TENTH ANNUAL REPORT

(1857)
EDWARD M. KINDLE
VICTORIA MEMORIAL MUSEUM
OTTAWA, CANADA
150

OF THE

REGENTS OF THE UNIVERSITY

OF THE

State of New-York,

ON THE

CONDITION OF THE STATE CABINET

OF

NATURAL HISTORY,

AND THE

HISTORICAL AND ANTIQUARIAN COLLECTION

CONNECTED THEREWITH.

Made to the Senate, March 11, 1857.

ALBANY:
C. VAN BENTHUYSEN, PRINTER TO THE LEGISLATURE,
No. 407 Broadway.
1857.

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C. VAN BENTHUYSEN, PRINTER TO THE LEGISLATURE.
No. 407 Broadway.
1857.

State of New-York.

No. 109.

IN SENATE, MARCH 11, 1857.

TENTH ANNUAL REPORT.

TO THE HON. HENRY R. SELDEN,

President of the Senate.

SIR:

I HAVE the honor to transmit the Annual Report of the Regents of the University, on the State Cabinet of Natural History, and the Historical and Antiquarian Collection connected therewith.

I remain, very respectfully,

Your obedient servant,

G. Y. LANSING, *Chancellor.*

MARCH 5, 1857.

REGENTS OF THE UNIVERSITY, 1857.

GERRIT Y. LANSING, *Chancellor.*

JOHN GREIG, *Vice-Chancellor.*

JOHN A. KING, Governor, *ex officio.*

HENRY R. SELDEN, Lieutenant-Governor, *ex officio.*

JOEL T. HEADLEY, Secretary of State, *ex officio.*

VICTOR M. RICE, Superintendent of Public Instruction, *ex officio.*

GULIAN C. VERPLANCK, LL.D.

JOHN K. PAIGE.

ERASTUS CORNING.

PROSPER M. WETMORE.

JOHN L. GRAHAM.

JOHN M'LEAN.

GIDEON HAWLEY, LL.D.

DAVID BUEL.

JAMES S. WADSWORTH.

JOHN V. L. PRUYN, LL.D.

ROBERT CAMPBELL.

SAMUEL LUCKEY, D.D.

ROBERT G. RANKIN.

PHILIP S. VAN RENSSELAER.

JOHN N. CAMPBELL, D.D.

ERASTUS BENEDICT.

GEORGE W. CLINTON.

S. B. WOOLWORTH, *Secretary.*

STANDING COMMITTEES OF THE REGENTS,

SPECIALLY CHARGED WITH THE CARE OF THE STATE CABINET.

1856.

MYRON H. CLARK, *Governor.*
JOEL T. HEADLEY, *Secretary of State.*
ERASTUS C. BENEDICT.
REV. DR. CAMPBELL.
ERASTUS CORNING.

1857.

JOHN A. KING, *Governor.*
JOEL T. HEADLEY, *Secretary of State.*
REV. DR. CAMPBELL.
ERASTUS CORNING.
JOHN L. GRAHAM.

EZEKIEL JEWETT, *Curator.*
JAMES A. HURST, *Taxidermist.*

REPORT.

TO THE LEGISLATURE OF THE STATE OF NEW-YORK,

The Regents of the University

RESPECTFULLY REPORT:

That since their last annual report, no progress has been made in rearranging the collections in Natural History. In the supply bill reported by the Committee of ways and means in April last, provision for cases and fixtures, and for some alteration in the plan of the building, was made; but the unexpected adjournment of the Legislature without passing the bill, relieves this board, as the Curators of the Cabinet, from responsibility for its present condition.

It was a source of deep regret to the Regents, that on an occasion of great interest to the science of the country, when large numbers of the most eminent scientific men of the nation were gathered in the capital of the State, its collections could not be exhibited. The occasion had at an early day been designated as suitable for the inauguration of the new Geological Hall; and, on full consultation, it was regarded expedient, notwithstanding the condition of the Cabinet, that the ceremonies of the inauguration should take place An audience of some five thousand people filled a tent which had been erected in the Park of the Albany Academy, and listened with great interest to appropriate addresses from

Prof. LOUIS AGASSIZ, of Cambridge, Mass.;
Prof. CHESTER DEWEY, of Rochester;
Pres. EDWARD HITCHCOCK, of Amherst, Mass.;
Pres. A. B. ANDERSON, of Rochester;
Prof. CHARLES DAVIES, of Fishkill;
Rev. Dr. COX, of Owego.

The Regents regret that they have not been able to secure copies of all these addresses : those of Prof. DEWEY, Pres. HITCHCOCK and Prof. DAVIES, are appended to this report.

The necessary means for the proper exhibition of the collections having been made by the present Legislature, the work will be entered on at the earliest practicable day; and the Regents confidently hope to be able to make such arrangements of the Cabinet as will meet public expectation, and be a just pride to the citizens of the State.

The condition of the Cabinet requiring but little of the time of the Curator, he was directed to take the field for the purpose of collecting fossils in several of the geological formations which had not been fully explored, or in which the collections were deficient. He prosecuted the work with great zeal through the season, and his success has been highly satisfactory.

A catalogue of the fossils thus collected is appended : also descriptions of palæozoic fossils, chiefly from those constituting the third volume of the Palæontology of New-York, with others from the fourth volume, by Prof. JAMES HALL. Also a catalogue of miscellaneous contributions made during the year.

By Order of the Regents.

G. Y. LANSING, *Chancellor.*

S. B. WOOLWORTH, *Secretary.*

ACCOUNT CURRENT.

THE Regents of the University, in account current with the appropriation for preserving and increasing the "State Cabinet of Natural History, and the Historical and Antiquarian Collection annexed thereto," and for defraying the incidental expenses of the same.

DR.

1856,		
	To balance at close of last account	$119 72
	To balance of appropriation 1855–6	600 00
		$719 72

CR.

1856,			
Jan. 24.	By cash paid for removing from the wing to basement of old State Hall, Dec. 1854; and for removing again to Academy, 1855	No. 1,	$44 00
Feb. 5.	By ditto, rent of Mr. Hurst's room, Nov. 1855 to Feb. 1856	No. 2,	21 00
March 3.	By ditto, Dexter & Nelligar, alcohol and camphor	No. 3,	18 02
March 6.	By ditto, Mr. Hurst's salary, Dec. '55 to March 1856	No. 4,	50 00
April 28.	By ditto, to Mr. Hurst for assistance in removing collections	No. 5,	200 00
May 12.	By ditto, for rent of Mr. Hurst's room to May	No. 6,	21 00
May 17.	By ditto, for contingents	No. 7,	5 70
June 4.	By ditto, Mr. Hurst's salary to June	No. 8,	50 00
Sept. 1.	By ditto, Mr. Hurst's salary to September	No. 9,	50 00
Oct. 16.	By ditto, to Mr Hurst for removing collection	No. 10,	9 00
Dec. 1.	By ditto, for contingents	No. 11,	13 50
Dec. 1.	By ditto, Mr. Hurst's salary	No. 12,	50 00
Dec. 30.	By ditto, for contingents	No. 13,	7 72
			$539 94
	Balance to new account		$179 78

(COPY.)

ALBANY CITY BANK : *January* 2, 1857. I certify that there is a balance of one hundred and seventy-nine dollars and seventy-eight cents, standing to the credit of the State Cabinet of Natural History, on the books of this bank.

(Signed) H. H. MARTIN, *Cashier.*

On behalf of the Standing Committee on the State Cabinet, I have examined the above account, and find it correct. The payments are made by order of the standing committee, and are accompanied by proper vouchers.

J. N. CAMPBELL.

CONTENTS OF THE APPENDIX.

A. Addresses delivered at the Inauguration of the State Geological Hall, August 27, 1856 :

1. Prof. CHESTER DEWEY ;
2. Pres. EDWARD HITCHCOCK ;
3. Prof. CHARLES DAVIES.

B. Catalogue of Fossils collected by Ezekiel Jewett, Curator of the Cabinet, 1856.

C. Description of Palæozoic Fossils, by Prof. James Hall.

D. Miscellaneous.

APPENDIX.

A.

ADDRESSES

DELIVERED AT THE

INAUGURATION OF THE STATE GEOLOGICAL HALL,

August 27, 1856.

PROF. DEWEY'S ADDRESS.

Mr. Chairman, Ladies and Gentlemen :

We have listened with unalloyed pleasure to the distinguished lecturer (Prof. Agassiz), as he has shown us "Nature as an intelligent whole." Universal homage is paid to him, and his praise has been beaming from a thousand eyes. To him, in the wise arrangements of the committee, an hour, and more, was assigned, which he has admirably employed and filled. But several are to follow him ; and as time is short and flying, the same committee have kindly allotted to some of us fifteen minutes, to some ten, and to some five. Consider this, I pray you, ten minutes for a speech on this splendid occasion : ten minutes allotted to—what do you call him—an Old Fogie ? I accept the designation, for *more than ten minutes*. For, what is a Fogie ? I ask. As one of the Scientific Association, and on the authority of its "Linguical Committee," I answer for the advancement and diffusion of knowledge, a Fog-ie is one who has got out of the fog, and an old fogie has long been out of the fog. From the constitution of things, if there are old fogies, there must be young fogies. As it has been finely said that "the boy is father to the man," so the young fogie is father to the old fogie. The ladies will please to take this into special consideration.

Looking upon this brilliant scene in reference to the objects contemplated, the different state of things near the close of the last century seems hardly credible. Let us look at the facts, and briefly trace the history.

Then, only about half a dozen men in the Union understood even the elements of the geology of that day. Not a collection of minerals existed in any college or in private hands, and the very few which curiosity had picked up were unnamed and unknown.

Prof. SILLIMAN, who was graduated in 1796, carried, at a later day, the whole mass of the minerals at Yale for examination and study to Philadelphia, *in a candlebox ! !* Most of the colleges in the Northern States possessed still fewer minerals. The science itself was in its very infancy, and books were not formed or circulated. The world of minerals was a petrifying blank before the inquiring eye. But the pioneers in Natural History had begun their beneficent course, and their names will be honored by this intelligent audience to-day.

Prominent among them for his zeal, and his patronage of the aspirants after knowledge, was WILLIAM MACLURE, author of the first geological map of the United States, a work of indefatigable effort; Dr. BENJAMIN WATERHOUSE of Cambridge University, who had directed the attention and enlightened the taste of the public on some parts of this subject; Dr. ADAM SEYBERT of Philadelphia, who, coming fresh from the school of WERNER in Saxony, was able greatly to extend the knowledge of the lovers of Nature's works; Dr. SAMUEL L. MITCHILL of New-York, an ardent student and patron of natural science, who was the author of the first geological report in our country*; Dr. A. BRUCE of New-York, who published the American Journal of Mineralogy in 1810, the first work of the kind in the land; Col. GEORGE GIBBS, an ardent collector of minerals, and a zealous and patriotic amateur in the science : most of these brought into the country from Europe, in the first decade of this century, large collections of minerals and rich stores of geological knowledge. These have long since ceased from their honored labors. Two others remain, who belong to these pioneers of Natural Science.

PARKER CLEAVELAND, Professor in Bowdoin College, who conferred immense benefit upon our country by his excellent System of Mineralogy and Elements of Geology, the great text-book of this science for many years; and Professor SILLIMAN, perhaps the youngest of the pioneers, who had begun his noble course, the loved and honored Professor of Chemistry at Yale, who in a

* "The Society for promoting agriculture, arts and manufactures," incorporated in 1793, afterwards merged in the Albany Institute, appointed Dr. MITCHILL Commissioner to examine and report on the "Minerals of the State." His report was printed in the Medical Repository in 1798 and 1799, and treated chiefly of the rocks; but is the term *geology* used in it?

green old age gladdens our eyes and hearts to-day, the Emeritus Professor in the legitimate and full meaning of the term, *emeritus* in the minds of thousands besides the Yalenses. Fifty years ago last June, Prof. Silliman returned from his tour in Europe, stored with the facts and principles of the first age of geology, but possessing a richer treasure for the country in that spirit of enterprise and communication of science demanded at that day. Within five years he saw the magnificent cabinet of Col. Gibbs deposited in Yale College, for practical use there, and for the advantage of the whole country. The impulse was given, and the impulse was felt. What a change those pioneers had wrought in the twenty years from Silliman's graduation!

Forty years ago commenced the career of Prof. Amos Eaton, in short courses of lectures on chemistry and botany, mineralogy and geology. After he had been for years a graduate of Williams College, and settled in this State in the honorable profession of the law, he spent several months attending the various lectures at Yale College, to fit him for the proposed effort. I have ever rejoiced that my humble influence brought him to his Alma Mater, where for months he gave lectures on natural history to the students. Commended by the Faculty of Williams College, he went forth to diffuse the elements of this science, and to rouse the attention of the people to this subject. Singular as he seemed to some, he was scientific, ardent and confident; and he exerted a vast influence on the minds of the young, and of the older also, and many received directly from him that impulse which has led to great results Patronized by Gen. Stephen Van Rensselaer, of this city, so distinguished for his liberality, and so loved and honored by the great community, Mr. Eaton made, among other works, his famous Survey of the Canal Rocks. This was published by the Patroon, who also placed Mr. Eaton at the head of the Rensselaer Institute, only to act in a wider and more useful sphere. Prof. Eaton was the first to assert, from his examination of the rocks of New-York and New-England, that the geologists of Europe would come to the United States to study their favorite science on a grander scale. This day, and in your hearing, has Prof. Agassiz announced to you that the prophecy is already fulfilled.

With this time of EATON arose the *second* set of pioneers, as they have been named; active and enlightened, laborious and successful, in their efforts in this extensive field. Among them it was my privilege to act a humble part, making some tracks in the pathway of the science, or following the tracks of others. Many of them have followed the first pioneers to the grave; but some remain, widely known on both sides of the Atlantic for their developments of natural science in our State, and in other States; some of them to unite in this joyous festivity. Their familiar but furrowed faces need not designation by me.

In 1836, twenty years from the last era, another and numerous body of naturalists was spread over the land. For in twenty years of our history, a new set of colaborers in all the branches of natural science come to fill our horizon, while many of the preceding continue in full activity. For, among the great and efficient workers in our own State Survey were several from the school of EATON, or who had felt his influence, who have far outstripped their teacher; but, to-day they find themselves surrounded with the active, energetic minds of a younger generation.

Geological surveys of several States had been begun, or were already completed. The earliest survey, under legislative authority, was of North-Carolina by Prof. OLMSTED, the excellent Report being printed in 1824–5.

In 1836 began the Geological Survey of the State of New-York, on a grander scale, and over a grander series of rocks. To-day, it is our privilege and joy to inaugurate the results in that noble, if not perfect, edifice, the GEOLOGICAL HALL. Appropriate is this designation, however numerous and important the departments in it. Let it not be called *Zoological Hall*, or *Mineralogical* or *Agricultural Hall*, but GEOLOGICAL HALL in the widest and truest sense; since the objects in the several departments *form* the earth, or *spring* from the earth, or are *nourished* by the earth, or *operate* on the earth, or *support* the creatures of the earth, or *decorate* the earth, the mother of all: Geological Hall now, and Geological Hall forever!

By the statute for the Survey, the Legislature appropriated 26,000 dollars a year for four years of explorations; amounting to 104,000 dollars for the survey, the collections, and the general

and annual reports. The Legislature afterwards extended the Survey for two years more, at the same rate. The whole country was astounded at the sum; an amazing, unheard of sum for the expense of the Natural History of the State! There became necessary, a Geologist for each of the four great districts of the State, a Mineralogist and Chemist, a Botanist, a Zoologist, with their assistants; a Surveyor of its agriculture, and a Palæontologist for its fossils. For the statute required a "Complete Geological Survey of this State," which was to "furnish a full and scientific description of its rocks, soils and minerals, and of its botanical and zoological productions, together with specimens of the same." There must be many workers; and they have not introduced an object which was not contemplated in the law. While the statute was framed with apparent wisdom and great care, it contemplated magnificent results. These it has produced, in the estimation of the scientific world.

Consider merely the points in the Survey, in connection with the results.

1. The general provisions in the law embraced all the three kingdoms of nature in this State.

2. The law required extensive collections of the objects. While the most important and extensive collection fills and adorns the Geological Hall, a large collection in mineralogy and geology was given to each college in the State, and to some other literary institutions.

3. It required descriptions of all the specimens, and figures especially of the new or rare.

4. It required a wide range of publications. Already the geological map of the State, and nineteen volumes quarto have been published. These have been spread among our citizens and literary institutions with generous liberality; and many copies have gone, in the true national spirit, to other States, or been given to the institutions of Europe. To the two volumes on palæontology, so highly illustrated by plates, three more are to be added to complete the Natural History of the State. The next volume is to appear early in 1857.

5. The Survey has been magnificent in its cost, already exceeding 600,000 dollars. Such has been the liberality and wise foresight

of the State of New-York in this expense, that every citizen is actually made richer by this bounty, and the whole crowned with glory in the admiring eyes of the civilized world. But, had the Legislature known the cost involved in the terms of the law, they would never have passed, or would have greatly modified, the statute. For science, this ignorance was most fortunate ; and for the glory of the State, most propitious.

But, you ask, how came this blessed ignorance? In the most natural way. The Legislature had no adequate conception of the amount of the objects of natural history in the State ; no means of knowing it. The naturalists were also in darkness on the subject. Take only the fossils for illustration. No geologist suspected, from publications of similar surveys, that more than three or four hundred species could be found in the State ; but, on examination, these "medals of creation," resting in their secret habitations in the rocks, appeared in unthought of multitude. The first volume of the Palæontology contains 380 species, found in a few of the lowest series of the fossiliferous strata ; the second volume, 340 species in a few newer rocks : 720 species in less than half the series. The three coming volumes will contain from ten to twelve hundred, making in the whole near two thousand species of fossils. Hence it is that the work has so grown in the hands of the naturalists, altogether beyond their highest anticipations, and that unexpected appropriations have become necessary in carrying out the simple letter of the statute.

The expense for the collections, for the drawings, for the lithographs and engravings, for the coloring of plates, and for printing, binding and salaries, may be seen by a careful examination of the volumes already published. It is not surprising that the Legislature hesitated, and that the work had come to a temporary stand more than two years ago ; but so much labor had already been performed, and so great a sum already paid for results to appear in the coming volumes, that the stoppage of the work would involve too great a sacrifice. Consultation was needed, and consultation was had. A little of the light of the "Old Fog-ie" was called for, and it was cheerfully presented, and cordially accepted and adopted. It was felt and asserted in other States, as well as in our own, that the Empire State was committed, and her honor pledged before the

world. Her wise and patriotic citizens admitted the claim, and the obligation *to go forward*. In virtue of a statute in 1855, the completion of the Survey in three more volumes was settled, and the terms in due time arranged. In this arrangement, the late Secretary of the Regents of the University, an honored name, the *judicious* BECK, now sincerely mourned, gave his full soul and his strong arm to the then Secretary of State. These two were by law the commissioners. The work moved onward again. Favored by Divine Providence as she has been, the State will hold on in her steady, beneficent course to the end, so that the last shout of her glory shall be "EXCELSIOR!"

I have done. The light of history illumines our path. I rejoice in beholding this day and this splendid scene. In the GEOLOGICAL HALL you may behold the results : there are treasured up the lasting testimonials of this magnificent Survey, for your vision, improvement, and enjoyment. Born and educated a Yankee; having dwelt fifty years in Yankee land, and for twenty years been called an adopted son of this Commonwealth, it is my honor to-day to present before you, in my humble way, that glory which is emblazoned by this History upon the Escutcheon of the Empire State.

PROF. HITCHCOCK'S ADDRESS.

MR. PRESIDENT :

THIS interesting occasion turns my thoughts irresistibly backward upon the early periods of those scientific enterprises, of which we have before us in this city some of the magnificent results. For this Geological Hall, which we meet to dedicate, would neither have been devoted to this purpose, nor supplied with specimens, had not a Geological Survey preceded it. Having been acquainted with the men who originated and executed this Survey, will you allow me to indulge in a few reminiscences concerning that work and its results in the few moments allotted me.

This, I believe, is the first example in which a State Government in our country has erected a museum for the exhibition of its natural resources : its minerals and rocks; its plants and animals, living and fossil. And this seems to me the most appropriate spot in the country for placing the first Geological Hall erected by the Government : for the county of Albany was the district where the first geological survey was undertaken on this side of the Atlantic. This was in 1820, and was ordered by that eminent philanthropist, STEPHEN VAN RENSSELAER; who, three years later, appointed Professor EATON to survey in like manner the whole region traversed by the Erie canal. This was the commencement of a work, which, during the last thirty years, has had a wonderful expansion; reaching a large part of the States of the Union, as well as Canada, Nova-Scotia and New-Brunswick, and I might add several European countries, where the magnificent surveys now in progress did not commence till after the survey of Albany and Rensselaer counties. How glad are we, therefore, to find on this spot the first Museum of Economical Geology on this side of the Atlantic. Nay, embracing as it does all the departments of natural history, I see in it more than a European Museum of

Economical Geology, splendid though they are. I fancy rather that I see here the germ of a Cis-atlantic British Museum, or Garden of Plants.

North-Carolina was the first State that ordered a geological survey; and I have the pleasure of seeing before me the gentleman who executed it, and in 1824 and 5 published a report of 140 pages. I refer to Professor Olmsted, who, though he has since won still brighter laurels in another department of science, will always be honored as the first commissioned State Geologist in our land.

South-Carolina commissioned Professor Vanuxem only a year later, to do for her what had been done in North-Carolina. This report, however, was never published save in the newspapers. After this there was a long hiatus in the State surveys. In 1828 I published a review of Professor Olmsted's labors, in the hope of turning the attention of legislators to the subject, but in vain. In 1830, however, I was more successful. Pardon me if I tell you how. Being on my way to visit the Coal regions of Pennsylvania, the newspapers informed me that the State of Massachusetts had ordered a trigonometrical survey. I ventured to suggest to Gov. Lincoln, how desirable it would be to have a geological survey connected with the enterprise. On my return, I found that he had recommended it, and that the Legislature had adopted it, and that a geological commission awaited myself.

It was not till three or four years later, that any other State moved in this enterprise : then followed Tennessee, Maryland, and New-Jersey. But in 1836 New-York entered upon the work, on a scale more liberal and with a plan more judicious than any other State before or since. She first obtained the opinion of scientific men as to the best mode of procedure, by a circular sent forth from the Hon. John A. Dix, then Secretary of State : then she appropriated over $100,000 to the survey; and now behold the magnificent result, or rather some of the results! For the nineteen splendid quartos already issued do not tell the whole story; since others are in reserve, which are looked for with deep interest by scientific men on both sides of the Atlantic. This survey has developed the older fossiliferous rocks with a fullness and distinctness unknown elsewhere. Hence European savans study the New-York

Reports with eagerness. In 1850, as I entered the Woodwardian Museum in the Univerity of Cambridge in England, I found Prof. M'Coy busy with a collection of Silurian fossils before him, which he was studying with HALL's first volume of Palæontology as his guide; and in the splendid volumes entitled *British Palæozoic Rocks and Fossils*, which appeared last year as the result of those researches, I find Prof. HALL denominated "the great American palæontologist." I tell you, Sir, that this survey has given New-York a reputation throughout the learned world, of which she may well be proud. Am I told that it will probably cost more than half a million? Very well: the larger the sum, the higher will be the reputation of the people of New-York for liberality; and what other half million expended in our country has developed so many new facts, or thrown so much light upon the early history of the globe, or won so world-wide and enviable a reputation?

Allow me to add, that I have taken a deeper interest in this survey, because I was offered a commission by Governor MARCY to explore the first district, which I accepted, and actually entered upon the work; but the magnitude of the undertaking, and a poor state of health, led me early to resign, and leave the place to be filled by Prof. MATHER. I confess, also, that I had a strong hope that I might have an opportunity to resurvey Massachusetts; and finding Governor EVERETT in the chair of state, I offered my services anew; and through his recommendation, always ready to be given for the promotion of learning, I obtained a new commission, and went over ground a second time, which I would gladly survey again, did life and health allow. Geologists who enter upon such a work with all the facilities now within their reach, can form but a faint idea of the difficulties we encountered who were early in the field.

In regard to this matter of geological surveys, I can hardly avoid making a suggestion here. So large a portion of our country has now been examined more or less thoroughly by the several State Governments, that it does seem to me the time has come when the National Government should order a Survey, geological, zoological and botanical, of the whole country, on such a liberal and thorough plan as the surveys in Great Britain and Austria are now conducted upon; it being understood in the latter country, that at least

thirty years will be occupied in the work. Could not the distinguished New-York statesman, who was to have addressed us today, be induced, when the present great struggle in which he is engaged shall have been brought to a close by a merciful Providence, to introduce this subject and urge it upon Congress? And would it not be appropriate for the American Association for the Advancement of Science to throw a petition before the Government for such an object? Or might it not, with the consent of the eminent gentleman who has charge of the Coast Survey, be connected therewith, as it is with the Ordnance Survey in Great Britain?

But to return from this digression, another important result of the New-York Survey was the origination of the Association of American Geologists, which has gradually expanded into the American Association for the Advancement of Science. Many of us, who were engaged in the State surveys, were so isolated from one another, that we had few means of comparing views, or obtaining advice in our conclusions. Professor MATHER, I believe, through Professor EMMONS, first suggested the subject of a meeting to the Board of Geologists in November 1838, in a letter proposing several points for their consideration. I quote from that letter the following paragraph relating to the meeting. As to the credit he has here given me of having previously suggested the subject, I can say only that I had been in the habit for several years of making this meeting of scientific men a sort of hobby, in my correspondence with such. Whether others did the same, I did not then, and do not now, know. Were this the proper place, I could go more into details on this point; but I will merely quote Prof. MATHER's language to the Board*.

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* As this is a matter of some historical interest, it may not be arrogant or improper for me to add in a note, that in 1849 Prof. MATHER addressed a letter to me (dated Jackson, Ohio, Sept. 6), on this subject. A few extracts follow.

"PROF. HITCHCOCK:

"DEAR SIR—I received a few days since the Proceedings of the Am. Association for the Advancement of Science, 1st meeting, held in Philadelphia, Sept. 1848; and in it, page 91, I found a letter from Prof. HALL, and observed with some surprise the latter part of the sentence of the second paragraph (relating to Prof. VANUXEM), viz: 'and to whom is due, above all others, the honor of being the first man to propose such an organization.' Now I do not wish to detract at all from the merit due to Prof. VANUXEM; and perhaps Prof. HALL made the representation

"Would it not be well," says he, "to suggest the propriety of a meeting of the geologists and other scientific men of our country at some central point next fall, say in New-York or Philadelphia. There are many questions in our geology, that will receive new light from friendly discussion and the combined observations of various individuals who have noted them in various parts of our country. Such a meeting has been suggested by Prof. HITCHCOCK, and to me it seems desirable. It would undoubtedly be an advantage not only to science, but to the several surveys that are now in progress, and that may in future be authorised. It will tend to make known our scientific men to each other personally; give them more confidence in each other, and cause them to concentrate their observations on those questions that are of interest either in a scientific or commercial point of view. More questions may be satisfactorily settled in a day by oral discussion, than in a year by writing and publication."

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from memory only, or from hearsay, on the spur of the occasion; but that which belongs to the history of the Association of American Geologists ought, if stated where it will be referred to, to be stated accurately. *You* know that he was not the first to propose such an organization in 1838.

"In 1837, I received a letter from you on this subject; but it is lost, or I do not find it on my file of letters.

"On the 12th of Oct. 1838, you wrote me at Albany, and the letter was forwarded and reached me at Newburgh, in which you say: 'And I had also hoped that ere this a meeting of American Geologists would be brought about in New-York or Philadelphia; but I feel that I am to be disappointed in this also.'

"On the 26th of October 1838, the day I received your letter at Newburgh, I answered it, and said: 'It gives me much pleasure to see you express a wish to compare notes with others in relation to geological observations. I think it is much to be regretted that there is not a greater harmony of feeling, unity of action, and interchange of opinions and observations among our geologists.' As I had to go west before the meeting of the Geological Board of N.Y., and which you had been invited by me and perhaps others to attend, I wrote to the Board some suggestions that seemed to me important, as follows:" (Then follows the letter containing the extract in the text. Prof. M. closes his letter to me with the following:)

"*You*, so far as I know, first suggested the matter of such an association. I laid the matter before the Board of Geologists of N.Y., specifying some of the advantages that might be expected to result; and Prof. VANUXEM probably made the motion before the Board in regard to it, which may have been all that Prof. HALL knew about it.

"We can each of us well dispense with the honor that might be awarded for originating the matter in one case, and putting in train for execution in the other: still, where the origin of an important society and association of scientific men for the advancement of science is recorded in its memoirs as historical fact, it ought to be stated *correctly*."

Though the Board adopted the plan of a meeting, various causes delayed the first one till April 1840, when we assembled in Philadelphia, and spent a week in most profitable and pleasant discussion and the presentation of papers. Our number that year was only 18, because confined almost exclusively to the State geologists; but the next year, when we met again in Philadelphia, and a more extended invitation was given, about 80 were present, and the numbers have been increasing to the present time. But in fact those two first meetings proved the type, in all things essential, of all that have followed. The principal changes have been those of expansion, and the consequent introduction of many other branches of science, with their eminent cultivators. In 1842, we changed the name to that of the Association of American Geologists and Naturalists; and in 1847, to that of the American Association for the Advancement of Science. I trust it has not yet reached its fullest development, as our country and its scientific men multiply, and new fields of discovery open.

It may be thought that the New-York geologists, in their invitation, and the members of that first Philadelphia meeting, had no thought of extending their association beyond geologists; but Prof. Mather's language just quoted speaks of "a meeting of the geologists and other scientific men of our country," thus showing what were his aspirations; and they were shared by all of us who had any thing to do with that first meeting. But we knew that only a short time previous, the American Academy of Arts and Sciences at Boston had directed a request to the American Philosophical Society, as the oldest of the kind in the country, that it would invite the scientific men of the land to such a meeting as the one we are now enjoying; but the distinguished men of that society declined, through fear that the effort would prove a failure. Surely then it did not become us to announce any such intentions or expectations; yet we did talk of them, and could not but hope that what might fail if attempted on a large scale at first, might be accomplished step by step. Had not the New-York geologists issued that modest invitation, and confined it at first to the State surveyors, probably even yet we might have been without an Association for the Advancement of Science.

Such are some of the results of this Geological Survey, that have

become matter of history : others, perhaps greater than these, belong to posterity, and need the ken of prophecy to describe. We may be quite sure, however, that this Hall will be a centre of deep interest to coming generations. Long after we shall have passed away, will the men of New-York, as they survey these monuments, feel stimulated to engage in other noble enterprises by this work of their progenitors ; and from many a distant part of the civilized world will men come here to solve their scientific questions, and to bring far off regions into comparison with this. New-York, then, by her liberal patronage of science, has not only acquired an honorable name among the living in all civilized lands, but has secured the voice of history to transmit her fame to far off generations.

REMARKS OF PROF. DAVIES.

To one accustomed to speak only on the abstract quantities of number and space, this is an unusual occasion, and this an unusual audience. How is it possible for me to discuss the abstract forms of geometry, when I see before me, in such profusion, the most beautiful real forms that Providence has vouchsafed to the sight of man!

I propose to introduce and develop but a single train of thought, viz. the unchangeable connection between what in common language is called the theoretical and practical, but, in more technical phraseology, the ideal and actual.

The actual, or true practical, consists in the uses of the forces of nature according to the laws of nature; and here we must distinguish between it and the empirical, which uses or attempts to use those forces without a knowledge of the laws. The true practical, therefore, is the result or actual of an antecedent ideal. The ideal, full and complete, must exist in the mind before the actual can be brought forth according to the laws of science.

Who, then, are the truly practical men of our age? Are they not those who are engaged most laboriously and successfully in investigating the great laws? Are they not those who are pressing out the boundaries of knowledge into new and unexplored regions, where, perchance, yet may slumber some great principle of nature, corresponding in the simplicity of its laws, and the magnitude of its results, to that which gave birth to the steam engine or electric telegraph? Is not the gentleman from Massachusetts (Professor Agassiz) the most practical man in our country, in the department of natural history; not because he has collected the greatest number of specimens, but because he has laid open to us all the laws of the animal kingdom?

Are the formulas written on the blackboard by the gentleman

from Cambridge (Professor PEIRCE) of no practical value, because they cannot be read by the uninstructed? A single line may contain the elements of the motions of all the heavenly bodies; and the eye of science, taking its standpoint at the centre of gravity of the system, will see in the equation the harmonious revolutions of all the bodies which circle the heavens. It is such labors and such generalizations that have rendered his name illustrious in the history of mathematical science.

