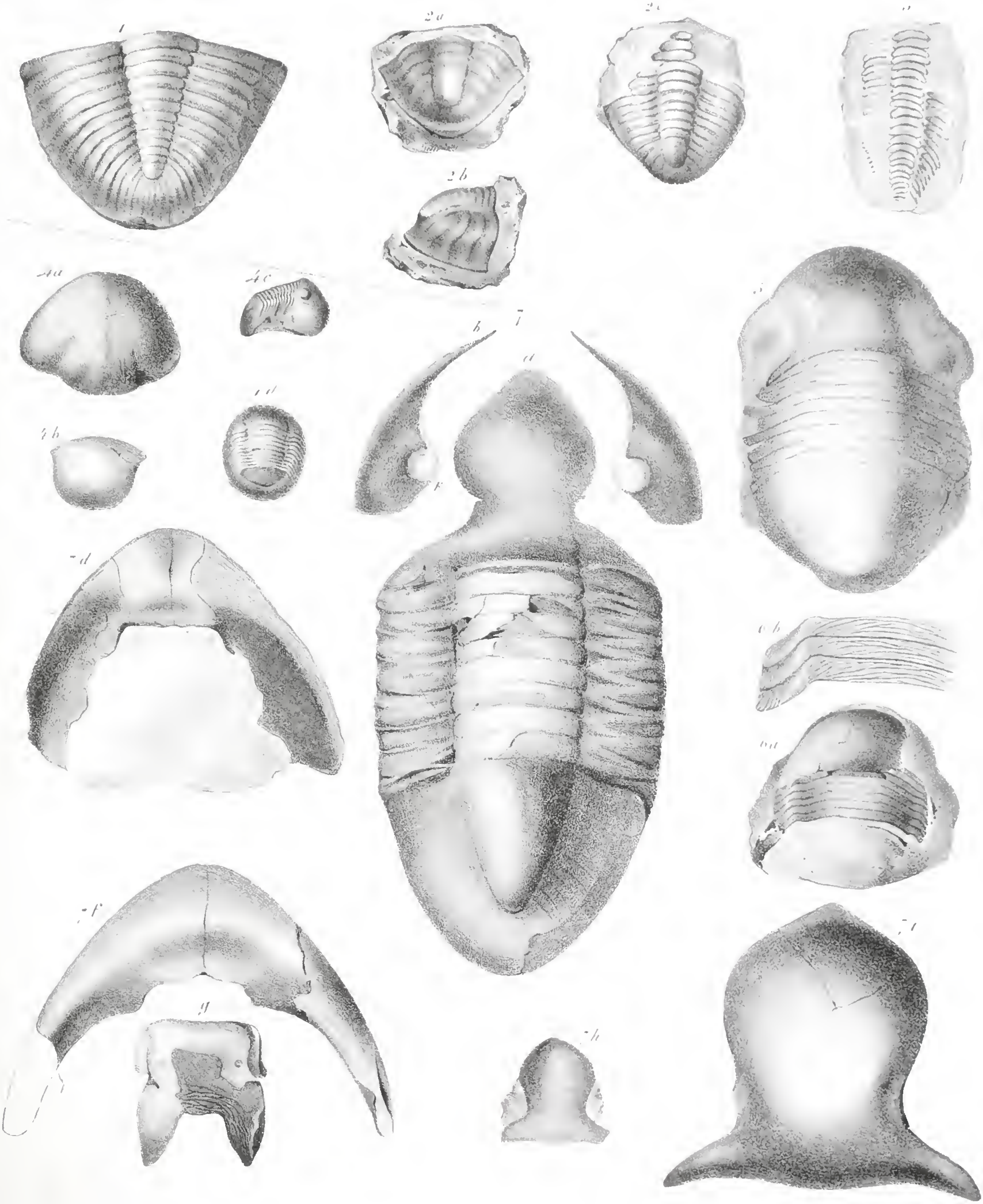

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PLATE 61.

Fig. 1. 306. 3. ASAPHUS? NODOSTRIATUS. (Pag. 248.)

1 *a*. The fragment, natural size.

1 *b*. A magnified portion of the surface, showing the lamellose striæ, with small nodes which interrupt the lines.

Fig. 2. 303. 4. CERAURUS? PUSTULOSUS. (Pag. 246.)

2 *a*. The fragment, natural size. 2 *b*. A magnified portion of the same

Fig. 3, 4. 43. 1. ISOTELUS GIGAS. (Pag. 231.)

3 *a*. The buckler of an individual of medium size. This is more extended in front, and the eyes are more prominent than usual.

3 *b*. The caudal shield, corresponding in size to the buckler. The crust is removed, showing the lines of the articulations.

3 *c*. A portion of the surface of the buckler enlarged, showing a peculiar punctate structure which is scarcely visible to the naked eye.

3 *d*, *e*. Lateral and dorsal views of a small perfect specimen from Kentucky. The buckler is somewhat compressed or bent in front, so that the facial suture is not shown to its full extent.

3 *f*. Buckler of an individual of ordinary size. The eyes are prominent, but less proportionally elevated, and the whole less convex than the specimen 3 *a*. The course of the facial suture is distinctly visible.

3 *g*. Caudal shield corresponding in size to the buckler 3 *f* : the marks of the transverse segments scarcely visible.

3 *h*. View of the eye of 3 *f* (natural size), as seen looking forwards and outwards.

3 *i*. Oblique front view of the eye, which, under ordinary magnifying glasses, presents no granulations.

3 *k*. The labrum or epistoma, showing the inner or upper side.

3 *m*. A portion of the same enlarged, showing the striæ upon the surface.

4 *a*, *b*, *c*. Front, lateral, and dorsal views of the original specimen to which GREEN applies the name of *I. cyclops*.

TRILOBITES

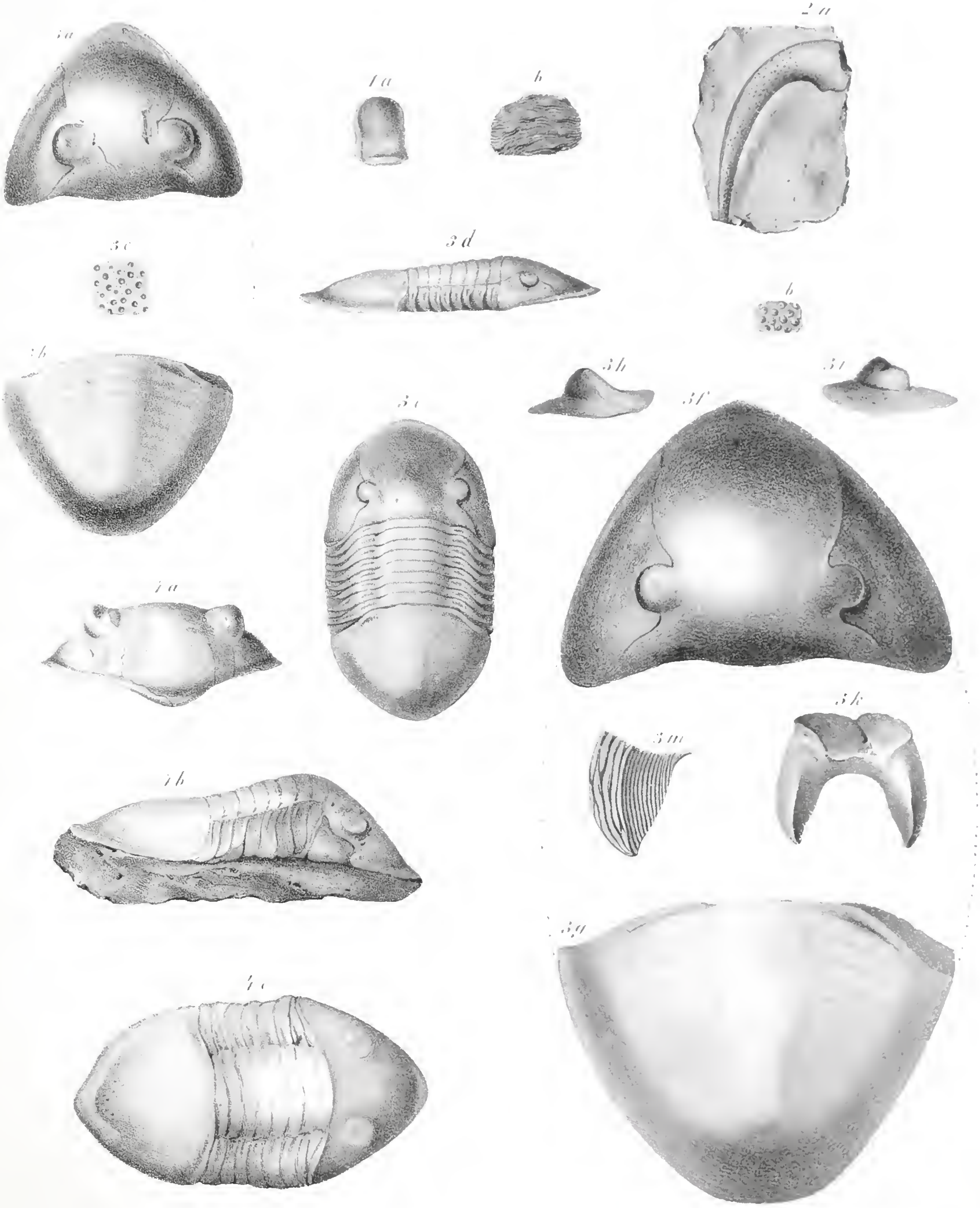

PLATE 62.

Fig. 1, 2. 43. 1. Isotelus gigas. (Pag. 231.)

1 *a*. A specimen folded so that the two extremities meet. The fossil is rarely found in this condition; and in many instances where it has originally assumed this form, it has been subsequently crushed.

1 *b*. The caudal shield of a young individual, showing the marks of the articulations, and preserving the trilobate form more perfectly than older specimens.

1 *c*. A magnified portion of the surface of one of the articulations of a large individual, showing, in addition to the punctures upon the surface, a series of curving impressed lines. The latter are not observed upon the buckler or caudal shield, which preserves a double series of punctures as shown in Pl. 61, fig. 3 *c*.

2. A specimen with the crust almost entirely removed. The upper part of the cephalic shield has been separated at the marginal suture, leaving the lower portion with the epistoma attached as represented in the figure.

PLATE 63.

Fig. 1. 43. 1. Isotelus gigas. (Pag. 231.)

The lower figure represents the caudal shield, and five of the articulations of a very large specimen. The superior covering is removed, showing the converging striæ in the deep grooves along the margin. The individual, when perfect, could not have been less than nine or ten inches in length : the buckler is of nearly corresponding size. The narrow thickened border, and course of the facial suture, are well shown in the specimen. The posterior angles are represented in the figure too much rounded, the one from being broken, and the other from being covered by the stone. The eyes are nearly perfect, and remarkably prominent.

TRILOBITES

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PLATE 64.

Fig. 1. 296. 1. PLATYNOTUS TRENTONENSIS. (Pag. 235.)

1 *a*, *b*. Portions of the buckler and caudal shield of this species.
1 *c*. A fragment of the buckler, more compressed than the preceding.
1 *d*. A magnified portion of the crust, showing the pustules upon the surface.
1 *e*. This figure is from a plaster cast of a specimen from the Blue limestone of Ohio.

Fig. 2. 297. 2. CALYMENE BECKII. (Pag. 237.)

2 *a*. An imperfect specimen, preserving the thorax and caudal shield, and the left maxillary portion of the buckler.
2 *b*. A perfect specimen, with the exception of the maxillary portions, which are separated at the facial suture.
2 *c*. A similar specimen, preserving the maxillary parts, which give a different outline to the cephalic shield.
2 *d*. Part of a single articulation enlarged, showing the spine upon the centre, with papillose surface.
2 *e*. A portion of the surface of the buckler enlarged, showing the papillose character of the surface.

Fig. 3. 298. 3. CALYMENE SENARIA. (Pag. 238.)

3 *a*. A large specimen from the Trenton limestone, with the buckler abruptly curved downward in front.
3 *b*. A small specimen from the same rock. 3 *c*. Lateral view of the same.
3 *d*. A small specimen from the Hudson-river group.
3 *e*, *f*, *g*. Three views of a contracted specimen from the Blue limestone of Ohio.
3 *h*. Lateral view of the eye of this species, enlarged. The eye is obtusely conical, with a depression or cavity at the apex, which is granulated as shown in 3 *i*. From the oblique conical form, this depression opens outwards and upwards, being protected on all sides by a thick crust.
3 *k*. The buckler of this species separated at the facial sutures, showing the form of the maxillary portions $\gamma\ \gamma$, which embrace more than half the oculiform tubercle.
3 *l*. Front view of the buckler, showing the termination of the facial sutures. λ is the labrum, which occupies this position beneath the buckler.
3 *m*. The same enlarged, showing the lines of the frontal suture, and the termination of the facial sutures.
3 *n*. The inside of the glabella, having the maxillary and basal portions separated.

Fig. 4. 299. 1. ACIDASPIS TRENTONENSIS. (Pag. 240.)

4 *a*. Front view of the specimen, which is folded (natural size).
4 *b*. The same enlarged, to show more distinctly this part of the fossil.
4 *c*. Dorsal view (natural size). 4 *d*. The same enlarged.
4 *e*. The caudal extremity and part of the thorax enlarged.
4 *f*. Margin of the maxillæ enlarged.

Fig. 5. 300. 2. ACIDASPIS SPINIGER. (Pag. 241.)

Fig. 6. 305. 2. PHACOPS? LATICAUDUS. (Pag. 248.)