Is it of no practical value that the Chief of the Coast Survey (Professor BACHE), by a few characters written on paper at Washington, has determined the exact time of high and low tide in the Harbor of Boston, and can determine by a similar process the exact times of high and low water at every point on the surface of the globe? Are not these results, the highest efforts of science, also of the greatest practical utility? And may we not then conclude that *there is nothing truly practical which is not the consequence of an antecedent ideal?*

Science is to art, what the great fly-wheel or governor of a steam engine is to the working parts of the machinery: it guides, regulates, and controls the whole. Science and art are inseparably connected: like the Siamese twins, they cannot be separated without producing the death of both.

How, then, should we regard the superb specimens of Natural History which the liberality, the munificence and wisdom of our State have collected at the Capital? They are the elements from which we can here determine all that belongs to the natural history of the State; and may we not hope that science and genius may be brought here, and, striking them with a magic wand, cause the true practical to spring into immortal life!

APPENDIX.

B.

CATALOGUE OF FOSSILS

COLLECTED BY EZEKIEL JEWETT,

CURATOR OF THE CABINET,

1856.

CATALOGUE OF FOSSILS COLLECTED BY E. JEWETT,

CURATOR OF THE CABINET.

BIRDSEYE LIMESTONE.

1 Slab PHYTOPSIS CELLULOSUM (large). Fort-Plain.

TRENTON LIMESTONE.

1 RETEPORA FENESTRATA. Sacket's-harbor.
2 STICTOPORA ACUTA. Jacksonburgh.
18 CHÆTETES LYCOPERDON. 2 species. Jacksonburgh.
5 Slabs various corals. do.
14 ORTHIS PECTINELLA. do.
1 LEPTÆNA FILITEXTA. do.
2 PLEUROTOMARIA BILIX. do.
6 BELLEROPHON BILOBATUS. do.
2 MURCHISONIA GRACILIS. do.

UTICA SLATE.

20 ORTHIS ? sp.? Utica.
21 ATRYPA sp.? do.
5 ORTHOCERATITES. do.
1 Slab GRAPTOLITES SCALARIS. Fort-Plain.
1 Slab GRAPTOLITES. do.
1 Slab 11 CALYMENE BECKII. do.

CLINTON GROUP.

1 CANNAPORA JUNCIFORMIS. Rochester.
1 HELOPORA FRAGILIS. do.
2 PHÆNOPORA CONSTELLATA. do.
5 Slabs GRAPTOLITES CLINTONENSIS. do.
10 do FUCOIDES (various). New-Hartford.
3 do Tracks of GASTEROPODA. do.
1 do Tracks of BRACHIOPODA. do.
1 do GLYPTOCRINUS PLUMOSUS. do.
1 do EPSOMITES. Lockport.

1	Slab CORALS (various).	New-Hartford.
5	Slabs CYCLOLITES ROTULOIDES.	do.
5	LINGULA OBLONGA.	do.
12	AVICULA RHOMBOIDEA.	do.
8	AVICULA EMACERATA.	do.
12	MODIOLOPSIS sp.?	do.
20	ORTHIS TENUIDENS.	do.
12	ATRYPA GIBBOSA.	do.
10	ATRYPA EQUIRADIATA.	do.
20	LEPTÆNA SERICEA.	do.
2	LEPTÆNA CORRUGATA.	do.
1	Slab ATRYPA CONGESTA.	Reynolds's Basin.
1	Slab ATRYPA HEMISPHERICA.	Rochester.
8	PENTAMERUS OBLONGUS.	do.
2	Slabs PENTAMERUS OBLONGUS.	do.
5	Slabs TENTACULITES MINUTUS.	do.
1	ORTHOCERATITE (very large).	New-Hartford.
2	ORTHOCERATITES, sp.?	do.

NIAGARA GROUP.

150	STREPTELASMA CALICULA.	Lewiston.
11	CERAMOPORA IMBRICATA.	do.
5	ASTROCERIUM CONSTRICTUM.	do.
1	HELIOLITES ELEGANS.	Lockport.
1	STOMATOPORA CONCENTRICA.	do.
2	HELIOLITES PYRIFORMIS.	do.
4	POLYDILASMA TURBINATA.	do.
1	Slab various corals.	do.
1	Slab CLADOPORA SERIATA.	do.
1	Slab CLADOPORA MULTIPORA.	do.
120	Various BRYOZOA.	Lewiston.
36	CARYOCRINUS ORNATUS.	do.
3	EUCALYPTOCRINUS DECORUS.	do.
80	STEPHANOCRINUS ANGULATUS.	do.
4	STEPHANOCRINUS GEMMIFORMIS.	do.
100	LEPTÆNA TRANSVERSALIS.	do.
42	LEPTÆNA DEPRESSA.	do.
4	LEPTÆNA SUBPLANA.	do.
4	LEPTÆNA STRIATA.	do.
25	ORTHIS ELEGANTULA.	do.
32	ORTHIS HYBRIDA.	do.

3	ORTHIS FLABELLULUM.	Lewiston.
20	SPIRIFER NIAGARENSIS.	do.
4	SPIRIFER BILOBUS.	do.
60	SPIRIFER CRISPUS.	do.
45	SPIRIFER SULCATUS.	do.
75	ATRYPA RETICULARIS.	do.
150	ATRYPA NODOSTRIATA.	do.
55	ATRYPA NITIDA.	do.
160	ATRYPA NEGLECTA.	do.
35	ATRYPA CUNEATA.	do.
4	ATRYPA CORALLIFERA.	do.
195	ATRYPA CARINOSA.	do.
5	ATRYPA OBTUSIPLICATA.	do.
26	ATRYPA RUGOSA.	do.
4	ATRYPA INTERPLICATA.	do.
45	PLATYOSTOMA NIAGARENSIS.	do.
7	ACROCULIA NIAGARENSIS.	do.
1	CALYMENE NIAGARENSIS.	Rochester.
7	BUMASTIS (imperfect).	Lewiston.

3 Slabs BEYRICHIA SYMMETRICA, CYTHERINA SPINOSA, TENTACULITES NIAGARENSIS. ORBICULA SQUAMIFORMIS, Parts of TRILOBITES, CRINOIDAL COLUMNS, etc.

ONONDAGA-SALT GROUP.

1	Slab CYTHERINA, sp.?	Blackrock.
1	Slab ORTHIS, sp.?	Waterville.
1	EURYPTERUS REMIPES.	Blackrock.
1	Head of EURYPTERUS REMIPES.	do.
1	Fragment showing structure.	do.

WATERLIME GROUP.

4	Slabs CORALS, sp.?	Litchfield, Herkimer county.
12	STREPTELASMA, sp.?	do.
1	Slab STREPTELASMA.	do.
54	TELLINOMYA, sp.?	do.
10	LEPTÆNA, sp.?	do.
6	SPIRIFER CRISPUS.	do.
1	Slab MODIOLOPSIS.	do.
80	ATRYPA SULCATA.	do.
1	ORTHOCERATITE, sp.?	Paris Hill.
7	LITTORINA ANTIQUA.	Litchfield.

6	MURCHISONIA, sp.?	Litchfield.
1	GOMPHOCERAS, sp.?	Paris Hill.
12	CYRTOCERAS.	Litchfield.
10	Slabs BEYRICHIA (various).	Paris Hill.
3	Slabs SPIRORBIS, sp.?	do.

PENTAMERUS LIMESTONE.

2	STOMATOPORA CONCENTRICA.	Litchfield.
2	FAVOSITE, sp.?	do.
1	Large slab various fossils.	do.
4	LEPTÆNA, sp.?	do.
16	LEPTÆNA, sp.?	do.
2	ORTHIS, sp.?	do.
4	AVICULA, sp.?	do.
6	ATRYPA, sp.?	do.
80	ATRYPA, sp.?	do.
10	ATRYPA RETICULARIS?	do.
1	ASTROCRINITES PACHYDACTYLUS.	do.
4	Parts of ditto.	do.
1	Large slab 7 CRINOIDS, sp.?	do.
1	Large slab 8 LEPTOCRINITES GEBHARDI.	do.
1	Large slab CRINOIDS, 2 species : sp.?	do.
2	CYSTIDEANS, sp.?	do.
2	ACROCULIA, sp.?	do.
2	PLATYOSTOMA, sp.?	do.
4	BELLEROPHON, sp.?	do.
1	CONULARIA, sp.?	do.

ONONDAGA LIMESTONE.

10	Slabs various corals.	Williamsville.
2	CYATHOPHYLLUM (very large), sp.?	do.
1	Slab CORALS.	Buffalo.
22	PENTAMERUS ELONGATUS.	Williamsville.
6	ICHTHYODORULITES.	Blackrock.

CORNIFEROUS LIMESTONE.

80	RETEPORA, sp.?	Buffalo.
85	FENESTELLA, sp.?	do.
1	Slab CORALS, sp.?	Babcock's Hill.
1	RETEPORA, sp.?	do.
1	Slab CORALS, sp.?	Blackrock.

1	Coral, sp.?	Blackrock.
2	Chætetes, sp.?	Babcock's Hill.
25	Streptelasma, sp.?	do.
8	Leptæna, sp.?	Sangersfield.
3	Leptæna acutiradiata.	do.
16	Leptæna.	do.
21	Orthis lenticularis.	Eastman's, Sangersfield.
20	Orthis, sp.?	do.
10	Atrypa, sp.?	do.
15	Atrypa, sp.?	do.
20	Atrypa reticularis.	do.
4	Spirifer fimbriata.	do.
9	Spirifer rugosa.	
1	Pleurorhyncus trigonalis.	Williamsville.
4	Pentamerus, sp.?	Sangersfield.
14	Crinoideans, sp.?	do.
4	Ornithichnites, sp.?	Williamsville.
23	Acroculia erecta.	do.
42	Euomphalus rotuloides.	do.
1	Crustacean ?	Blackrock.
1	Ditto, same species.	Schoharie.
6	Calymene bufo.	Blackrock.

MARCELLUS SHALE (Limestone stratum).

97	Fossils, and fourteen species undescribed.	Leroy.

HAMILTON GROUP.

12	Streptelasma recta.	Lake Erie Shore.
5	Madripores, sp.?	do.
28	Various Corals.	do.
1	Corals, sp.?	do.
2	Terrestrial Plants ?	do.
1	Ditto.	do.
9	Crinoideans, sp.?	do.
32	Crinoidal Columns, sp.?	do.
2	Slabs Diluvial Scratches.	do.
2	Slabs various fossils.	Buffalo Creek.
4	Avicula, sp.?	do.
32	Avicula, various.	Delphi.
8	Strophodonta demissa.	Lake Erie Shore.
10	Chonetes carinata.	do.

4	CHONETES, sp.?	Lake Erie Shore.
6	LEPTÆNA, largest sp.?	do.
2	LEPTÆNA, sp.?	do.
3	LEPTÆNA, sp.?	Delphi.
5	LEPTÆNA, sp.?	Darien.
24	ORTHIS, sp.?	Lake Erie Shore.
4	ORTHIS, sp.?	Darien.
36	ORTHIS UMBONATA.	do.
54	SPIRIFER MUCRONATA.	Lake Erie Shore.
16	SPIRIFER PUNCTILIFERA.	do.
6	SPIRIFER MEDIALIS.	do.
4	SPIRIFER FIMBRIATA.	do.
170	ATRYPA, sp.?	Darien.
12	ATRYPA, sp.?	do.
11	ATRYPA ROSTRATA.	Delphi.
7	ATRYPA, sp.?	do.
13	MODIOLOPSIS ?	do.
7	AMBONYCHIA ?	Lake Erie Shore.
3	MICRODON BELLISTRIATA.	Delphi.
7	GRAMMYSIA HAMILTONENSIS.	do.
8	MODIOLOPSIS ?	do.
2	ALLORISMA, sp.?	Lake Erie Shore.
5	BELLEROPHON, sp.?	do.
8	TURBO, sp.?	do.
3	TURBO, sp.?	Delphi.
8	PLEUROTOMARIA HAMILTONENSIS.	Lake Erie Shore.
2	PLEUROTOMARIA ?	Delphi.
35	PLEUROTOMARIA SULCOMARGINATA.	do.
4	LOXONEMA NEXILIS.	do.
8	LOXONEMA, sp.?	do.
3	ACROCULIA, sp.?	Buffalo Creek.
8	ACROCULIA, sp.?	Lake Erie Shore.
6	ACROCULIA, sp.?	Delphi.
1	CYRTOCERAS, sp.?	do.
2	GONIATITES, sp.?	do.
15	Slabs CYTHERINA, sp.?	Lake Erie Shore.
3	Slabs CYTHERINA, sp.?	Darien.
3	ORTHOCERATITES, sp.?	Lake Erie Shore.
2	ORTHOCERATITES, sp.?	do.
1	ORTHOCERATITE (very large).	do.

2	ORTHOCERATITES, sp.?	Delphi.
3	ORTHOCERATITES, sp.?	do.
2	DIPLEURA DEKAYI (heads).	Cazenovia.
1	PHACOPS BUFO.	Delphi.
4	CRYPHEUS CALLITELES.	Lake Erie Shore.
70	PHACOPS BUFO.	do.
1	ICHTHYODORULITE, with six teeth.	Darien.

APPENDIX.

C.

DESCRIPTIONS

OF

PALÆOZOIC FOSSILS,

CHIEFLY FROM THOSE CONSTITUTING THE THIRD VOLUME
OF THE

PALEONTOLOGY OF NEW-YORK;

WITH OTHERS FROM THE FOURTH VOLUME, etc. etc.

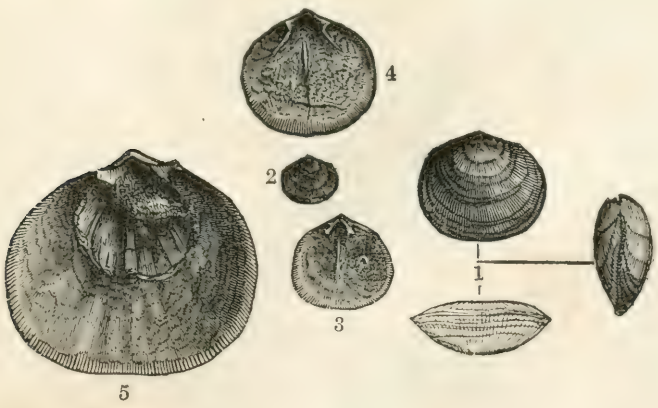
PALÆOZOIC FOSSILS.

Orthis oblata (new species).

Palæontology of New-York, Vol. iii, pl. 10, f. 1 – 14.

Shell (in the young state) longitudinally subovate, and varying from circular to transversely oval in its stages of growth, resupinate : ventral valve convex at the beak, flattened in the middle, and convex towards the front ; dorsal valve very convex in the middle and towards the beak; beaks of the two valves nearly equally elevated, that of the ventral valve pointed; area very small ; foramen large. Surface finely striated ; striæ frequently bifurcating and curving towards the lateral and cardinal margins, concentrically marked by finer striæ and stronger lines of growth, which are numerous in the older shell.

Locality. Helderberg mountains.



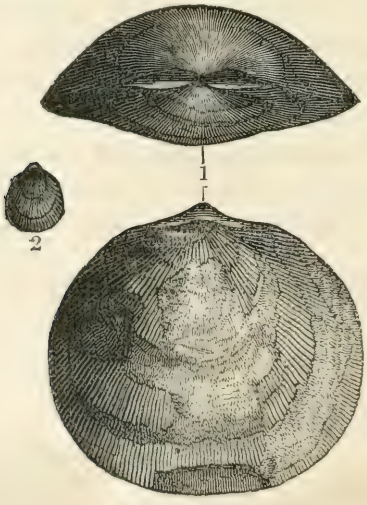
Orthis oblata.

ORTHIS EMINENS (n. s.).

Pal. N.Y. Vol. iii, pl. 11, f. 7 – 14.

SHELL circularly subquadrate, wider than high; ventral valve very convex near the beak, flattened or depressed towards the base; beak very prominent, projecting much beyond the opposite valve, pointed and slightly incurved: dorsal valve convex in the middle, and depressed almost equally towards the margins; beak rising but slightly above the hinge-line, with a central depression which is lost before reaching the middle of the valve: hinge-line less than the width of the shell; area large, extending to nearly two-thirds the entire width of the shell; foramen large and high. Surface finely striated with frequent bifurcations, and curving upwards to the hinge-margin.

Locality. Helderberg mountains.



ORTHIS EMINENS.

ORTHIS TUBULOSTRIATA (n. s.).

Pal. N.Y. Vol. iii, pl. 11, f. 1 – 6.

SHELL subcircular: valves nearly equally convex, depressed near the margin; ventral valve more prominent towards the beak,

which is sharply incurved over the area; area narrow, length about half the width of the shell. Surface striated; striæ somewhat tubular, prominent, fasciculate, increasing by implantation and bifurcation, extremely curved towards the margins, and presenting at somewhat regular intervals small tubular pore-like openings upon the surface; radiating striæ, when not worn, crossed by prominent concentric striæ, and, rarely, by stronger lines of growth.

In the usual condition of the specimens, the concentric striæ are only visible in the depressions between the radiating striæ, and sometimes are imperceptible.

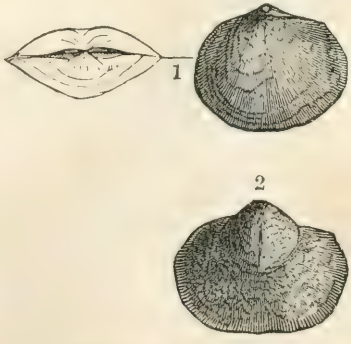
Locality. Helderberg mountains.

Orthis subcarinata (n. s.).

Pal. N.Y. Vol. iii, pl. 12.

Shell somewhat transversely oval, plano-convex: ventral valve very convex, strongly elevated or subcarinate along the middle; beak small, incurved: dorsal valve more or less flattened, with a distinct depression along the middle, which becomes wider towards the base, producing a sinus in the margin of the shell; beak scarcely rising above the hinge-line; area narrow, linear, one-half to two-thirds the width of the shell.

The depressed line along the middle of the dorsal valve, and the ridge upon the ventral valve, very frequently diverge from the central line, though the specimens do not appear to have suffered any distortion from pressure.



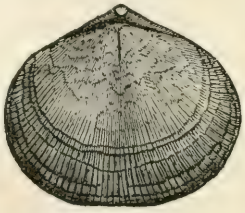
Orthis subcarinata.

ORTHIS PERELEGANS (n. s.).

Pal. N.Y. Vol. iii, pl. 13.

SHELL transversely oval; valves nearly equally convex : ventral valve elevated along the middle from the beak towards the front, and sloping laterally; beak small, pointed, incurved, extending little beyond the other : dorsal valve subventricose, more or less depressed along the middle from near the beak to the front; beak small, not much elevated above the hinge-line : cardinal margin generally sloping a little from the beaks, rounding imperceptibly into the lateral margins; area narrow, nearly half the width of the shell; foramen broad triangular, extending nearly to the apex of the beak. Surface marked by fine, irregular, bifurcating, longitudinal striæ, crossed by concentric lines of growth.

Chiefly distinguished from the last by its more ventricose dorsal valve, and by the hinge-line sloping more from the beaks laterally; but more readily distinguished by the internal differences.



ORTHIS PERELEGANS.

ORTHIS DEFORMIS (n. s.).

Pal. N.Y. Vol. iii, pl. 14, f. 3.

SHELL suborbicular, lenticular : ventral valve more convex than the opposite, most elevated between the centre and beak; beak straight, often distorted in consequence of having been the point by which the shell was attached : dorsal valve depressed-convex, most elevated near the beak; beak not extending beyond the hinge-line; hinge-line straight, equalling about three-fourths

the width of the shell ; area broad, flat, sometimes nearly on a plane with the greater diameter of the shell; foramen closed. Surface marked by prominent rounded striæ, which increase by implantation, and are crossed at intervals by distinct subimbricating concentric lines of growth.

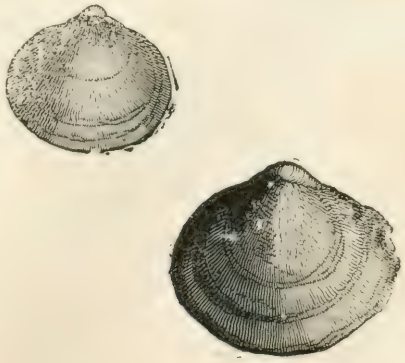
This shell has much the general habit of *O. umbraculum* of the Carboniferous system, but is not resupinate.

Orthis multistriata (n. s.).

Pal. N.Y. Vol. iii, pl. 15, f. 2.

Shell circular or transversely suboval : ventral valve most convex near the beak, depressed so as to form a broad shallow undefined sinus, which sometimes gives to the front a subemarginate aspect; beak a little more prominent than the opposite, slightly incurved : dorsal valve more elevated, most convex between the middle and the beak ; beak rising above the hinge, obtuse and incurved ; hinge-line straight, about half the width of the shell ; area small ; foramen narrow, extending nearly to the apex. Surface marked by fine, crowded, nearly equal striæ, which increase chiefly by implantation, and are crossed by a few faint concentric lines of growth.

Closely related to the ventricose varieties of *Orthis resupinata*, and also to the *Orthis striatula* of D'Orbigny.



Orthis multistriata.

ORTHIS STROPHOMENOIDES (n. s.).

Pal. N.Y. Vol. iii, pl. 14, f. 2.

SHELL transverse, somewhat semioval : ventral valve flattened convex, with a distinct narrow mesial elevation passing from beak to base; beak scarcely distinct from hinge-line, straight : dorsal valve more convex than the opposite, most elevated between the middle and the beak, from which a distinct narrow depression extends towards the front; beak more prominent than the opposite, obtuse, incurved : hinge-line straight, nearly equalling the greatest width of the shell; area large, plane; foramen apparently closed. Surface marked by coarse radiating striæ, which increase by implantation and bifurcation : several of those on the mesial elevation of the ventral valve appear to coalesce along the centre, before reaching the beak. In well preserved specimens, strong concentric striæ are visible in the depressions between the radiating striæ. Shell marked by a few strong concentric undulations of growth.

Resembles very nearly *O. fasciata* of the Niagara group.

ORTHIS MUSCULOSA (n. s.).

Pal. N.Y. Vol. iii, pl. 91, f. 1 – 3.

SHELL suborbicular, the length about nine-tenths as great as the width : ventral valve depressed-convex, sometimes slightly concave near the front; beak prominent, equalling or extending a little beyond that of the opposite valve, pointed and slightly incurved : dorsal valve regularly and distinctly convex, most elevated in the central region, sometimes a little depressed towards the front; beak prominent, triangular, pointed and incurved; cardinal teeth and process strong; hinge extremely short; area triangular, scarcely extending beyond the foramen; foramen large, partly occupied by the prominent cardinal process of the other valve, visceral impression large, fan-shaped, and strong. Surface marked by fine, distinct, radiating striæ, those nearest the cardinal margin being curved outwards from the beak; concentrically marked by obscure lines of growth.

This species bears a general resemblance to *O. oblata* of the Delthyris shale; but it attains a larger size, is more ventricose, and never so distinctly resupinate. The beaks are more prominent and incurved, that of the dorsal valve curving beyond the hinge-line. The cardinal views of the two species also differ: the hinge-line of the present species arches upwards on each side of the beaks, while in the other it is straight. The area is also higher in the Oriskany species than in that from the Shaly limestone.

In the Oriskany sandstone of New-York, this species usually occurs in the form of casts. I have obtained fine specimens of the fossil entire, and of the separate valves, from Cumberland, Md.

Geological position and locality. Oriskany sandstone, Albany and Schoharie counties; Cumberland (Md.), etc.

Leptæna concava (n. s.).

Pal. N.Y. Vol. iii, pl. 18, f. 2.

Shell concavo-convex, hemispherical: ventral valve regularly convex; umbonial region prominent; cardinal margin rounding from the beak towards the lateral extremities: dorsal valve deeply concave; hinge-line less than the greatest width of the shell; area of ventral valve broad, that of dorsal valve linear; foramen triangular, nearly closed by a thick callosity. Surface marked by very fine, close, radiating striæ, each fifth or sixth one a little more prominent than those between; crossed by fine regular concentric wrinkles, producing a beautiful subcancellate appearance.

Geological position and locality. In the shaly limestone of the Helderberg group, Albany county.

Leptæna nucleata (n. s.).

Pal. N.Y. Vol. iii, pl. 94, f. 1.

Shell semicircular: ventral valve extremely gibbous, abruptly depressed or flattened towards the lateral extremities; beak (internal cast) very abruptly incurved, and divided by a central groove (left by the mesial plate) which extends back nearly to the centre of the valve: dorsal valve unknown; hinge-line

equal to the greatest width of the shell, terminating in minute triangular extensions; area sublinear, incurved beyond the plane of the valves. Surface unknown.

Internal casts of the ventral valve of this little shell are common in the Oriskany sandstone; but no specimens have been met with, showing its external characters, nor have any specimens of the dorsal valve yet been recognized.

Geological position and locality. In the Oriskany sandstone, Albany county.

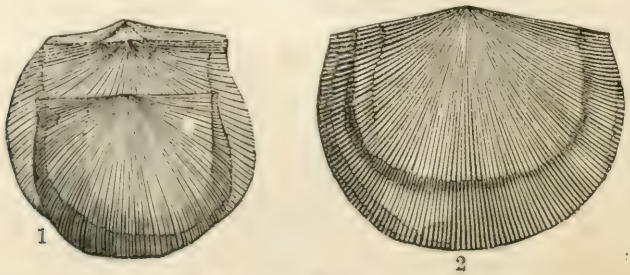
STROPHOMENA WOOLWORTHANA (n. s.).

Pal. N.Y. Vol. iii, pl. 17, f. 1.

SHELL semielliptical, often extremely elongate: ventral valve concave towards the front and flat on the lateral margins, depressed convex near the beak; beak small, and scarcely rising above the edge of the valve: dorsal valve convex, most elevated near the front, and flattened near the umbo; beak not projecting: hinge-line straight, equal to the greatest width of the shell; area linear, conspicuous, partly common to both valves; foramen broadly triangular, partly or entirely closed Surface finely striated; striæ rounded, crowded, simple, increasing by implantation; concentrically crossed by closely arranged striæ and a few distant lines of growth.

This species approaches in character to *Strophomena* (*Leptæna*) *subplana* (Palæontology of New-York, Vol. ii, pl. 53, f. 8, 9 & 10); but the shell is more robust, and the striæ more round and stronger than in that shell.

Geological position and locality. Shaly limestone of the Lower Helderberg, Albany and Schoharie counties.



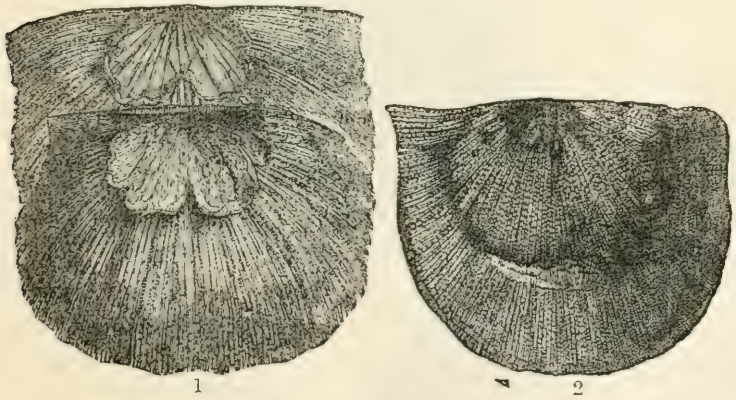
STROPHOMENA WOOLWORTHANA.

STROPHOMENA (STROPHODONTA) HEADLEYANA (n. s.).

Pal. N.Y. Vol. iii, pl. 20, f. 1 & 2.

SHELL nearly semicircular, about three-fourths as long as broad: ventral valve very concave especially near the front, sometimes depressed-convex at the beak; beak scarcely distinct from the margins of the area: dorsal valve depressed at the umbo, and very convex towards the front; beak not extending beyond the cardinal margin: hinge-line equalling the greatest width of the shell, crenulated; area somewhat wide, and marked by transverse striæ produced by the continuation of the crenulations from the hinge-line across its surface; foramen narrow, closed. Surface marked by coarse, sharply elevated striæ, which increase chiefly by implantation, and present a peculiar irregularly waved appearance.

Geological position and locality. Shaly limestone of the Lower Helderberg, Albany and Schoharie counties.



1 2

STROPHOMENA HEADLEYANA.

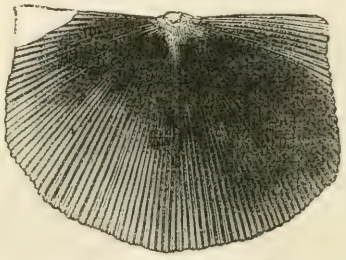
STROPHOMENA RADIATA.

Pal. N.Y. Vol. iii, pl. 21, f. 8 & 9.

Strophomena radiata, VANUXEM, Report Third District N.Y., p. 122, f. 6.

SHELL nearly semicircular, about three-fourths as long as wide : ventral valve flat or subconcave, except near the umbo, where it is depressed-convex ; beak rising a little above the line of the cardinal margin : dorsal valve flat, or slightly concave near the beak and towards the extremities, very gibbous in the middle and towards the front; beak not elevated above the cardinal margin; hinge-line equalling the greatest width of the shell, apparently not crenulated. Surface marked by distinct radiating striæ, which increase by implantation and bifurcation, crossed by fine concentric striæ : interior indistinctly granulose.

Geological position and locality. Shaly limestone of the Lower Helderberg, Albany and Schoharie counties.



STROPHOMENA RADIATA.

STROPHOMENA (STROPHODONTA) PUNCTULIFERA.

Pal. N.Y. Vol. iii, pl. 21, f. 4.

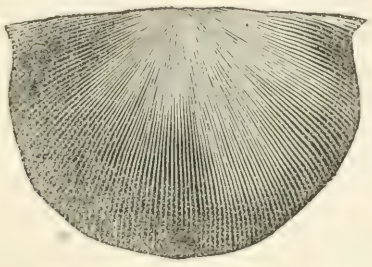
Strophomena punctulifera, CONRAD : Vanuxem's Report on the Third Geological District N.Y., p. 122, f. 5.

SHELL subsemicircular, about four-fifths as long as wide : ventral valve concave; beak not projecting beyond the hinge : dorsal valve concave near the umbo, very convex near the middle ; beak not elevated above the cardinal margin; sides somewhat

contracted below the extremities of the hinge; hinge-line straight, nearly or quite equalling the greatest width of the shell, finely crenulated. Surface marked by distinct bifurcating striæ : interior granulose; cast punctate.

This species is nearly related to the last, but differs in the crenulated hinge-line, and in having the internal surface more distinctly granulose; in consequence of which, the surface of casts always presents a punctate aspect, from which it has received its name.

Geological position and locality. Shaly limestone of the Lower Helderberg, Albany, Schoharie, Herkimer and Oneida counties.



STROPHOMENA PUNCTULIFERA.

STROPHOMENA (STROPHODONTA) CAVUMBONA (n. s.).

Pal. N.Y. Vol. iii, pl. 21, f. 1 – 3.

SHELL subsemicircular, from two- to four-fifths as long as wide, usually contracted below the extremities of the hinge-line; cardinal border sloping a little from the beaks, nearly or quite equalling the greatest width of the shell : ventral valve concave in the umbonial region and near the hinge, very convex in the middle and towards the front : dorsal valve flat or concave; beak very small, scarcely elevated above the cardinal margin : hinge-line straight, crenulated; area linear, partly common to both valves, transversely striate on the ventral valve; foramen small, narrow, closed. Surface marked by coarse irregular radiating striæ, which increase by implantation.

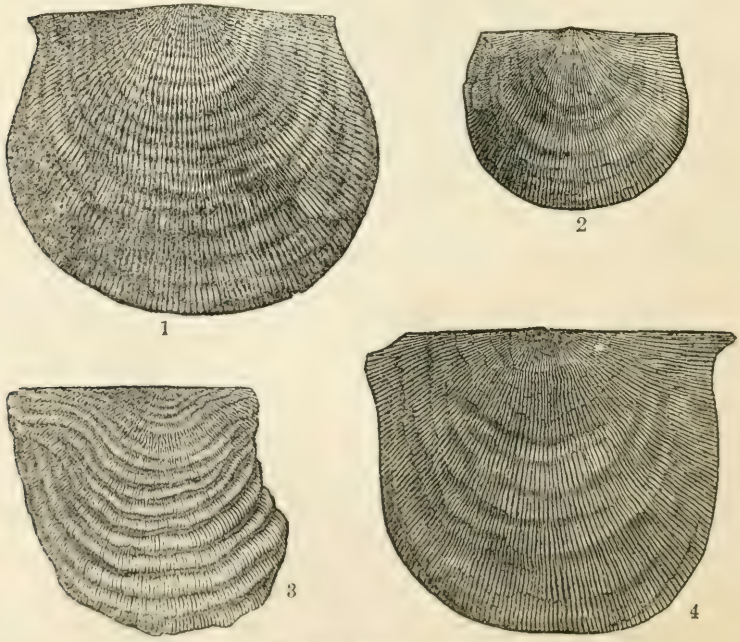
Geological position and locality. Shaly limestone of the Lower Helderberg, Albany and Columbia counties.

STROPHOMENA (STROPHODONTA) BECKII (n. s.).

Pal. N.Y. Vol. iii, pl. 22, f. 1a – 1t.

SHELL subsemicircular or subquadrate; length sometimes equal to the width (though usually from two-thirds to three-fourths as great): ventral valve depressed-convex; beak very small: dorsal valve flat or a little concave near the hinge, slightly convex near the front: hinge-line crenulated, generally equal to the greatest width of the shell, but sometimes less; area linear, confined to the ventral valve; foramen small, open or closed. Surface marked with fine, regular, closely arranged, bifurcating, radiating striæ, crossed by fine obscure concentric lines, and small more or less regular concentric wrinkles which curve outwards on approaching the hinge.

This species is very closely allied to *Strophomena (Leptæna) sowerbyi* of BARRANDE (Sil. Brach. aus Böhmen, pl. 21, f. 1 & 2 a, b, c, e); but differs from those figures in being more coarsely striate, with the concentric



STROPHOMENA BECKII.

wrinkles stronger, especially near the beak : they are, also, generally more curved outwards near the hinge. The lateral margins of our shell are likewise, in most specimens, more contracted below the extremities of the hinge, than in the examples given by BARRANDE.

Geological position and locality. Shaly limestone of the Lower Helderberg, Albany and Schoharie counties.

STROPHOMENA (STROPHODONTA) LEAVENWORTHANA (n. s.).

Pal. N.Y. Vol. iii, pl. 21, f. 5 – 7.

SHELL subsemicircular, about three-fourths as long as wide, contracted below the extremities of the hinge; cardinal border sloping slightly from the beak : ventral valve flattened in the middle and cardinal margin, so as to form a semicircular inclined plane ascending from the hinge to beyond the middle of the shell; the front and lateral margins abruptly inflected, giving a deep concavity to the whole valve : dorsal valve flattened or slightly concave in the umbonial and central regions, very convex towards the front and lateral margins : hinge-line equal to the greatest width of the shell, crenulated; area linear, vertically striated; foramen small, triangular, closed in full-grown individuals. Surface marked by fine, obscure, closely arranged, radiating striæ, crossed on the depressed part of the valves by small regular concentric wrinkles.

This shell bears a general resemblance to *Strophomena depressa.* It differs, however, remarkably from that species, in its resupinate character, the convexity and concavity of the valves being in the opposite direction. The area of the ventral valve is also wider than in that species, and the cardinal margin is crenulated.

Geological position and locality. In the shaly limestone of the Lower Helderberg, Albany county.

STROPHOMENA (STROPHODONTA) MAGNIVENTRA (n. s.).

Pal. N.Y. Vol. iii, pl. 92, f. 3.

SHELL subsemicircular varying to longitudinally suboval, variable; length usually two-thirds the breadth, sometimes equal or greater : ventral valve convex in the central and umbonial regions, flattened towards the extremities; beak slightly incurved; cardinal border sloping from the umbo : dorsal valve unknown, probably concave : hinge-line crenulated, equal to the greatest width of the shell, sometimes extended into mucronate points beyond the lateral margins of the shell; area of ventral valve very broad, slightly curved, distinctly marked by vertical striæ produced by the prolongation of the crenulations of the hinge; foramen large, triangular, apparently mostly closed. Surface marked by regular, rounded, slightly elevated, radiating striæ : interior scarcely granulose, strongly marked with a plicated flabelliform muscular impression, covering nearly two-thirds of its extent.

This species is recognized in the casts (its usual mode of occurrence in the Oriskany sandstone) by the large and strongly marked vascular impressions.

Geological position and locality. In the Oriskany sandstone in Albany and Schoharie counties.

STROPHOMENA (STROPHODONTA) MAGNIFICA (n. s.).

Pal. N.Y. Vol. iii, pl. 93, f. 4; and pl. 95, f. 1.

SHELL very large, transversely suboval, somewhat semicircular, more or less rounded at the extremities of the hinge; length and breadth sometimes equal : ventral valve depressed-convex in the middle and umbonial regions, flattened near the lateral extremities; cardinal margin sloping slightly from the beak : dorsal valve slightly concave; hinge-line crenulated, usually a little less than the width of the shell; area broad, distinctly and regularly marked with transverse striæ produced by the pro-

longations of the hinge crenulations; foramen very narrow, not closed. Surface marked by somewhat faint radiating striæ, which bifurcate regularly about two or three times at uniform distances from the beak.

This species is remarkable for the large size to which it sometimes attains; a few individuals having been found measuring from 3⅝ to 4 inches in breadth, and from 3 to 3⅝ inches in length: being perhaps the largest brachiopod known in the rocks of this State.

Geological position and locality. In the Oriskany sandstone, Albany and Schoharie counties.

STROPHOMENA (STROPHODONTA) LINCKLÆNI (n. s.).

Pal. N.Y. Vol. iii, pl. 93, f. 2 & 3; pl. 94, f. 2.

SHELL subsemicircular, more than three-fourths as long as broad; lateral margins usually contracted near the extremities of the hinge-line: ventral valve convex in the central region and towards the front, somewhat flattened laterally: dorsal valve concave, deflected round the front and sides; hinge-line crenulated, nearly or quite equal to the greatest width of the shell. Surface marked by fine, closely arranged radiating striæ, crossed by obscure concentric lines of growth: interior granulose, and more or less striate; visceral impressions strongly marked.

Both internal and external casts of the dorsal valve of this species are quite abundant; but no specimens of the ventral valve have yet been recognized. Consequently its form and character can only be inferred from those of the opposite valve.

Geological position and locality. Oriskany sandstone, Albany and Schoharie counties.

STROPHOMENA DEPRESSA, *var.* VENTRICOSA.

Pal. N.Y. Vol. iii, pl. 94, f. 3.

SHELL transversely oblong, subsemicircular; length and breadth sometimes nearly equal; front often straight in the middle, and parallel to the hinge-line: ventral valve extremely ventricose,

scarcely geniculate in front : dorsal valve forming an inclined plane from the hinge towards the front, near which it is abruptly deflected, giving the valve a deep concavity : hinge-line equal to the greatest width of the shell; lateral margins contracted, so as to leave small auricular extensions at the extremities of the cardinal border; area sublinear, longitudinally striate : interior distinctly granulose ; muscular attachments strongly marked.

Internal casts, with fragments of separate valves of this shell have been seen : its general aspect is like that of *Strophomena depressa*, though its internal muscular attachments often deviate considerably from those of well-marked specimens of that species. The ventral valve is also more regularly arched and gibbous in outline than is usual in *S. depressa;* and it has not the abrupt geniculation in front, so characteristic of that shell.

Geological position and locality. Oriskany sandstone, Albany county, and Cumberland (Md.).

CHONETES COMPLANATA (n. s.).

Pal. N.Y. Vol. iii, pl. 63, f. 1.

SHELL nearly semicircular, compressed? about two-thirds as long as wide : ventral valve flat or concave : dorsal valve unknown; tubular spines of the cardinal margin directed obliquely outwards. Surface marked by fine, closely arranged (bifurcating?) striæ, which appear to have been crenulated by closely arranged concentric striæ. Some of the specimens show distant imbricating concentric lines of growth : interior finely granulose; viscera impression large, uniform, not strongly marked.

All the specimens seen of this rare species consist of internal and external casts of the ventral valve, from which it is impossible to make out a complete diagnosis. The few remaining impressions of the row of tubular spines along the cardinal margin are barely sufficient to show the presence of these appendages, without clearly indicating their number, length, curvature, etc. It may be recognized by its extreme flatness, finely striated surface, a few distant laminæ of growth, and great proportional width.

Geological position and locality. Oriskany sandstone of Albany and Schoharie counties.

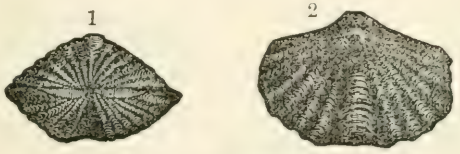
Spirifer ventricosa (n. s.).

Pal. N.Y. Vol. iii, pl. 14, f. 1.

Shell globose; valves almost equally convex: ventral valve having a narrow sinus extending down the centre from beak to base; beak projecting above the other, strongly incurved and pointed (in many specimens the beaks are nearly equal): dorsal valve having a central depressed line, but less conspicuous than in the opposite valve; area very small, concave; surface marked by concentric lines of growth.

This species resembles *Spirifer pisum* of the Niagara group; but the form is slightly more extended, the beak of the ventral valve more elevated and incurved, and the area more distinct.

Geological position and locality. Lower Helderberg limestone, Albany county.



Spirifer ventricosa.

Spirifer perlamellosa (n. s.).

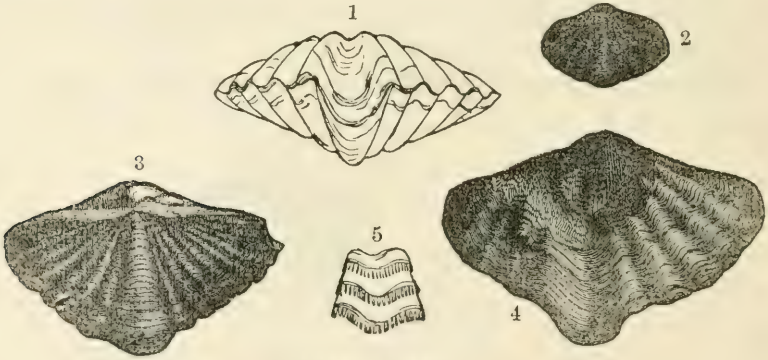
Pal. N.Y. Vol. iii, pl. 26, f. 1.

Spirifer rugosa, Hall, in Catalogue.

Shell trigonal or semicircular, more or less extended on the hinge-line, the extremities varying from obtuse or rounded to extremely mucronate: ventral valve arcuate, the beak much extended beyond the opposite valve, and incurved at the apex; sinus deep, gradually expanding, and produced in front into a linguiform extension: dorsal valve convex towards the middle, the mesial elevation very prominent, and the beak closely incurved against the area, or partially closing the foramen of the ventral valve; area moderately wide, frequently much expanded, and becoming linear towards the extremities where the shell is much

extended. Surface marked by from four to six strong and abruptly elevated plications on each side of the mesial sinus and elevation, concentrically marked by strong imbricating lamellæ, which are abruptly arched in passing over the plications, giving an extreme roughness to the surface. In well preserved specimens, finer longitudinal lines mark the surface of these lamellæ: in ordinary specimens, the concentric lamellæ are more closely arranged and more distinctly imbricate towards the margin; while near the beaks they are more distant, and are scarcely imbricate.

Geological position and locality. Lower Helderberg limestone, Albany county.



SPIRIFER PERLAMELLOSA.

SPIRIFER CYCLOPTERA (n. s.).

Pal. N.Y. Vol. iii, pl. 25, f. 1.

SHELL semicircular; extremities of the hinge-line more or less symmetrically rounded: ventral valve gibbous; beak moderately elevated, more or less incurved; sinus moderately deep, curved on the sides, and nearly flat in the middle: dorsal valve very convex towards the middle, the mesial fold abruptly elevated and very prominent; beak little elevated above the hinge-line, and scarcely incurved; area moderate, scarcely extending to the extremity of the hinge-line; foramen large. Shell marked by five to seven rounded plications on each side of the mesial line, concentrically marked by fine close imbri-

cating lamellose striæ, which are more or less prominent, depending on the condition of preservation in the shell : surface of lamellæ ornamented by short fine vertical striæ or crenulations, which project in fimbriæ on the edge of the lamellæ.

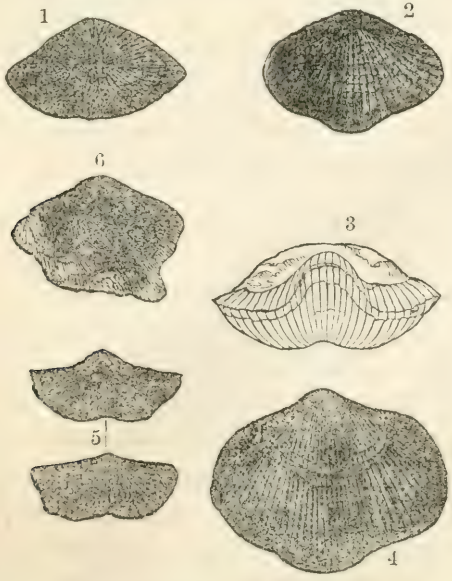
This species resembles in its surface characters the *Spirifer crispus* of the Niagara group, but is much larger, has a greater number of plications and a narrower and longer area, while the valves are more nearly equal in size.

Geological position and locality. Lower Helderberg limestones, Albany county.

Spirifer multistriatus (n. s.).

Pal. N.Y. Vol. iii, pl. 24, f. 3.

Shell transversely oval, or pentagonal with the angles rounded : ventral valve moderately convex towards the beak, with a broad (not sharply defined) sinus below, which often becomes obsolete before reaching the beak ; beak abruptly incurved over the beak of the opposite valve : dorsal valve more convex than the opposite, the middle elevated in a broad scarcely defined lobe ;



Spirifer multistriatus.

beak closely incurved : hinge-line slightly declining on each side of the centre, and rounded at the extremities; area narrow, strongly striated longitudinally. Surface marked by numerous fine striæ which bifurcate once or oftener between the beak and base of the shell, concentrically crossed by imbricating lamellæ.

The species is distinguished by its rounded extremities and numerous fine striæ, which bifurcate or increase by interstitial addition, chiefly near the middle of the shell, but often near the beak and base. A few of the striæ (six or eight) near the beaks are much stronger than the others.

Geological position and locality. Shaly limestone of the Lower Helderberg, Albany and Schoharie counties.

SPIRIFER? PERFORATUS (n. s.).

Pal. N.Y. Vol. iii, pl. 27.

SHELL somewhat semicircular, with the hinge extremities rounded; hinge-line slightly curved; area very small : ventral and dorsal valves nearly equally convex; beak of the ventral valve slightly incurved and perforate at the extremity; dorsal valve with the beak strongly incurved, and filling the foramen of the opposite valve. Entire surface marked by sharp radiating striæ, which bifurcate once or twice before reaching the base, so as to present fascicles of two or three on the centre of the shell.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county and Hudson.

SPIRIFER CONCINNA (n. s.).

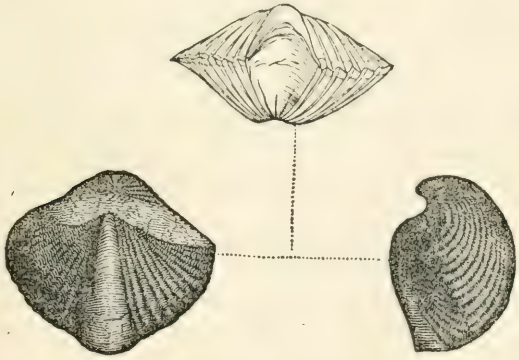
Pal. N.Y. Vol. iii, pl. 25, f. 2.

SHELL semicircular or semielliptical; extremities rounded; valves almost equally convex : ventral valve gibbous towards the beak; beak more or less elevated above the hinge-line, and abruptly incurved at the apex; mesial sinus subangular, and produced into an angular extension which is much elevated, and sometimes slightly incurved in front : dorsal valve very convex

in the centre; beak scarcely incurved; mesial elevation obtusely angular; hinge-line equal to or a little less than the width of the shell; area of medium size, well defined, and extending to the extremities of the hinge-line. Surface marked by from twelve to fourteen rounded, little elevated, simple costæ on each side of the lobe and mesial sinus; concentrically marked by imbricating lamellæ, which are striated upon their surfaces and granular on the edges.

In many specimens there are faint indications of a fold on each side of the mesial sinus, and of several upon the corresponding mesial elevation: this character, however, is not constant in the specimens examined.

Geological position and locality. In the Shaly and Upper Pentamerus limestones of the Lower Helderberg group in Albany and Schoharie counties, Hudson, etc.



SPIRIFER CONCINNA.

SPIRIFER MODESTA (n. s.).

Pal. N.Y. Vol. iii, pl. 25, f. 1.

SHELL small, subglobose: ventral valve very gibbous near the middle and towards the beak, having a shallow undefined sinus extending from the beak to the front: dorsal valve depressed-convex, semicircular or subtriangular; extremities rounded, sometimes an undefined elevation down the middle; beak scarcely extending above the hinge-line, not incurved; hinge-line very short and rounded at the extremities; area triangular, faintly defined, less than the width of the shell, arcuate; foramen

moderate, narrow triangular. Surface marked by faint concentric lines of growth.

This species resembles somewhat *S. ventricosa* of the Lower Helderberg shaly limestone, but has a much higher area. It still more resembles *S. lineatus* of the Carboniferous system, but differs in its surface markings and its narrower foramen.

Geological position and locality. Limestones of the Lower Helderberg group, Cumberland (Md.).

SPIRIFER OCTOCOSTATA (n. s.).

Pal. N.Y. Vol. iii, pl. 28, f. 2.

SHELL subglobose; valves nearly equally convex: ventral valve most elevated near the beak; sinus extending nearly to the apex; beak slightly incurved; dorsal valve most convex in the middle; mesial elevation not prominent; beak rising little above the hinge-line, slightly incurved; hinge-line less than the width of the shell, rounded at the extremities; area triangular, faintly defined, somewhat arcuate; foramen very narrow. Surface having about four rounded, slightly prominent folds on each side of the mesial sinus and elevation; concentrically marked by fine, regular, closely arrangéd striæ.

This species resembles *S. crispus* of the Niagara group, but is more globose in form, has a much shorter area, more rounded extremities, and less strongly marked plications. It appears to be intermediate between that species and *S. bicostatus* of the same group, but may be readily distinguished from either.

Geological position and locality. Limestones of the Lower Helderberg group, Cumberland (Md.).

SPIRIFER SUBMUCRONATUS (n. s.).

Pal. N.Y. Vol. iii, pl. 100, f. 3.

SHELL semicircular, with the extremities mucronate; valves equally and moderately convex: ventral valve regularly convex at

the lateral extremities; beak little elevated and scarcely incurved; mesial sinus shallow, and flat in the middle : dorsal valve depressed-convex in the middle and flattened laterally, often a little concave towards the extremities; mesial fold distinctly defined, equal in width to the two adjoining costæ, somewhat flattened in the centre; beak little elevated above the hinge-line, and scarcely incurved; area moderate; foramen somewhat large, often partially closed. Surface marked by ten to fourteen simple rounded and moderately elevated costæ; concentrically marked by imbricating lamellæ, which are usually almost obsolete or obliterated when the shell is silicified.

This differs from the preceding species in being a smaller and more delicate shell, with the extremities more distinctly mucronate. The surface is less strongly marked with concentric lamellæ.

Geological position and locality. Oriskany sandstone, Cumberland, Md.

Spirifer cumberlandiæ (n. s.).

Pal. N.Y. Vol. iii, pl. 100, f. 4.

Shell broadly semicircular; valves moderately and nearly equally convex : ventral valve regularly convex; mesial sinus narrow, shallow, and flat in the middle; beak gently incurved, and projecting slightly beyond the hinge-line : dorsal valve having a narrow flattened mesial fold, with a faint depression down the centre; beak scarcely incurved, and nearly in the same plane with the cardinal margin; hinge-line straight; extremities extended; area broad, nearly flat, parallel with the axis of the shell; foramen somewhat large, often partially or entirely closed. Surface marked by from fourteen to seventeen simple rounded costæ, which are crossed by concentric elevated lines or lamellæ.

In general form, this shell resembles *S. mucronatus*, but is conspicuously distinct in its wider area. It is usually broader, with the mesial sinus and elevation narrower.

Geological position and locality. Oriskany sandstone, Cumberland, Md.

CYRTIA DALMANI.

Pal. N.Y. Vol. iii, pl. 24, f. 2.

SHELL trigonal; valves extremely unequal: ventral valve triangularly pyramidal: dorsal valve semicircular; mesial lobe flat, or with a slightly depressed line; beak scarcely defined, or rising above the hinge-line; hinge-line straight; area triangular, flat or slightly arcuate; foramen narrow, linear, usually closed in the lower part, with a semitubular opening above; concentric lamellæ strong, and often very conspicuous near the margin. Surface granulose-punctate.

This species differs from the *Cyrtia* (*Spirifer*) *pyramidalis* of the Niagara group; having the dorsal valve more uniformly convex, the mesial fold broader and more prominent; while the depressions are not so deep, the mesial sinus is broader, the plications bounding it are less conspicuous, and the concentric imbricating lamellæ are stronger in the species under consideration than in the Niagara species.

I have heretofore referred this species, with doubt, to the *C. heteroclitus* of Europe; for among the variety of forms referred to this species, it is difficult to know the typical one. It differs, however, from the Eifel species of that name.

Geological position and locality. Limestones of the Lower Helderberg group, Albany and Schoharie counties.

CYRTIA ROSTRATA (n. s.).

Pal. N.Y. Vol. iii, pl. 100, f. 5.

SHELL semicircular or triangular: ventral valve much elevated at the beak, a distinct sinus extending from beak to front; beak simple, angular, not incurved: dorsal valve depressed-convex, semicircular; mesial fold moderately elevated, slightly flattened and marked with a faint longitudinal depressed line; beak scarcely elevated above the cardinal margin; hinge-line straight, equalling the greatest width of the shell; area broad triangular, plane, or rarely subarcuate; foramen narrow, extending to the apex of the beak of the ventral valve, partly closed above by a central plate. Surface marked by nine to eleven elevated angular costæ on each side of the middle, crossed by strong imbricating concentric lamellæ.

Resembles *Spirifer heteroclitus* of VON BUCH, but has more plications and a wider foramen, which appears to be never quite closed as in that species. The area is also generally less extremely elevated in our shell.

Geological position and locality. Oriskany sandstone, Cumberland, Md.

RHYNCHONELLA SEMIPLICATA (n. s.).

Pal. N.Y. Vol. iii, pl. 29, f. 1.

SHELL (in the young state) compressed-ovate, becoming more gibbous and subtriangular : valves nearly equal; ventral valve slightly more gibbous, most prominent in the middle, and having towards the front a more or less defined mesial sinus, in which there are from one to two plications, while from one to three lateral plications occupy the space on each side of the sinus; beak closely incurved over that of the opposite valve : dorsal valve depressed-convex, having from two to four rounded plications on each side of the medial fold, which is itself bifid or trifid; plications strongly marked in front, and usually becoming obsolete near the middle of the valve. Surface having traces of extremely fine radiating striæ, crossed by concentric undulations of growth.

Geological position and locality. Pentamerus limestone of the Lowe Helderberg group, Albany and Schoharie counties.

RHYNCHONELLA SEMIPLICATA.

RHYNCHONELLA ÆQUIVALVIS (n. s.).

Pal. N.Y. Vol. iii, pl. 29, f. 2.

SHELL ovate, somewhat compressed; sides sloping from the beaks at a little less than a right angle; front semicircular; valves nearly equally convex: ventral valve having sometimes towards the front a broad very faint depression or sinus; beak pointed and incurved. Surface ornamented by twenty-eight to thirty-two simple rounded plications, broader than the depressions between. On the dorsal valve the central depression is a little deeper than the others, extending quite up to the beak: fine concentric lines, which arch a little upwards, cross the plications.

This species may be compared with *Terebratula haidingeri* of BARRANDE, to some varieties of which it bears considerable resemblance: it is, however, generally less gibbous, and the beak of the ventral valve is much less prominent. The concentric undulations, marking the stages of growth, are likewise more faint than in BARRANDE'S species.

Geological position and locality. Pentamerus limestone of the Lower Helderberg group, Albany county.

RHYNCHONELLA MUTABILIS (n. s.).

Pal. N.Y. Vol. iii, pl. 29, f. 4; and pl. 30, f. 1 & 2.

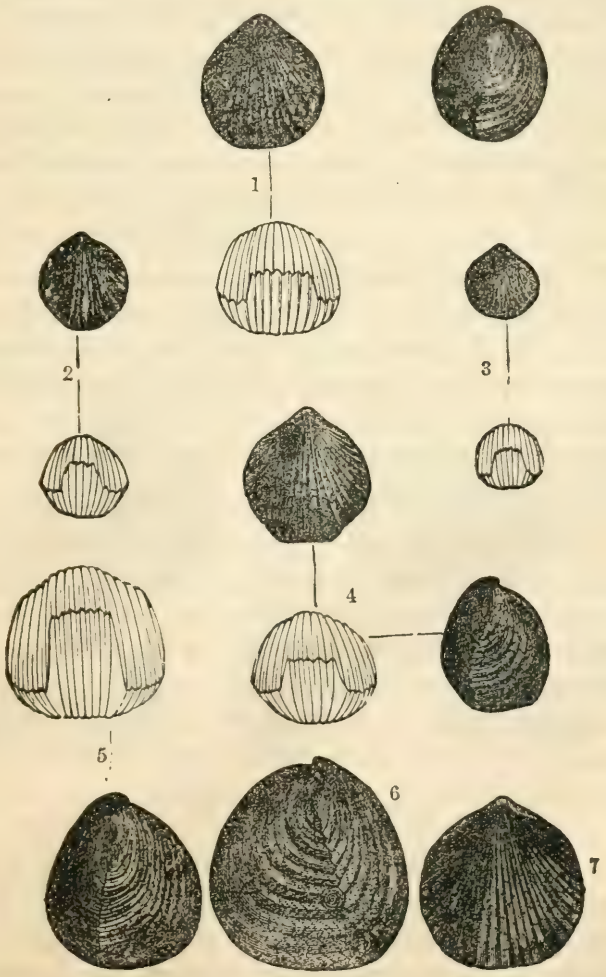
SHELL varying from ovate to spherical: ventral valve sometimes depressed, generally most convex in the umbonial region; beak small, pointed, closely incurved over that of the opposite valve: dorsal valve gibbous; beak incurved beyond the hinge-line; cardinal border on each side of the beak, concave. Surface marked by twenty to twenty-six depressed, rounded, simple plications, of which about six or eight are slightly raised towards the front of the dorsal valve into an indistinct mesial elevation; and five or six depressed near the front of the ventral valve, and extended into a short linguiform prolongation, fitting into a corresponding depression in the front of the opposite valve.

The plications on this shell are generally simple, though in a few specimens one or two of them are seen to bifurcate. The surface of perfect

specimens would probably show fine concentric lines; but those hitherto found, have such markings only near the margins of the valves. As is usual in this type of *Rhynchonella*, there is on each side of the plications on the front of the shell a faint longitudinal impressed line.

In form and general aspect this species varies greatly, being sometimes longitudinally ovate or oblong, in others globose to subpentagonal. The extremes of these varieties, without the intermediate forms, would appear to present well-marked specific differences; but a careful study of the series shows such an imperceptible gradation of form as to leave little doubt of their identity.

Geological position and locality. Pentamerus limestone of the Lower Helderberg group, Albany and Schoharie counties.



RHYNCHONELLA MUTABILIS.

RHYNCHONELLA NUCLEOLATA (n. s.).

Pal. N.Y. Vol. iii, pl. 31, f. 1 & 2.

SHELL varying from spherical to spheroid-pentagonal or subpentagonal: ventral valve convex or depressed-convex, abruptly deflected towards the margins; beak small, depressed, closely incurved over that of the opposite valve, often subangular on its lateral margins: dorsal valve larger, sometimes very gibbous, often a little depressed towards the beak; beak never prominent. Surface marked by fifteen to twenty-three simple rounded plications, about four or five of which are slightly elevated towards the front of the dorsal valve into a mesial prominence, and three to five depressed on the ventral valve, so as to form a more or less distinct sinus, which never extends above the middle of the shell. These depressed plications are prolonged in front into a more or less distinct linguiform extension fitting into a corresponding sinus in the front of the opposite valve, and sometimes curved inwards beyond the plane of a right angle with the back of the valve.

This species is perhaps more nearly related to *Rhynchonella* (*Terebratula*) *wilsoni*, than any other species in the rocks of New-York. Indeed the analogy between this one and some of the forms referred to that species is so great, that until the limits of the variation to which it is subject are better defined, it is scarcely possible to point out characters by which they can always be distinguished.

The species under consideration differs from authentic specimens of *R. wilsoni*, from Dudley, England, in being uniformly more coarsely plicated, and usually more angular in outline. When compared with specimens of the same species from Bohemia, these differences are not so conspicuous.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

RHYNCHONELLA ABRUPTA.

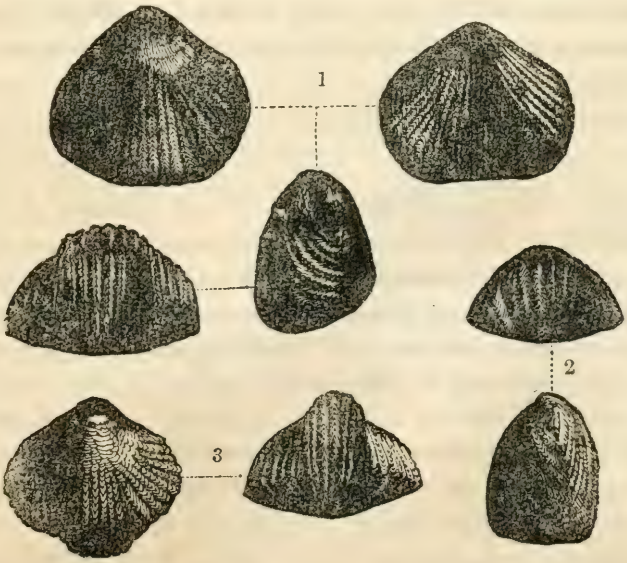
Pal. N.Y. Vol iii, pl. 31, f. 3.

SHELL transversely oval, subpentagonal: ventral valve depressed-convex, very abruptly deflected towards the opposite valve on the lateral margins; beak small, depressed on the outside and

subangular along its lateral slopes, closely incurved over that of the opposite valve : dorsal valve much the larger, very prominent in front, obliquely declining towards the beak ; beak depressed, incurved. Surface ornamented by from twenty-five to thirty-three simple subangular plications, seven or eight of which are elevated towards the front of the dorsal valve into a somewhat distinct mesial prominence ; and from six to eight of those on the middle of the ventral valve are depressed so as to form a broad undefined sinus, which scarcely extends beyond the centre of the valve towards the beak, but is prolonged in front, and abruptly bent upwards nearly at right angles to the dorsal valve into a distinct linguiform extension. The plications are marked in front by the usual longitudinal depressed line along the centre of each, and extremely fine regular zigzag lines corresponding to the sharp interlocking edges of the front and lateral margins of the valves. These fine striæ doubtless represent lines of growth, which have become wholly obsolete on other parts of the shell.

In this species the two plications bounding the sinus of the ventral valve, and the mesial elevation of the dorsal, sometimes bifurcate towards the beak or middle of the valves, one becoming obsolete on the front.

It resembles some of the Bohemian forms which are considered varieties



1 : Rhynchonella abrupta. 2, 3 : Rhynchonella vellicata.

of *R. wilsoni*, but is a larger and relatively broader shell, the mesial elevation is more distinct, and the general form is less rotund. It is possible that more extensive collections may prove this species to be an extreme variety of the preceding.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany and Schoharie counties.

RHYNCHONELLA PYRAMIDATA.

Pal. N.Y. Vol. iii, pl. 32, f. 1 & 2.

SHELL pyramidal, subpentagonal; outline subtriangular: ventral valve nearly flat or depressed-convex, more or less abruptly deflected at the margins towards the other valve; beak prominent, flattened, and closely incurved over that of the opposite valve: dorsal valve very gibbous, declining from near the front towards the beak; beak angular, incurved, flattened: lateral slopes with a distinctly impressed suboval space beneath the beaks, which is bounded by an angular fold extending from the beak downwards to the valves at the first strong plication. Surface marked by from thirteen to twenty-two simple strong subangular plications, four to six of which are more or less elevated towards the front of the dorsal valve into a mesial prominence, and three to five depressed on the ventral valve so as to form a shallow sinus, and produced in front into a distinct linguiform projection.