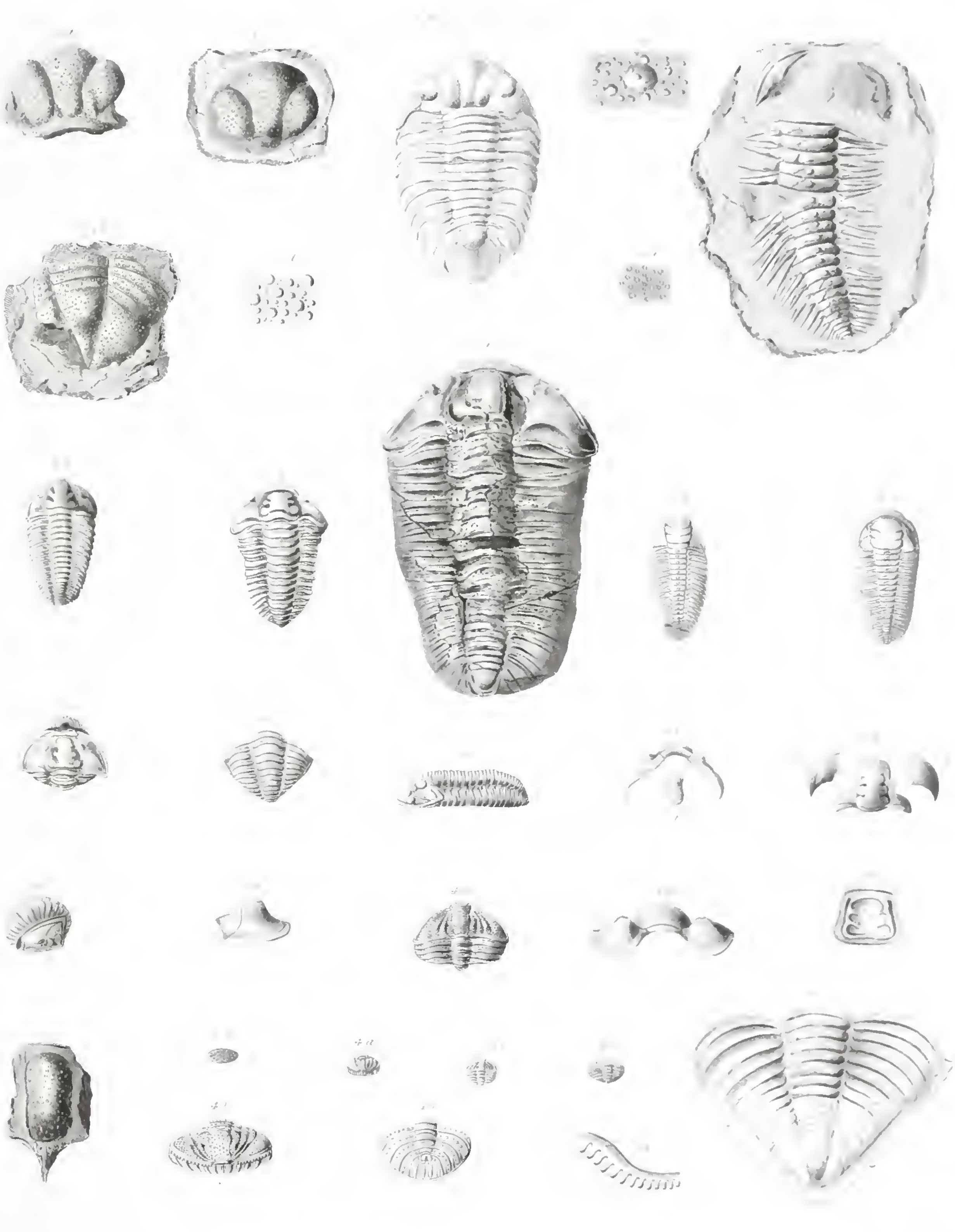

PLATE 65.

Fig. 1. 301. 2. CERAURUS PLEUREXANTHEMUS. (Pag. 242.)

1 *a*. A nearly entire specimen, with the maxillary portions obscure or entirely removed. The buckler is partially crushed and obscured by soft shaly matter, and the oculiform tubercle very imperfectly preserved. The posterior prolongations of the buckler are distorted and obscure, as are also the spines proceeding from the caudal shield.

1 *b*. A specimen of the same partially folded, with the buckler curved forward and the margin broken off. The crust is partially exfoliated, so that the surface markings are not well preserved.

1 *c*. Front view of the buckler, showing the junction of the epistoma.

1 *d*. A large imperfect specimen, showing more distinctly the peculiar structure of the articulations. The buckler is imperfect, but still partially preserves the posterior spines : the caudal spines are broken off. (This specimen has been left by the engraver imperfectly represented.)

1 *e*. Lower side of the buckler of the last, showing the epistoma joined by a straight suture to the front of the glabella.

1 *f*. A separated labrum, with the upper margin broken off. 1 *g*. A buckler, with the maxillæ removed.

1 *h*, *i*. The glabellæ of two large individuals. 1 *i**. A magnified portion of the surface.

1 *k*. A caudal shield, with the spines removed.

1 *l*. The spines of the caudal extremity, with a single articulation connecting them. View from the lower side.

1 *m*. The caudal shield, with the spines attached. 1 *m**. A magnified portion of the surface.

1 *n*. A transverse section, showing the elevation of a segment, and the lateral extension of the articulations into fin-like processes.

Fig. 2. 302. 3. CERAURUS VIGILANS. (Pag. 245.)

2 *a*. An entire specimen, preserving the posterior spines of the buckler.

2 *b*. Front view of the same, showing the elevation of the oculiferous tubercles.

2 *c*. A small specimen with the surface markings obscure.

2 *d*. Lateral view of a specimen, showing the extension of the extremities of the lateral articulations.

2 *e*. Caudal shield of a larger individual.

2 *f*. An enlarged portion of the buckler of 2 *a*, showing pustulose tubercles.

2 *g*. The caudal shield and a portion of the thorax enlarged, showing the tubercles upon alternate and third segments. 2 *h*. Profile of the same.

Fig. 3. 304. 1. PHACOPS CALLICEPHALUS. (Pag: 247.)

3 *a*. Cephalic shield of this species. 3 *b*. A small entire specimen.

3 *c*. The caudal shield of the last, showing the number of articulations, etc.

3 *d*. Magnified portion of the surface of the buckler, showing the pustulose-punctate character of the surface.

3 *e*. A magnified portion of the articulations of the thorax, showing the irregular pustulose surface.

3 *f*. Lateral view of the eye of this species. 3 *g*. Magnified view of the eye.

3 *h*. A contracted specimen. The lobes of the glabella are obliterated, and the surface of the eye crushed or absorbed.

3 *i*. View of the same specimen, showing the caudal shield and front of the buckler.

Fig. 4. 307. 1. TRINUCLEUS CONCENTRICUS. (Pag. 249.)

4 *a*. The cephalic shield of this species, still preserving one of the slender spines from the posterior angle. The posterior spine of the glabella is broken off, though the fracture is not conspicuous.

4 *b*. Lateral view of the cephalic shield of a smaller specimen.

4 *c*. The cephalic shield of a small specimen, in which the glabella preserves its posterior spine.

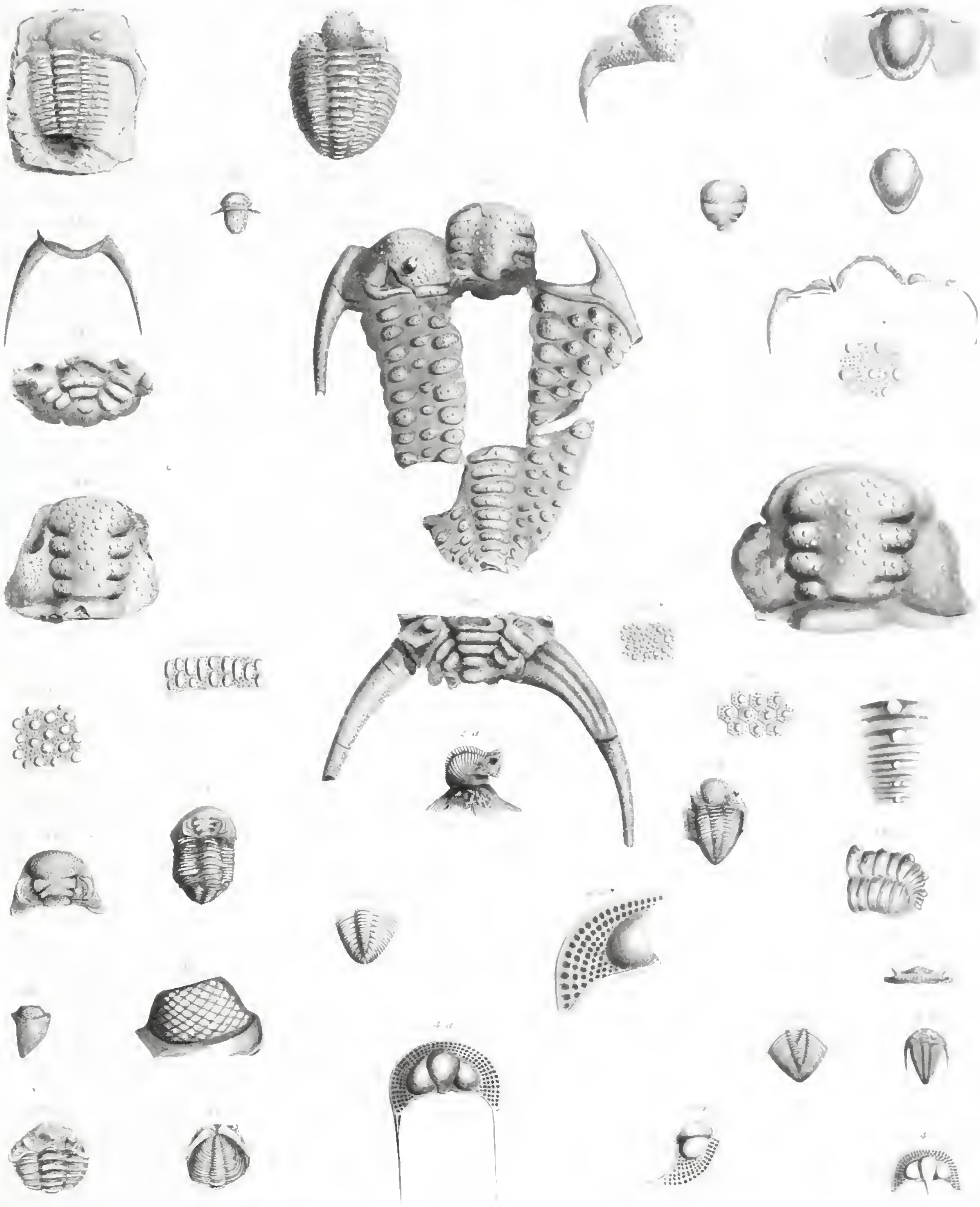

PLATE 66.

Fig. 1. 301. 2. CERAURUS PLEUREXANTHEMUS. (Pag. 242.)

1 *a*. A fragment of a large individual, preserving the buckler and eight articulations of the thorax. The surface is beautifully and evenly granulated or papillose, with larger tubercles upon the cephalic shield, and mamillary tubercles upon the articulations : these are enlarged in the figures 1 *b*. *c*, *d*.

1 *e*. Front view of the specimen 1 *a*, showing the elevation of the oculiferous tubercles.

1 *f*. One of these tubercles magnified. When magnified to this degree, they exhibit only rounded granulations.

1 *g*. The cephalic shield represented in 1 *a*, showing the separation of the maxillæ γ γ at the facial sutures.

1 *h*. The right maxilla, separated from the cephalic shield. (This figure on the plate is without a number.)

Fig. 2. 297. 2. CALYMENE BECKII. (Pag. 250.)

2 *a*. An entire specimen, with the exception of the maxillary shields, which are separated at the facial suture, leaving the cephalic shield in the usual form.

2 *b*. An imperfect specimen, with the maxillary portions partially preserved, but separated at the suture, and pressed downwards.

2 *c*. The thorax and caudal shield, preserving the crust, with the tubercles upon the middle lobe, in a very perfect manner.

2 *d*. The cephalic shield, with the maxillary portions separated at the facial suture.

2 *e*. The cephalic shield entire, but so much compressed that the eyes are obliterated. The posterior angles are too much rounded in the figure; in other respects, the true form of the buckler is represented.

2 *f*. The cephalic shield preserved in compact calcareous stone.

2 *g*. A larger specimen, in compact limestone, preserving a more convex form in all its parts.

2 *h*. A small individual, preserving the thorax and the maxillary portions of the buckler, the glabella being separated.

2 *i*. The maxillary shields, as they frequently occur in the slate, separated from any other part of the fossil. The lower figure is the labrum.

2 *k*. A single maxillary shield of this species.

Fig. 3. 308. 4. CALYMENE (*Species undetermined*). (Pag. 253.)

3 *a*. A part of the thorax, preserving eight or nine articulations.

3 *b*. The caudal shield, with a few segments of the thorax.

Fig. 4. 309. 5. ASAPHUS? LATIMARGINATA. (Pag. 253.)

4 *a*. The caudal shield of a small individual.

4 *b*. A fragment of the lateral lobe of the caudal shield of a larger individual.

Fig. 5. 43. 1. ISOTELUS GIGAS. (Pag. 254.)

The labrum or epistoma of a very large individual.

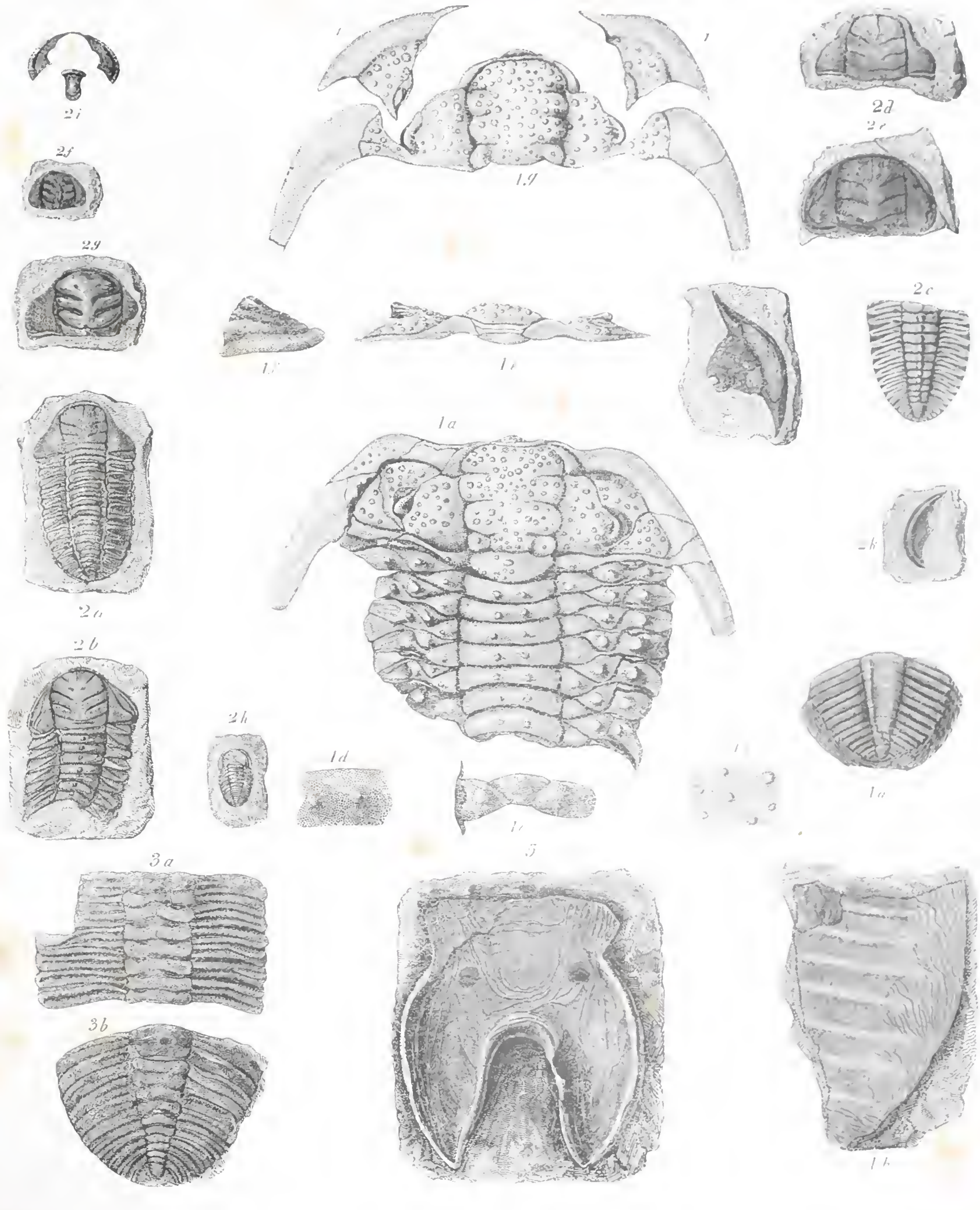
2i
2f
2g
2a
2b
2h
1d
3a
3b
1g
1a
2d
2c
5
1h

PLATE 67.