The plications on the front of this shell have but very faint traces of the longitudinal depressed lines so common in this type of *Rhynchonella*, though occasionally remains of very fine closely arranged zigzag striæ are seen crossing them near the margins of the valves.

In some of its varieties, this species approaches the *R. nucleolata* (pl. 31, f. 1 & 2), but differs conspicuously in being usually larger, and in its more angular outline and much stronger plications. The beaks are also more prominent in this species, and the dorsal valve is more extremely elevated near the front: there are also differences in the visceral impressions.

This species belongs to the type of *R. wilsoni*, and may be said to be one step farther removed from that species than *R. nucleolata;* or, in other words, bearing about the same relation to the latter species, which that one does to *R. wilsoni*.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

Rhynchonella vellicata.

Pal. N.Y. Vol. iii, pl. 33, f. 1 *a* to *h*.

Shell varying from transversely oval to subtriangular : ventral valve depressed-convex ; beak somewhat prominent, depressed, closely incurved over the opposite : dorsal valve more gibbous ; beak incurved, not prominent. Surface marked by twenty-four to thirty-six plications, six to eight of which are elevated in front of the dorsal valve so as to form a rather distinct mesial prominence, rarely extending beyond the middle of the valve. On the ventral valve, five to seven of the plications are depressed, towards the front, into a more or less distinctly defined sinus, and prolonged, forming a mesial projection, which is more or less elevated in the front of the other valve. Near the junction of the valves in front, very fine closely arranged lines of growth are visible.

This shell approaches very nearly, in some of its characters, the *Rhynchonella abrupta :* there are, indeed, some forms which it is difficult to distinguish. In the well-characterized specimens of this species, it differs from *R. abrupta* in its smaller and more numerous plications, and in being proportionally less ventricose, as well as in the narrower and deeper sinus of the ventral valve. The general aspect of the shells is usually quite distinctive.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany and Schoharie counties.

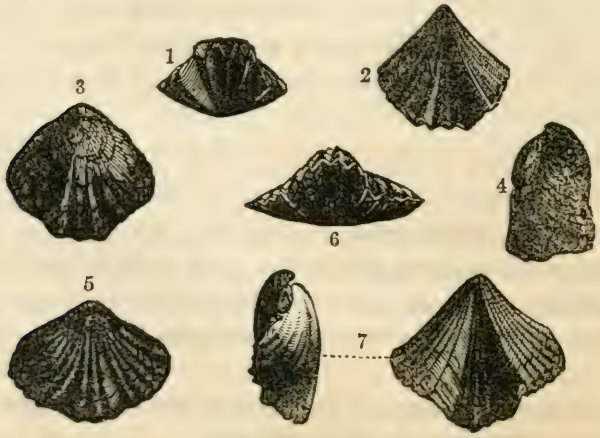
RHYNCHONELLA ALTIPLICATA.

Pal. N.Y. Vol. iii, pl. 33, f. 2.

SHELL subtrigonal, more or less gibbous : ventral valve depressed-convex; beak pointed, arched or nearly straight : dorsal valve the larger, most elevated in the middle, declining with a curved outline towards the beak and margins; beak incurved; foramen triangular, extending to the apex of the beak. Surface marked by from ten to about nineteen simple, strongly elevated, sharply angular plications on each valve; two to four of which are elevated on the dorsal valve into a more or less distinct mesial prominence extending nearly to the beak, and from one to three depressed on the middle of the ventral valve into a distinct sinus, which widens regularly and somewhat rapidly from near the beak to the front, where it is prolonged into a short projection, filling a corresponding sinus in the front of the opposite valve : shell traversed by fine concentric lines of growth.

Along the lateral slopes of the cardinal margin, on each side of the beaks, there is generally an oval space of greater or less extent, not plicated. This, although sometimes slightly concave, is never so distinctly impressed as often in species of the type of *R. wilsoni*.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany and Schoharie counties.



1, 2, 3, 4 : R. ALTIPLICATA. 5, 6 : R. TRANSVERSA. 7 : R. ACUTIPLICATA.

Rhynchonella acutiplicata.

Pal. N.Y. Vol. iii, pl. 33, f. 3.

Shell subquadrangular, compressed : ventral valve depressed-convex, most prominent near the beak : dorsal valve slightly larger than the ventral, most prominent in the middle, declining with a gentle curve towards the beak and margins ; beak incurved. Surface ornamented by about twenty-seven simple, moderately elevated, acutely angular or subcarinate plications on each valve, about five of which are elevated on the dorsal valve into a mesial prominence, which dies out before reaching the beak, and widens rapidly towards the front. On the ventral valve, four of the plications are depressed so as to form a broad rather shallow mesial sinus, with sloping sides, extending about two-thirds of the way to the beak. Shell marked by fine very regular subimbricating concentric lines of growth.

A distinguishing feature of this species is the sharply angular or subcarinate plications : in this character, however, it approaches the last described species ; but its general form is much more compressed, proportionally more elongate, with more numerous and finer plications.

Geological position and locality. Shaly limestone of the Lower Helderberg group.

Rhynchonella? bialveata.

Pal. N.Y. Vol. iii, pl. 33, f. 1, 2, 3 & 4.

Shell small, triangular or triangular-ovate, sometimes compressed : valves nearly equally convex ; beak of dorsal valve incurved ; beak of ventral valve almost straight and subangular ; foramen narrow triangular, and continued to the apex of the beak. Surface ornamented by from twelve to fourteen simple angular plications on each valve ; the two central of which, on the dorsal valve, die out a little before reaching the beak, near which they are somewhat depressed, but towards the front they become slightly elevated above the others, so as to form an indistinct mesial prominence : the middle plication on the ventral valve is smaller than the others, and depressed near the front

so as to produce a faint sinus, which extends about two-thirds of the way to the beak, at which point the valve is most convex: the two plications bordering the sinus are larger and more prominent than those on each side of them, and become obsolete before reaching the beak. A few faint imbricating lines of growth are visible near the junction of the valves in front.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

RHYNCHONELLA INUTILIS.

Pal. N.Y. Vol. iii, pl. 34, f. 7 & 8.

SHELL subtriangular, subglobose; beak of ventral valve small, closely curved upon the opposite : dorsal valve a little larger; beak incurved. Surface ornamented by eighteen or nineteen simple sharply elevated plications, about four or five of which are elevated on the dorsal valve so as to form a more or less distinct mesial fold, which extends to about the middle of the valve; while three or four of those on the middle of the ventral valve are depressed towards the front into a sinus, which is faint and broad in some specimens, and narrow and more distinctly defined in others. A few strong imbricating zigzag lines of growth near the margins of the valves.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

RHYNCHONELLA TRANSVERSA.

Pal. N.Y. Vol. iii, pl. 34, f. 9 – 14.

SHELL subtriangular, wider than long, tapering abruptly to the beak : ventral valve depressed-convex, most prominent near the the beak; beak arched : dorsal valve a little larger, most elevated near the front; beak incurved; foramen narrow, continued up to the apex of the beak. Surface ornamented by about fourteen or fifteen sharply elevated plications on each valve, of

which from three to four are elevated near the front into a rather faint mesial fold, and from two to three depressed on the ventral valve so as to form a faint sinus in the front. Somewhat strong zigzag lines of growth mark the surface of the valves near the margin in front.

There is another shell associated with the above, which agrees so very nearly with it, that I am unwilling, without a better series of specimens for comparison, to regard as distinct, though it differs somewhat in the number of plications (See f. 17 – 19, same plate).

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

Rhynchonella rudis.

Pal. N.Y. Vol. iii, pl. 34, f. 21.

Shell triangular, wider than long; lateral margins abruptly tapering to the beak : ventral valve much depressed or flattened; beak unknown : dorsal valve the larger, most elevated in front, declining towards the beak, which is slightly incurved. Surface marked by about ten rather distant plications on each valve, three of which are elevated near the front of the dorsal valve into a prominent mesial fold, and three depressed in the front of the other valve.

The surface of this shell was doubtless marked by concentric striæ ; but the only specimen I have seen is not sufficiently well preserved to retain them.

Geological position and locality. Upper calcareous part of the Shaly limestone of the Lower Helderberg group, Hudson.

Rhynchonella planoconvexa.

Pal. N.Y. Vol. iii, pl. 34, f. 2.

Shell subcircular or transversely oval : ventral valve depressed-convex, most prominent near the beak : dorsal valve larger, regularly convex. Surface marked by about twenty-four sharply

elevated bifurcating plications on each valve, about six of which are very slightly elevated near the front of the dorsal valve, so as to form a broad flat indistinct mesial prominence, corresponding to a faint shallow sinus in the opposite valve.

A single imperfect specimen only of this species has come under my observation. The regularly arched dorsal valve (very slightly elevated), flattened mesial fold, depressed ventral valve, and bifurcating striæ will probably serve to distinguish it from all the allied forms found in our rocks.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

RHYNCHONELLA SULCOPLICATA.

Pal. N.Y. Vol. iii, pl. 35, f. 1.

SHELL subtriangular, wider than long, compressed : valves nearly equal ; beak of the ventral valve prominent, attenuated, acutely pointed and arched ; beak of the dorsal valve incurved. Surface marked by about sixteen simple longitudinally grooved plications, four of which are very faintly elevated towards the front of the dorsal valve, forming an indistinct mesial fold, corresponding to a sinus in the opposite valve which is occupied by three plications.

A marked peculiarity of this species is the longitudinal groove along the centre of each of the plications. Of the four plications elevated on the dorsal valve, the two central ones are less prominent than the others, and separated by a deeper and wider depression which continues quite to the apex of the beak.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

RHYNCHONELLA FORMOSA.

Pal. N.Y. Vol. iii, pl. 35, f. 6.

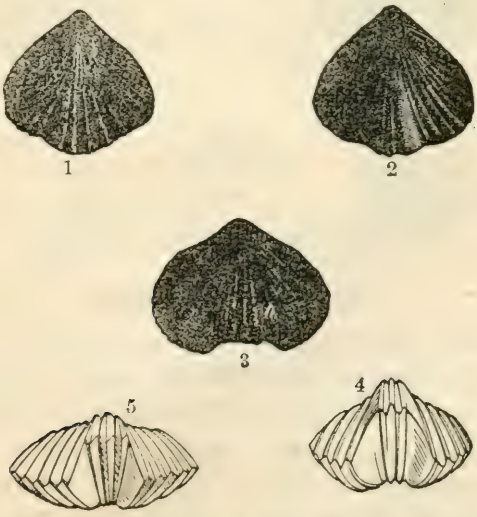
SHELL subtriangular or transversely oval; lateral margins forming an angle at the beak of about 90° to 110° : ventral valve some-

what more depressed than the opposite; beak prominent, arched, not strongly incurved : dorsal valve larger, declining with a gentle curve towards the margins; beak incurved. Surface marked by twenty to twenty-four simple angular plications on each valve, from two to four of which in the middle are coarser and depressed in the ventral, having a corresponding number abruptly elevated upon the dorsal valve.

This handsome species may be recognized by the neatly rounded outline of the latero-basal margins, the abrupt sinus, and the stronger central plications.

A single specimen from the same position as the above, shows a less distinctly defined sinus and mesial elevation, with five plications on the latter and four in the former, and only six on each side. I am disposed to regard this as only a variety of the above, though future collections may prove it to be distinct. Figure 2 *a*, *b*, *c* and *d* of the same plate are given to illustrate this form. Figures 3 and 4 *a*, *b*, *c*, *d*, *e*, *f*, of the same plate, illustrate specimens with from two to four plications on the mesial elevation, and from four to six on each side.

Geological position and locality. Shaly limestone of the Lower Helderberg group, and the Upper Pentamerus limestone of Albany and Schoharie counties.



RHYNCHONELLA FORMOSA.

RHYNCHONELLA EMINENS.

Pal. N.Y. Vol. iii, pl. 37, f. 2.

SHELL abruptly ovoid or depressed subglobose : dorsal valve the larger, elevated near the front into a flattened mesial prominence, from which it declines gently towards the beak and more abruptly towards the lateral margins, which are deflected towards the opposite valve; beak incurved : ventral valve flattened, very abruptly deflected at the margins towards the opposite valve, having a broad well defined sinus reaching from near the middle to the front, which is prolonged into a linguiform extension. Surface marked by about twenty-six rounded or scarcely subangular plications, about six of which are on the mesial fold and five in the opposite sinus; the whole crossed by fine undulating or zigzag lines of growth near the front of the valves.

Sometimes the plications bounding each side of the mesial fold in this species bifurcate, and one of them becomes obsolete before reaching the front, as in *R. abrupta* and *R. vellicata*. From both of these species, it may be distinguished by its more rounded plications and more prominent mesial fold.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

RHYNCHONELLA VENTRICOSA.

Pal. N.Y. Vol. iii, pl. 43, f. 1.

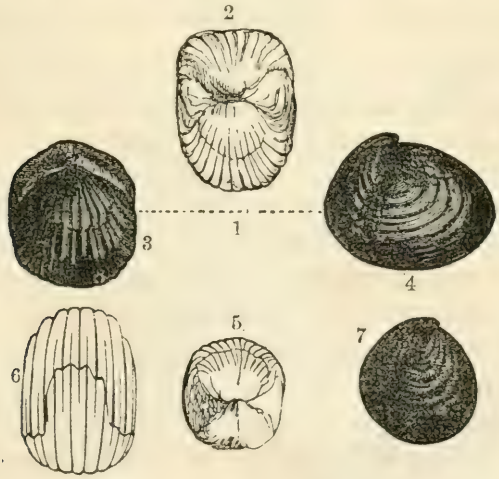
SHELL varying from spheroidal to vertically ovoid, extremely ventricose; depth of the valves often nearly double that of the breadth; valves nearly equal : dorsal valve sometimes a little depressed in the umbonial region; beak incurved; cardinal region on each side of the beak elevated : ventral valve having a long linguiform extension; beak rather small and obtuse, closely incurved upon the opposite, subangular along its lateral slopes. Surface marked by fourteen to twenty rounded plications, three or four of which are sometimes very slightly elevated

on the middle of the dorsal valve, so as to form an extremely obscure mesial fold, and two or three as much depressed on the ventral valve : plications on the front marked with a longitudinal depressed line, and remains of much finer closely arranged zigzag lines of growth.

This species belongs to the type of *R. wilsoni*, and is one of those forms which are often referred to that species. In some of its varieties it resembles *R. pyramidata*, but is more angular on the sides, and never so abruptly sloping to the beaks. In some of its phases it more nearly resembles the *R. nucleolata* in form, but the plications are stronger.

Among many hundreds of individuals of the preceding species collected from the Shaly limestone, I have not seen one of this species, and it appears to be restricted to a bed in the upper part of the group.

Geological position and locality. Upper Pentamerus limestone of the Lower Helderberg group, Schoharie and Carlisle.



RHYNCHONELLA VENTRICOSA.

RHYNCHONELLA CAMPBELLANA.

Pal. N.Y. Vol. iii, pl. 43, f. 2.

SHELL longitudinally oval, ovate or oblong, laterally compressed, two-thirds as broad as long, length and height about equal : dorsal valve the larger, elevated near the front into a broad

undefined mesial fold, declining near the beak and curving down abruptly at the sides; beak incurved : ventral valve compressed, abruptly deflected towards the opposite valve at the lateral margins, depressed into a broad rounded sinus which occupies almost the entire breadth of the narrow front; front margin curving upward, and extended into a triangular prolongation. Surface marked by twenty-two or twenty-four simple rounded subangular plications, five or six of which are elevated on the mesial fold, and four or five occupy the sinus of the ventral valve. Fine zigzag lines of growth are seen on the front of the shell, near the junction of the valves.

Geological position and locality. Shaly limestone of the Lower Helderberg group, and in the succeeding "*Scutella limestone*" of the same group, Albany county.

RHYNCHONELLA NOBILIS.

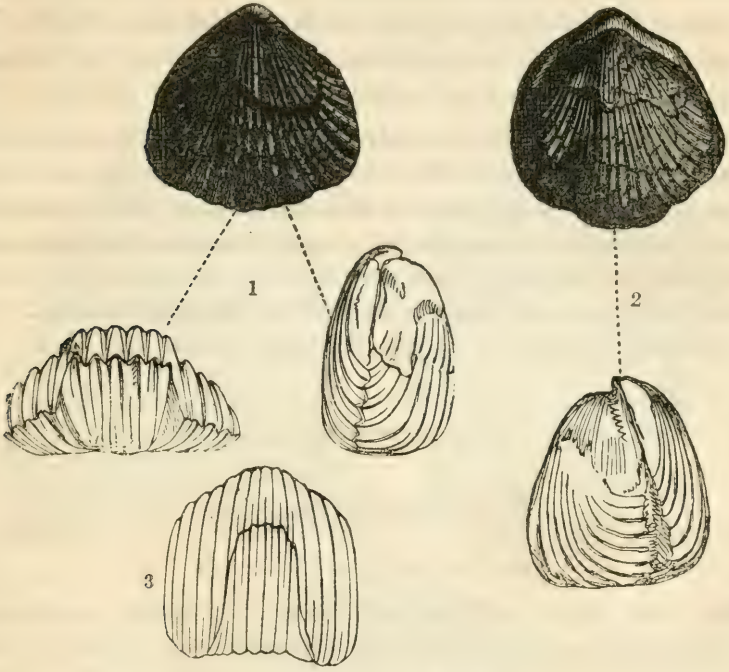
Pal. N.Y. Vol. iii, pl. 43, f. 3.

SHELL varying from compressed-ovate to subrhomboidal, becoming in adult specimens broad-ovate and much more gibbous : dorsal valve the larger, elevated in front into a somewhat rounded mesial prominence which rarely extends beyond the middle of the shell, declining laterally with an abrupt curve to meet the inflected edges of the opposite valve; beak incurved : ventral valve depressed, (in old specimens) abruptly deflected at the margins towards the opposite valve, depressed towards the front into a shallow rounded mesial sinus, sometimes prolonged into a vertical extension with nearly parallel sides; beak small, not prominent, incurved. Surface marked by twenty six to thirty-two elevated angular plications, six to eight of which are elevated on the mesial fold of the dorsal valve, and five to seven depressed in the sinus of the other valve. Fine closely arranged zigzag lines of growth may be seen near the margins of the valves in front.

This species holds an intermediate position between *R. abrupta* and *R. subcontracta* : it is, however, always more elongated than the first, and

not so much so as the latter. It also resembles *Terebratula eucharis* of BARRANDE (Silur. Brach. aus Bömen, pl. 17, f. 2); but is more gibbous in old specimens, and more elevated in front, as well as more finely plicated.

Geological position and locality. Upper Pentamerus limestone, Albany and Schoharie counties.



RHYNCHONELLA NOBILIS.

RHYNCHONELLA SPECIOSA.

Pal. N.Y. Vol. iii, pl. 103 A, f. 1.

SHELL longitudinally ovoid, vertically flattened on the sides, higher than wide, abruptly rounded or subtruncate in front; sides nearly parallel; no sinus in either valve: dorsal valve extremely elevated, abruptly deflected on each side towards the opposite valve; beak incurved; cardinal margin on each side of the beak profoundly sinuate, for the reception of the prominent rounded dental laminæ of the opposite valve; anterior and lateral mar-

gins uniting by sharp prominent interlocking notches : ventral valve flattened or much the less convex, forming a regular elliptical arch from beak to front, and abruptly deflected upwards at the sides so as to form distinct angles along the lateral margins, the whole front forming a broad truncated projection; beak somewhat obtuse, incurved. Surface marked by strongly elevated, subangular plications, each of which on the front and sides of the shell has a fine depressed line along the centre, crossed by fine regular concentric zigzag lines of growth.

This beautiful shell is remarkable for its regular ovoid form, and vertically compressed sides. It differs from any other species of equal size known to me, by the entire absence of a sinus in either valve. Adult specimens appear to have been generally higher than wide, though younger individuals were doubtless more compressed. It is decidedly the most beautiful *Rhynchonella* known to me in all our American formations.

Geological position and locality. Oriskany sandstone, Maryland.

RHYNCHONELLA BARRANDI.

Pal. N.Y. Vol. iii, pl. 103, f. 3 – 8.

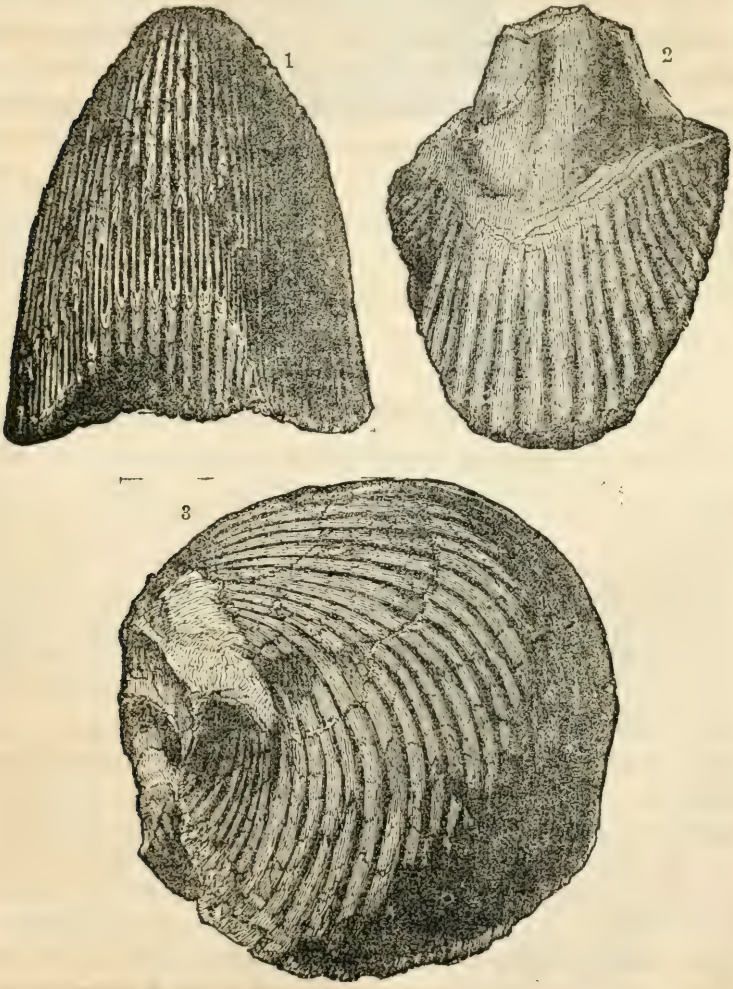
SHELL very large, ovoid or subglobose; full-grown specimens higher than wide, vertically flattened on the sides : dorsal valve very convex, often extremely elevated; beak incurved; cardinal border on each side of the beak profoundly sinuate, for the reception of the thick, strongly projecting laminæ of the opposite valve : ventral valve much the smaller, strongly arcuate longitudinally, having a broad shallow rounded sinus towards the front, abruptly deflected upwards at the lateral margins which are distinctly angular, prolonged in front into a subtriangular vertical projection. Surface marked by forty to forty-six simple (rarely bifurcating) strongly elevated [angular?] plications on each valve.

This species, the largest of the genus known to me in the rocks of this country, we have yet only met with in the condition of more or less distorted internal casts. The large size, however, of the shell, together with its form and the well-defined internal characters usually so strongly im-

pressed upon the casts, will prevent it from being confounded with any other species found in our rocks.

In many respects it resembles *R. speciosa*, which may be regarded as a representative form in the Maryland rocks : it is, however, distinguished from that shell by its larger size, its more elevated dorsal valve and relatively broader form, and its broad shallow rounded sinus near the front of the ventral valve.

Geological position and locality. Oriskany sandstone, Albany and Schoharie counties.



RHYNCHONELLA BARRANDI.

RHYNCHONELLA BARRANDI.

RHYNCHONELLA PRINCIPALIS.

Pal. N.Y. Vol. iii, pl. 106, f. 4.

SHELL large, longitudinally ovate : dorsal valve unknown : ventral valve depressed-convex, forming a low elliptical arch from beak to front, most prominent along the middle, flattened or somewhat concave near the lateral margins which are abruptly deflected upwards towards the opposite valve; beak somewhat prominent and moderately incurved; front slightly concave, but not distinctly sinuate. Surface ornamented by about eighty regular rounded plications, which occasionally bifurcate, and are crossed by indistinct lines of growth.

This species is closely related to *R. barrandi;* and having but a single ventral valve, I cannot readily decide how far it may differ in its entire characters. The casts of the preceding species are all proportionally broader when not compressed, have a more distinct sinus in front, and fewer plications. With the knowledge at present possessed, this species may be considered as holding a place intermediate between the very well-marked *R. speciosa*, and the equally well-marked *R. barrandi.*

Geological position and locality. Oriskany sandstone, Auburn (N.Y.).

Rhynchonella fitchana.

Pal. N.Y. Vol. iii, pl. 103, f. 1.

Shell longitudinally oval or ovate : dorsal valve convex ; beak slightly incurved ; cardinal margin excavated on each side of the beak for the reception of the broad dental laminæ of the other valve : ventral valve depressed-convex, most elevated in the umbonial region, flattened towards the lateral margins and depressed in front, forming a faint broad and undefined sinus. Surface ornamented by about seventy-five angular plications, which occasionally bifurcate.

This species differs from the last, which it nearly approaches in general form, in being more distinctly sinuate, and in having sharper and less numerous plications, while the beak is more pointed and less incurved.

Geological position and locality. Oriskany sandstone, Carlisle (N.Y.).

Rhynchonella multistriata.

Pal. N.Y. Vol. iii, pl. 102, f. 5 (3 on plate); and pl. 106, f. 3.

Shell subcircular, transversely suboval-depressed : ventral valve depressed-convex, most elevated in the umbonial region, flattened towards the lateral margins and slightly depressed in front, forming a broad, very shallow, undefined sinus : dorsal valve unknown. Surface marked by numerous fine regular bifurcating striæ, which are well defined nearly to the apex of the beak.

This species may be distinguished from the foregoing by its transversely oval form, and more numerous as well as much finer striæ or plications.

Geological position and locality. Oriskany sandstone, Helderberg mountains.

RHYNCHONELLA OBLATA.

Pal. N.Y. Vol. iii, pl. 102, f. 2.

SHELL subcircular, somewhat compressed : dorsal valve the larger, depressed-convex, declining with a gentle curve towards the lateral margins, rising slightly in front into a broad round undefined mesial fold; beak somewhat incurved : ventral valve much compressed, slightly convex in the umbonial region, depressed into a broad shallow undefined sinus in front. Surface marked by seventy-five to eighty coarse striæ which occasionally bifurcate.

Internal casts of this species only have been observed, but its general form appears to be sufficient to distinguish it from any of the preceding species.

Geological position and locality. Oriskany sandstone, Carlisle (N.Y.).

RHYNCHONELLA PLEIOPLEURA.

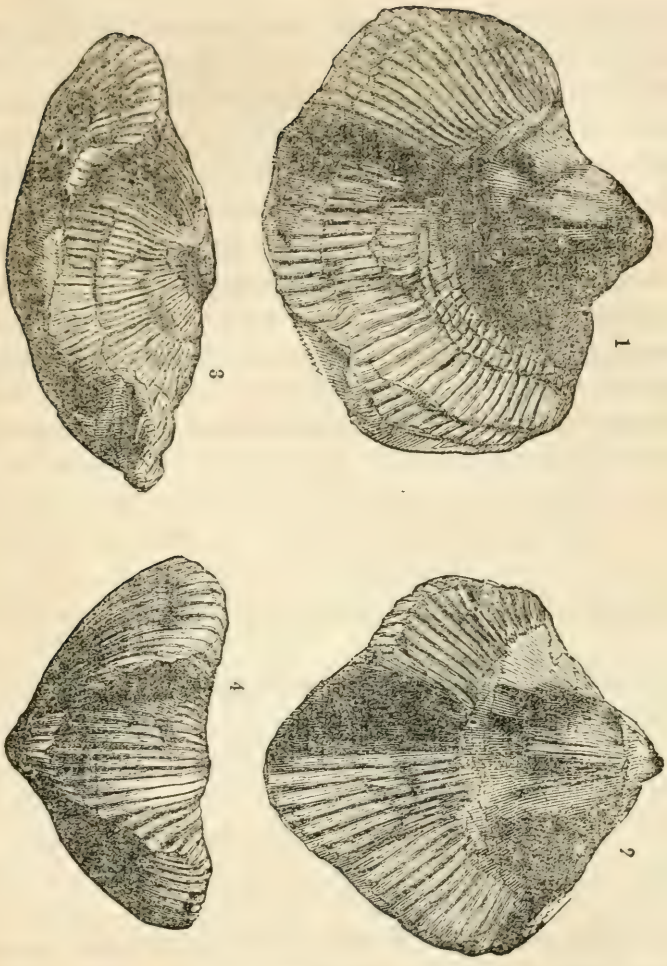
Pal. N.Y. Vol. iii, pl. 102, f. 3 a – c and 4 a – e.

Atrypa pleiopleura, CONRAD : An. Report Pal. N.Y. p. 55.

SHELL transversely oval : dorsal valve the larger, somewhat gibbous, having a round or sloping mesial fold; beak incurved; cardinal border excavated on each side of the beak, for the reception of the dental laminæ of the opposite valve : ventral valve nearly flat, most elevated near the beak, having a somewhat deep, broad, rounded sinus near the front margin, which is prolonged into a rounded or subtriangular projection. Surface ornamented by from sixty-four to seventy rather angular bifurcating striæ or plications.

This shell has been found in casts only : it differs from the last species in being more gibbous, more distinctly sinuate, the striæ stronger, and impressions of the adductor muscles larger and more prominent.

Geological position and locality. Oriskany sandstone, Schoharie.



RHYNCHONELLA PLEIOPLEURA.

WALDHEIMIA GLOBOSA.

Pal. N.Y. Vol. iii, pl. 36, f. 1.

SHELL subglobose, oval : ventral valve a little larger than the opposite one, most gibbous in the umbonial region ; beak prominent, rounded and arched, perforate at the extremity by a round aperture, one side of which is formed by a deltidium : dorsal

valve shorter than the ventral; beak incurved. Surface marked by twelve to sixteen somewhat angular plications on each valve, two or three of which are slightly depressed on the middle of both valves, so as to produce sometimes a faint emargination in front; the depressed plications smaller than the others, and often becoming obsolete before reaching the beak.

The globose form and slightly elevated plications of this shell, as well as its more distinctly imbricating lamellæ, will serve to distinguish it from another species in the same rock.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

WALDHEIMIA FORMOSA.

Pal. N.Y. Vol. iii, pl. 36, f. 2.

SHELL longitudinally ovate: ventral valve tapering towards the beak; beak prominent, rounded, arched or incurved, truncated at the apex by a round perforation, one side of which is formed by the deltidium: dorsal valve convex, sometimes most prominent near the umbo; beak incurved. Surface marked by eighteen to twenty-two or twenty-three simple angular or somewhat rounded plications, two or three of which are much smaller and slightly depressed on the middle of each valve, so as to form a faint narrow sinus extending nearly or quite to the apex of the beaks, and giving a slight emarginate outline to the front. Shell marked by fine imbricating concentric lines of growth.

This species differs from the preceding in its more elongate form, larger size of full-grown individuals, and less rugose imbricating lines of growth. The plications are less strongly developed and more numerous, and the central ones become obsolete or nearly disappear before reaching the beak.

There are rarely individuals, as fig. 2 of pl. 36, which approach more nearly in character to the preceding species; but they are always less rotund in form, and the beak larger.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

Waldheimia rectirostra.

Pal. N.Y. Vol. iii, pl. 36 A.

Shell longitudinally ovate, tapering towards the beak at an angle of about 45°, slopes on each side of the beaks, flattened and not plicated; beak of ventral valve straight, extending beyond the opposite, truncated at the apex by a round perforation partly formed by the deltidium; beak of dorsal valve incurved. Surface marked by twelve or thirteen prominent subangular plications, the two central of which, on the ventral valve, are slightly smaller than the others, and a little depressed. These two plications coalesce before reaching the beak: the central plication of the dorsal valve is smaller and a little more depressed than the others, and becomes obsolete before reaching the beak.

This well-marked species may be at once distinguished from either of the preceding by its less ventricose form, and the more attenuated and straight beak of the ventral valve.

Geological position and locality. Oriskany sandstone, Maryland.

Waldheimia deweyi.

Pal. N.Y. Vol. iii, pl. 36, f. 3.