Fig. 1. 307. 1. Trinucleus concentricus. (Pag. 255.)

1 *a.* A large individual, destitute of spines upon the posterior angles of the buckler and glabella. The border in front of the glabella has three distinct rows of punctures, four in front of the cheeks, and five on each side, with six or seven near the base.

1 *b.* The thorax and caudal shield enlarged, to show more clearly the character of the segments.

1 *c.* A smaller specimen, preserving the spines of the buckler There are four rows of punctures in front, and six on each side of the buckler.

1 *d.* The buckler, preserving the posterior spine of the glabella.

1 *e.* Fragments of the cephalic border, showing a variable number of rows of punctures in front; one having five, with seven or eight at the posterior margin.

1 *f.* A portion of the marginal fillet, where the crust is partially removed, showing the little studs or points which fill these pores from below.

1 *g.* A fragment of a large buckler, having but two distinct rows of punctures in front of the glabella.

1 *h.* A portion of the thorax and caudal extremity, from the glazed slate at Waterford.

Fig. 2. 310. 1. Olenus asaphoides. (Pag. 256.)

2 *a.* An imperfect cephalic shield, with several articulations. 2 *b.* A smaller imperfect cephalic shield.

2 *c.* A fragment of one of the lateral articulations of the thorax.

Fig. 3. 311. 2. Olenus undulostriatus. (Pag. 258.)

3 *a.* The fragment, natural size.

3 *b.* A part of the same enlarged, showing the course of the facial suture, and the rugose striated glabella.

Fig. 4. 297. 2. Calymene beckii. (Pag. 250.)

4 *a.* The buckler, with a few of the articulations of the thorax. The specimen is very much compressed, and the crust removed.

4 *b.* A specimen of the same fossil, presenting nearly the entire length of the individual.

4 *c.* An impression of the body, showing the indentations produced by the short spines upon the back.

4 *d.* A portion of the same enlarged, showing the impressions of the fine granulations of the crust.

4 *e.* A fragment preserving an impression of a part of the central and one lateral lobe of this species.

Fig. 5. 312. 1. Agnostus lobatus. (Pag. 258.)

5 *a*, *b.* Individuals of the natural size. 5 *c*, *d.* The same magnified.

5 *e*, *f.* Specimens showing an articulation of the lobes. Magnified views.

Fig. 6. 313. 1. Thaleops (Illænus) ovatus. (Pag. 259.)

6 *a.* The specimen of the natural size. The upper figure has a strong thick spine at the posterior angles of the cephalic shield.

6 *b.* A part of the cephalic shield magnified, showing the punctures and the course of the facial suture.

PLATE 68.

Fig. 1. 314. 1. SPHENOTHALLUS ANGUSTIFOLIUS. (Pag. 261.)

Fig. 2. 315. 2. SPHENOTHALLUS LATIFOLIUS. (Pag. 262.)

2 *a*. A leaf nearly entire, showing a depressed line along the centre.
2 *b*. A similar leaf, with a sharp ridge along the centre.
2 *c*. A leaf of a narrower and more elongated form, with a broad ridge along the centre.
2 *d*. Another fragment, with a ridge extending a part of the length.
2 *e*, *f*. Fragments of what may have been stems of this plant.

Fig. 3. 316. 4. BUTHOTREPHIS SUBNODOSA. (Pag. 262.)

3 *a*, *b*. Figures of imperfect specimens, illustrating the prevailing form of the species.

PLANTS

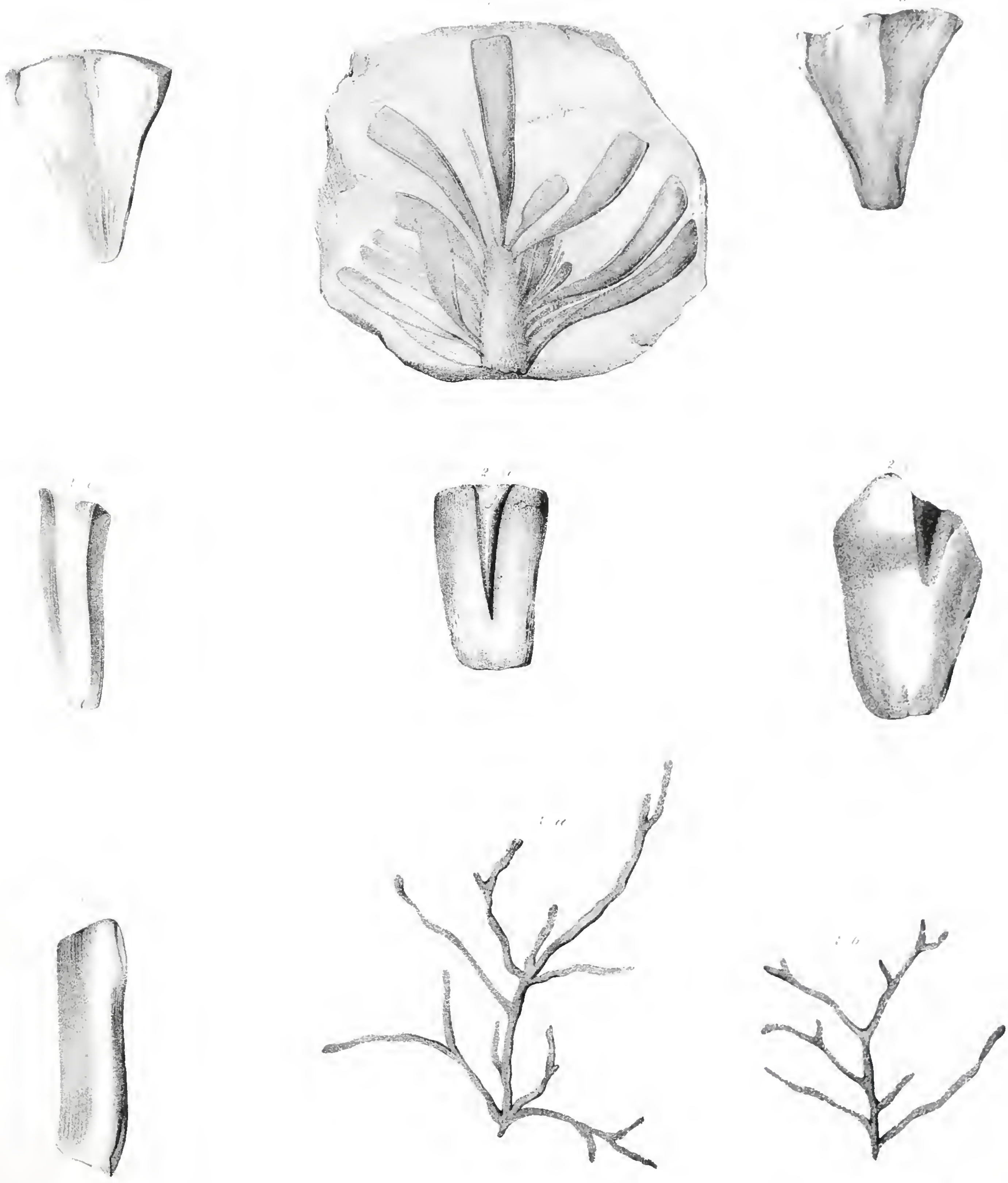

PLATE 69.

Fig. 1. 317. 5. BUTHOTREPHIS? FLEXUOSA. (Pag. 263.)

1 *a*. A large fragment, with numerous branches or leaves. The plant appears to have been long macerated before it was imbedded.

1 *b*. A specimen in the same condition as the last, with the branches less diverging.

1 *c*. A fragment of stone, with two smaller specimens retaining more of the original substance of the plant.

PLANTS

ON STONE BY F SWINTON

LITH OF G & A ENDICOTT N YORK

PLATE 69 A.

Fig. 1. 317. 5. Buthotrephis flexuosa. (Pag. 263.)

A fragment of slate from Greenwich in Washington county, with a nearly entire specimen of this plant, which presents some slight differences from the preceding one. Specimens of the same species have recently been obtained from the unaltered slates of the Hudson-river group in Lewis county.

PLANTS

PLATE 70.

Fig. 1.	318. 5.	Palæophycus virgatus.	(Pag. 263.)
Fig. 2.	319. 6.	Palæophycus (*Species undetermined*).	(Pag. 264.)

PLANTS

1

2

PLATE 71.

Fig. 1 *a*, *b*. 320. 1. GORDIA MARINA. (Pag. 264.)

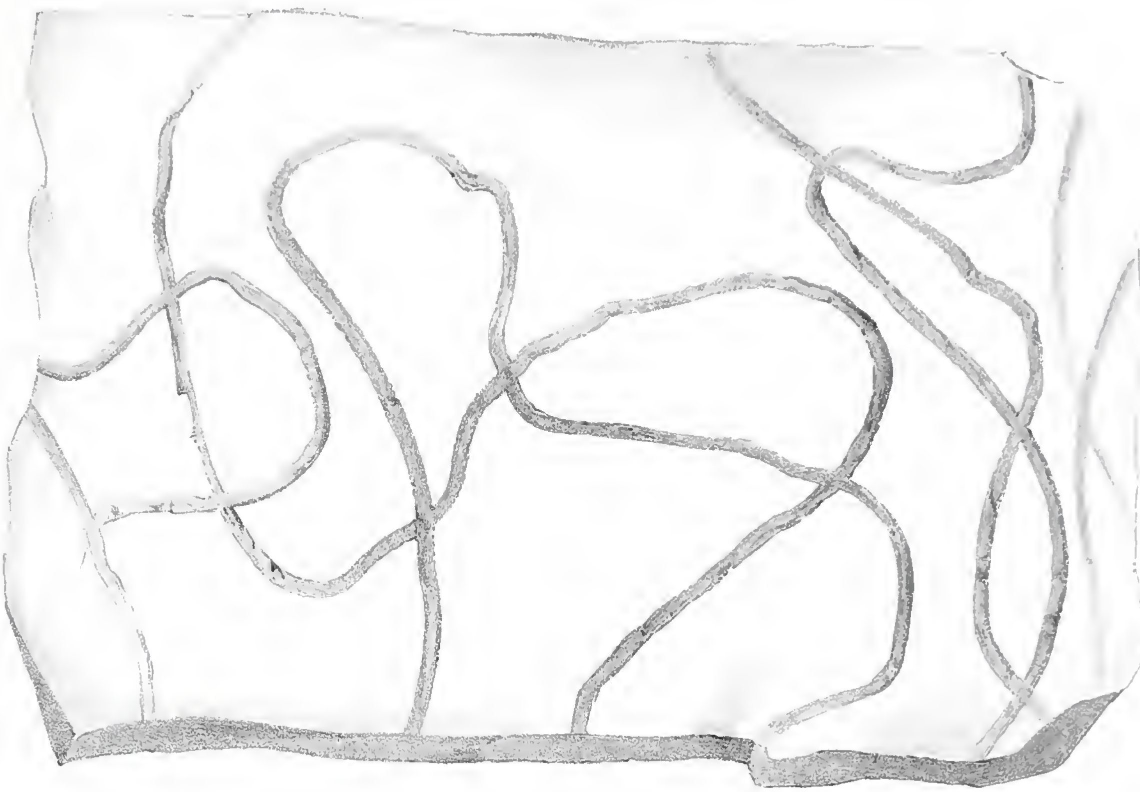

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PLATE 72.

Fig. 1. 321. 2. GRAPTOLITHUS PRISTIS. (Pag. 265.)

1 *a.* A fragment of arenaceous slate from the Hudson-river group at Turin, preserving the base of several specimens. 1 *b.* A portion of the same magnified.

1 *c.* A magnified fragment of the same species on the opposite side of this specimen, showing obtuse serratures.

1 *d.* A specimen of the same species from the black slate of Oxtungo creek, south of Fortplain.

1 *e.* A magnified portion of the same.

1 *f.* A fragment of the same species from the olive slate of the Hudson-river group at Loraine.

1 *g.* The same magnified, showing the obtuse termination of the teeth.

1 *h.* A specimen from the olive slate in Lewis county. 1 *i.* A magnified portion of the same.

1 *k.* A narrow and somewhat more finely serrated specimen from the Utica slate. 1 *l.* The same magnified.

1 *m.* A small specimen, showing the axis extending beyond the serrated portion in both directions.

1 *n.* The same magnified.

1 *o.* A fragment of the same from the black slate of the Hudson-river group near Albany.

1 *p.* A magnified portion of the same, showing the acute teeth near the base, and the broader obtuse ones above.

1 *r.* This specimen resembles *G. foliaceus* of MURCHISON, and differs slightly from the preceding in the short mucronate points of the teeth shown in the magnified portion 1 *s* : in other respects it is similar.

Fig. 2. 322. 3. GRAPTOLITHUS SECALINUS. (Pag. 267.)

2 *a.* A portion of the surface of a lamina of the Hoosick slate, with specimens of this fossil presenting some variations in character. The broader one crossing the figure has the form and appearance of *Prionotus folium* of HISINGER; but it is evidently only a more extenuated form of the same species as the more elongated and narrower ones.

2 *b, b.* Fragments of the slate from Baker's falls, with forms intermediate between the more expanded varieties of *G. pristis* and those from Hoosick.

2 *c.* A specimen from Hudson, where the slates are partially metamorphic, but much less thinly laminated, and the fossils less expanded, than those at Baker's falls or at Hoosick.

PLATE 73.

Fig. 1. 323. 4. GRAPTOLITHUS MUCRONATUS. (Pag. 268.)

1 *a*. Two fragments of this species. 1 *b*. A portion of one enlarged.

1 *c*, *d*. Fragments of the same species, one of them much contracted, and both preserving extremely mucronate teeth.

Fig. 2. 324. 5. GRAPTOLITHUS BICORNIS. (Pag. 268.)

2 *a*. A small specimen of the natural size, showing the bifurcation below.

2 *b*. A portion of the same magnified, showing the form of the teeth.

2 *c*. A larger specimen having the same character, with a stronger bifurcation, which is thickened at the point of separation. 2 *d*. A portion magnified.

2 *e*. A specimen having similar obtuse teeth, with the base removed and the midrib projecting above.

2 *f*. A fragment of slate, with several specimens preserving the peculiar radical termination; associated with *G. ramosus*.

2 *g*, *h*. Magnified portions of these, showing a dissimilar form in the teeth.

2 *i*. A fragment in the slate, preserving its original form in a good degree. 2 *k*. The same enlarged.

2 *l*. A fragment in limestone. 2 *l'*. A more compressed form in the same.

2 *m*, *m'*. Enlarged portions of the same.

2 *m''*. A magnified view of the edge of a specimen in limestone, showing an appearance analogous to *G. scalaris*. 2 *n*. Transverse sections of the same magnified.

2 *o*. A slender specimen, with the sides parallel.

2 *p*. A similar specimen, preserving the capillary axis beyond the remaining portion of the stipe.

2 *r*, *s*. Magnified portions of these, showing their identity with the preceding.

Fig. 3. 325. 6. GRAPTOLITHUS RAMOSUS. (Pag. 270.)

3 *a*, *a'*. Small specimens near the radical termination, having a simple bifurcation above.

3 *b*. A specimen with a more diverging and elongated bifurcation, with a smaller specimen lying obliquely across the right ramus.