Shell depressed-subglobose, sometimes subquadrilateral with the sides curving, moderately compressed; valves nearly equal: ventral valve a little the most prominent towards the umbo, having a narrow faint sinus from near the beak to the front, where it sometimes produces a slight sinuosity; beak apparently not perforate, extending a little beyond the opposite beak, upon which it is closely incurved: dorsal valve symmetrically arched. Surface marked by about forty regular simple rounded striæ, crossed by indistinct lines of growth, and, near the front, occasionally by stronger imbricating concentric marks indicating interrupted stages of growth.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

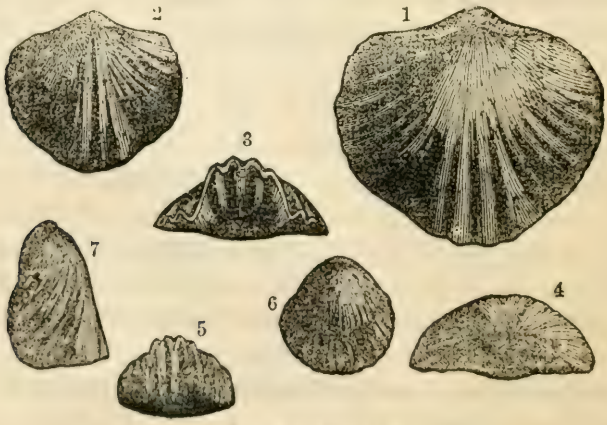
EATONIA MEDIALIS.

Atrypa medialis, VANUXEM.

Pal. N.Y. Vol. iii, pl. 37, f. 1.

SHELL transversely oval, suborbicular or subquadrate; hinge nearly straight, and forming a very obtuse angle at the beaks: dorsal valve much larger than the ventral, greatly elevated in the middle (especially near the front), declining with a gentle curve laterally and towards the hinge: ventral valve flat or concave, depressed in front so as to form a broad and profound mesial sinus; beak very small, pointed but not prominent, incurved, perforate at the extremity. Surface marked by from twelve to sixteen broad rounded rarely bifurcating plications, four of which usually occupy the summit of the mesial fold of the ventral valve, and about three the bottom of the sinus in the dorsal valve: lines of growth obscure. The visceral impression in the ventral valve moderately large, ovate, very distinctly defined by a prominent border, and marked by longitudinal slightly radiating plications: near its centre is the small cordiform longitudinally striate impression of the adductor muscle.

Associated with this species are a few forms, which, although differing materially from it, I am at present inclined to regard as merely extreme varieties of the same species. Some of these are given on the same plate (See fig. 1 a, b, c, d, e, f, g). In some instances (such as 1 c, d, f & g),



EATONIA MEDIALIS.

the plications are nearly entirely obsolete, and the valves are compressed together around the front and lateral margins.

Geological position and locality. Shaly limestone of the Lower Helderberg, Albany and Schoharie counties.

Eatonia sinuata.

Pal. N.Y. Vol. iii, pl. 101 A, f. 2.

Shell circular or longitudinally oval : ventral valve concave, except in the umbonial region, from which point, as well as from the lateral margins, it slopes generally into the broad deep sinus without defined margins : dorsal valve convex, rising in front into a broad undefined mesial prominence, often nearly as high as the highest part of the central region of the valve ; beak incurved. Surface marked by thirty-six to forty strong elevated rounded or subangular plications on each valve. Visceral impressions large, broad, and marked with radiating plications towards the margin, strongly defined by an elevated border : impression of the adductor muscles cardiform, small, located in the middle of the visceral impression, longitudinally striate.

The two middle plications on the dorsal valve are separated by a wider depression than between those on other parts of the shell, which continues quite up to the beak : in this depression there is sometimes near the front a slender plication, which becomes obsolete before reaching the beak.

The surface of this shell was doubtless also marked by fine concentric lines of growth, but none of the specimens coming under my observation are in a condition to have preserved them.

This species differs from *C. medialis* in being proportionally more elongate, having more plications, and a broader and less distinctly defined sinus in the ventral valve. The two plications bordering the sinus and mesial fold of the former species are also proportionally much broader than in this one.

Geological position and locality. Oriskany sandstone, Cumberland, Md.

EATONIA EMINENS.

Pal. N.Y. Vol. iii, pl. 37, f. 2.

SHELL somewhat depressed-globose or subquadrilateral, deeply sinuate and abruptly elevated in front : ventral valve sloping from the beak and sides into a broad undefined sinus, and abruptly extended in front with a regular curve into a large subtriangular prolongation, which lies nearly at right angles to the plane of the valve near the beak : dorsal valve much the larger, extremely elevated in front, and declining abruptly towards the beak and sides ; mesial elevation with four plications, the two middle ones much more prominent. (The specimen a cast.)

This species differs from the two preceding, to which it is related, in the much greater prominence of the mesial fold in front, the plications broader than in the first, and not nearly so many in the last. It also presents notable differences from *C. medialis*, in the characters of the internal impressions.

Geological position and locality. Lower Helderberg limestone, Tennessee.

MERISTA BELLA (n. s.).

Pal. N.Y. Vol. iii, pl. 40, f. 1.

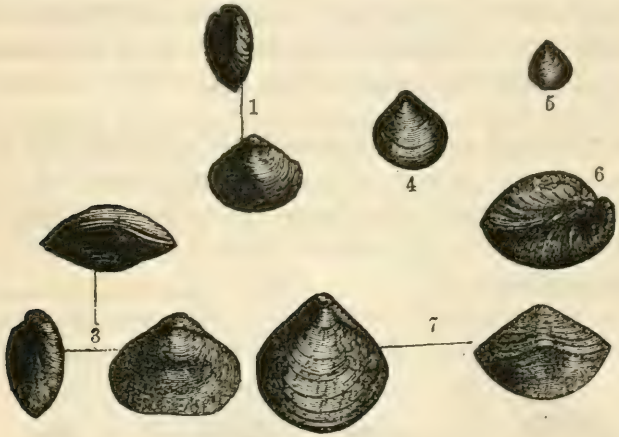
SHELL varying from subcircular or subquadrilateral to transversely oval, usually somewhat broader than long, rather gibbous : ventral valve a little the larger, most convex near the umbo ; beak somewhat prominent and closely incurved : dorsal valve convex ; both valves marked with a small sublinear mesial sinus, that of the ventral valve stronger than the other, the two often giving a distinct emarginate outline to the front. Surface smooth, or marked by faint concentric lines of growth.

This species is characterized by its symmetrical form and the distinctly emarginate character of the front, caused by the meeting of the small mesial depressions of the two valves. The sinus on the front of the ventral valve is always broader and deeper than that on the other, giving a waved outline to the margins of the valves. Some of the specimens appear to have a small open foramen in the point of the beak, but which may be accidental.

It is closely related to *Terebratula compressa* (MURCHISON), but attains a larger size than any of that species figured, and is almost always more gibbous, especially the ventral valve near the beak.

A single specimen, apparently of this species (pl. 40, f. 2 c, d, e & f), is much more compressed than the others, and less distinctly sinuate on the middle of the valves, and consequently nearly destitute of the emargination in the front : this, however, is only a single exception to the general characters of the species.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.



MERISTA BELLA.

MERISTA SUBQUADRATA (n. s.).

Pal. N.Y. Vol. iii, pl. 40, f. 3.

SHELL subquadrate : ventral valve the larger, gibbous in the middle and umbonial region; beak prominent, incurved, apparently not perforate : dorsal valve depressed-convex; front slightly elevated, forming a small undefined mesial prominence immediately on the margin; beak well defined, incurved. Surface smooth, or marked with many indistinct concentric lines of growth.

The most marked characters of this species are its obliquely subquadrate form, and the slight elevation of the front margin of the dorsal valve, without any traces of a corresponding sinus in the opposite valve.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

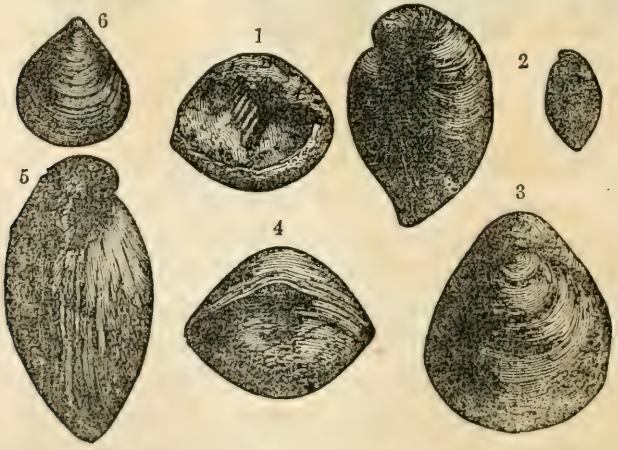
MERISTA LÆVIS (Vanuxem).

Pal. N.Y. Vol. iii, pl. 39, f. 3.

SHELL ovate, thin, somewhat ventricose : ventral valve the larger, most gibbous in the centre and umbonial region, having a small mesial sinus extending from the front more than half way to the umbo; beak prominent, ventricose, incurved, not perforate : dorsal valve regularly convex, rounded in the middle, but without a defined mesial fold; beak incurved. Surface smooth, or only marked by obscure concentric lines and occasional stronger concentric wrinkles of growth.

Some varieties of this species, especially the adult shell, often resemble *Merista bella*, but differ in being proportionally longer, and are never marked by a sinus on the dorsal valve. Young shells are sometimes comparatively much more compressed, and often destitute of any trace of a sinus on either valve.

Geological position and locality. Shaly and compact limestones of the Lower Helderberg group : Albany, Schoharie and Herkimer counties.



MERISTA LÆVIS.

Merista arcuata (n. s.).

Pal. N.Y. Vol. iii, pl. 41, f. 1.

Shell broad-ovate, sometimes transversely oval : ventral valve longitudinally arcuate, gibbous in the central and umbonial region, having in front a shallow rounded depression scarcely reaching the middle of the valve ; front margin (in old specimens) elevated, and fitting into the broad rounded sinus of the opposite valve : dorsal valve often abruptly elevated along the middle and sloping laterally, having no distinct mesial fold ; beak incurved. Surface smooth, or marked by faint concentric lines and occasional stronger wrinkles of growth.

Some varieties of this species bear considerable resemblance to the last : they are, however, always ventricose and proportionally broader. The ventral valve is also more arcuate longitudinally, more distinctly sinuate, and elevated at the front. The dorsal valve is likewise more compressed in this species, especially near the lateral margins.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany and Schoharie counties.

Merista arcuata.

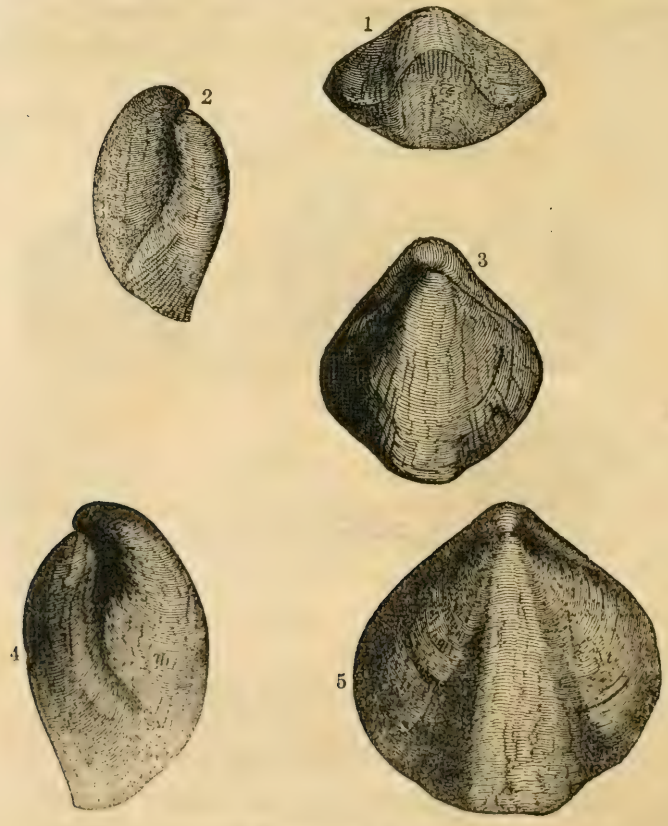
Merista princeps (n. s.).

Pal. N.Y. Vol. iii, pl. 44, f. 1 – 5.

Shell ovate ; sides sloping towards the beaks at an angle of about 30° : ventral valve more or less profoundly arcuate longitudi-

nally, most ventricose near the central and umbonial region, depressed and having a broad shallow flat or subangular mesial sinus in front, terminating (in old specimens) in a linguiform extension : dorsal valve elevated and rounded along the middle, declining laterally, having (in old specimens) a strong rounded mesial fold in front; beak incurved. Surface marked by obscure traces of very fine radiating striæ, which are crossed by indistinct concentric lines of growth.

This fine large species differs considerably in the form and depth of the mesial sinus, as well as in the greater or less extension of the mesial prolongation of the anterior border of the ventral valve. In some of the specimens the sinus is very shallow and flattened within, while in other instances it is more impressed and angular in the middle : other specimens present intermediate grades of difference in this respect, the sinus being nearly flat within, and marked by a narrow, nearly linear, deeper depression



MERISTA PRINCEPS.

along its middle. Young individuals are almost entirely destitute of a sinus, though the front of the dorsal valve in such cases is usually slightly elevated.

Geological position and locality. Upper Pentamerus limestone of the Lower Helderberg group, Carlisle and Schoharie.

Merista meeki.

Pal. N.Y. Vol. iii, pl. 44, f. 6.

Shell cordate-ovate, very gibbous, sloping from below the middle towards the beaks at an angle of about 80°: ventral valve profoundly arcuate from the beak to the anterior margin, where it terminates in a prominent abruptly tapering mesial prolongation, having a broad angular sinus from near the beak quite to the termination of the anterior prolongation; beak flattened on the outside, subangular on its lateral slopes, closely incurved upon that of the opposite valve: dorsal valve elevated along the middle, sloping laterally with an abrupt curve, very gibbous in the umbonial region; beak incurved. Surface smooth, or marked by faint concentric lines of growth.

The shorter and more globose form of this species, as well as the deep angular sinus and flattened umbo of its ventral valve, are sufficient to distinguish it from all the preceding species.

Geological position and locality. Limestone of the age of the Lower Helderberg, Tennessee.

Meganteris mutabilis.

Pal. N.Y. Vol. iii, pl. 45, f. 2.

Shell ovate varying to elliptic and obovate, not sinuate on either valve; old specimens sometimes very gibbous, but generally compressed towards the anterior border in young individuals; valves nearly equally convex: ventral valve most elevated

near the middle and towards the umbo; beak pointed, subangular along the lateral slopes, arched or closely incurved; foramen narrow, and extending nearly or quite to the apex of the beak: dorsal valve slightly less elevated and a little shorter than the opposite; beak not projecting, incurved. Surface marked by twelve to twenty-eight coarse obscure radiating striæ, crossed by fine indistinct lines of growth, and sometimes near the border by a few strong concentric undulations. The radiating striæ are usually obsolete on the upper half of the shell.

This species varies considerably in form, as well as in other characters. Young individuals are generally more compressed near the front, and the beak is more nearly straight; while older specimens are often quite gibbous, and sometimes marked by very strong concentric undulations: in the latter case, the beak of the ventral valve is generally closely incurved.

Geological position and locality. Higher part of the Shaly limestone, and more compact beds just beneath the Upper Pentamerus limestone of the Lower Helderberg group, Albany and Columbia counties.

MEGANTERIS ELLIPTICA.

Pal. N.Y. Vol. iii, pl. 45, f. 4.

SHELL elliptical, rather gibbous; valves nearly equally convex; front rather sharply rounded; no trace of a sinus on either valve: dorsal valve most elevated near the middle, rounding laterally, and having a semielliptical outline from the front to the beak, which is incurved: ventral valve curving from the middle towards the lateral margins, and forming longitudinally a semielliptic curve; beak rather gibbous, closely incurved and extended over that of the other valve. Surface marked by fine indistinct radiating striæ, which are crossed by obscure remains of concentric lines and faint undulations of growth.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

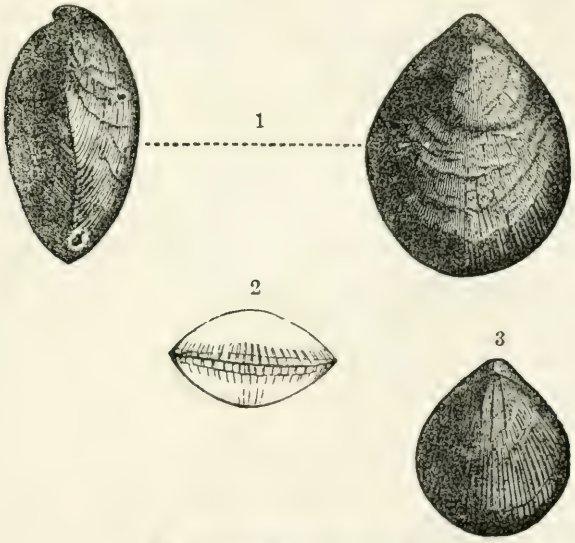
Meganteris æquiradiata.

Pal. N.Y. Vol. iii, pl. 45, f. 4.

Atrypa æquiradiata, Conrad : Jour. Acad. Nat. Sc. Phil., Vol. 8, p. 266; pl. 16, f. 17.

Shell elliptical or subovoid; valves nearly equal; surface marked by simple regular radiating striæ; beak of the ventral valve moderately incurved, scarcely gibbous; margins of valves not sinuous.

Geological position and locality. Upper Pentamerus limestone of the Lower Helderberg group, Schoharie.



Meganteris æquiradiatus.

Meganteris lævis.

Pal. N.Y. Vol. iii, pl. 40, f. 2.

Shell broad oval or subquadrate, not sinuate : ventral valve the more convex, most prominent along the middle and towards the beak, which is pointed and arched so as to rise above the hinge-line, but not closely incurved; foramen narrow, extending quite

to the apex of the beak : dorsal valve flat or depressed-convex. Surface smooth, or only marked by very obscure lines of growth.

The plano-convex form and smooth surface of this species will at once distinguish it from all its known congeners in the rocks of this State. It is possible there may be very fine obscure radiating striæ on perfectly preserved specimens of this species, though the only individual I have yet seen appears to have been smooth.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

MEGANTERIS SUESSANA.

Pal. N.Y. Vol. iii, pl. 106 A, f. 1.

SHELL longitudinally obovate, varying to oval or subelliptical, somewhat compressed; valves nearly or quite equal; no traces of a sinus on either valve; front narrowly rounded; lateral margins very abruptly inflected : ventral valve depressed convex, most prominent along the middle, sloping very gradually towards the sides; beak pointed, small, very angular along its lateral borders, incurved, rising above the hinge-line but not touching the other valve, perforate in the apex by a small round aperture partly completed by the two small deltidial pieces, which, together with the thickened dental apophyses of the opposite valve, close the triangular foramen below : dorsal valve symmetrically depressed-convex, sloping very gradually from near the middle laterally and towards the front, rounding a little more abruptly towards the beak, which is pointed and scarcely incurved : hinge-line nearly straight, or sloping from the beak at a very obtuse angle, much less than the width of the shell. Surface usually appearing to be smooth, but, on well-preserved specimens, remains of very faint simple radiating striæ may be seen towards the margin, which always become obsolete above.

Geological position and locality. Oriskany sandstone, Maryland.

Meganteris ovalis.

Pal. N Y. Vol. iii, pl. 106, f. 2.

Shell longitudinally oval, compressed, lateral margins subtruncate and abruptly inflected; front rather narrowly rounded: ventral valve slightly the more elevated, most prominent along the middle, sloping gradually towards the sides; beak pointed, arched so as to bring the apex above the hinge-line, but not touching the opposite valve, angular along the lateral slopes: dorsal valve regularly depressed-convex; beak incurved. Surface marked by very faint simple radiating striæ, which become obsolete on the upper part.

Casts and much-worn specimens of this species only have come under my observation. None of these have the apex of the beak entire, nor do they show the character of the foramen. It is evidently very near the last species, but differs, however, in being larger, more compressed, and often proportionally broader. Casts of this species also resemble those of *Terebratula archiaci* of de Verneuil (Dunker und von Meyer, Palæontologie, dritter band, 4, pl. xxvii, f. 2); which species, I infer from the reference, is the type of Suess's Genus Meganteris*.

Geological position and locality. Oriskany sandstone, Helderberg and Schoharie.

Meganteris cumberlandiæ.

Pal. N.Y. Vol. iii, pl. 106 a, f. 2.

Shell oval, ovate or elliptical; valves nearly equal, somewhat acutely rounded in front; no trace of a sinus in either valve; lateral margins abruptly inflected: ventral valve rounded and most convex along the middle, sloping laterally and forming a broad semielliptical curve from front to beak, a little more gib-

* At the time of writing this description, I have seen the name of Meganteris only in a catalogue of the genera given by Davidson in the Annals and Magazine of Natural History for December 1855.

bous above than below the centre; beak prominent, slightly arched; extremity perforate; perforation generally connected with the broad triangular foramen below, but probably often separated by the deltidial pieces, which, with the thickened dental apophysis, nearly or quite close the foramen: dorsal valve depressed-convex, slightly the smaller; beak scarcely incurved. Surface apparently smooth, or marked only by obscure concentric lines and faint wrinkles of growth.

The specimens examined are silicified, and it is probable that fine radiating striæ may have existed on the original shell, which have been obliterated by the change.

This species may be distinguished from *M. suessana*, which it most resembles, by its more elongate form and the more prominent beak of the ventral valve. The cardinal margin of the ventral valve, on each side of the beaks, is also more prominent, and that of the other valve more excavated, so as to impart a waved outline to the line of junction of the two valves from the beaks along the lateral slopes.

Geological position and locality. Oriskany sandstone, Maryland.

MEGANTERIS OVOIDES.

Pal. N.Y. Vol. iii, pl. 104 & 105, f. 1.

Terebratula ovoides, EATON (1832): Geol. Text-book. p. 45. (Not Sowerby, 1812.)

T. perovalis, EATON (1832): Geol. Text-book, p. 45. (Not Sowerby, 1825.)

Atrypa elongata, CONRAD: An. Rep. N.Y. 1839. p. 65.

Not *Meganteris elongata* (*Pentamerus elongatus*) of the Onondaga limestone, VANUXEM: Geol. Rep. 1842, p. 132, f. 1.

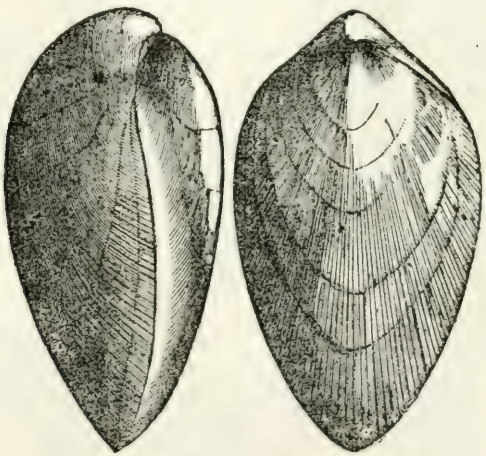
SHELL elongate-ovate or elliptical-ovate, gibbous or compressed, broadest above the middle, abruptly rounded towards the cardinal end, narrowing to the front, which is often depressed and rounded or subtruncate; no traces of a sinus in either valve: in gibbous specimens, the sides are sometimes vertically flattened or a little concave, often slightly contracted near the front: ventral valve the larger, most gibbous in the umbonial region; beak (in old specimens) somewhat obtuse, closely incurved upon the opposite: dorsal valve depressed-convex, less elevated than the other, most prominent along the middle or a little

above it, forming a low semioval or semielliptical arch from beak to front, sloping very gradually to the sides, which (in old specimens) are often so abruptly deflected, or even inflected, as to form a distinct angular ridge extending from near the beak two-thirds of the way to the front; beak obtuse, scarcely incurved. Surface marked by regular simple radiating striæ, sometimes crossed near the borders by distinct concentric wrinkles.

This species varies greatly in form; some individuals being very gibbous and distinctly ovate, while others are more or less compressed and very elongate-ovate or narrow elliptical: the first variety was Eaton's *T. ovoides*, and the latter his *T. perovalis*. After studying a large collection of these forms, I am satisfied that they are varieties of the same species, rather than distinct types.

I have some fine specimens from Cumberland (Md.), apparently identical with this one; but they are usually smaller than those found in New-York, and appear to be a little more finely striated.

Geological position and locality. Oriskany sandstone, Helderberg and Schoharie.



Meganteris ovoides.

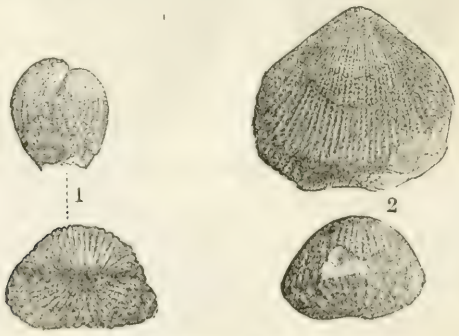
PENTAMERUS VERNEUILI.

Pal. N.Y. Vol. iii, pl. 48, f. 1.

SHELL subglobose; transverse diameter generally greater than the height: ventral valve more depressed than the opposite, having a distinct sinus, commencing near the beak and regularly widening and deepening to the front, where it terminates in a short truncated extension fitting into a corresponding depression in the front of the other valve; beak shorter than the opposite, perforated by a triangular foramen, which is generally covered by the strongly gibbous incurved beak of the other valve: dorsal valve very much elevated; beak extremely gibbous and incurved. Surface marked by from twenty-four to thirty sharply angular elevated plications, which increase by interstitial addition and bifurcation: from four to six of the plications on the ventral valve usually occupy the sinus; while from five to eight of those on the dorsal valve are very slightly elevated, so as to form a flat rather indistinct mesial fold.

This beautiful species is unlike any form known to me in our rocks: it bears an analogy to *Atrypa interplicata* of the Niagara group, which is probably a *Pentamerus*, though its internal characters have not yet been seen. This species will, however, be easily distinguished from that, by its larger size and more globose form, as well as more numerous and sharper plications.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany and Schoharie counties.



PENTAMERUS VERNEUILI.

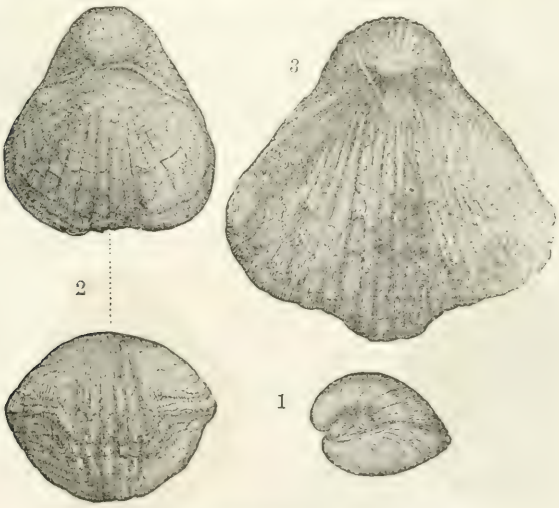
Pentamerus galeatus.

Pal. N.Y. Vol. iii, pl. 46 & 47.

This widely distributed species is characteristic of the compact limestones at the base of the Lower Helderberg group, and is known to occur in the same position as far south as Tennessee.

It presents a great variety of form and surface markings. In New-York, the extremely young specimens are always smooth, so far as I have observed. In the various stages of growth, they present every possible degree of development in the plications; some individuals of nearly full size remaining smooth, while others are strongly plicated before reaching half the full size. Some individuals present plications only on the mesial fold and sinus. The plications are sometimes bifurcate, as shown in a single individual on plate 46 and another on plate 47.

The illustrations upon plate 46 show a few of the varieties of form and marking to which this species is subject.

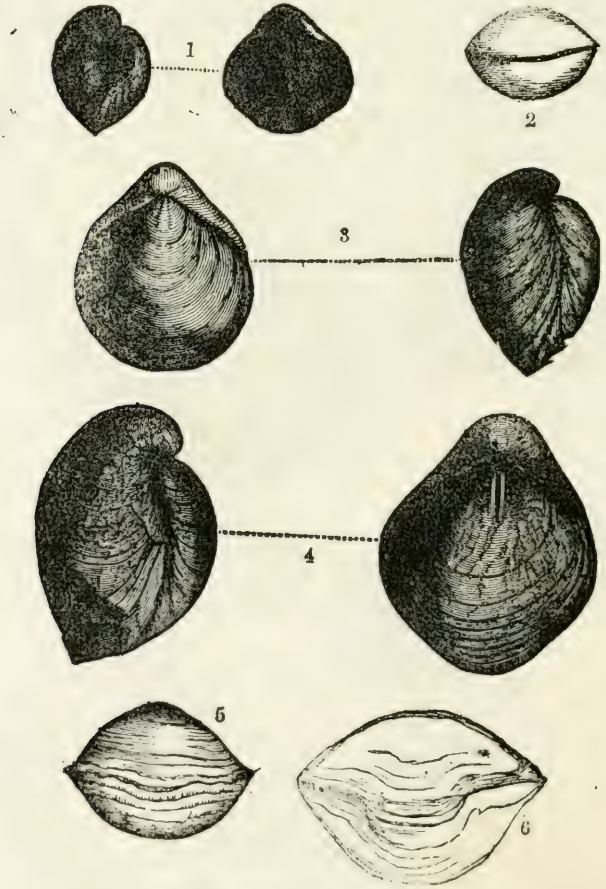


Pentamerus galeatus.

PENTAMERUS PSEUDOGALEATUS.

Pal. N.Y. Vol. iii, pl. 46, f. 2.

SHELL longitudinally ovate : ventral valve extremely convex, especially in the umbonial region ; beak very prominent and strongly gibbous, incurved, and projecting far beyond that of the other valve ; front margin in adult shells sometimes having a faint mesial prominence : dorsal valve subcircular, or much shorter and more compressed than the opposite ; beak incurved ; front obliquely flattened, or very slightly depressed so as to form sometimes an indistinct sinus, often a little produced into a short



PENTAMERUS PSEUDOGALEATUS.

truncate or rounded extension. Surface smooth, or marked by faint concentric lines of growth.

Young specimens of this species might be mistaken for the young of *P. galeatus*, which are, like this, destitute of plications. Its form, however, is much more elongated, and the beak more extended than in *P. galeatus*.

Geological position and locality. Upper Pentamerus limestone of the Lower Helderberg group, being the fossil which characterizes the higher compact beds of the group, as *P. galeatus* does those of the lower beds of the same.

Leptocœlia concava.

Pal. N.Y. Vol. iii, pl. 38, f. 1 to 7.

Shell ovate or suborbicular : ventral valve convex, elevated along the middle into a mesial prominence, which extends to the umbo; beak small, incurved beyond the hinge-line : dorsal valve near the lateral margins, depressed in the middle, forming a shallow undefined sinus which is deeper in the centre than at the front, and rapidly diminishes towards the umbo; beak straight : area small ; foramen triangular and extending to the apex of the beak, sometimes closed below by a deltidium. Surface marked by fourteen to seventeen striæ, which sometimes bifurcate : the one on the middle of the mesial fold of the ventral valve is generally smaller than the others, giving a slightly grooved appearance along its centre quite up to the beak.

The sinus in the dorsal valve of this shell widens so rapidly from the beak towards the front, and is so much deeper in the centre than near the beak and at the front of the shell, that it gives in some instances a marked concavity to this valve.

This species may be considered a representative of *Terebratula duboisi* of De Verneuil (Géologie de la Russie, pl. x, f. 16) ; from which it differs in its more rotund outline, and in the greater concavity of the dorsal valve.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

LEPTOCŒLIA IMBRICATA.

Pal. N.Y. Vol. iii, pl. 38, f. 8 to 12.

SHELL longitudinally semielliptical or suborbicular : ventral valve convex, most prominent along the middle, and sloping laterally; beak small, incurved at the apex and perforated by a very small round aperture, one side of which is formed by the deltidium : dorsal valve flattened or depressed-convex; beak scarcely elevated above the hinge ; hinge sloping from the beaks at an angle of about 150°, rounded at the extremities, nearly equal to the greatest width of the shell ; area narrow, shorter than the hinge. Surface marked by ten to twelve plications on each valve, of which the two on the middle of the ventral valve are larger and more elevated than the others, and separated by a wider and deeper depression than between those on each side. The central plication on the dorsal valve is larger than the others near the front, but usually dies out before reaching the beak. Shell marked by strong imbricating concentric lamellæ of growth.

This species resembles *Leptocalia* (*Atrypa*) *disparilis* of the Niagara group, but is generally larger, has more plications and a straighter hinge ; its dorsal valve also differs, in being slightly convex instead of concave. It also bears a general resemblance to *Terebratula lepida* (GOLDFUSS) and *T. sublepida* (DE VERNEUIL), but has a wider hinge than either of these, and differs likewise from them in other obvious and essential characters.