3 *b'* & *b''*. The same species. 3 *c*, *d*. Enlarged portions of the two last.

3 *e*. A specimen with elongated rami, which are serrated on one side only. Fragments of *G. sagittarius* on the same specimen.

3 *f*. A specimen branched below, and bifurcating above. The branches and bifurcate stipe above are serrated on one side only; while the stipe below and between the branches and bifurcation is serrated on both sides.

3 *g*, *h*. Enlarged portions, showing the character of the teeth at the points of divergence, below and upon the branches.

Fig. 4. 326. 7. GRAPTOLITHUS SCALARIS. (Pag. 271.)

4 *a*. A specimen showing the radical termination. 4 *b*. A portion of the same magnified.

4 *c*. A more slender and tapering specimen, with a single range of dissepiments. 4 *d*. Magnified portion.

4 *e*, *f*. A small fragment, with oblique dissepiments and smooth margin.

4 *g*. A specimen with apparently a single range of dissepiments, and a central capillary axis projecting beyond the stipe.

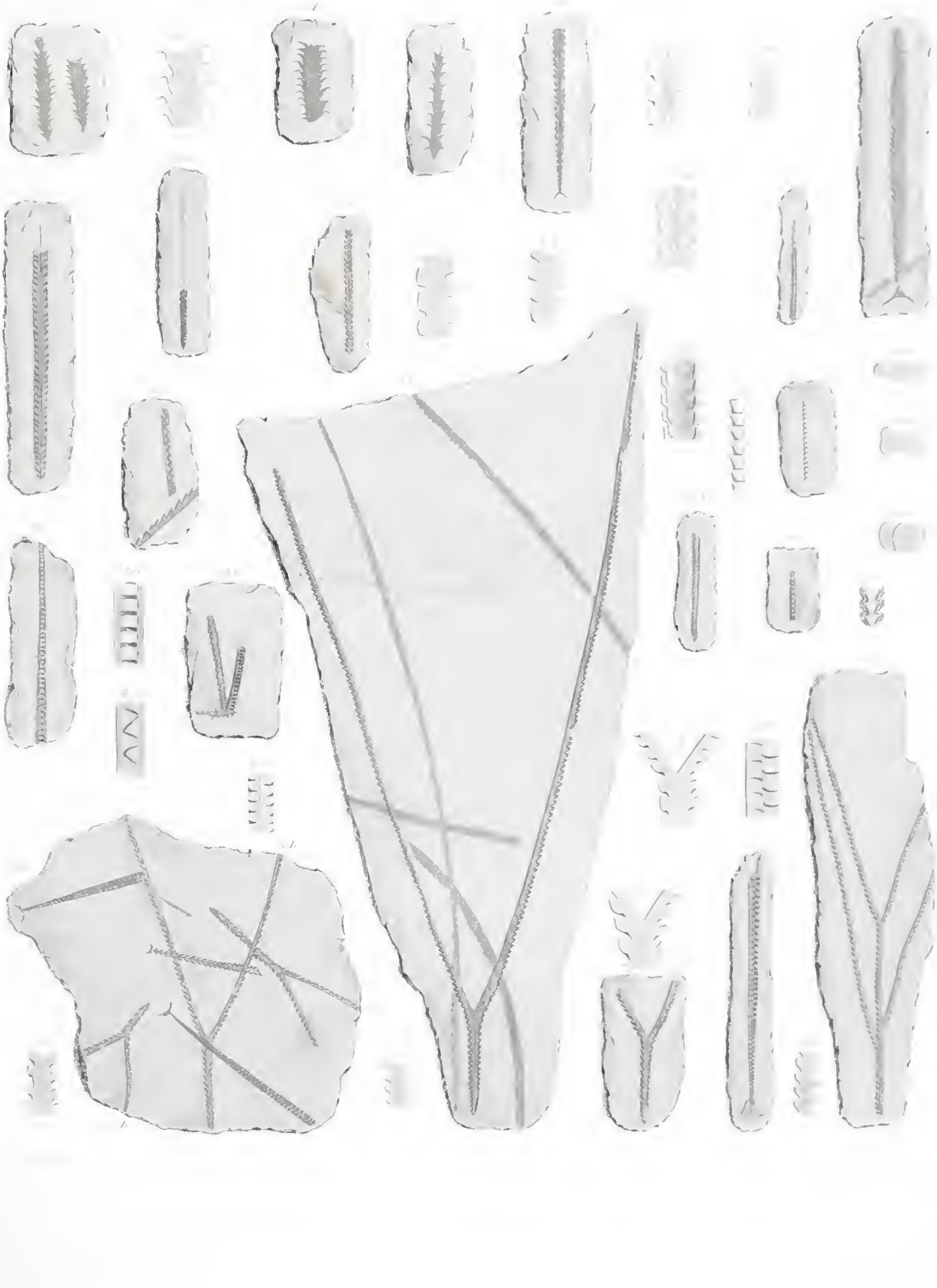

PLATE 74.

Fig. 1. 327. 8. GRAPTOLITHUS SAGITTARIUS. (Pag. 272.)

1 *a*. A fragment of the slate, showing three nearly parallel stipes of this species.

1 *b*. A magnified portion, showing the upper margin of the teeth to be nearly rectangular to the direction of the stipe, while the lower side is oblique.

Fig. 2. 328. 9. GRAPTOLITHUS TENUIS. (Pag. 272.)

2 *a*. Slender elongated stipes of this species, associated with *G. sagittarius*.

2 *b*. A portion of one of these magnified.

2 *c*. A small filiform stipe, gradually tapering and bent abruptly backwards.

2 *d*. A portion of the same magnified, showing the serratures of the same character as the preceding.

Fig. 3. 329. 10. GRAPTOLITHUS SEXTANS. (Pag. 273.)

3 *a*. A fragment of slate on which are two specimens of this species, with straight diverging branches.

3 *b*. A portion of one of these magnified, showing the mucronate teeth. 3 *c*. Specimen with larger branches.

3 *d*, *d*. Two specimens, showing the appendages at the base. 3 *e*. One of the last magnified.

Fig. 4. 330. 11. GRAPTOLITHUS FURCATUS. (Pag. 273.)

4 *a*. An individual on the same stone with 3 *d*, showing the difference in form. 4 *b*. Magnified portion.

4 *c*. A small specimen, with the branches more converging than usual.

4 *d*. A portion of the last magnified, showing no serratures on the inside of the branches.

4 *e*. Another specimen, similar in form to 4 *c*.

4 *f*. A part of the same magnified, showing serratures on the inside of the branches.

4 *g*. A specimen with elongated branches which cross each other.

4 *h*. A part of the same magnified, showing both margins to be serrated.

Fig. 5. 331. 12. GRAPTOLITHUS SERRATULUS. (Pag. 274.)

5 *a*. A specimen of the natural size, diverging from a slender smooth spine or mucronate radicle below.

5 *b*. A portion magnified, showing the form and opposite direction of the serratures at the base.

Fig. 6. 332. 13. GRAPTOLITHUS GRACILIS. (Pag. 274.)

6 *a*, *b*. Two specimens (natural size), showing the principal stipe and branches, one of the latter being subdivided.

6 *c*. A specimen in which the principal stipe is obscure: several branches are subdivided. A fragment of *G. pristis*, and of *G. mucronatus*, are shown on the same piece of slate.

6 *d*. A fragment magnified, showing the serratures of the branches.

Fig. 7. 333. 14. GRAPTOLITHUS? LÆVIS. (Pag. 274.)

Fig. 8. 381. 15. GRAPTOLITHUS ARUNDINACEUS.

8. The specimen, natural size. 8 *a*. The same magnified

PLATE 75.

Fig. 1. 334. 1. Favistella stellata. (Pag. 275.)

1 *a*. A fragment of this coral, showing a vertical section, with an oblique section of the extremities of the tubes.

1 *b*. A transverse section of the cells, showing the starlike extremities.

1 *c*. An enlarged view of the extremities of several cells.

Fig. 2. 101. 2. Chætetes lycoperdon. (Pag. 276.)

2 *a*, *b*. The bases of two hemispherical forms, where the tubes have a barely perceptible extension.

2 *c*. A fragment of a ramose form, one of the largest occurring in this group.

2 *d*. A subhemispheric form, which commenced its growth upon the column of a crinoid.

2 *e*. A fragment of stone, with several ramose forms associated with a crinoidal column, a small *Murchisonia* and *Orthis testudinaria*.

2 *f*. Magnified section of a ramose form, showing the columns to be nearly parallel to the axis of the specimen.

Fig. 3. 335. 1. Discophyllum peltatum. (Pag. 277.)

Fig. 4. 336. 1. (*Undetermined.*) (Pag. 277.)

HUDSON RIVER GROUP.

(CORALS.)

PL. 7

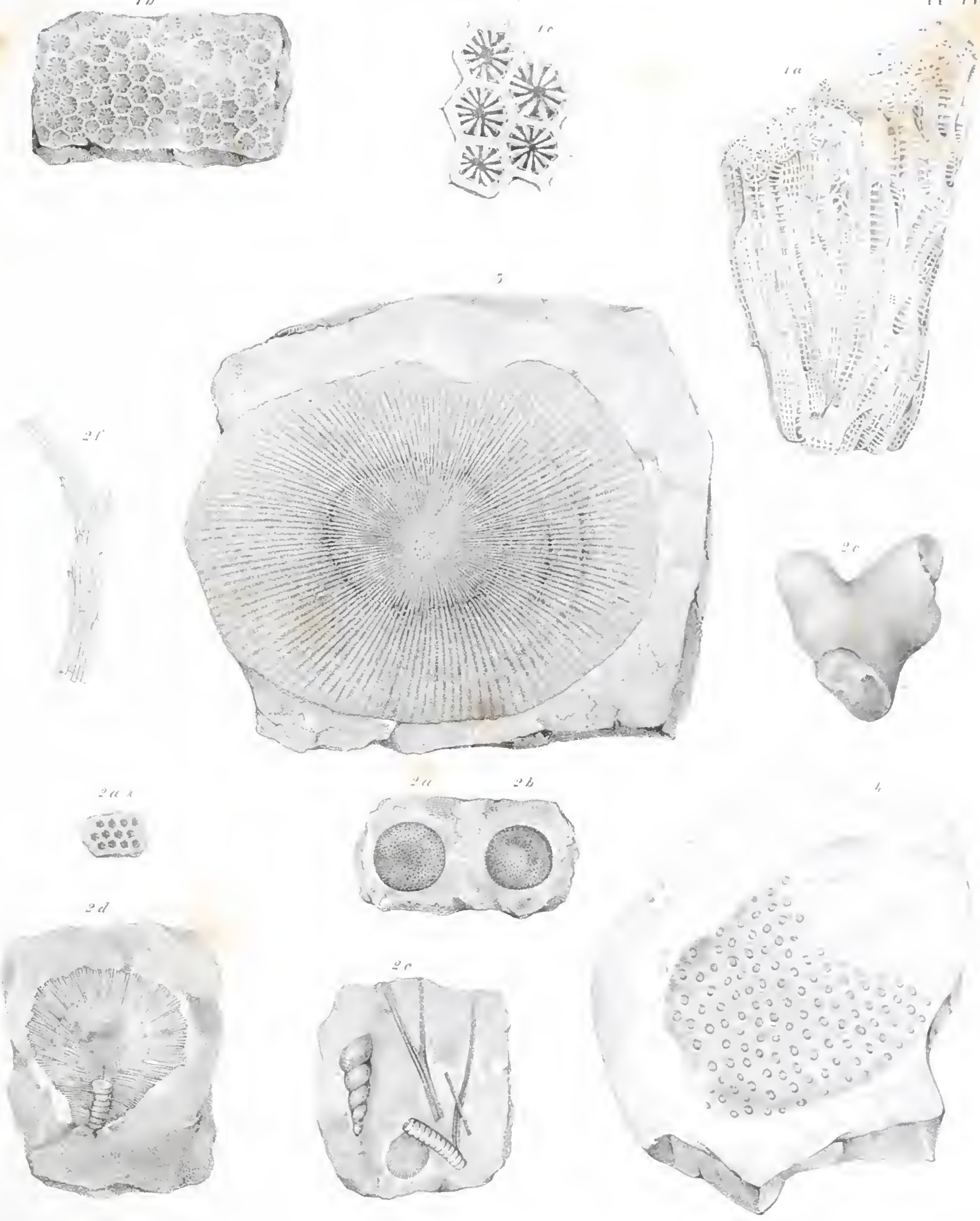

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PLATE 76.

Fig. 1. 337. 1. HETEROCRINUS HETERODACTYLUS. (Pag. 279.)

1 *a*, *b*. Two specimens of the natural size.

1 *c*. The body of the same enlarged. 1 *c'*. Transverse section of the column, enlarged.

1 *d*. An enlarged figure, representing the structure of this species.

1 *e*, *f*. Fragments of slate with pentagonal columns of this species, showing the body at *f'*. (The letter *f'* is omitted on the plate.)

1 *g*. A fragment of one of these columns enlarged, showing the nodulose angles.

1 *h*. A fragment of a column, with a section of the same.

1 *i*. A fragment of slate, showing numerous impressions of the plates or discs of the column.

1 *k*, *l*, *m*, *n*, *o*. The same magnified, showing the pentapetalous expansion around the canal, and the deeply impressed striæ, which are different in each one.

Fig. 2. 338. 2. HETEROCRINUS SIMPLEX. (Pag. 280.)

2 *a*. The specimen, natural size. 2 *b*. A few joints of the columns enlarged.

2 *c*. Section of the same, which is flattened from pressure.

2 *d*. An enlarged figure, showing the structure of the body and arms of this species.

Fig. 3. 339. 3. HETEROCRINUS? GRACILIS. (Pag. 280.)

3 *a*. A specimen of the natural size.

3 *b*. The same magnified. (The figure 3 *b* is erroneously marked 2 *b* on the plate.)

PLATE 77.

Fig. 1. 340. 1. GLYPTOCRINUS DECADACTYLUS. (Pag. 281.)

1 *a.* A fragment of stone with two small specimens, preserving the tentaculated fingers.

1 *b.* Figure of a larger specimen, showing the character of the plates and their arrangement more distinctly.

1 *c.* The upper extremity or crown of the last specimen, showing the capital plates. 1 *d.* Same enlarged.

1 *e.* A portion of the surface enlarged, showing the form and character of the plates, and the strong radiating ridges.

1 *f.* An enlarged figure, showing the structure and arrangement of the plates as described (pag. 284, note).