Geological position and locality. Shaly limestone of the Lower Helderberg group, Albany county.

LEPTOCŒLIA PROPRIA.

Pal. N.Y. Vol. iii, pl. 106, f. 1.

SHELL somewhat semicircular, varying to suborbicular or transversely oval, generally broader than long : ventral valve convex, most prominent along the middle, declining laterally; beak incurved, with a small round perforation in the extremity, which is completed on the lower side by the two deltidial pieces :

dorsal valve flat; beak straight : hinge sloping from the beaks at an angle of 110° to 160°, rounded at the extremities. Surface marked by twelve or thirteen simple angular plications; two of which, on the middle of the ventral valve, are a little larger and slightly more prominent than the others : between these, there is a third smaller depressed plication, forming an indistinct sinus. On the dorsal valve the two middle plications are a little closer together, and slightly more prominent near the front, than the others; while the depressions separating them from these, each side, are a little wider and deeper than those between the other plications.

This species presents some varieties of form, apparently due to age; the hinge-line of younger or smaller individuals being more extended and more nearly straight. The silicified condition of the specimens has obscured the finer surface markings. Many of the specimens appear to retain remains of fine radiating striæ; while more distinct concentric lines, and occasional stronger undulations of growth, are visible in most of them.

Along the hinge-line, in many specimens of this species, there is a peculiar fimbriated appendage apparently coming from between the valves, and anchylosing them firmly together. I have noticed this appendage in so many instances, that I am inclined to believe that it had some connexion either directly with the animal, or with the cardinal apparatus.

Geological position and locality. Oriskany sandstone : New-York, Maryland and Canada.

Orthis æquivalvis.

Pal. N.Y. Vol. iv.

Shell subcircular, compressed; hinge about three-fourths the width of the shell : dorsal valve depressed-convex : ventral valve flattened, much depressed or concave towards the front, slightly elevated in the umbonial region; foramen of medium size; area moderately high, extending to the extremities of the hinge. Surface marked by numerous small radiating striæ, which bifurcate two or three times between the beak and the margins.

Geological position and locality. Limestone of the Upper Helderberg, Williamsville, N.Y.

ORTHIS PROPINQUA.

Pal. N.Y. Vol. iv.

SHELL transversely oval, rather gibbous; hinge straight, equalling about one half the greatest breadth of the shell : dorsal valve the larger, gibbous especially in the umbonial region; beak equalling or sometimes extending a little beyond that of the opposite valve, incurved; dorsal area incurved : ventral valve depressed-convex, somewhat prominent towards the beak, having a broad faintly defined depression near the anterior margin, giving it a straight or somewhat emarginate outline; foramen narrow; area broad, triangular, arcuate. Surface marked by numerous fine irregular striæ, apparently increasing chiefly by interstitial additions, and crossed by fine indistinct concentric lines and a few stronger wrinkles of growth.

This species approaches so closely *O. multistriata* of the Pentamerus limestone, that it is very difficult to distinguish them, the form and surface characters being generally almost precisely the same. Sometimes, however, the beak and area of the ventral valve of this species is a little more arcuate than in *O. multistriata*, and that of the dorsal valve is usually more gibbous, while internally they present some well-marked differences. In this shell, the vascular impressions bifurcate once, twice, or even three times, before reaching the border; while those of *O. multistriata* appear to pass down the front without bifurcation.

ORTHIS TULLIENSIS, of the Tully limestone, is also another form very difficult to distinguish from this : it is, however, generally more gibbous, and presents internal differences; the divisions of the vascular impressions pass down the front of the dorsal valve nearly parallel to each other, or slightly converging; while those of the species under consideration, as well as of *O. multistriata*, diverge distinctly.

Geological position and locality. Limestone of the Upper Helderberg group, New-York and Ohio.

Strophomena (Strophodonta) crenistria.

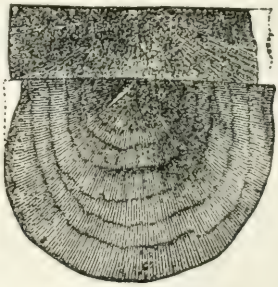
Pal. N.Y. Vol. iv.

Strophomena crenistria, Hall : Rep. Geol. 4th Dist. New-York, pa. 171, pl. 35, f. 3 & 4.

Shell somewhat semicircular, much compressed; length from two-thirds to three-fourths as great as breadth; hinge crenulated, nearly or quite equal to the greatest width of the shell, and sometimes having small salient angles at the extremities : dorsal valve unknown : ventral valve much compressed. Surface marked by fine striæ, increasing by bifurcation and interstitial addition; crossed by fine closely set concentric lines of growth and a few indistinct wrinkles, giving a subcrenulate aspect to the radiating striæ : interior granulose; granules on each side of the fan-shaped vascular impression, larger than those nearer the margins.

This shell has much the form and general aspect of *Leptæna pluristriata* (Conrad) from the Hamilton group, but has rather coarser and more rounded striæ, which are not so sharply crenulated.

Geological position and locality. Limestone of the Upper Helderberg group, Williamsville, N.Y.



Strophomena crenistria.

Strophomena (Strophodonta) ampla.

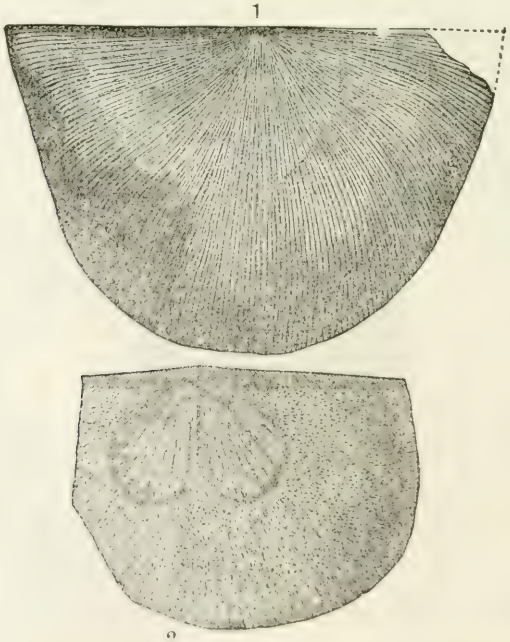
Pal. N.Y. Vol. iv.

Shell large, transverse, nearly semicircular; hinge-line crenulated, equal to the greatest width of the shell : dorsal valve prominent

in the middle, sloping towards the front and lateral margins, depressed or concave near the umbo : ventral valve deeply concave, except at the beak ; foramen narrow, closed ; area wide, vertically striate. Surface marked by strong, somewhat unequal radiating striæ, which bifurcate three or four times between the umbo and the margin.

This shell is allied to *S. woolworthana* of the Lower Helderberg shaly limestone, but differs in being more strongly resupinate, and in the character of its striæ ; those of *S. woolworthana* being more irregular, and increasing generally by abrupt implantation, while those of the present species usually bifurcate very regularly ; in consequence of which, those at the margin are smaller than those near the umbo. It is also nearly related to a species in the Schoharie grit, *S.* ?

Geological position and locality. Limestone of the Upper Helderberg group, Albany and Schoharie counties ; and along the outcrop of the same formation as far as Erie county, N.Y.



STROPHOMENA AMPLA.

Strophomena (Strophodonta) hemispherica (n. s.).

Pal. N.Y. Vol. iv.

Shell subcircular or semicircular; hinge crenulated, nearly or quite equal to the greatest width of the shell, terminating in small distinct ears: dorsal valve extremely gibbous, almost hemispherical: ventral valve concave, sometimes geniculated on the front and lateral margins; dental apophyses prominent, and extending beyond the hinge-line. Surface marked by fine, closely arranged radiating striæ; about every fourth, fifth, or sixth one of which is a little larger than the others: extremely fine, nearly obsolete concentric striæ mark the surface in the other direction: sometimes very small indistinct concentric wrinkles are visible, especially in the umbonal region. Interior of the shell granulose.

Geological position and locality. Corniferous limestone, N.Y., and in the same rock at the falls of the Ohio, and at many other western localities.

Strophomena (Strophodonta) inequiradiata (n. s.).

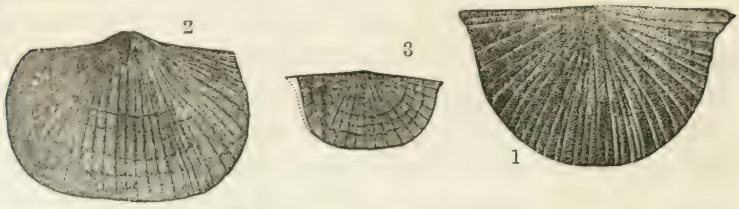
Pal. N.Y. Vol. iv.

Shell nearly semicircular; length about two-thirds the breadth; hinge-line crenulated, equalling the greatest width of the shell: dorsal valve concave, distinctly incurved near the hinge: ventral valve convex, forming a distinct arch from beak to front, sloping to the sides; beak and area strongly incurved. Surface marked by somewhat coarse distant radiating striæ, which increase by interstitial addition: the spaces between these larger striæ are occupied by extremely fine closely arranged parallel lines, which are crossed by finer, regular, close concentric striæ, so as to present, under a good magnifier, a delicate cancellate surface. Interior finely granulose; granules arranged in irregular radiating rows.

This species is closely related to *Leptæna haueri* of Barrande (Brach. aus Böhm; Haidinger, Naturwissenschaftliche Abhandlungen, pa. 242,

pl. xxiii, f. 2 & 3). The general form and the finest details of the surface markings are almost exactly the same : the difference is in the more strongly incurved beak and area in our shell, and the finer intermediate and concentric striæ. Some varieties of this species show, in addition to these surface markings, fine interrupted concentric wrinkles in the umbonal region, which give it somewhat the character of *Strophomena patersoni*.

Geological position and locality. Limestone of the Upper Helderberg group, New-York.



STROPHOMENA INEQUIRADIATA.

STROPHOMENA (STROPHODONTA) PATERSONI (n. s.).

Pal. N.Y. Vol. iv.

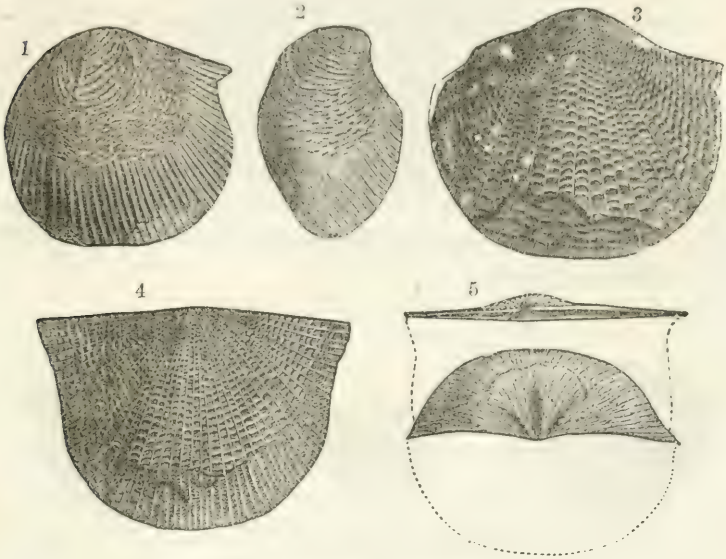
SHELL semioval : ventral valve very convex, gibbous in the middle, somewhat abruptly deflected at the sides and front, sometimes marked by a few radiating undulations which affect both ventral and dorsal valves towards the front; hinge-line straight, often slightly salient. Surface marked by distant elevated radiating lines; the intermediate spaces marked by fine radiating striæ, and crossed by short abruptly arching wrinkles which are interrupted by the strong radiating striæ : finer radiating striæ, from twelve to twenty, between the stronger ones; area unknown.

This shell varies, in the convexity of the ventral valve, from moderately convex to very gibbous; some specimens being abruptly bent or geniculate towards the front. The vascular impression is bilobed, of moderate size, and the cast presents a closely punctate surface.

This species is related to *Leptæna stephani*, BARRANDE (Brach. aus Böhmen, taf. 20, f. 7; HAIDINGER, Naturwissenschaftl. Abhandlungen), but is never so extended in the hinge-line nor so arcuate as the representatives of that species; the vascular impression is larger, and the concentric wrinkles are always arched in well-preserved specimens of our species.

This species likewise bears considerable resemblance to *Orthis* (*Leptæna*) *corrugata* of PORTLOCK, but is a larger shell as it usually occurs in our rocks. It is not *Strophomena corrugata*, CONRAD (Jour. Acad. Nat. Sci. Phil. 1842; Pal. N.Y. Vol. ii, 1852, pa. 59, pl. 21, f, 2).

Geological position and locality. In the limestone of the Upper Helderberg group, Albany and Seneca counties.



STROPHOMENA PATERSONI.

STROPHOMENA CONCAVA (n. s.).

Pal. N.Y. Vol. iv.

SHELL large, triangular-hemispherical; hinge-line equalling the greatest width of the shell: dorsal valve unknown: ventral valve profoundly concave, extremely gibbous in the umbonal region, from which a prominent rounded mesial lobe extends quite to the narrow rounded front; beak strongly incurved. Surface marked by numerous distinct, irregular, bifurcating, subangular striæ.

The most marked characters of this species are the deep concavity, strongly incurved beak, and triangular form of its ventral valve; which presents also the somewhat unusual character of a prominent ridge down the middle, with indications of smaller ones on each side.

Geological position and locality. Limestone of the age of the Upper Helderberg, Western New-York.

CHONETES HEMISPHERICA (n. s.).

Pal. N.Y. Vol. iv.

SHELL transverse, semicircular, greatest width being along the hinge-line; ears extending beyond the body of the shell, and distinct from it, but not flattened : dorsal valve unknown : ventral valve extremely ventricose, forming, without the ears, nearly a hemisphere; umbonal region gibbous, and projecting a little beyond the hinge. Surface marked by numerous regular rounded, radiating, occasionally bifurcating striæ.

The distinguishing features of this shell are its hemispherical form, prominent gibbous umbonal region, and regular rounded striæ about equalling the intermediate grooves.

Geological position and locality. Schoharie grit.

CHONETES HEMISPHERICA.

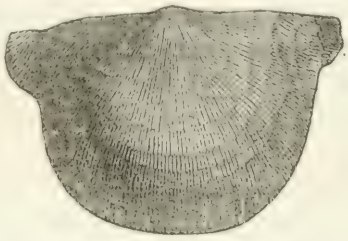
CHONETES ARCUATA (n. s.).

Pal. N.Y. Vol. iv.

SHELL semicircular, greatest width being along the hinge-line, which terminates in short, slightly depressed, triangular ears, extending a little beyond the body of the shell : dorsal valve profoundly concave, corresponding very nearly with the curvature of the opposite valve : ventral valve ventricose, forming an elevated arch from beak to front, sometimes having a faint depression in the middle from near the umbo to the anterior margin; umbonal region prominent; beak incurved, and rising a little above the hinge-line. Surface marked by numerous fine regular striæ, which increase both by bifurcation and implantation, and are crossed by very fine obscure concentric lines.

This species is larger, and not quite so gibbous as the last. The most marked difference between the two species consists in the much finer striæ of the latter; sixteen occupying the space of one-fifth of an inch, while only half that number can be counted in the same space on *C. hemispherica*.

Geological position and locality. Corniferous limestone.



CHONETES ARCUATA.

CHONETES ACUTIRADIATA (n. s.).

Strophomena acutiradiata, HALL : Geol. Rep. 4th Dist. N.Y. 1843, p. 171, f.3.

This species is a true *Chonetes*, with strong diverging cardinal spines. The surface of well-preserved specimens is marked by strong equal rounded striæ, which bifurcate irregularly towards the margin. Some specimens show a distinct sinus down the centre of the ventral valve; and rarely the striæ are narrow and acute, with wider interstices. It is probable that the original described was an extreme specimen of this kind. Well preserved specimens of the same shell from the original locality have the striæ rarely acute, though strong and rather abruptly rounded.

CHONETES GLABRA (n. s.).

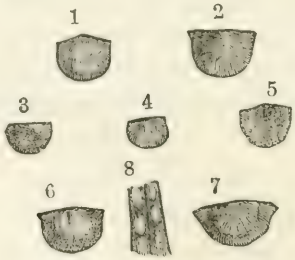
SHELL semioval in outline, ventricose, hemispheric; hinge-line about equal to the greatest width of the shell : surface of the ventral valve marked by obscure or slightly elevated rounded striæ, a few of which are more prominent near the beak; striæ increasing by bifurcation and interstitial addition, and numbering from fifty-four to sixty or more upon the margin of the shell, concentrically marked by fine closely arranged striæ,

which produce a faint reticulated appearance under the magnifier. Surface of the shell, when well preserved in limestone, smooth and shining. Cast strongly and deeply punctate, particularly towards the margins : spines small and nearly vertical to the hinge-line; number unknown.

The striæ do not extend to the angles of the cardinal extremities; a considerable space being left smooth, or marked only by concentric striæ. In this respect it resembles *Chonetes pusilla*, from which it is readily distinguished by its finer and more numerous striæ. This species is also distinguished from *C. yandellana* of the limestone at the Falls of the Ohio, by its finer and less distinctly defined striæ, which do not reach the cardinal extremities, while in that species they are very distinct and well defined on that part of the shell. From *C. scitula*, this species is distinguished by its smaller size and less elevated striæ, and more gibbous or hemispheric form, and less proportional width.

This species is usually regarded as the *C. nana;* from which it is distinguished by its more gibbous form and much greater number of striæ, as well as, frequently, its greater size, though many individuals are not larger than the figures of that species.

Geological position and locality. In the higher beds of limestone of the Upper Helderberg at Oneida falls; between Jamesville and Manlius, Onondaga county; in Seneca county; and on the Indian reservation a few miles southeast of Buffalo.



CHONETES GLABRA.

CHONETES YANDELLANA (n. s.).

SHELL semioval, more or less gibbous; hinge-line equalling the greatest width of the shell; cardinal spines four or five on each side of the beak, apparently nearly vertical to the hinge-line. Surface distinctly striated; striæ somewhat equal, bifur-

cating and increasing by interstitial addition, so that the margin of the shell presents from sixty to seventy (or perhaps a greater number in large specimens) : striæ distinct, rounded, and the depressions between them sharply defined ; area narrow, linear. Interior striate papillose.

The striæ extend over the entire surface of the shell, and are as distinct on the latero-cardinal extremities as elsewhere upon the surface.

This species is about the same size and general form as the *Chonetes pusilla ;* but the striæ are much finer, and, when no exfoliation has taken place, are well defined, extending to the cardino-lateral margins, while in that species a considerable space at the angles is plain. It is a smaller and more rotund species than *Chonetes scitula ;* resembling *C. glabra* in form and proportions, but differing in the character and distribution of the striæ.

This shell has usually been referred to *Chonetes nana ;* but its surface presents about double the number of striæ which that species possesses according to the original description of M. E. DE VERNEUIL, thirty-five to forty-five being the number of striæ upon the margin.

The *Chonetes nana* has been cited by M. DE VERNEUIL as occurring at the Falls of the Ohio, but I have not seen it among my collections from that locality.

Geological position and locality. In the upper beds of the limestone of the age of the Upper Helderberg, at the Falls of the Ohio.

CHONETES LATICOSTA (n. s.).

SHELL small, subhemispherical ; hinge-line a little shorter than the greatest width of the shell : dorsal valve with a narrow linear area and prominent dental process : ventral valve with a wider area ; cardinal margin garnished by four or five tubular spines on each side of the beak, which diverge very abruptly, making a low angle with the hinge-line. Surface marked by about ten or twelve strong rounded striæ near the beak, which increase to about twenty or twenty-four near the margin ; bifurcations of the striæ strongly marked and divergent. Shell concentrically marked by fine close striæ and more distant somewhat squamose lamellæ. The surface of the shell, when partially exfoliated, presents a peculiar striato-punctate appearance.

This species, in its general characters, resembles *C. subhemispherica;* but all the individuals I have seen are smaller, the radiating striæ or plications are less prominent and more broadly rounded, proportionally stronger and fewer in number and more divergent, and remarkable in their divergent bifurcation. In a single small specimen which preserves, almost entire, two of the spines, the outer one is nearly as long as the whole length of the hinge-line.

In its diverging spines, this species resembles *C. koninckiana*, PRATTEN & NORWOOD; but that species has double the number of striæ, and half as many cardinal spines. The specimens present some variation in different localities, but all agree in the principal characteristics.

I have specimens which are essentially undistinguishable from this species, in a hard limestone from the "Devil's Bake-oven," Illinois. The striæ are, however, slightly less divergent, though corresponding in number. Of two specimens among these, showing the spines imperfectly, both are divergent in the same manner as in the New-York specimens. In the western locality it is associated with *Chonetes carinata*, *C. pusilla* and *Strophomena laticosta*, as well as other fossils characteristic of the Hamilton group.

Geological position and locality. In limestone a few miles southeast of Buffalo, associated with *Chonetes glabra*, and in shales of the Hamilton group on Canandaigua lake. In limestone, as cited above from Illinois, of the age of the Hamilton group.

PENTAMERUS ARATUS.

Pal. N.Y. Vol. iv.

Atrypa arata, CONRAD : 1841, Ann. Rep. Pal. N.Y. p. 55.
Atrypa octocostata, CONRAD : Idem.

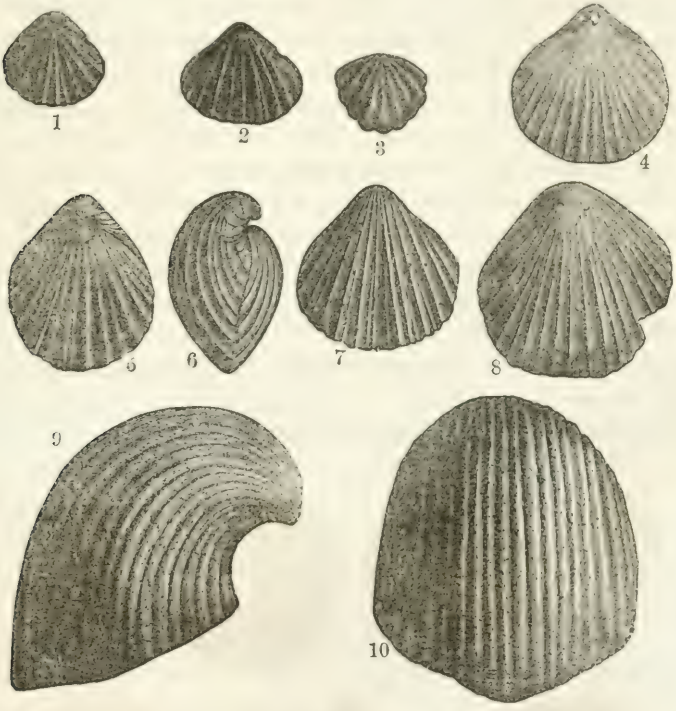
SHELL arcuate-ovoid : dorsal valve much the smaller, depressed-convex : ventral valve extremely elevated, forming almost a semicircle from beak to front; beak strongly incurved; foramen large, triangular. Surface marked by somewhat strong unequal angular plications, which bifurcate very irregularly.

A well-marked peculiarity of this species, in its mature condition, is the extremely elevated arcuate ventral valve, giving it much the aspect of a *Productus*. Of the other valve, little is known, further than that it is much depressed.

This species bears some resemblance to *P. knighti* of Sowerby, and may be regarded as the nearest representative of that shell in our rocks: it differs, however, in its smaller size, and in having stronger and much less regular plications.

The young individuals of this species bear a close resemblance, in general form and character, to *Rhynchonella* (*Atrypa*), and two varieties have been thus described by Mr. Conrad as distinct species. There are still some intermediate gradations wanting, to show the relations of figs. 4 and 6 with 9 and 10, of which I have fragments. A specimen more recently obtained, of the dimensions of fig. 6, shows the internal structure of *Pentamerus* in the most perfect manner.

Geological position and locality. Schoharie grit, Albany and Schoharie counties; and Onondaga limestone of the Upper Helderberg group, Erie county, etc.



Pentamerus aratus.

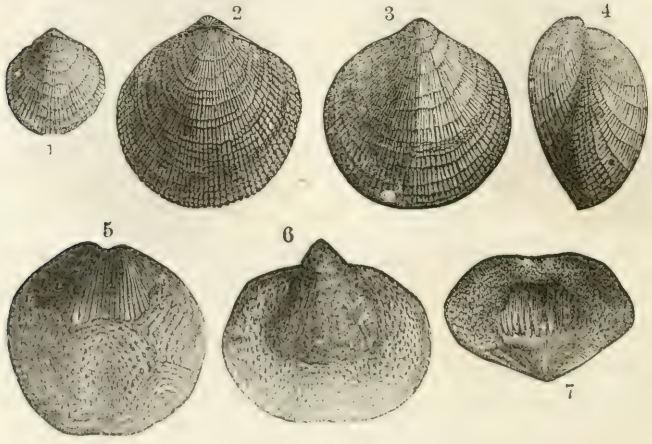
ATRYPA IMPRESSA (n. s.).

Pal. N.Y. Vol. iv.

SHELL longitudinally obovate or oval : dorsal valve the larger, very gibbous, most elevated above the centre, often having a ridge in the middle, along which is generally a faint sulcus; dorsal margin excavated on each side of the beak, for the reception of the dental laminæ of the opposite valve ; beak distinctly incurved : ventral valve depressed-convex, most prominent in the umbonal region and along the middle ; beak closely incurved upon the opposite. Surface marked by numerous small bifurcating radiating striæ, which are crossed by distinct, crowded, concentric, imbricating lamellose lines of growth.

This shell resembles very closely the well-known *A. reticularis*, and has heretofore been referred to that species. I have long been satisfied, however, that it is a distinct species. It may always be distinguished from the *A. reticularis* by the prominent, broad, flattened space down the middle of the dorsal valve, which is bounded by obtusely angular margins, and often depressed in the centre upon the exterior shell, and always in the cast. Owing to this character, the front is usually truncate or emarginate, a feature not well represented in the accompanying illustrations. The ventral valve is convex along the middle quite to the front, instead of being depressed or sinuate as in *A. reticularis*. In a few instances, the front of the ventral valve, though not sinuate, is slightly produced into a short rounded projection. There are also internal differences between this shell and *A. reticularis*.

Geological position and locality. Schoharie grit.



ATRYPA IMPRESSA.

Meganteris subtrigonalis (n. s.).

Pal. N.Y. Vol. iv.

Shell subtriangular, broadest above the middle, rounded at the lateral extremities, sloping towards the front, which is somewhat narrowly rounded : dorsal valve the smaller, depressed-convex, most elevated a little above the middle; front slightly depressed; beak incurved : ventral valve most elevated along the middle, gibbous a little above the centre, sloping laterally and towards the front, where it is sometimes depressed. Surface smooth, or marked by faint lines of growth.

Geological position and locality. Limestone of the Upper Helderberg group, Erie county (N.Y.).

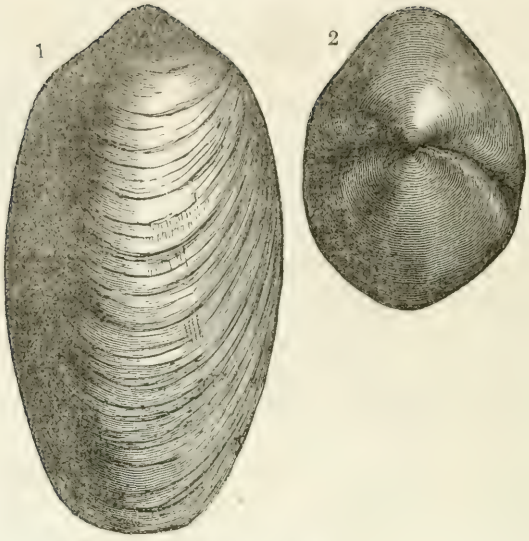
Meganteris elongatus.

Pal. N.Y. Vol. iv.

Pentamerus elongatus, Vanuxem : Rep. 3d Geol. Dist. N.Y. p. 132.

This species, which has usually been referred to the Genus *Pentamerus*, is a true *Meganteris*. Fragments of it are not unfrequent in the Onondaga limestone, but perfect specimens are rarely met with. It has much the form of the elongated varieties of *M. ovoides* of the Oriskany sandstone, but appears to have been nearly destitute of radiating striæ, or preserving only faint traces of them, although the concentric wrinkles of growth are sometimes quite distinct. It resembles yet more closely *Terebratula caiqua* (See Dunker und Von Meyer, Paläont. u.s.w. dritter band, 4, tab. 26, f. 5); but instead of a round perforation in the beak of the ventral valve, it appears to have been provided with a triangular foramen. This character, however, may depend on the state of preservation or perfection of the specimen.

Geological position and locality. Onondaga limestone of the Upper Helderberg group, Onondaga and Ontario counties.



MEGANTERIS ELONGATUS.

RHYNCHONELLA? ALVEATA (n. s.).

Pal. N.Y. Vol. iv.

SHELL longitudinally oval or subrhomboidal, much longer than wide, sloping from near the middle towards the prominent beak at an angle of about 70°: dorsal valve trough-shaped, or having a sinus so large as to involve its entire breadth below the middle; lateral margins along the upper half curving down, and occupying broad undefined sinuosities on each side of the beak in the cardinal border of the other valve: ventral valve transversely arcuate, and almost wholly included in the prominent rounded mesial fold, from which it slopes rather abruptly to the lateral margins; beak extending beyond the opposite beak, nearly straight. Surface smooth.

Geological position and locality. Onondaga limestone,

Rhynchonella glans-fagea (n. s.).

Pal. N.Y. Vol. iv.

Shell broad ovate or subquadrate; sides sloping from near the middle to the beaks at an angle of about 85°; front rounded: dorsal valve the shorter, transversely arcuate or sloping from the sides towards the middle, forming a shallow sinus involving nearly the whole width of the shell; beak not incurved: ventral valve much the larger, very prominent and forming an elliptic arch along the middle from beak to front, sloping at an angle of about 80° towards the lateral margins; beak extended beyond the opposite, arched or incurved so as to bring the apex above the plane of the centre of the other valve. Surface smooth, or with faint concentric lines of growth.

Geological position and locality. Schoharie grit, Albany and Schoharie counties.

Rhynchonella glans-fagea.

Rhynchonella unisulcata.

Pal. N.Y. Vol. iv.

Atrypa unisulcata, Conrad: Ann. Rep. Geol. Surv. N.Y. 1841, p. 56.

Shell subquadrangular, broader than long: dorsal valve rising in the middle into an undefined mesial fold, along which a distinct longitudinal sulcus extends quite to the apex of the beak; from this elevation the valve slopes laterally at an angle of about 90° quite to the anterior lateral extremities in front, but near the cardinal margin it again curves upwards at the extremities

of the hinge; beak incurved: ventral valve convex, having two prominent ridges extending at an angle of about 90° from the beak to the anterior and lateral margins: the space between these ridges is occupied by a very broad, deep, sloping mesial sinus extending from the beak to the front, where it terminates in a broad triangular extension; beak closely incurved. Surface smooth, or marked by faint lines of growth.

This remarkable shell differs so widely from any other species hitherto found in our rocks, as to be at once recognized merely by its form. I have placed it provisionally in the Genus *Rhynchonella*, not having yet had an opportunity of seeing its internal characters.

RHYNCHONELLA INEQUIPLICATA (n. s.).

Pal. N.Y. Vol. iv.

SHELL subquadrilateral, broader than long; hinge and area unknown, apparently rounded at the lateral extremities: dorsal valve the larger, convex, rising in the middle into an undefined mesial fold; entire surface marked by about twelve or thirteen irregular bifurcating plications, three or four of which occupy the mesial elevation; beak distinctly incurved: ventral valve most prominent near the umbo, depressed in the middle into a shallow undefined sinus, which is occupied by three or four smaller plications, and terminates in a short subangular projection. Finer surface markings unknown.

Of this rare species, I have yet only seen a single and somewhat mutilated specimen. It appears to be quite distinct from all the other forms known in our rocks.

Geological position and locality. Limestone of the age of the Upper Helderberg group, Western New-York: particular locality unknown.

Spirifer gregaria.

Spirifer gregaria, Dr. Clapp in MSS.

Pal. N.Y. Vol. iv.