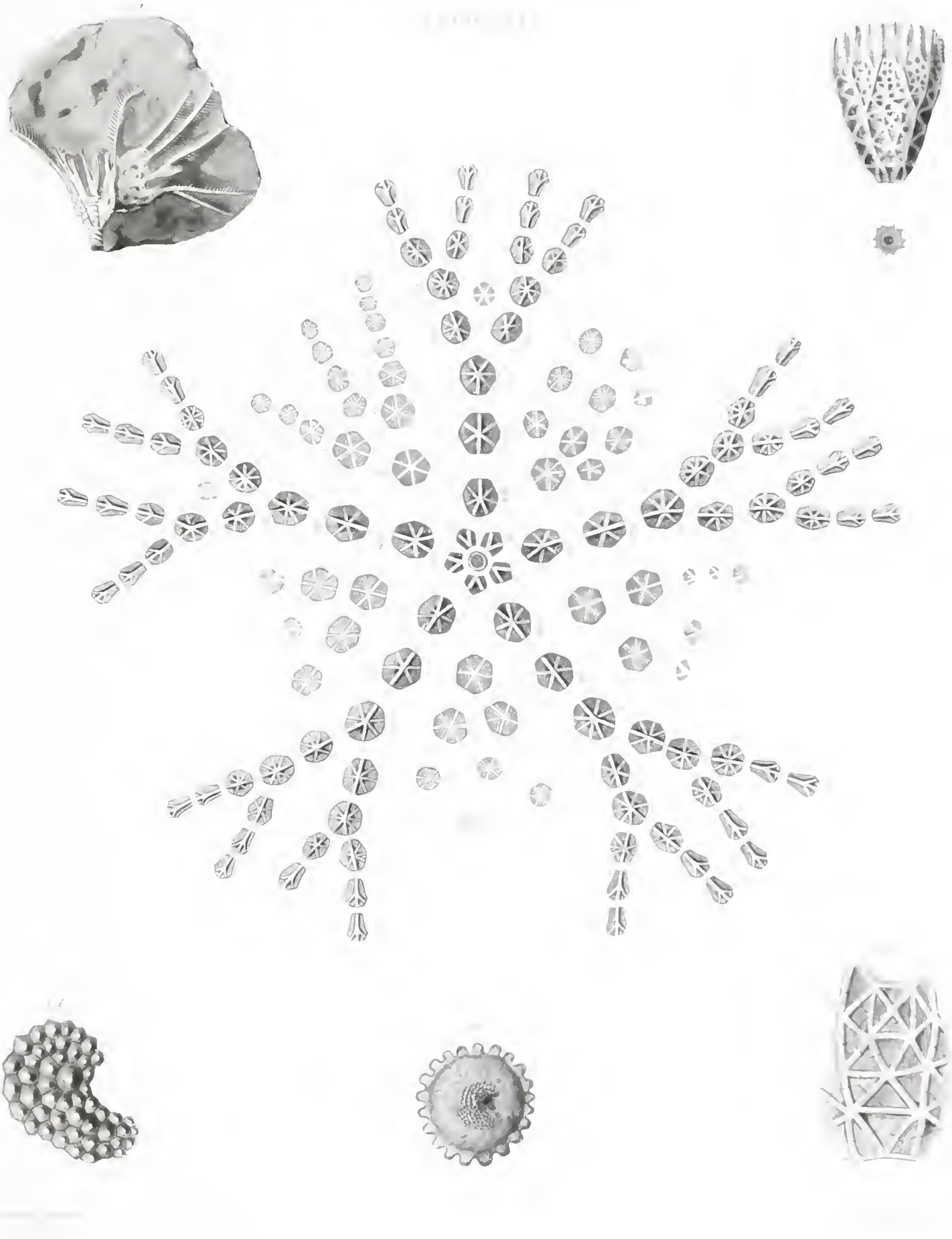


PLATE 78.

Fig. 1. 340. 1. GLYPTOCRINUS DECADACTYLUS. (Pag. 281.)

1 *a*. A figure of a specimen, preserving a small portion of the column and the entire length of the fingers.
1 *b*. Fragments of columns, composed of alternating large and smaller discs with angular edges.
1 *c*. Section of the same.
1 *d*. Section and figure of a similar fragment of a column enclosed in a coral.
1 *e*. Fragment and section of a column where the discs are excavated on their upper side, and have plain rounded edges with a pentapetalous impression on the extremities.
1 *f*. Fragment of similar character, having the upper edges of the plates fimbriated.
1 *g*. Section of the same enlarged. 1 *h*. Magnified portion, showing the fimbriated edges of the discs.
1 *i*. Separate plates or discs of a similar column, showing the variable character of the marginal crenulations, one specimen being marked by six prominent angles.
1 *k*. Two figures, showing the proportionate size of the larger and smaller discs in the columns, composed of plain alternating joints.
1 *n*. Fragment of a column, with the edges of the discs rounded and slightly nodulose : intermediate plates thin.
1 *o*. Edges of the discs rounded and nodulose ; intermediate ones thin, nodulose.
1 *p*. Edges of the discs rounded and smooth, the intermediate ones thin.
1 *r*. Edges of the discs flat and broad, the intermediate ones thin.
1 *s*. A fragment of slate with moniliform columns ; the intermediate plates often being scarcely distinct, while in others they are half as thick as the larger ones.
1 *t*. Large fragments of columns in the compact slaty rocks of the Hudson-river group, with the discs thick, the intermediate ones being scarcely visible.
1 *u*. A similar fragment of a column, with a section of the end, showing identity with the preceding figures.

Fig. 2. 129. 1. TENTACULITES FLEXUOSA. (Pag. 284.)

2 *a*. Fragment of stone with several specimens *a*, *a*, *a*, associated with corals, shells, etc.
2 *b*. A specimen enlarged, showing the longitudinal striæ.

CRINOIDEA

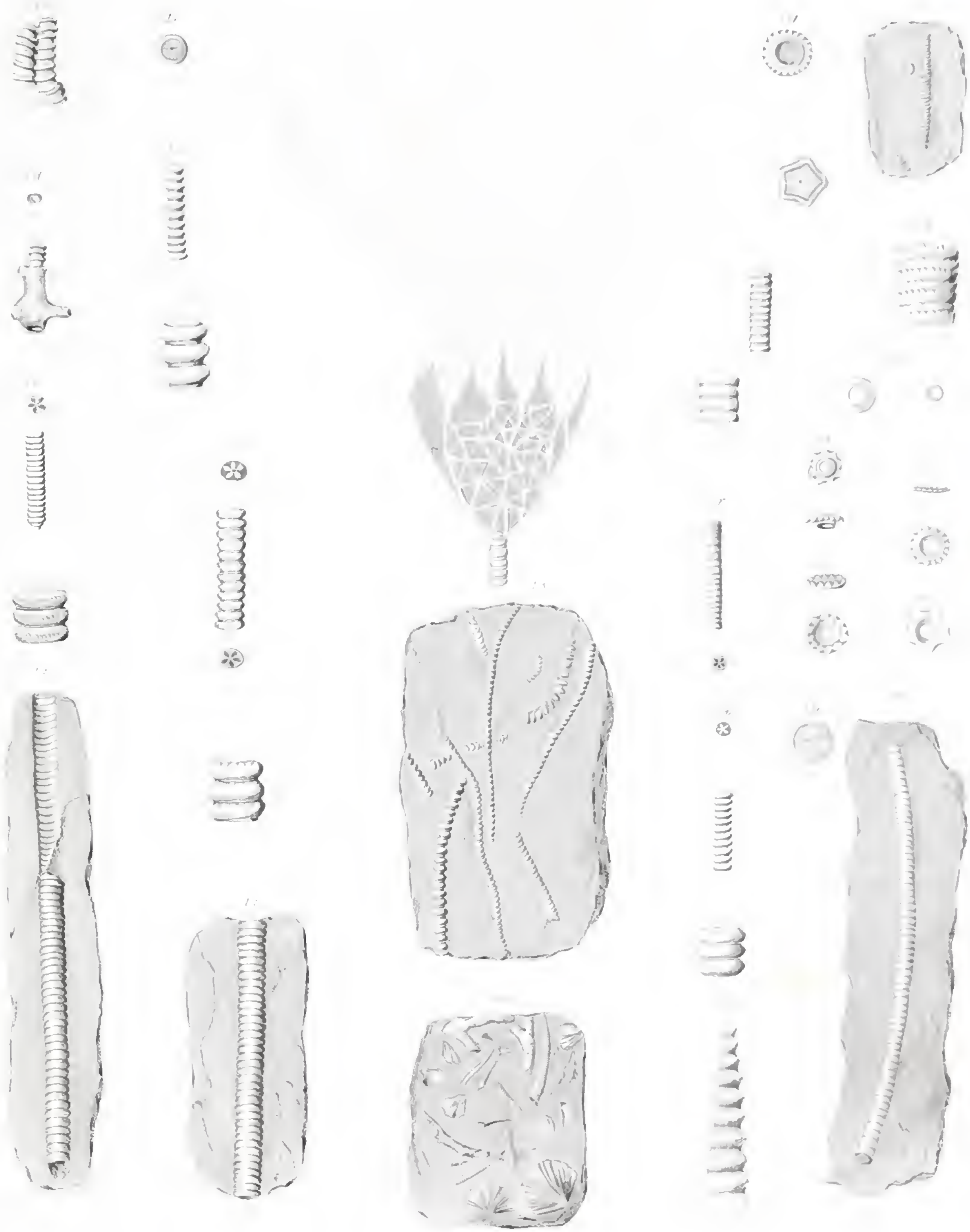


PLATE 79.

Fig. 1. 133. 7. LINGULA QUADRATA. (Pag. 285.)

1 *a, b.* Figures of two specimens, showing the difference ordinarily seen in the form of this fossil.
1 *c.* A portion of the surface magnified.

Fig. 2. 141. 4. LEPTÆNA ALTERNATA. (Pag. 286.)

2 *a.* Mould of the interior of the convex valve of this species, showing the form of the visceral impression, the oblique teeth, etc. The nasute character is well preserved.
2 *b.* Figure of a similar specimen, where the nasute character is less conspicuous.
2 *c.* A smaller specimen of the same character, showing a slight contraction in front.
2 *d.* A portion of the surface of one of these enlarged, showing the striato-punctate character.
2 *f.* The impression made by the outside of the convex valve of this species, showing the fascicles of striæ in a perfect manner.
2 *f**. A cast of a large symmetrical specimen, showing the same characters of the surface, form of visceral impression, etc.
2 *g.* A small specimen, preserving the shell, and showing the striæ in interrupted fascicles.
2 *g†.* A portion of the surface enlarged.
2 *h, i.* Figures of specimens which still preserve a part of the shell, having the striæ in broad fascicles of small ones separated by larger ones.
2 *k.* Interior of the ventral valve, showing two small teeth on the hinge line, with three diverging callosities.
2 *l.* Mould of the interior of the ventral valve, showing the two cavities made by the teeth, and the impressions of the radiating callosities.

Fig. 3. 146. 9. LEPTÆNA SERICEA. (Pag. 287.)

3 *a.* A mould of the interior of the shell.
3 *b.* An enlarged portion, showing the striato-punctate character of the surface.
3 *a**. Another specimen, presenting more distinctly the usual character of casts of this species.

Fig. 4. 155. 2. ORTHIS TESTUDINARIA. (Pag. 288.)

4 *a, b.* Casts of the interior of the dorsal valve. 4 *c.* Cast of the interior of the ventral valve.
4 *d.* A similar cast, more strongly impressed by the striæ.
4 *e.* A fragment of the impression of the outer side of the ventral valve, showing the fine concentric striæ, which crenulate the diverging striæ.

Fig. 5. 341. 19. ORTHIS ERRATICA. (Pag. 288.)

5 *a, b.* Dorsal and ventral views of the cast of a large specimen. 5 *d.* Ventral view of a small specimen.
5 *c.* Front view of a larger specimen. 5 *e.* Cardinal view of a large specimen.
5 *f.* Profile view of a moderately convex specimen.

Fig. 5*. 342. 20. ORTHIS CENTRILINEATA. (Pag. 289.)

5 *a**. A specimen, natural size. 5 *b**. Magnified portion of the cardinal line and visceral impression.
5 *c**. Several striæ enlarged, showing the bifid and trifid character.

Fig. 6. 186. 19. ATRYPA INCREBESCENS. (Pag. 289.)

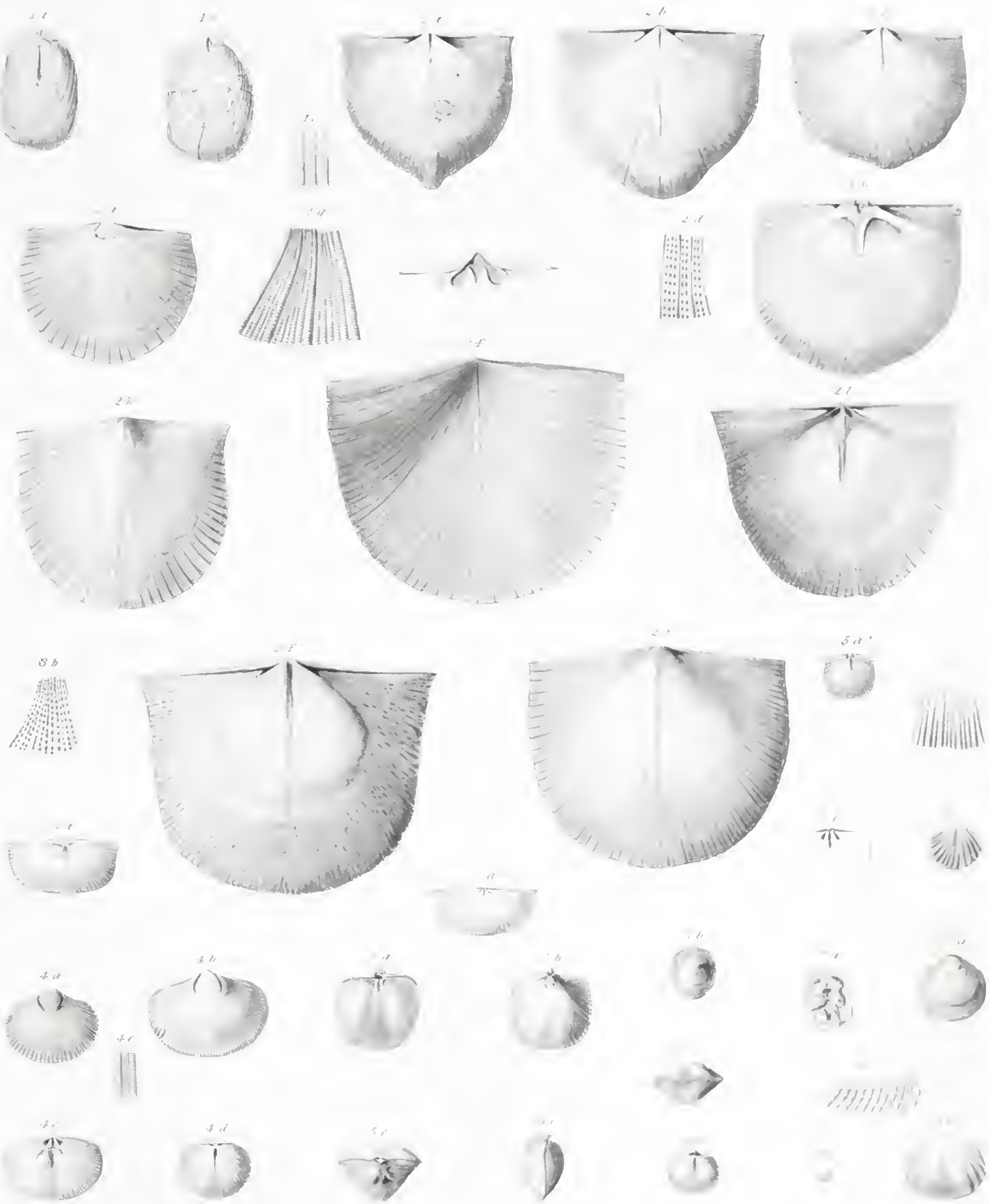
Fig. 7. 343. 5. ORBICULA? SUBTRUNCATA. (Pag. 290.)