Shell irregularly subglobose, longitudinally or transversely a little oval; hinge equalling the greatest width of the shell, angular or slightly rounded : dorsal valve the smaller, somewhat semicircular, length about two-thirds the width, rising along the middle into a prominent mesial fold, on each side of which there are five to nine simple rounded plications; mesial elevation slightly flattened, or marked with a faint longitudinal depressed line; beak rising a little above the hinge, more or less incurved : ventral valve subquadrilateral, having a distinct subangular sinus extending from the beak to the front, where it terminates in a short subtriangular projection (fitting into a corresponding depression in the front of the opposite valve); on each side of the sinus, there are about six to ten rounded plications; beak rising far above the hinge, extremely gibbous and strongly incurved; foramen somewhat narrow triangular; area rather broad, sublinear, extending to the extremities of the hinge line, distinctly arcuate. Surface ornamented by regular subimbricating zigzag lamellæ or lines of growth.

Geological position and locality. In the limestone of the Upper Helderberg, rarely in Eastern New-York : common in Genesee and Erie counties, and in Ohio and Kentucky, in the same geological position.

Spirifer grieri (n. s.).

Pal. N.Y. Vol. iv.

Shell transversely oval or subrhomboidal; length about five-sixths the breadth; valves nearly equal, more or less gibbous; hinge less than the greatest width of the shell, rounded at the extremities : dorsal valve with a prominent angular mesial fold extending from the beak to the front, marked with indistinct plications, about three originating near the beak and bifurcating once or twice before reaching the front, having on each side about nine rounded simple plications; beak rising a little above

the hinge : ventral valve most prominent near the umbo, having about ten simple rounded plications on each side of the sinus, in which are four to seven smaller bifurcating plications; beak projecting above the opposite one, incurved; foramen triangular; area short, broad, triangular, strongly arcuate. Surface marked by regular, strongly undulating, subimbricating lines of growth, which are crossed by fine radiating striæ, giving the edges of the lamellæ a fimbriated appearance.

This species is distinguished from most of the allied forms by its simple strong plications on each side of the mesial fold and sinus, while those occupying the same are smaller and bifurcating. Sometimes the middle plication on the summit of the mesial fold is simple, in which case the fold is quite angular; while in other instances it bifurcates, leaving a longitudinal depressed line on the middle, giving it a more rounded outline. It is only on specimens which have suffered no injury by wearing or exfoliation, that the fimbriate appearance of the concentric markings is visible.

Geological position and locality. Gray limestone of the age of the Upper Helderberg group, near Columbus, and also near Sandusky, Ohio.

I am indebted to Judge GRIER of Dayton, Ohio, for this and other specimens.

SPIRIFER MANNI (n. s.).

Pal. N.Y. Vol. iv.

SHELL triangular-semioval, very gibbous; hinge straight, equal to the greatest width of the shell, angular at the extremities : dorsal valve nearly semicircular, convex, having a distinct mesial fold which is depressed or faintly grooved along the middle, giving the lateral margins great prominence; on each side of the mesial elevation, about ten or eleven simple rounded plications; beak and narrow area strongly incurved : ventral valve extremely prominent at the umbo and sloping laterally, having about eleven simple rounded plications on each side of the deep smooth mesial depression; beak not incurved; foramen narrow; area very wide, slightly arcuate. Surface unknown.

A single specimen of this species, from Columbus, Ohio, is much exfoliated; the plications are more rounded, and the mesial fold less depressed in the centre, than in specimens of similar general character from New-York. The species has doubtless been originally marked by fine radiating striæ and concentric lines of growth.

In many respects this shell resembles *S. eurutines* of Owen, but has a greater convexity of the dorsal valve, with beak more prominent and incurved; and it likewise has a narrower foramen, and only about half the number of plications of that species.

Geological position and locality. Upper Helderberg limestone of Western New-York? and near Columbus, Ohio. Dr. Mann.

Spirifer oweni (n. s.).

Pal. N.Y. Vol. iv.

Shell transversely oval, moderately gibbous; length about three-fourths the breadth; valves nearly equal; hinge nearly or quite equal to the greatest width of the shell, angular or a little rounded at the extremities; front nearly straight, sometimes a little concave at the termination of the sinus: dorsal valve transversely oblong, somewhat semicircular, having a smoothly rounded mesial fold marked by a longitudinal depression down the middle, sloping gently to the anterior and lateral margins, but flattened a little near the extremities of the hinge, having on each side of the mesial elevation about fifteen simple subangular plications; beak rising somewhat above the hinge-line, incurved; area incurved: ventral valve most prominent near the umbo, having sixteen or seventeen plications on each side; mesial sinus somewhat deep, rounded, reaching from the beak to the front, where it terminates in a short rounded extension; beak prominent, projecting beyond the opposite, arched but not incurved; area high, arcuate, extending obliquely beyond the beak of the dorsal valve. Surface retaining traces of very fine radiating striæ, which are crossed by stronger concentric lines of growth.

This species is abundant at Louisville and other western localities. It

has generally been referred to *S. lævicosta*, LK. sp. (*Terebratulites ostiolatus*, SCHLOT.), from which it differs in being less gibbous, and having a depressed line along the mesial elevation of the dorsal valve. It may be easily distinguished from *S. eurutines* of OWEN, with which it is associated, by its narrower and much more arcuate area and less angular plications. Some specimens show remains of a faint impressed line along the centre of each plication.

Geological position and locality. Limestone of the age of the Upper Helderberg : Falls of the Ohio, and vicinity.

SPIRIFER VARICOSUS (n. s.).

Pal. N.Y. Vol. iv.

SHELL subsemicircular, length less than half the width; hinge equalling the greatest breadth of the shell, and terminating in salient angles : dorsal valve marked on each side of the narrow somewhat prominent mesial fold by about ten elevated, simple, angular plications; mesial elevation abruptly elevated at the sides, flattened or slightly depressed along the middle; beak projecting little beyond the hinge, and, together with the narrow area, slightly incurved : ventral valve much the more convex, most prominent at the umbo, having ten or twelve plications on each side of the sinus, in the centre of which is sometimes a faint indication of a single plication; sinus distinctly defined to the apex of the beak, which is pointed and slightly arched; area somewhat high and extending to the extremities of the hinge, slightly arcuate; foramen narrow triangular. Surface marked by regular distinct imbricating lines of growth, which sometimes give a subnodose character to the plications.

This species differs from *S. eurutines* of OWEN, in being smaller and more transverse, with more angular plications and stronger concentric lines of growth; also in the greater prominence of the two plications bounding the dorsal sinus of the present species, as well as the abrupt and angular mesial fold.

Geological position and locality. Limestone of the age of the Upper Helderberg : Falls of the Ohio, and Charleston landing, Indiana.

Spirifer segmentus (n. s.).

Pal. N.Y. Vol. iv.

Shell transversely semioval, less than half as long as broad; hinge equalling the greatest width of the shell, terminating in salient angles: dorsal valve depressed-convex; beak projecting slightly beyond the hinge, scarcely incurved; mesial fold narrow depressed and rounded, not plicated: ventral valve the more convex, most prominent at the beak, which is scarcely elevated above the margin of the area and not incurved; sinus shallow, rounded and extended quite to the apex of the beak; area high, nearly flat and slightly inclined towards the front, transversely striate; foramen narrow triangular. Surface ornamented by twenty or more simple rounded plications on each side of the mesial sinus and fold, the lateral ones of which do not reach the beak, but run out along the margin of the area. Faint lines and occasional stronger wrinkles of growth mark the shell concentrically.

This species is associated with the last, and may be distinguished from that by its less elevated, smoother, and more numerous plications, and more depressed and rounded mesial fold. It is also proportionally more transverse, and has a flatter area as well as less distinct marks of growth.

This species may be confounded with *S. oweni;* but the area inclines forward, instead of being vertical or slightly arcuate as in that species, and the number of plications in a much smaller individual is fully equal or greater than in the full-grown specimens of that species.

Geological position and locality. In limestone of the age of the Upper Helderberg group: Falls of the Ohio and Charleston landing, Indiana.

Spirifer arctisegmentus (n. s.).

Pal. N.Y. Vol. iv.

Shell transversely semioval, length less than one-third the breadth; hinge equalling the greatest width of the shell, and terminating in mucronate points: dorsal valve depressed convex, having about eight simple elevated angular plications on

each side of the small mesial fold; beak scarcely elevated above the cardinal border, and, together with its linear area, incurved: ventral valve the more convex, most prominent at the umbo, from which it slopes regularly to the anterior lateral borders, marked by about nine angular plications on each side of the sinus, the lateral plications not reaching the beak, but coalescing with a marginal ridge along the border of the area; mesial sinus angular, and rather sharply defined quite to the apex of the beak; area flat, rather high, transversely striated, obliquely inclined from the hinge; foramen very narrow; beak scarcely elevated above the margins of the area, not incurved. Surface ornamented by fine undulating concentric lines of growth.

This shell may be distinguished from the last, as well as from other somewhat allied forms, by its larger and more angular as well as less numerous plications, and in having a distinct linear ridge along the margin of the area of the ventral valve. Its foramen is likewise narrower, and the sinus deeper and more angular than in *S. segmentus*.

Geological position and locality. Limestone of the Upper Helderberg: Stafford, Genesee county.

SPIRIFER MACROTHYRIS.

Pal. N.Y. Vol. iv.

SHELL large, transversely semioval, about twice as broad as long; hinge nearly or quite equalling the greatest width of the shell, angular or somewhat rounded at the extremities: dorsal valve convex, rising in the middle into a narrow rounded mesial fold, with eleven or twelve simple broadly rounded and slightly elevated plications on each side; beak extending but little beyond the hinge, together with its narrow area distinctly incurved: ventral valve the more depressed, plicated like the other, and having a distinct somewhat broad mesial sinus, which becomes much broader and deeper in front, imparting a sinuous outline to the shell; beak comparatively small, incurved; area narrow, somewhat abruptly arcuate above; sides parallel, extending to the extremities of the hinge; foramen large, broad triangular. Surface marked by fine regular concentric lines of growth.

This is a fine robust species, remarkable for its comparatively narrow area, broad triangular foramen, and extended hinge. Some of the specimens show traces of an indistinct plication in the middle of the mesial sinus of the ventral valve, which would indicate the presence of a small longitudinal depression on the mesial fold of the other valve; but the only specimens I have yet seen are much worn, and the shell more or less exfoliated. There were probably fine radiating striæ, though no traces of them remain on any of the specimens coming under my observation.

Geological position and locality. In limestone of the Upper Helderberg group at Williamsville, Erie county, N.Y.; and in the same limestone near Columbus, Ohio. Dr. MANN.

SPIRIFER DIVARICATUS.

Pal. N.Y. Vol. iv.

SHELL somewhat semicircular, breadth nearly double the length; hinge equalling the greatest width of the shell, abruptly angular at the extremities: dorsal valve imperfectly known: ventral valve convex; mesial sinus broad, deep, becoming undefined at the margins towards the front, rapidly narrowing and more distinctly defined as it approaches the beak, ornamented by numerous irregular bifurcating somewhat angular plications, not more than one-half or one-third of which reach the beak; area moderately wide, extending to the hinge extremities, arcuate, transversely striate; foramen broad triangular; beak small, incurved. Surface marked by fine obscure closely arranged concentric striæ.

This species has come under my observation only in the condition of casts, or specimens so much exfoliated as to leave much doubt in regard to the details of the finer surface markings. It occurs in the same locality with the last described species, from which it may at once be distinguished by its more gibbous form, less extended hinge, broader area, and smaller as well as bifurcating plications, which are as distinctly marked in the sinus as upon the sides; a character preserved even in the casts.

Geological position and locality. In the limestone of the age of the Upper Helderberg group at Williamsville, Erie county,

SPIRIFER MACRA.

Pal. N.Y. Vol. iv.

SHELL transverse : ventral valve presenting a subquadrangular outline; hinge-line greatly extended, terminating in mucronate points; sides nearly straight and sloping abruptly to the mesial sinus in front, the beak much elevated : dorsal valve smaller, somewhat semicircular, convex in the middle, flattened or concave towards the extremities, having a narrow abruptly elevated mesial fold, on each side of which there are about six or seven simple plications; beak scarcely incurved or elevated above the hinge-line : ventral valve most prominent near the umbo, having a narrow and very distinct mesial sinus terminating in a short round projection in front; plications about seven or eight on either side, those bounding the sinus very prominent; beak and upper part of the area arcuate, and projecting beyond the cardinal margin of the opposite valve; area moderate, and sloping gradually from the beaks to the cardinal extremities. Surface markings unknown.

Geological position and locality. In the limestones of the Upper Helderberg group, Erie county.

SPIRIFER DISPARILIS.

Pal. N.Y. Vol. iv.

SHELL small, semicircular, length more than half the width; hinge a little less than the greatest breadth of the shell, rounded at the extremities : dorsal valve much the more depressed, marked by five or six broad rounded plications, the middle one smaller than those contiguous, and separated from them on each side by a larger depression than those between the others; beak scarcely incurved : ventral valve much the more convex, most prominent at the umbo, marked by about five large plications, of which one on each side of the sinus is larger and more elevated; beak arcuate; area moderate, sloping from the beaks to the lateral extremities; foramen conspicuous. Surface unknown.

Geological position and locality. In limestones of the Upper Helderberg group, Erie county.

Spirifer acuminatus.

Delthyris acuminatus, Conrad : Annual Geological Report of New-York, 1839, p. 65.

Spirifer cultrijugatus, F. Rœmer in Das Rheinische Uebergangsgebirge, 1844, pa. 70, pl. iv, f. 4 a, b, c.

This well-marked and widely distributed American species has been recognized by M. de Verneuil and Dr. Römer as identical with *S. cultrijugatus* of Europe. The species was, however, described by Mr. Conrad five years before the European one.

This species was designated by the late Prof. A. Eaton as *Spirifer alternatus ;* but I have not been able to find any published description of it.

It occurs in the Upper Helderberg limestone, throughout, in New-York and Ohio, and in Indiana and Kentucky in the continuation of the same beds. It likewise occurs in the Hamilton group (See *Spirifer prora*).

ORGANIC REMAINS OF THE HAMILTON GROUP.

Orthis vanuxemi (n. s.).

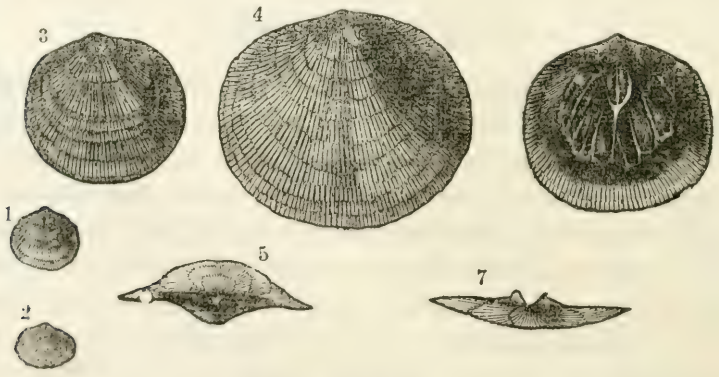
Shell circular or transversely a little oval, compressed; hinge-line very short; margins of the valves crenulated within; interior minutely punctate : dorsal valve depressed-convex; beak scarcely distinct from the cardinal border, not incurved; teeth and dental process prominent : ventral valve nearly flat, or a little concave towards the front, slightly convex in the umbonal region; beak small, extending little beyond that of the other valve, arched but not incurved; area very small, scarcely equalling more than one third the greatest breadth of the shell, arcuate; foramen comparatively large, triangular, and partly filled by the dental process of the other valve; teeth prominent. Surface ornamented by fine, closely arranged, radiating tubular striæ, which are perforate at intervals and increase both by

implantation and bifurcation, crossed by very fine indistinct concentric lines and occasional more distinct concentric imbricating marks of growth; entire surface granulate or punctate under a magnifier.

This species is so nearly like *O. michilina* of LEVEILLE, that it is very difficult to point out characters by which they may be distinguished, especially until that species is better defined. From the figures of that species, ours presents considerable differences in the vascular impression and dental processes. The minute granulations or punctæ upon the exterior surface present characters which are not noticed in the descriptions and figures, so far as I have observed.

The minutely tubular striæ are characteristic of so many species of *Orthis*, that it appears to me this character can be of no value in distinguishing species, unless its peculiarities are pointed out. A single European specimen of *Orthis michilina*, from the Carboniferous rocks of Belgium, in my cabinet, presents a more elongated and less gibbous form, a flattening along the centre of the dorsal valve, and a proportionally more extended area.

Geological position and locality. In the shales and shaly sandstones of the Hamilton group in Eastern and Central New-York, and more abundantly in the western part of the State. It likewise occurs in the soft sandstones of the age of the Chemung group in Eastern Ohio. Some small and poorly developed specimens of *Orthis* in the shales of the Hamilton group in Iowa closely resemble this species; but the rotund and gibbous forms never appear there, and the identity of the two is not determined.



ORTHIS VANUXEMI.

Orthis perversa (n. s.).

Shell unsymmetrically subelliptical in outline, much wider than long; valves unequally convex; area large and confined to the ventral valve, extending to the hinge extremities; hinge-line shorter than the greatest width of the shell: dorsal valve most convex near the umbo or above the centre of the shell, and sloping somewhat abruptly to the hinge-line; extremities rounded: ventral valve most convex at the beak, which is slightly arcuate and often distorted, depressed below; area nearly vertical; foramen closed. Surface marked by distant elevated striæ, which bifurcate several times before reaching the margin, as well as increase by interstitial addition; concentrically marked by closely arranged undulating lines of growth.

This shell is of the type of *Orthis umbraculum*, and presents the irregularities of form common on that shell. Among the specimens examined, there are no symmetrical forms; both valves showing some slight degree of distortion, which appears to have been the normal condition of the shell. The species is readily distinguished among other species of the Hamilton group, even by fragments of the shell from the unsymmetrical form, the distant radiating striæ, and the concentric striæ, which are closely arranged, abruptly undulating between the strong radiating striæ.

Geological position and locality. In the shales of the Hamilton group, Erie county, N.Y.

Strophomena (Strophodonta) demissa.

Strophomena demissa, Conrad: Jour. Acad. Nat. Sci. Phil. 1842, Vol. viii, pa. 258, pl. 14, f. 14.

Shell semielleptical, usually wider than high (length and breadth often nearly equal); hinge-line equal to, greater or less than the width of the shell, abruptly contracted below the hinge extremities which are often auriculate: ventral valve very regularly convex, sometimes gibbous, greatest elevation nearly central: dorsal valve moderately concave, rarely following the convexity of the opposite valve; area conspicuous, wide, sublinear, that of the ventral valve arcuate, that of the dorsal valve convex

and often divided into two equal parts by an elevated line along the centre; entire area strongly striated transversely, and more slightly in a longitudinal direction; inner edges strongly crenulated. Surface marked by numerous crowded striæ, about nine or ten of which are much stronger and more elevated near the beak of the ventral valve, with finer ones between and on either side; striæ frequently increasing by interstitial addition and bifurcation, until they become very numerous and much finer at the margin; striæ of dorsal valve similar to those of the ventral valve. In well preserved specimens, fine concentric striæ mark the entire surface, but the greater number of specimens do not preserve these markings.

The interior of the ventral valve presents a double foliate vascular impression without dividing ridge between; ligamental pits of the adductor muscles strongly marked, and situated close under the arch of the hinge, and separated by a smooth space from the vascular impressions: hinge, upon the under side of the projecting area, and in the place of the foramen, furnished with a double dental process which articulates with the teeth of the other valve: dorsal valve with the pits of the adductor muscles near the hinge-line, and just below the inner margin of the hinge furnished with a double tooth, somewhat crescent-shaped, with the horns enlarged and indented at the extremities.

This process of articulation would leave a small circular space between the projecting portions of the teeth of the two valves, but the margins of the valves in well preserved specimens are absolutely close and continuous. I have seen, in some specimens, evidence of a minute pore at the apex of the ventral valve, but in many well preserved specimens this does not appear.

The character of the vascular impression, and the mode of articulation of the hinge, and absence of foramen, in this species, are all so different from the typical forms of *Strophomena*, that I proposed in 1850 the name of *Strophodonta*.

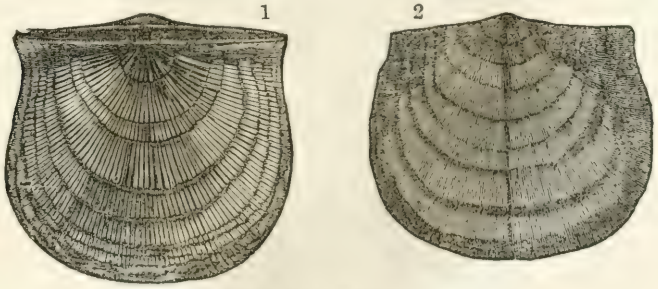
At the time of writing the description originally, I had had no opportunity of knowing fully the character of the interior of the valves as here shown in the typical species. I am now satisfied that a crenulated hinge-line, alone, is not sufficient to distinguish the species of this genus; but when we have, united with that character, the entire area and absence of foramen,

with the structure of hinge here described, it seems to me sufficient ground for separation. I should not omit to mention, that in far the larger number of specimens of the *S. demissa*, the centre of the area of the ventral valve with the dental process is broken; and though I have a large number of specimens in which the two valves are united, and also many separate valves, it is only in one or two specimens that these dental processes of the ventral valve are perfectly preserved. This fractured condition of the area may produce the impression that a foramen has once existed, from its analogy with shells having that character.

In two or three other species having entire areas, I have found internal characters corresponding so nearly with those of *S. demissa*, that I can have no doubt of their relations; and in the absence of better means of determination, I have placed all species having the area without visible foramen, or deltidium, in this genus.

In the descriptions of preceding species, it is quite possible that some true *Strophomena* have been included under the generic designation of STROPHODONTA, and the language has not always been sufficiently definite; the foramen being spoken of as closed when none has existed. For the present the name of STROPHODONTA is given as a subgenus, but which I regard as corresponding in value to either of the other subdivisions, LEPTÆNA or STROPHOMENA.

Geological position and locality. This species occurs abundantly in the Hamilton group of Western New-York, and at Rock Island, Illinois; New-Buffalo, Iowa, and at other localities in the same neighborhood. The specimens from Iowa and Illinois are always much less convex than those of New-York, many of them being depressed and nearly plano-convex in form.



STROPHOMENA DEMISSA.

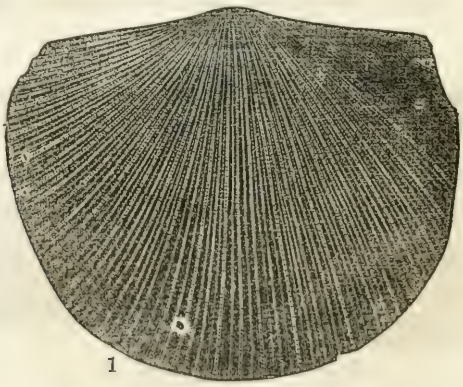
STROPHOMENA (STROPHODONTA) CONCAVA (n. s.).

SHELL large, concavo-convex, hemispherical; hinge crenulated, generally less than the greatest breadth of the shell: dorsal valve regularly and profoundly concave: ventral valve strongly convex; area broad linear; margins nearly parallel, strongly striate vertically, a little arcuate; foramen none. Surface ornamented by rather abruptly angular distant elevated radiating striæ, which always increase by implantation, and are crossed by fine regular closely arranged elevated concentric lines. Where worn or partly exfoliated, the shell is finely punctate.

This species resembles somewhat *S. demissa*, with which it is associated; but differs in being more deeply concave, and in generally having the hinge shorter in proportion to the breadth of the shell: the striæ are also proportionally smaller and much more distant, especially near the beaks. When well preserved, the striæ are abruptly prominent upon the body of the shell, and sharply crenulated by the concentric lines, which are less conspicuous in the spaces between the striæ.

The shell varies much in its convexity, and is often somewhat irregularly ridged or plicated in the direction of the striæ.

Geological position and locality. Seneca lake, Moscow, York, and many other localities in Western New-York.



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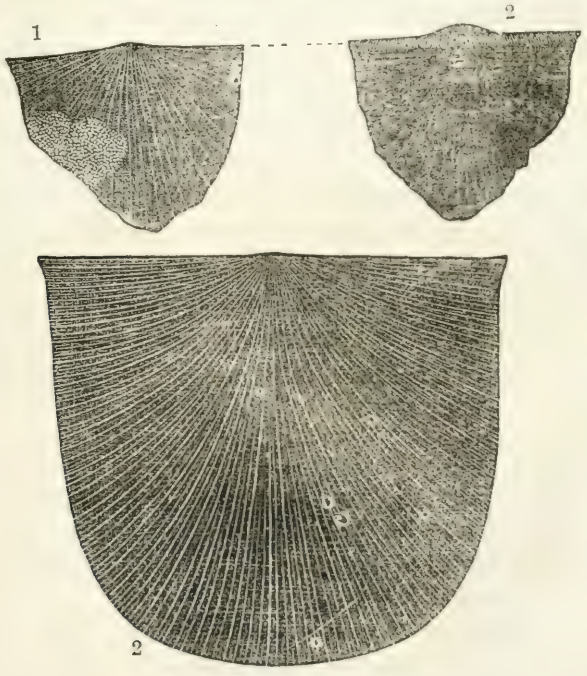
STROPHOMENA CONCAVA.

Strophomena (Strophodonta) textilis (n. s.).

Shell very thin, semioval, sometimes longer than wide, much compressed; hinge about equal to the greatest breadth, nearly rectangular at the extremities: dorsal valve scarcely concave: ventral valve flat, or very slightly convex; area linear, striated vertically, and marked by a narrow linear callosity in place of the foramen. Surface marked by slender distant elevated radiating striæ, which increase by interstitial addition: spaces between the striæ marked by extremely fine radiating lines, which are crossed by minute closely arranged concentric striæ.

This shell differs from the preceding in its nearly flat ventral valve and less prominent radiating striæ, while the concentric striæ are very conspicuous on the surface between the coarser ones. There are from four to twelve finer radiating striæ between the coarser ones, which become less conspicuous towards the beak.

The alternations of the striæ are not unlike those of *Strophomena interstitialis* (Phillips), and *S. inequistriata* (Conrad); but the flattened



Strophomena textilis.

form and large size of the shell are sufficient to distinguish it from these species.

Geological position and locality. In the Hamilton group : Eighteen-mile creek, Seneca and Canandaigua lakes, etc.

STROPHOMENA (STROPHODONTA) INEQUISTRIATA.

Strophomena inequistriata [?] CONRAD: Jour. Acad. Nat. Sci. Phil. 1842, Vol. viii, pa. 254, pl. 14, f. 2.
Strophomena inequistriata, HALL : Geol. Rep. 4th Dist. 1843, pa. 200, f. 4.
Compare *Orthis interstrialis*, PHILLIPS : Pal. Fossils, 1839, pa. 61, pl. 25, f. 103, a, b, c, d.

SHELL semicircular or semioval in outline; hinge-line extended beyond the width of the shell, acute, sometimes auriculate : dorsal valve moderately concave : ventral valve more or less gibbous in the middle, abruptly arched towards the hinge-line, and often depressed-convex at the summit or umbo, more gradually sloping towards the base and abruptly contracted at the cardinal extremities; beak small, scarcely prominent on the hinge-line; area narrow, linear, extending to the extremities of the hinge-line, striated vertically with the inner margins crenulate; foramen none, a slight linear elevation extending across the area; area of dorsal valve scarcely more than half as wide as the other, and having, in very perfect specimens, a narrow elevated ridge crossing it in continuation of that of the opposite valve. Surface of the entire shell marked by slender distant elevated striæ, which are increased by interstitial addition, and the spaces occupied by much finer closely arranged striæ, which are scarcely visible to the naked eye; transversely marked by fine concentric striæ.

This species bears such close resemblance to the figures of Professor PHILLIPS cited above, that in my Report on the Fourth Geological District of New-York, I regarded the two as identical. I have, however, some doubts of the propriety of this reference. It is indeed somewhat uncertain whether the identification with Mr. CONRAD'S species is correct. His description mentions "sharp radii alternating in size;" and the figure represents the striæ as alternately larger and smaller, but without any indication of fascicles of finer striæ between the stronger ones. I am there-

fore in doubt as to the correctness of the original reference of this shell.

This species differs much in the convexity of the ventral valve; being sometimes extremely gibbous, and in other individuals very moderately convex. The area is subject to some slight variations in width, perhaps owing to compression. The general character of the surface of the convex valve is much like that of good specimens of *Strophomena alternata* of the Trenton limestone, but it does not appear to be subject to such extreme variations in respect to the striæ. It resembles very closely, in its surface markings, the *S. textilis;* but is always a smaller shell, has a more extended hinge-line, and is never so flat as that species.

Geological position and locality. In the shales of the Hamilton group: Shores of Seneca and Cayuga lakes, Canandaigua lake, Moscow, Geneseo, etc.

Strophomena (Strophodonta) fragilis (n. s.).

Pal. N.Y. Vol. iv.

Shell semioval; hinge-line often extended beyond the width of the shell; margins a little contracted below the hinge extremities: dorsal valve scarcely concave: ventral valve very slightly convex, or nearly flat; area very narrow, linear, almost entirely formed by the ventral valve, striated vertically, and crenulate on the inner edges throughout the entire length; foramen none. Surface covered by minute closely arranged radiating striæ; and these are crossed by fine concentric lines, which become very prominent on the radiating striæ of the ventral valve, giving a minutely nodulose or granulate character to the entire surface when well preserved. The radiating striæ of the dorsal valve are more evenly rounded, and increase mainly by bifurcation (while those of the opposite valve increase by interstitial additions), and are crossed by even, raised, concentric lines which produce no granulations upon the surface. The dorsal valve is frequently marked by faint concentric undulating wrinkles; while the ventral valve often presents some short oblique folds just below the hinge-line, and very rarely a few short interrupted scarcely perceptible undulations upon the general surface.

Vascular impressions of the ventral valve double, foliate, without central dividing ridge, margined by a slightly elevated ridge on each side for a short distance below the hinge-line.

This shell may be recognized by its excessive tenuity and the extremely narrow space between the two valves, which seems scarcely greater than the thickness of the shell. There is no appearance of a foramen in the ventral valve, or of the closing of one by a deltidium; but in place of it are two prominent dental processes on the inner side. Numerous separate ventral valves have been seen, but, up to the present time, we do not know the interior of the dorsal valve. From the character of the area, absence of foramen, and form of vascular impressions, it seems strictly referable to the Genus *Strophodonta*.

Geological position and locality. In the shales of the Hamilton group in Central and Western New-York; and also in considerable numbers in the shales of the same age at Rock island, Illinois, and at New-Buffalo in Iowa.

STROPHOMENA (STROPHODONTA) NACREA (n. s.).

SHELL small, semicircular, having a brilliant metallic (or coppery nacreous) lustre; hinge crenulated, equalling the greatest breadth, and terminating in more or less distinct angles: dorsal valve concave: ventral valve convex, flattened at the extremities, depressed-convex in the umbonal region, and abruptly arched towards the front; beak very small and depressed; area rather narrow, having no foramen. Surface apparently smooth, but showing under a lens very faint concentric lines of growth, with sometimes obscure traces of radiating lines: whole interior, excepting the muscular impressions, studded with prominent scattering granules or papillæ. The crenulations of the hinge-line are rather distant, but quite conspicuous.

Fragments, even, of this species may be always distinguished from its associates, by the peculiar metallic lustre.

This species bears some resemblance to *Orthis lepis* of BRONN; but is much less distinctly striated than well-preserved specimens of that shell, and the crenulations of the hinge-line are less numerous, as well as the hinge-line less proportionally extended. The generally smooth surface and strong lustre of the two, in specimens before me, give a similar external appearance, which is not confirmed by a comparison of the details.

Geological position and locality. Hamilton group: Town of Darien, Genesee county.

STROPHOMENA (STROPHODONTA) SUBDEMISSA (n. s.).

SHELL, when young, semicircular, having the hinge equal to the greatest breadth, and terminating in distinct angles; in older individuals the form is subcircular, with the hinge less than the greatest breadth, and obtusely angular or rounded at the extremities : dorsal valve regularly and distinctly concave; area rather wide : ventral valve regularly convex; beak very small, and scarcely distinct from the cardinal margin; area broad, arcuate and considerably inclined over the hinge, marked by rather strong radiating striæ, which probably form crenulations along the hinge-line; no distinct foramen. Surface ornamented by radiating striæ, which are distinct near the beak, and bifurcate so frequently as to diminish in size towards the border; they also increase in number by implantation : these are crosssed by distant concentric wrinkles of growth. There were doubtless also fine concentric striæ, which have been obliterated by wearing on the only specimens I have seen.

Very much like *Strophodonta demissa*, but has a wider area and the striæ less distinct near the beak : it may be only a variety of that species.

Geological position and locality. Hamilton group : Shore of Lake Erie, Maumee river.