7 *a.* A small fragment with several individuals upon the surface. 7 *b.* A single specimen enlarged.

Fig. 8 *a.* 344. 6. ORBICULA? CRASSA. (Pag. 290.)

Fig. 9. 345. 7. ORBICULA CÆLATA. (Pag. 290.)

9 *a.* An imperfect specimen. 9 *b.* The same enlarged, to show the central depression and lateral plications.
9 *c.* A portion of the surface still farther enlarged, showing the character and arrangement of the papillæ.



3 b
5 a
4 a
4 b
4 d

PLATE 80.

Fig. 1. 346. 3. AVICULA INSUETA. (Pag. 291.)

1 *a*. A specimen, natural size. 1 *b*. A portion of the surface enlarged.

Fig. 2. 347. 4. AVICULA DEMISSA. (Pag. 292.)

2 *a*. A large perfect specimen, which is more elevated than usual.
2 *b*. The impression of a smaller specimen in sandstone.

Fig. 3. 348. 5. AVICULA? DESQUAMATA. (Pag. 292.)

3 *a*. A specimen, natural size. 3 *b*. An enlarged portion of the surface.

Fig. 4. 349. 7. AMBONYCHIA RADIATA. (Pag. 292.)

4 *a*, *b*. The right and left valves of different specimens of this species.
4 *c*. A smaller individual, with the radii distinctly marked, and more than thirty in number.
4 *d*. A young specimen, with the radii finely marked. 4 *e*. A portion of the surface enlarged.
4 *f*. A cast of the interior of the right valve: the posterior slope shows a straight, well defined, impressed line.
4 *h*. Profile view of a specimen preserving both valves.
4 *i*. Lateral view of the same. The difference in form between this and the preceding specimens is due to pressure.
4 *j*. A large specimen incrusted at its base with a coral, of which an enlarged portion is given in 4 *g*. (The letter is omitted on some of the plates.)
4 *k*. Enlarged portion of the surface, showing the same structure as 4 *e*.
4 *l*. An impression of a part of the valve of a very large and strongly ribbed specimen.

Fig. 5. 350. 8. AMBONYCHIA CARINATA. (Pag. 294.)

5 *a*. Left valve of this species.
5 *b*. Profile view, showing both valves. The apparent inequality of the beaks is produced by a slight displacement from pressure.

ACEPHALA

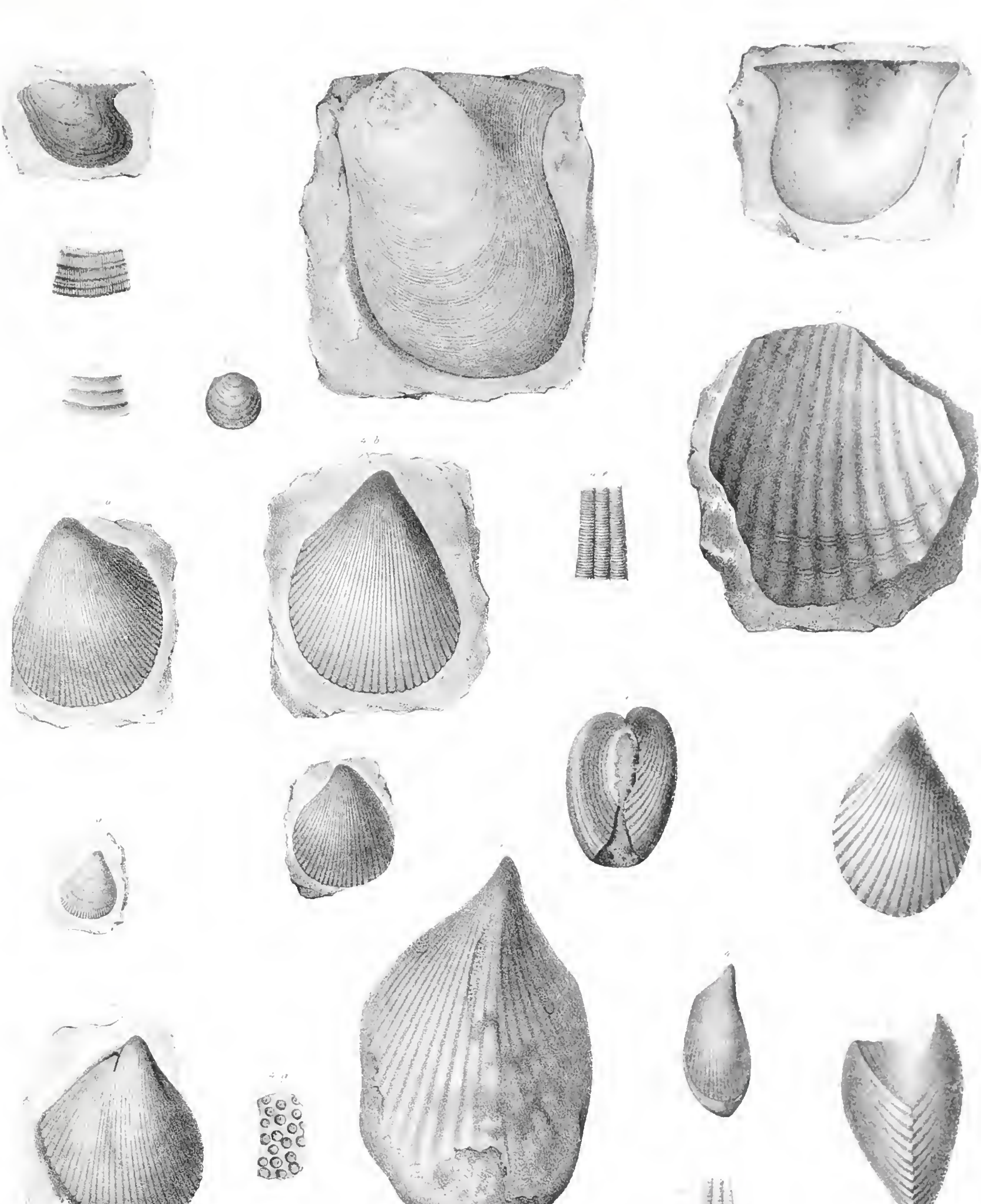


PLATE 81.

Fig. 1. 351. 11. MODIOLOPSIS MODIOLARIS. (Pag. 294.)

1 *a*. A specimen preserving the two valves in connection, showing the hinge-line, and the anterior muscular impression, which produces an elevation upon the outer surface of the shell.

1 *b*. Another specimen preserving the two valves, which are laterally compressed. The anterior extremities are narrowed, and somewhat obtusely pointed.

1 *c*. A single valve, with the posterior extremity more regularly rounded, and the hinge-line curved.

1 *d*. A smaller and shorter specimen, with the base not contracted or arched.

1 *e*. A small specimen, contracted at the anterior, and expanded towards the posterior extremity. The base is arched, and the hinge-line apparently curved.

1 *f*. A specimen from the shales at Madison (Indiana), preserving both valves.

1 *g*. The anterior extremity of a cast of this species, showing the prominence of the muscular impression.

Fig. 2. 203. 4. MODIOLOPSIS NASUTUS. (Pag. 296.)

Fig. 3. 352. 12. MODIOLOPSIS TRUNCATUS. (Pag. 296.)

3 *a*. View of the right valve of this species.

3 *b*. Profile view, one valve being more compressed than the other.

Fig. 4. 353. 13. MODIOLOPSIS CURTA. (Pag. 297.)

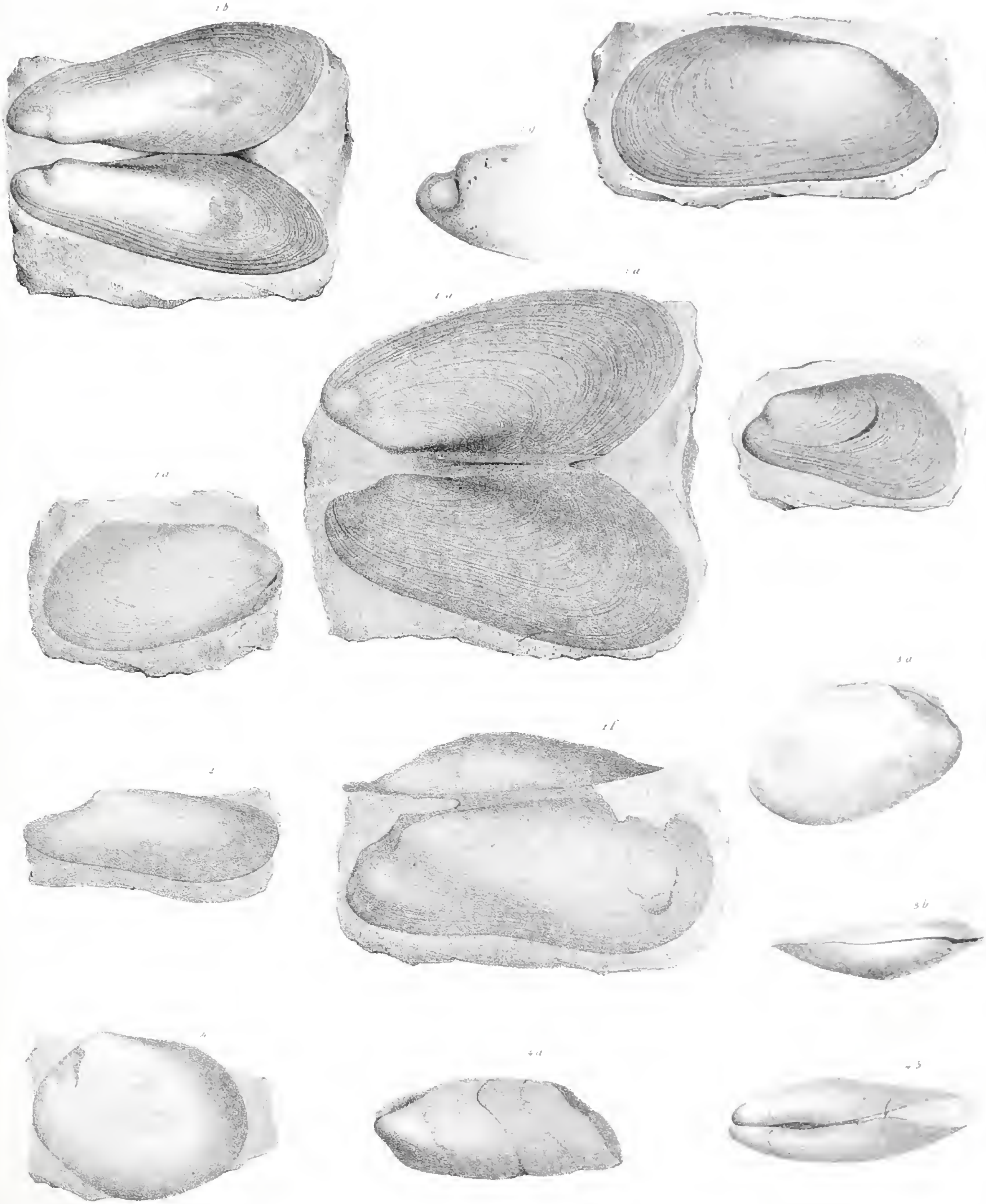
A large individual of this species, from near Grimsby, Canada West.

Fig. 5. 354. 14. MODIOLOPSIS (*Species undetermined*). (Pag. 297.)

5 *a*. Left valve of the fragment. 5 *b*. Dorsal view of the same.

(This species is erroneously marked 4 *a*, *b*, on some of the plates.)

ACEPHALA



ON STONE BY F SWINTON G & W ENDICOTT LITH N.Y.

PLATE 82.

Fig. 1. 351. 11. MODIOLOPSIS MODIOLARIS. (Pag. 294.)

A young specimen of this species.

Fig. 2. 353. 13. MODIOLOPSIS CURTA. (Pag. 297.)

2 *a*. A specimen from Loraine, Jefferson county, New-York.
2 *b*. A small specimen in shale, from Rodman, Jefferson county.
2 *c*. Figure of a small specimen from Mineral Point, Wisconsin. 2 *d*. Cardinal view of the same species.

Fig. 3. 355. 15. MODIOLOPSIS ANODONTOIDES. (Pag. 298.)

3 *a*. A specimen in sandstone, preserving the original form of the shell.
3 *b*. A specimen in soft shale, more compressed than the preceding, and consequently rounded at the posterior extremity. 3 *c*. A specimen in shale, where both valves are still adhering.

Fig. 4. 202. 3. MODIOLOPSIS FABA. (Pag. 298.)

4 *a*, *b*. Views of two specimens — casts in sandstone.

Fig. 5. 356. 16. MODIOLOPSIS? NUCULIFORMIS. Pag. 298.)

5 *a*. Specimen preserving both valves. 5 *b*. A right valve, less compressed than the preceding.

Fig. 6. 357. 1. ORTHONOTA PHOLADIS. (Pag. 299.)

Fig. 7. 358. 2. ORTHONOTA PARALLELA. (Pag. 299.)

7 *a*. The left side of a cast scarcely retaining any markings. 7 *d*. Dorsal view of the same.
7 *b*. Dorsal view of a cast in coarse sandstone, where the folds are visible on the dorsal margin.
7 *c*. The left valve, preserving the shell, which is finely striated concentrically, and shows the folds upon the cardinal line.

Fig. 8. 359. 3. ORTHONOTA CONTRACTA. (Pag. 300.)

8 *a*. The left valve, showing the distinct carina and concentric striæ of the surface.
8 *b*. Dorsal view of the same, showing the oblique wrinkles on the posterior cardinal margin of the shell.

Fig. 9. 360. 1. CLEIDOPHORUS PLANULATUS. (Pag. 300.)

9 *a*. Specimen of arenaceous slate, with several individuals of this species, associated with crinoidal columns.
9 *b*, *c*, *d*. Other individuals from different localities, showing a slight difference in form.
9 *e*. A specimen from the altered slates, preserving both valves.

Fig. 10. 190. 2. NUCULA? POSTSTRIATA. (Pag. 301.)

10 *a*. A small specimen in the ferruginous sandstone.
10 *b*. A larger specimen, preserving very distinctly the striæ on the posterior slope.

Fig. 11. 361. 1. LYRODESMA PLANA. (Pag. 302.)

11 *a*. The right valve. 11 *b*. Interior of the same, showing the cardinal teeth.

Fig. 12. 362. 2. LYRODESMA PULCHELLA. (Pag. 302.)

12 *a*. A specimen of the natural size, from the black slate near Watertown, Jefferson county.
12 *b*. The same enlarged, showing the character of the crenulations.
12 *c*. A smaller specimen from the partially altered slates near Waterford on the Hudson river.
12 *d*. The cardinal line enlarged.

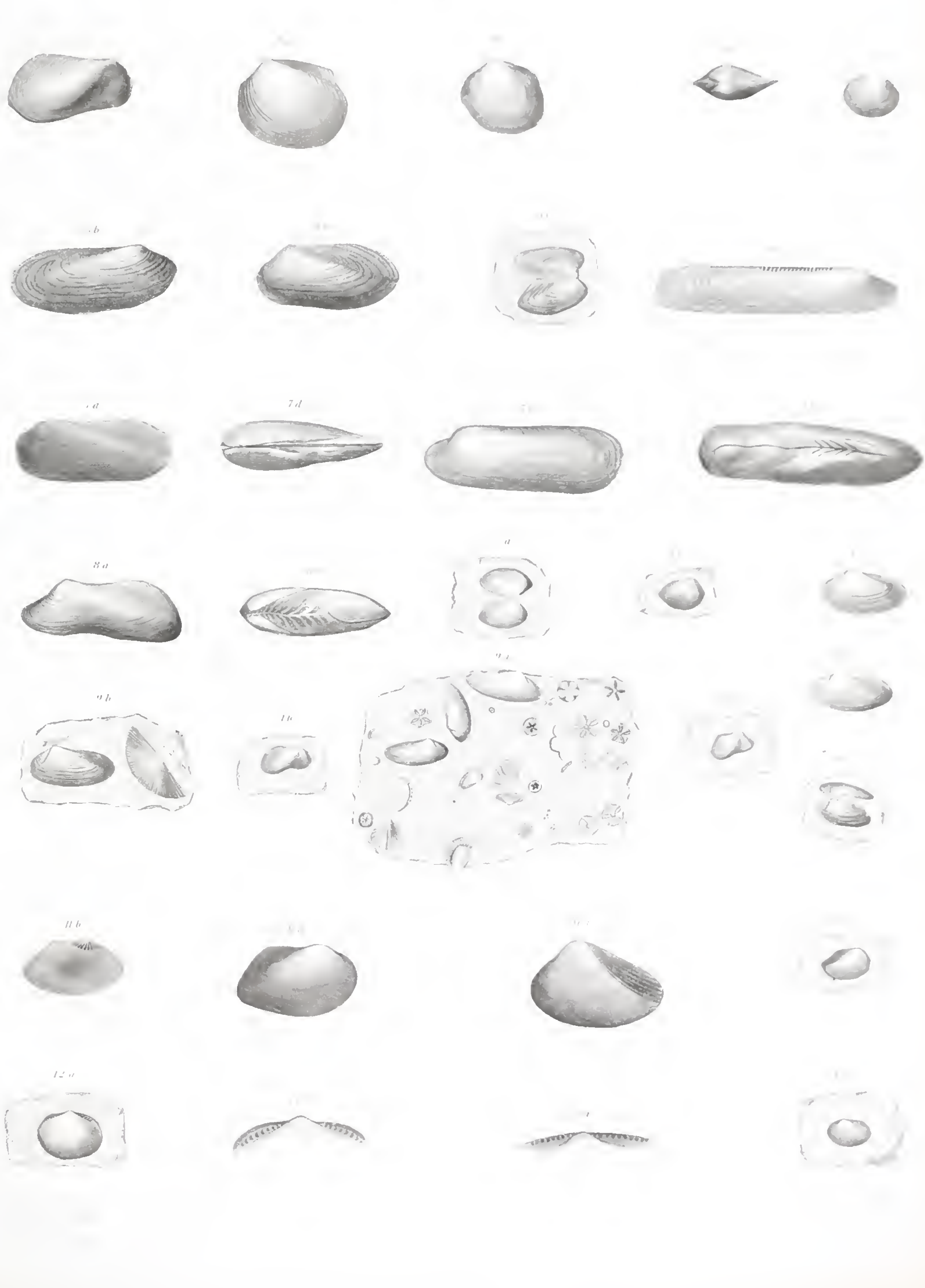

6 b
7 d
8 a
9 b
11 b
12 a

PLATE 83.

Fig. 1. 236. 13. MURCHISONIA GRACILIS. (Pag. 303.)

1 *a*. A specimen (a cast) from the calcareous sandstone. 1 *b*. A similar cast from the soft shales at Loraine.
1 *c*. A fragment of slate, with several small specimens.

Fig. 2. 363. 14. MURCHISONIA UNIANGULATA, *var.* ABBREVIATA. (Pag. 304.)

2 *a*, *b*. Two specimens which preserve a part of the shell.
2 *c*. A portion of the surface of the last volution magnified, showing the double spiral band.
2 *d*. A specimen with the volutions more acutely angulated, but apparently identical.

Fig. 3. 225. 13. PLEUROTOMARIA SUBCONICA. (Pag. 304.)

3 *a*. A specimen preserving the vertical striæ. 3 *b*. A portion of the same enlarged.
3 *c*, *d*. Imperfect casts, from the shales of the Hudson-river group.
3 *e*. A more perfect cast of the same species, from Wisconsin.

Fig. 4. 364. 17. PLEUROTOMARIA [?] BILIX. (Pag. 305.)

4 *a*. A small specimen of this species, showing the back of the spire, and the expansion of the last volution towards the aperture.
4 *b*. A portion of the surface enlarged, showing the alternating larger and smaller carinæ, which are crossed by the oblique fine striæ.
4 *c*. A larger specimen : a view from the outside obliquely into the aperture.
4 *d*. Another specimen, showing the form of the aperture, which is entire on the outer margin.
4 *e*. The base, viewed in the direction of the spire.

Fig. 5. 365. 18. PLEUROTOMARIA (*Species undetermined*). (Pag. 305.)

5 *a*, *b*. Views of the apex and base of two small casts.

Fig. 6. 366. 2. METOPTOMA ? RUGOSA. (Pag. 306.)

6 *a*. Upper surface of the shell. 6 *b*. Lateral view. 6 *c*. Enlarged portion of the surface.

Fig. 7. 239. 2. CARINAROPSIS PATELLIFORMIS. (Pag. 306.)

7 *a*. A large individual of this species.
7 *b*. Profile of the same. The elevation of the shell is less than usual, from compression.

Fig. 8. 367. 3. CARINAROPSIS ORBICULATUS. (Pag. 306.)

8 *a*. View of a specimen, looking upon the apex. 8 *b*. Lateral view of specimen partially distorted.
8 *c*. A portion of the surface enlarged.

Fig. 9. 240. 1. BELLEROPHON BILOBATUS. (Pag. 307.)

9 *a*. A large imperfect specimen.
9 *b*, *c*. Lateral and profile view of a smaller specimen, showing the volutions compressed.

Fig. 10. 368. 4. BELLEROPHON CANCELLATUS. (Pag. 307.)

10 *a*. Lateral view of an entire individual.
10 *b*. A portion of the surface enlarged, showing the cancellated striæ.
10 *c*. A fragment of a shell, apparently of the same species.

HUDSON RIVER GROUP Pl.

GASTROPODA

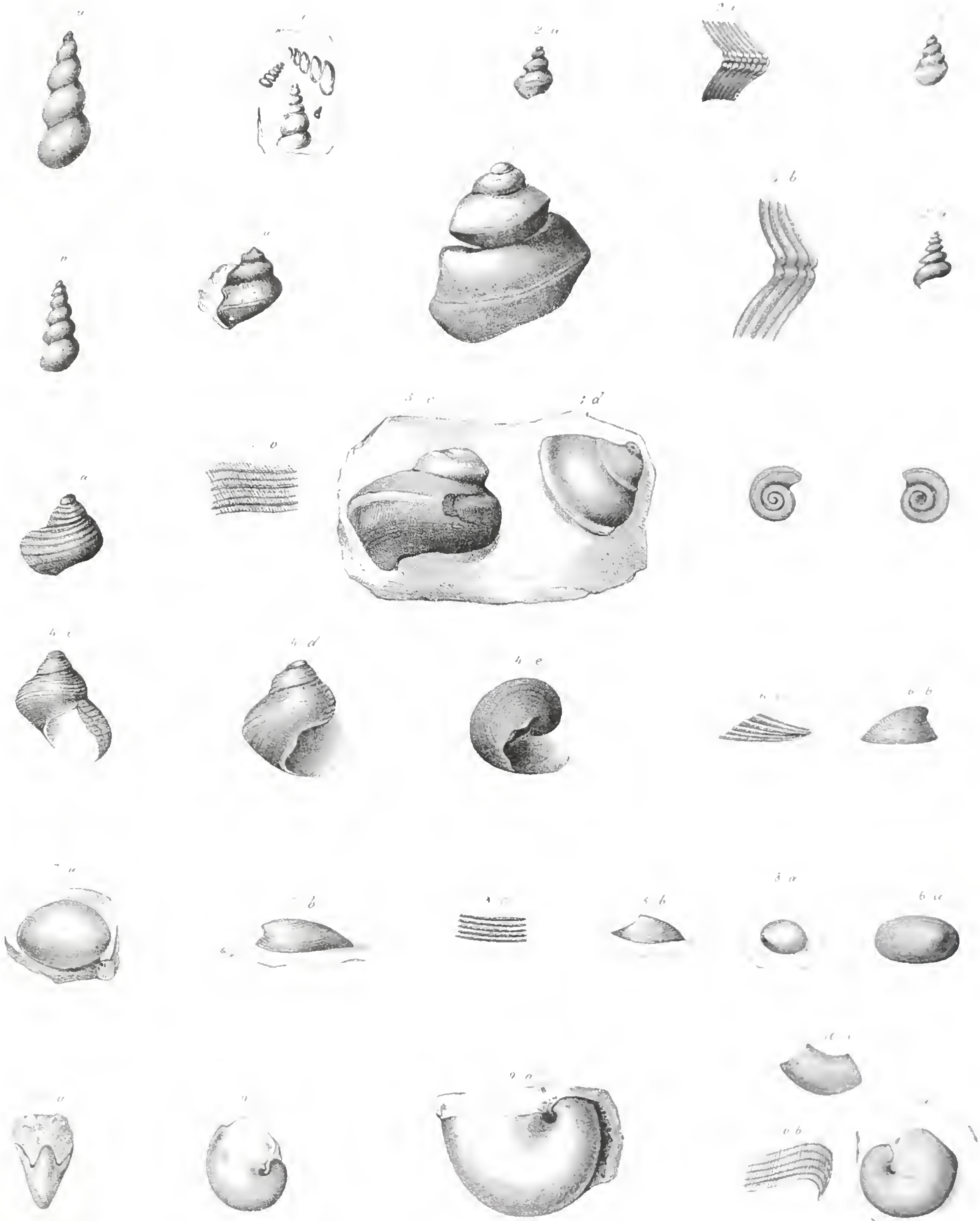


PLATE 84.

Fig. 1. 369. 4. CYRTOLITES ORNATUS. (Pag. 308.)

1 *a*. Lateral view of a cast of this species. 1 *b*. Profile of the same, looking into the aperture.

1 *c*. Another specimen (a cast), where the volutions are contiguous.

1 *d*. A specimen preserving the shell, from which the finer striæ are removed.

1 *e*. A portion of the surface of the shell, showing the sculpture. 1 *f*. Part of the same magnified.

1 *g*. A transverse section of the shell.

Fig. 2. 249. 1. TROCHOLITES AMMONIUS. (Pag. 309.)

2 *a*. A small specimen, partially preserving the shell in some parts, and showing the septa in others.

2 *b*. An enlarged portion of the surface, which is partially exfoliated, and slightly different from similar magnified parts of those in the Trenton limestone, where the shell is well preserved.

2 *c*. Mould of a large specimen in the black slate.

Fig. 3. 370. 2. TROCHOLITES PLANORBIFORMIS. (Pag. 310.)

3 *a*. Figure of a specimen nearly entire. 3 *b*. Dorsal view of the same.

3 *c*. Ventral view of a fragment, preserving part of the two outer volutions, showing the concave ventral side, and tho position of the siphuncle.

3 *c**. Section of the outer volution. 3 *d*. A portion of the surface magnified.

3 *e*. A specimen crushed in a vertical direction, a part of the outer volution retaining its form.

3 *f*. Dorsal view of the same, showing the slightly arching septa upon the dorsal line, and a part of the outer chamber.

GASTROPODA AND CEPHALOPODA

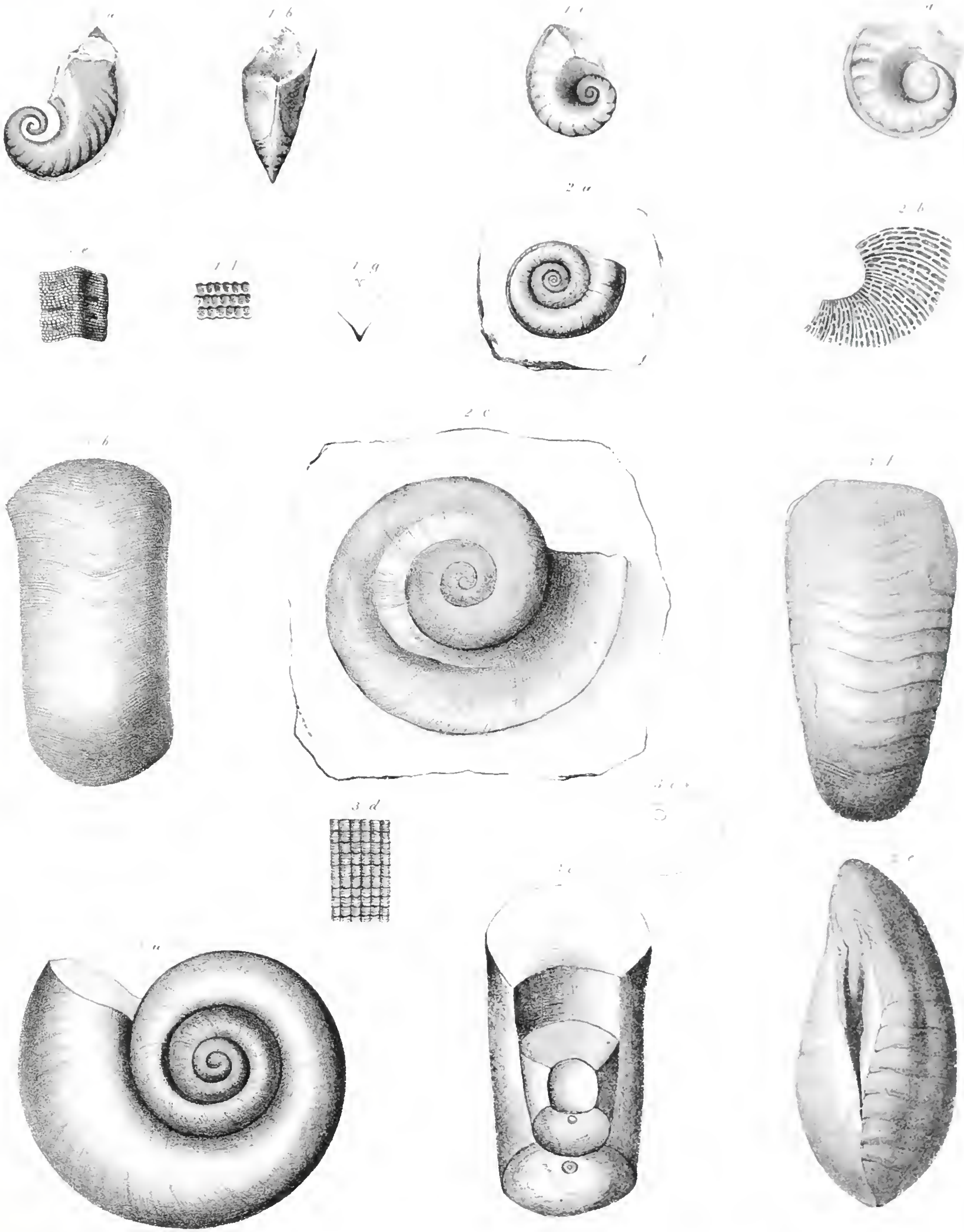


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PLATE 85.

Fig. 1. 371. 18. ENDOCERAS PROTEIFORME? (Pag. 311.)

1 *a*. A specimen preserving a large part of the outer chamber. The longitudinal groove is due to pressure which has broken the shell, the broken edges curving inwards.

1 *b*, *c*. Specimens of the smaller extremity of the fossil.

1 *d*. A fragment and sections of the two extremities, showing an elliptical form, which is due to pressure.

1 *e*. A similar fragment of the same form. 1 *f*. A smaller fragment, with sections circular.

Fig. 2. 372. 26. ORTHOCERAS (*Species undetermined*). (Pag. 311.)

Fig. 3. 373. 27. ORTHOCERAS CORALLIFERUM. (Pag. 312.)

A large specimen, extremely compressed, from the Utica slate.

ORTHOCERATA

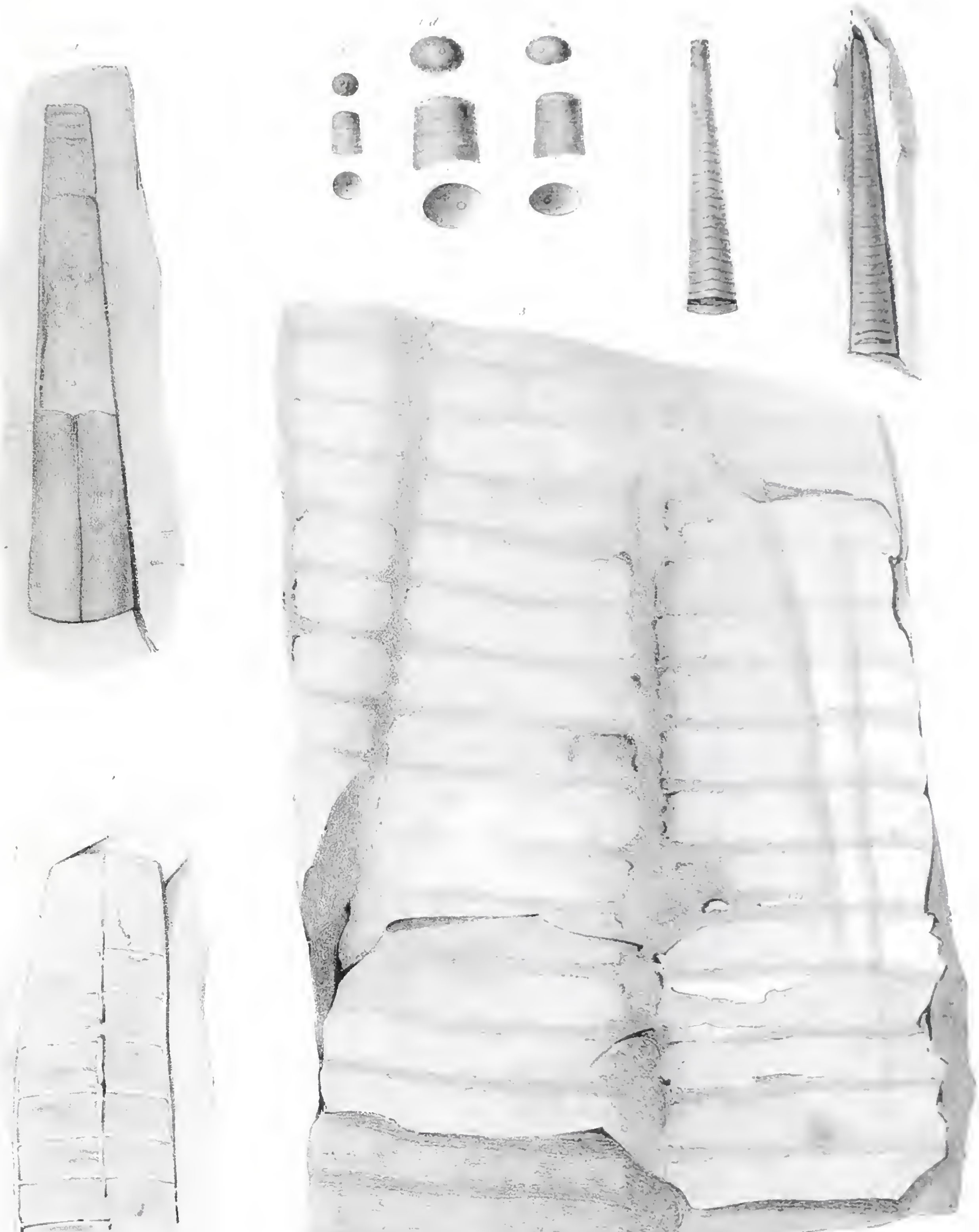


PLATE 86.

Fig. 1. 373. 27. ORTHOCERAS CORALLIFERUM. (Pag. 312.)

1 *a*. A small fragment from the altered shales near Waterford, Saratoga county. The septa are represented too distant in the figure. A portion of the coral covering the surface is magnified in 1 *b*.

1 *c*. A fragment from the green shales of Lewis county.

1 *d*. A fragment from the sandstone of the Hudson-river group.

Fig. 2. 374. 28. ORTHOCERAS LAMELLOSUM. (Pag. 312.)

2 *b*, *c*. Fragments near the smaller extremity; the septa being indistinctly preserved.

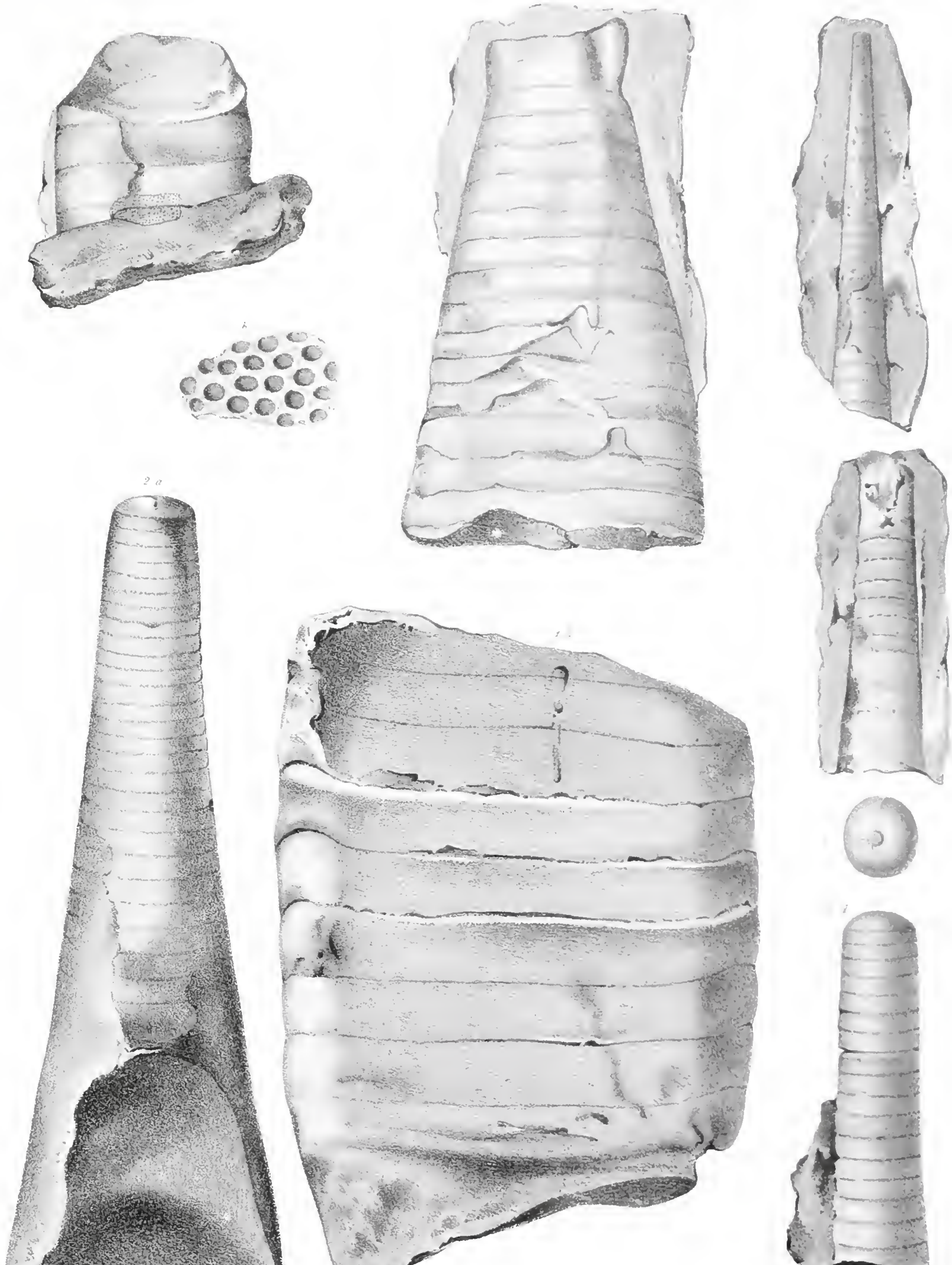
2 *d*. A fragment showing the comparative distance of the septa, in which it varies slightly from 2 *c*.

2 *e*. Section of the last, showing the position of the siphuncle.

Fig. 2 *a*. 375. 2. ORMOCERAS CREBRISEPTUM. (Pag. 313.)

A fragment of this species, the siphuncle being distinctly moniliform.

ORTHOCERATA



ON STONE BY F. SWINTON

PLATE 87.

Fig. 1. 376. 1. THECA? TRIANGULARIS. (Pag. 313.)

1 *a*. A portion of a large specimen, with the smaller extremity broken off. 1 *c*. Section of the same.

1 *b*. A smaller specimen, very perfectly terminated at both extremities.

1 *d*. A minute specimen of the same species.

Fig. 2. 375. 2. ORMOCERAS CREBRISEPTUM. (Pag. 313.)

2 *a* A part of the outer chamber of this species.

2 *b*. A fragment still preserving a portion of the shell, showing some strong longitudinal striæ, and the dorsal line or ridge.

2 *c*. A fragment showing the position of the siphuncle on the highly arched septum at the upper extremity of the figure.

2 *d*. A fragment of stone, with numerous small specimens of this species, associated with crinoidal joints.

2 *e*. A longitudinal section of a fragment, showing the deeply arched septa, and the alternate enlargement and contraction of the siphuncle.

⁂ These figures are all erroneously marked 4 on the plate.

ORTHOCERATA

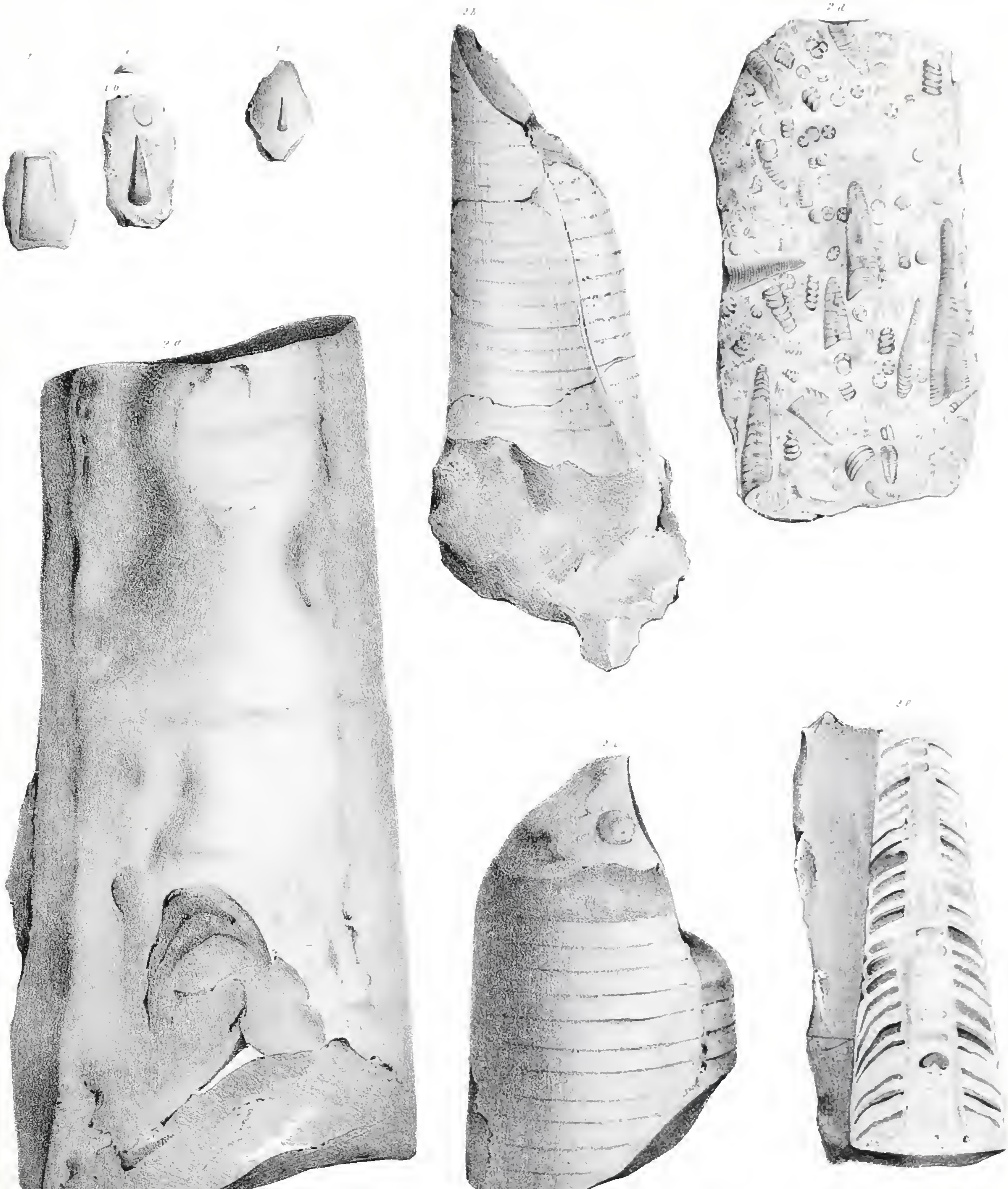


PLATE 33*.

Fig. 1. 175. 8. ATRYPA CUSPIDATA. (Pag. 138.)

1 *a*. Ventral valve of a perfect specimen. 1 *b*. Front view. 1 *c*. Dorsal valve. 1 *d*. Profile view.
1 *e*. Front view of a specimen, where the sinus is narrower and more angular than in the preceding.
1 *f*. Profile view of the same.
1 *g*. Dorsal valve of a specimen which is more extended laterally. 1 *h*. Front view of the same.

Fig. 2 *a*, *b*. 377. 8. AMBONYCHIA MYTILOIDES. (Pag. 315.)

Fig. 3. 379. 3. NUCULA? DONACIFORMIS. (Pag. 316.)

3 *a*. Right valve of this species. 3 *b*. Cardinal view of the same.

Fig. 4. 380. 6. BUCANIA INTEXTA. (Pag. 317.)

4 *a*. Dorsal view of the fragment. 4 *b*. Lateral view. 4 *c*. A portion of the surface magnified.
4 *d*. A portion of the surface of *B. sulcatina* magnified.

Fig. 5. 354. 14. MODIOLOPSIS TERMINALIS. (Pag. 318.)

5 *a*. Left valve of the fragment. 5 *b*. Dorsal view of the same.