CHONETES GIBBOSA (n. s.).

SHELL semicircular; hinge equalling the greatest breadth, and nearly rectangular at the extremities : dorsal valve unknown : ventral valve very convex in the middle and umbonal regions, compressed at the extremities of the hinge; beak incurved; cardinal margins having (three?) long slender spines on each side of the beak, which are directed outwards (almost in a line with the hinge?). Surface ornamented by distinct, round, closely arranged striæ, which increase both by implantation and bifurcation; of these, about forty-two to forty-four may be counted at the border : fine undulating lines of growth traverse the shell in the other direction.

In some respects this shell resembles *C. nana*, but the striæ are more regular and stronger : in the only specimens I have seen showing the spines, these appendages are directed outwards almost at right angles to the longitudinal axis of the shell. It is barely possible, however, that this may be due to accident. In the oblique direction of the spines, it resembles *C. koninckana* of NORWOOD and PRATTEN ; but it differs remarkably from that shell, in the greater convexity of the ventral valve : it also has more numerous striæ, etc. A rare species.

Geological position and locality. Hamilton group : York, Livingston county.

CHONETES CORONATA.

Strophomena carinata (Scr. *coronata*), CONRAD, 1842 : Jour. Acad. Nat. Sci. Phil. Vol. viii, p. 257.

Not *S. carinata*, CONRAD : Rep. Pal. N.Y. 1839, p. 64.

Compare *C. tuomeyi*, NORWOOD and PRATTEN. Jour. Acad. Sci. Phil., Vol. iii, new ser., pa. 30, pl. 2, f. 9.

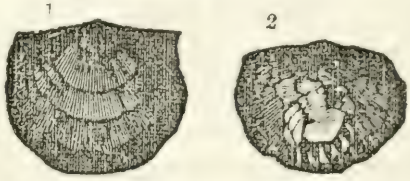
SHELL transversely oval or nearly semicircular ; hinge not quite equalling the greatest breadth, obtusely angular at the extremities : dorsal valve concave; area narrow and inclined obliquely towards the front of the shell, having in the middle a small but projecting dental process : ventral valve convex, most gibbous in the central and umbonal regions, depressed at the extremities, sometimes faintly sinuate down the middle ; beak small, and scarcely projecting beyond the cardinal margin ; area rather narrow, distinctly arcuate ; foramen small, broadly triangular, generally closed by a convex deltidium, and occupied below by the prominent dental process of the other valve ; cardinal margin having five tubular spines on each side of the beaks, the lateral of which is removed from the extremity of the hinge, and those nearest the beak are very small or mere granules. Surface ornamented by distinct elevated striæ, of which about fourteen may be counted near the beaks, but which bifurcate as they approach the front, so that the number is increased to about one hundred at the border (on large specimens) : crossed by extremely fine closely arranged concentric striæ.

This species agrees exactly with CONRAD'S figure and description of

Strophomena carinata, and some of the specimens before me are from the same locality and position as those investigated by him. I am inclined to think there must have been a typographical error in printing the name of this species in the Journal of the Academy, both because there is no carina about the shell, and because Mr. CONRAD had previously (1839) applied that name to a shell supposed to belong to the same genus.

I am much inclined to think our shell is identical with *C. maclurea* of NORWOOD and PRATTEN. Their figures and description agree very nearly with specimens of this species of the same size as those they figure, excepting that their shell appears to have had one spine more on each side of the beaks.

Geological position and locality. Hamilton group : Seneca lake shore, Moscow, etc.



CHONETES CORONATA.

CHONETES SCITULA (n. s.).

SHELL small, semicircular ; hinge not quite equalling the greatest breadth, obtusely angular at the extremities : dorsal valve concave ; area narrow, inclined forwards from the hinge-line, having a small projecting dental process in the centre : ventral valve convex in the middle, depressed at the extremities; beak small, slightly convex ; area narrow and arcuate, having five tubular spines along the margin on each side of the beak, of which the two or three inner ones are very small or mere granules, while the outer two are larger and a little removed from the extremities of the hinge ; foramen small, broad triangular, closed above by a convex deltidium, and below by the strongly projecting dental process of the other valve. Surface ornamented by distinct abruptly rounded striæ, of which twelve to eighteen may be counted near the beaks; but from the bifurcation and intercalation of others between these, the number is increased on the margin to about fifty or sixty. Traces of concentric striæ are obscurely visible on all the specimens before me, and in some instances they may be quite conspicuous.

This species resembles the *C. coronata* very much, but is smaller, and scarcely ever shows any traces of a sinus on the ventral valve. It is also very near *C. nana*, with which it has been considered identical : it differs, however, from that species as described by DE VERNEUIL, in having one or two more spines on each side of the beak, and the greater inequality of the areas of the two valves, that of the dorsal or concave valve of our shell being not more than half as broad as that of the ventral valve. The much greater number of striæ is also a distinguishing feature.

Geological position and locality. Hamilton group : Cayuga lake, and other localities in Western New-York.

CHONETES LEPIDA (n. s.).

SHELL very small, nearly semicircular ; hinge equalling the greatest breadth, rectangular at the extremities : dorsal valve concave; area linear, leaving a small projecting dental process in the middle : ventral valve convex in the central regions, depressed at the extremities; area rather narrow, arcuate; foramen closed above by a convex deltidium, extending about half way down, occupied below by the prominent dental process of the other valve. Surface ornamented by distinct, rather strong striæ, of which about ten or eleven may be counted near the beaks, but the number is augmented chiefly by intercalation, so that about twenty may be counted round the margin : no concentric striæ visible. Two of the striæ on each side of the centre near the beak of the ventral valve are larger and more prominent than the others; the space between them is depressed, and occupied by two or three smaller striæ, which are given off from the larger ones on each side. The larger striæ are more prominent near the beak than on any other part of the valve, and give almost a bicarinate aspect to the umbo, with a distinct sinus between, which becomes obsolete near the base of the shell.

This species can be readily distinguished by the small size, the two larger striæ and the sinus in the middle. Three or four tubular spines may be counted on each side of the beak, the outer ones of which are nearly vertical to the hinge line.

Geological position and locality. Hamilton group : Shore of Cayuga Lake.

Chonetes deflecta (n. s.).

Shell subhemispherical; hinge rather less than the greatest breadth, obtusely angular, or a little contracted at the extremities: dorsal valve concave; area linear, and having in the middle a small projecting process: ventral valve convex, gibbous over the central and umbonal regions, depressed at the extremities; area of medium breadth, arcuate, and extending obliquely upwards; foramen narrow, triangular, partly or entirely closed by its pseudo-deltidium and the dental process of the other valve; cardinal margin garnished by four or five tubular spines. Surface ornamented by distinct and prominent radial striæ which number about fifteen to twenty near the beak, but which increase by intercalation and bifurcation to about thirty to thirty-two at the border: extremely fine closely arranged concentric striæ may be seen by the aid of a good lens. Surface near the lateral extremities smooth or with slight radiating undulations, with more distinct concentric striæ, which are likewise often more conspicuous on the concave than on the convex valve.

Resembles *C. gibbosa*, but is not so convex on the umbo of the ventral valve, and is less strongly arched: it is also less extended on the hinge, and has fewer and more elevated striæ. The bifurcation and implantation of striæ usually take place upon the upper half of the shell, and the striæ are often quite simple below the first third of the shell. The hinge extremities are not unfrequently bent downward or toward the umbo of the ventral valve.

This species, in its general aspect, resembles the young shells of *Tropidoleptus carinatus;* but the striæ are more numerous.

Geological position and locality. In the shales of the Hamilton group: Canandaigua lake shore.

Chonetes pusilla (n. s.).

Shell small, nearly semicircular; hinge about equalling the greatest breadth, rather obtusely angular at the extremities: dorsal valve concave; area unknown: ventral valve gibbous

in the central and umbonal regions, compressed at the extremities; area unknown. Surface ornamented by indistinct rounded radiating striæ, which are obsolete near the extremities; of these striæ about twelve to fifteen may be counted near the beaks, but in passing towards the front they occasionally bifurcate, and others are implanted between, so that at the border the whole number amounts to near thirty. Extremely fine and very obscure concentric striæ are also visible under a lens, on unworn parts of the shell.

This little *Chonetes* has generally been referred to *C. nana*, which it resembles very nearly in size and form; but it differs in averaging from about ten to fifteen striæ less than we usually see on that species; the striæ are also much more depressed and rounded than those of *C. nana*. Unfortunately none of the specimens I have seen give a clear idea of the spines. I have as yet seen but two remaining bases of spines on each side of the beak, though there may have been one or two more. The striæ usually bifurcate near the beak or on the upper half of the shell, so that they appear at first view to be simple; and in some specimens there is no bifurcation or interstitial addition of striæ below the upper third of the shell, so that it presents the aspect of a shell with simple rounded striæ.

Geological position and locality. In the limestones of the age of the Hamilton group, associated with *C. coronata* and *Tropidoleptus carinatus:* Devil's Bake-oven, Illinois.

CHONETES SETIGERA.

Strophomena setigera, HALL: Geol. Rep. 4th Dist. N.Y. 1843, p. 180.

This species occurs in the Marcellus shale and Hamilton group of New-York, in great numbers. It occurs in various states of preservation, sometimes extremely flattened in the thinly laminated dark shale, and more convex in the calcareous portions of the group. The specimens preserve from thirty-two to forty striæ on the borders of the shell, and some individuals perhaps a few more. The cardinal tubular spines are nearly vertical to the hinge-line, and in well preserved specimens are equal in length to half the height of the shell or even longer.

This species is often referred to *Chonetes nana* of DE VERNEUIL, and corresponds more nearly with that species than any other known to me in the State of New-York.

The original specimens of this species are in a thinly laminated black shale, and much compressed. Other specimens in more calcareous shales are more convex, and sometimes gibbous. There are also gradations in size and number of striæ, which incline me to regard this species as possibly identical with *C. scitula*, notwithstanding the wide differences of character in many individuals. A large number of individuals are required for the determination of this question.

Geological position and locality. In the black shales (Marcellus shales) at the base of the Hamilton group, and in the higher shale of the same, and in the Genesee slate which succeeds that group.

Tropidoleptus carinatus.

Strophomena carinata, Conrad : Ann. Geol. Rep. 1839, p. 64.
Leptæna laticosta, Hall, 1843.
Leptæna laticosta of Owen and others.

Shell transversely oval; hinge straight, not crenulated, generally a little less than the greatest breadth of the shell, rounded or very obtusely angular at the extremities; sides broadly rounded; basal margin slightly sinuous : dorsal valve concave, having a shallow mesial sinus, which is broad in front but continues above the middle of the shell as a narrow groove, not larger than those between the other costæ; beak very small, projecting beyond the hinge-line, straight or curving slightly outward; dental process extended beyond the hinge-line : ventral valve convex, slightly flattened and contracted toward the extremities, gibbous above the centre and in the umbonal region; beak obtuse and truncated by the foramen ; area distinct, variable in width, extending to the cardinal extremities, longitudinally striated, limited entirely to the ventral valve; foramen very broad, reaching to the beak and having a semicircular outline above, more or less closed by the prominent dental processes of the opposite valve. Plications usually simple and rounded, about eighteen to twenty on each valve, the middle one on the ventral valve being larger and more elevated than the others, so as to form a small mesial fold or carina. Surface ornamented by very fine distinct concentric striæ, presenting under a magnifier a very fine textile style of ornament : substance of the shell punctate throughout.

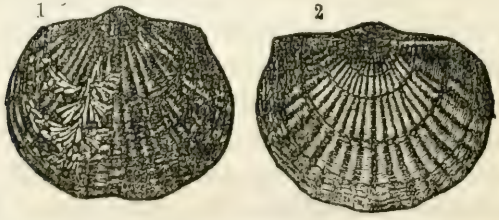
In some instances the costæ bifurcate, and the central one on the ventral valve more frequently presents this character. Specimens from certain localities show a scarcely perceptible difference in the size of the costæ, and no central carination.

This species is quite peculiar, having no representative as far as at present known in any of our formations, and may be regarded as the type of a distinct genus. It is likewise very closely allied to those forms which I have designated under the name of *Leptocœlia*.

This species has been described by several authors as *Leptæna laticosta*, and accredited to Mr. CONRAD. This name was originally proposed by the writer, to obviate the confusion arising from the circumstance of two species having been described by Mr. CONRAD under the name of *Strophomena carinata* : the first in the Annual Geological Report of New-York, 1839; and the second in the Journal of the Academy of Natural Science, in 1842. Among some original drawings and manuscripts recently received from Mr. CONRAD, I find the latter designated under the name *S. coronata*, and the name *S. carinata* is simply a typographical error as I had always suspected. This species proves to be a *Chonetes* (*C. coronata*), and the original *Strophomena carinata* of Mr. CONRAD will form the type of the Genus TROPIDOLEPTUS.

This species has been recognized in Europe, and is published under the name of *Leptæna laticosta* in the Bulletin de la Soc. Géol. de France, Tome iv, pa. 325, pl. 3 ; but it is there represented as having about thirty-two plications, a number much greater than any of our specimens, and it may not unlikely prove a distinct species of the same generic type.

Geological position and locality. In the Hamilton group in Schoharie county, and at Eighteen-mile creek on Lake Erie; upon the shores of Seneca, Cayuga and Canandaigua lakes, extending in fact throughout the entire breadth of the State from near the Hudson river on the east, to Lake Erie on the west. It likewise occurs in rocks of the same age in Illinois and Iowa.



TROPIDOLEPTUS CARINATUS.

Spirigera spiriferoides.

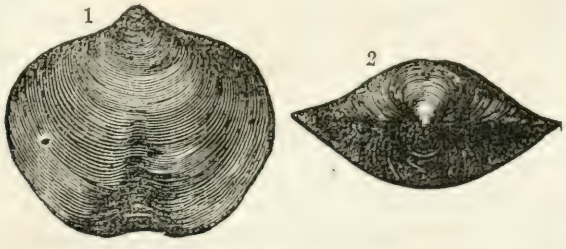
Terebratula spiriferoides, Eaton : Silliman's Journal, 1831, Vol. xxi, p. 137; Geol. Text-book, p. 46, 1832.

Atrypa concentrica, Conrad (not *T. concentrica*, Bronn) : Ann. Rep. N.Y. 1838, p. 111, 112.

A. concentrica : Final Rep. 4th Dist. N.Y., p. 198, f. 5.

Shell varying from transversely oval to suborbicular ; young individuals rather compressed, adult specimens gibbous; hinge nearly straight, but rounded at the extremities : dorsal valve generally a little more convex than the other, most prominent near the middle, elevated in front into a broad rounded undefined mesial fold, which is usually indistinct, but sometimes strongly elevated near the border ; beak and umbonal region not extending much above the hinge line : ventral valve most convex near the beak, depressed in front into a shallow rounded sinus, which is sometimes faintly indicated nearly to the beak, and occasionally very deep at the border; beak small, not projecting far beyond that of the other valve, lying close against it but scarcely incurved, perforated by a small round aperture. Surface marked by distinct concentric imbricating lamellæ of growth.

This species has generally been referred to *Terebratula* (*Spirigera*) *concentrica* of Bronn, from which it differs in the straightness of its hinge and much less prominent beak. It also presents other slight but constant differences of form, the broadest part being almost always a little above the middle, while in *S. concentrica* it is generally a little below it. The lamellæ are likewise more distinctly imbricated in our shell than in *S. concentrica*. A comparison of the European specimens with American ones has shown the propriety of separating them, and of adopting the name given by Prof. Eaton in 1831.



Spirigera spiriferoides.

Geological position and locality. In the shales of the Hamilton group: rarely in Eastern New-York, more common in the central and very abundant in the western part of the State, and particularly on the shore of Lake Erie at Eighteen-mile creek.

SPIRIFER FORMOSA (n. s.).

Pal. N.Y. Vol. iv.

SHELL somewhat semicircular, two-thirds to four-fifths as long as broad, moderately ventricose; hinge equal to the greatest width of the shell, slightly salient at the extremities; valves about equal: dorsal valve regularly convex, having a flattened mesial fold, on each side of which there are from fifteen to seventeen rounded plications; beak incurved: ventral valve most prominent near the umbo; mesial sinus shallow, flat in the middle, and distinctly limited by the adjacent plications; beak somewhat prominent, arched or incurved; area moderately high, arcuate, sloping from the beak to the extremities of the hinge; foramen distinct, wider than high. Surface marked by fine regular concentric striæ, which arch upwards in crossing the mesial fold: faint traces are sometimes seen of extremely fine radiating striæ.

This is a neat symmetrical species, with a gracefully curved outline and salient angles. In profile, the beak of the ventral valve projects but little beyond that of the dorsal valve. The mesial fold, which is usually flat in the middle and lower part of the shell, is distinctly grooved along the centre in the upper part, and this depression sometimes continues to the base.

Geological position and locality. In limestone of the age of the Hamilton group: Illinois.

SPIRIFER FORNACULA (n. s.).

Pal. N.Y. Vol. iv.

SHELL (dorsal side) nearly semicircular, from two-thirds to three fourths as long as wide; hinge equalling the greatest width of

the shell, angular at the extremities : dorsal valve convex, but much more compressed than the opposite ; mesial fold narrow, abruptly elevated, flattened or slightly grooved in the middle ; beak unknown : ventral valve very prominent at the umbo, from which it slopes abruptly to the margins ; mesial sinus narrow, deeply impressed ; sides sloping ; base flat ; beak unknown ; area high, triangular, slightly arcuate ; foramen narrow, finely striate longitudinally and transversely. Surface ornamented by about eighteen to twenty simple, regular, rounded plications on each side of the mesial fold and sinus, concentrically marked by fine closely arranged lines of growth.

The specimens of this species in my possession are somewhat imperfect; a single individual with both valves attached has the beaks imperfect. The beak of the dorsal valve projected beyond the plane of the area of the opposite valve : the high area of the ventral valve is slightly arched near the beak.

There is much general resemblance between this species and the *S. eurutines* of Owen, but the beak of the ventral valve is more arcuate, the plications finer, and the mesial sinus and fold more angular.

Geological position and locality. In limestones of the age of the Hamilton group : Illinois.

Spirifer fornax (n. s.).

Pal. N.Y. Vol. iv.

Shell semicircular, width a little more than twice the length ; hinge equalling the greatest width of the shell, angular at the extremities : dorsal valve depressed-convex, having a narrow depressed rounded mesial fold, sloping from the beak very abruptly with a slight curve to the front and sides : ventral valve having the sinus moderately broad, shallow and rounded ; beak scarcely arched ; area high, slightly arcuate, and inclined a little backwards over the hinge-line ; foramen somewhat narrow. Surface marked by fifteen to eighteen simple rounded plications on each side of the mesial fold and sinus.

I have seen this species only in the form of casts, or with a portion of the shell adhering. It resembles *S. fornacula*, from the same geological position; but it is a much larger shell, with fewer plications and a more shallow and less angular sinus. The area of the present species is proportionally less elevated. In general form it bears a resemblance to *S. macronota*, but the plications are stronger and fewer than in that species, and the area is proportionally higher and more arcuate.

Geological position and locality. Limestones of the age of the Hamilton group : Illinois.

SPIRIFER WORTHENI (n. s.).

Pal. N.Y. Vol. iv.

SHELL transversely oval, very gibbous, length more than two-thirds the width; hinge equalling the greatest breadth of the shell; extremities salient : dorsal valve semicircular, gibbous, distinctly arcuate longitudinally, rising in the middle into a very prominent rounded fold; beak and area incurved : ventral valve very convex in the region of the umbo, having a deep rounded sinus extending from beak to front, where it terminates in an obtuse triangular projection; beak arched, and projecting beyond that of the other valve; area high, strongly arcuate, transversely and longitudinally striate; foramen large, forming an equilateral triangle : about sixteen or seventeen simple rounded or subangular plications on each side of the mesial fold and sinus. Surface marked by fine radiating striæ, which are crossed by undulating lines of growth.

This fine Spirifer seems to be intermediate in form between *S. acuminata*, CONRAD (*S. cultrijugatus*, RÖMER), and *S. granulifera* of the Hamilton group, but differs from both by obvious characters. The area is much wider, and the hinge extremities more salient, than in *S. acuminata*, while the mesial fold is somewhat less elevated and much less acute; and the plications are likewise simple.

This species is more angular in outline, the valves less rotund and more unequal in size, the area larger, and the sinus and fold more angular than in *S. granulifera*.

Geological position and locality. In limestone of the age of the Hamilton group : Calhoun county, Illinois. From Mr. A. H. WORTHEN.

Spirifer eatoni (n. s.).

Pal. N.Y. Vol. iv.

Shell transversely oval, one-half to two-thirds as long as wide; hinge equalling the greatest width of the shell, obtusely angular at the extremities: dorsal valve very convex in the middle, nearly semicircular, rising into a moderately prominent rounded or slightly flattened mesial fold; beak and narrow area distinctly incurved: ventral valve the more convex, most prominent near the beak; mesial sinus moderately rounded; beak small, somewhat abruptly arcuate; area high, slightly arcuate just below the beak; foramen narrow, partly closed above by a pseudo-deltidium. Surface marked by about nineteen simple rounded plications on each side of the mesial fold and sinus, and crossed below the middle of the shell by imbricating laminæ of growth.

This shell differs from *S. granulifera* in the following characters: It is smaller, with a higher and much less arcuate area, and has no distinct longitudinal depression on the mesial fold; the mesial sinus is also smaller and more angular at the margins, while the beak of the ventral valve is less arched and prominent.

The only specimens I have seen of this species are somewhat exfoliated; so that I have no means of determining positively the character of the finer markings of the surface, but it was probably granulated as in *S. granulifera.*

In form and in the number of plications, this species approaches *S. eurutines* of Owen; but it differs in having the beak and area of the ventral valve more arched, the lateral slopes of the area more rounded, the dorsal valve more convex, and the shell generally thinner.

Geological position and locality. Hamilton group, Erie county; and shores of Seneca lake.

Spirifer clintoni (n. s.).

Pal. N.Y. Vol. iv.

Shell semicircular, gibbous in the central region, much compressed at the extremities of the hinge, width nearly twice the length;

hinge equalling the greatest breadth of the shell, and terminating in salient angles : dorsal valve convex; mesial fold prominent, rounded, marked along the middle by a distinct narrow sulcus; beak incurved : ventral valve convex, most prominent at the umbo, sloping somewhat abruptly with a convex curve to the front and anterior lateral margins; mesial sinus angular, extending from the beak to the front, where it terminates in a rounded projection; beak pointed, slightly arched; area moderately high, vertically and transversely striate, arcuate, and sloping from the beak to the extremities of the hinge with a concave curve. Surface marked by nineteen or twenty simple rounded plications on each side of the mesial sinus and fold, and crossed by fine regular concentric lines of growth.

This species may be distinguished by its general neatness and symmetry of form, and the distinct sulcus along the middle of the smoothly rounded mesial fold of the dorsal valve, as well as by the angular character of the sinus of the ventral valve. Sometimes the sloping sides of the ventral sinus show very faint indications of an obtuse flattened fold on each side of the much more distinct angular depression down the middle, so as to give to the sinus, when viewed in some lights, a subplicate appearance. This latter character is, however, often very obscure, and may be overlooked.

Geological position and locality. In the shales of the Hamilton group at Eighteen-mile creek, Erie county, N.Y.

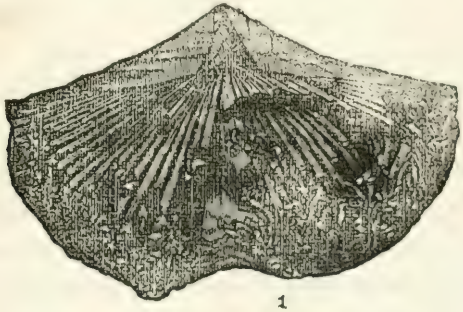
SPIRIFER MARCYI* (n. s.).

Pal. N.Y. Vol. iv.

SHELL semicircular, width about twice the length; hinge equalling the greatest breadth of the shell, and terminating in more or

* NOTE. At the same time that I receive this proofsheet from the printer, I also learn of the sudden death of Ex-Governor MARCY, to whom I had dedicated this species as a very slight tribute of my profound respect and esteem, though an entirely inadequate expression of the obligations due from science to this eminent statesman, to whom the State of New-York is indebted for the liberal and impartial organization of her Geological Survey; to which, it may be said without prejudice to others who have since done nobly, is mainly due many of the most valuable results to modern science, and the high character acquired by the State for the scientific achievements her generous patronage has called forth.

less salient angles : dorsal valve moderately convex ; mesial fold narrow above and somewhat expanded in front, depressed and scarcely rounded, extending to the apex of the beak, and marked along the middle by a faint linear depression which is sometimes obsolete ; beak and narrow area scarcely incurved : ventral valve the more convex, most prominent in the umbonal region, from which it slopes with a regular convex curve to the front and anterior lateral margins ; beak somewhat vertically compressed, arched ; sinus well defined, shallow, flat in the bottom ; area moderately broad, extending quite to the ends of the hinge, sharply angular along the margins between the beak and the extremities, slightly arcuate backwards beyond the hinge-line ; foramen of medium size, narrow triangular; lateral slopes of the valves marked by about twenty-three to twenty-five simple rounded plications on each side of the mesial fold



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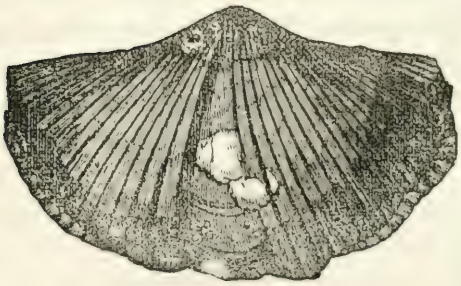

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SPIRIFER MARCYI.

It is twenty years since the writer was commissioned by Governor MARCY to the charge of the Fourth Geological District of New-York, including that part of the State west of Cayuga lake; and since that time, has had the satisfaction of knowing him as a true and personal friend.

and sinus. Surface marked by very fine obscure radiating striæ, which are crossed near the borders by small, closely arranged, subimbricating lines of growth. Fine distant granules are distributed over the whole surface, and most conspicuously in the sinus and between the plications.

This shell may be readily distinguished from *S. granulifera*, with which it is associated, by its less gibbous form, shallower sinus, more depressed mesial fold, and much less distinctly arcuate beaks. Under a magnifier, the granulations of the surface are always seen to be much more scattered than on *S. granulifera;* while the plications are narrower and more numerous, and more abruptly elevated above the general surface.

This species is among the finest of the Hamilton spirifers, and superior in size and beauty to all except the *S. granulifera.*

Geological position and locality. In shales of the Hamilton group: Covington, Genesee county.

SPIRIFER CORTICOSA (n. s.).

Pal. N.Y. Vol. iv.

SHELL semicircular, more than half as long as broad; hinge nearly or quite equalling the greatest width of the shell: dorsal valve unknown: ventral valve convex; sinus deep and well defined, extending from the apex of the beak to the front, where it terminates in a short rounded projection; beak incurved; area narrow and arcuate; foramen small; plications simple and rounded, numbering about ten to twelve on each side of the sinus. Surface ornamented by very fine closely arranged concentric striæ, and stronger more distant imbricating marks of growth.

This is a rare species, of which I have yet seen no perfect individuals. In its narrow area, it resembles *S. mucronata;* but the beak is more arched, the sinus deeper, the plications stronger and less numerous, while the concentric lamellæ are equally strong but less sharply arched over the plications. Single valves may be distinguished by the absence of a slight elevation along the centre of the sinus, which marks the well-preserved specimens of *S. mucronata.*

Geological position and locality. In the shales of the Hamilton group, near Darien, Genesee county.

Spirifer arata (n. s.).

Pal. N.Y. Vol. iv.

Cast of interior transversely oval or oblong, gibbous; valves nearly equal; hinge nearly or quite equalling the greatest width, rectangular at the extremities; front broadly sinuate in the middle: dorsal valve convex, rising gradually into an indistinct mesial fold, which is marked along the middle by a profound sulcus from near the beak to the front; beak incurved: ventral valve very convex at the umbo; mesial sinus broad subangular, not strongly defined at the margins, extending from the beak to the front, where it terminates in a broad rounded projection; beak elevated (?); area high, sloping from the beak to the extremities, slightly arcuate and inclined back beyond the hinge; foramen large, having the form of an equilateral triangle; lateral slopes of the valves marked by about fifteen flattened or depressed plications, which are separated by small linear depressions. A few strong imbricating wrinkles of growth mark the valves near the margins.

This species bears some general resemblance to *S. granulifera*, but is smaller than that species usually occurs, is less elevated in front with a proportionally broader sinus, and is well marked by the strong groove down the mesial fold: the plications are also more flattened, and separated by linear grooves. These characters, with others, seem quite sufficient to distinguish the species, even in the form of casts.

This species corresponds in some respects with *Spirifer* (*Delthyris*) *duplicata*, Conrad (Jour. Acad. Nat. Sci. Phila., Vol. viii, pa. 261, pl. 14, f. 16); but the superior valve is more gibbous or ventricose, and the ribs are not angulated. Since no allusion is made to the ventral valve or area, it is probable that Mr. Conrad described his species from a single valve.

Geological position and locality. In the shales of the Hamilton group, Otsego county.

SPIRIFER TENUIS (n. s.).

Pal. N.Y. Vol. iv.

SHELL very thin and fragile, transversely oval, two-thirds to three-fourths as long as broad; hinge about equalling the greatest width of the shell, obtusely angular at the extremities: dorsal valve convex; mesial fold broad, rounded (?), and marked the whole length by a strong sulcus: ventral valve the more convex, most prominent near the umbo; mesial sinus broad, giving a sinuous outline to the anterior border, undefined at the margins, and having along the middle a deep groove, and on each side several indistinct folds; beak unknown; area high, longitudinally and transversely striate, arcuate, and extending obliquely beyond the hinge line; foramen moderately large; lateral slopes of the valves ornamented by about eighteen or nineteen very obtuse simple plications on each side of the mesial sinus and fold: those on the dorsal valve more distinct than those on the ventral, which do not reach the margin of the shell. Surface marked by fine nearly obsolete radiating striæ, which are raised at intervals into granulations or papillæ: these are crossed by stronger, closely arranged, irregular, concentric lines of growth.

This species, in general form, agrees with the last (*S. arata*); but is less rotund, and the shell less elevated by the sinus in front. The longitudinal furrow along the centre of the mesial fold corresponds to that species; but the plications are more rounded with broader spaces between them, and they are scarcely conspicuous on the ventral margin of the dorsal valve, and on the ventral valve are scarcely distinct below the middle of the shell. The sinus is undefined at the margins, and the concentric lines very closely arranged, giving the surface rather the aspect of *Spirigera* or *Merista* than of *Spirifer* proper.

Geological position and locality. In the shales of the Hamilton group: Cumberland, Maryland.

Spirifer pertenuis (n. s.).

Pal. N.Y. Vol. iv.

Shell extremely fragile, transversely oval, gibbous, about three-fourths as long as broad; hinge equalling the greatest width of the shell, more or less angular at the extremities according to age: dorsal valve regularly convex; mesial fold of medium breadth, rounded and somewhat depressed above, sometimes having a faint depression along the middle: ventral valve the more convex, most prominent at the umbo, from which it slopes abruptly with a slight convex outline to the front and lateral margins; mesial sinus shallow, rounded, with faint indications of plications; beak unknown; area moderately high, more or less arcuate; foramen higher than wide. Shell marked by about twenty-three simple depressed and rounded plications on each side of the mesial fold and sinus. Surface ornamented by faint traces of fine irregular radiating striæ, which are studded with fine granulations, and crossed by very fine, regular, undulating, concentric lines of growth, arching gently upwards on the mesial fold.

This species is remarkable for the extreme tenuity of the shell. It differs from the preceding species (*S. tenuis*) in the more conspicuous as well as more numerous plications, and the less conspicuous concentric lines of growth. The mesial sinus is more distinctly defined at the margins, and the slight depression on the mesial fold differs extremely from the broader and deeper one of the preceding species. In the last-named character, as well as in its more numerous plications and more strongly defined mesial sinus and fold, it differs very conspicuously from *Spirifer arata*.

Geological position and locality. In the shales of the Hamilton group near Cumberland, Maryland.

Spirifer granulifera.

Delthyris granulifera, Hall: Geol. Rep. 4th Dist. N.Y. 1843, p. 207, f. 1.
Delthyris congesta, Hall: Idem.

An examination of a large number of specimens of the *S. granulifera*, in various phases of preservation, has convinced me of the identity of this

species with *S. congesta*. The specimen from which the latter was described is a very symmetrical and rotund form, in which the depression on the mesial fold is scarcely marked; while the surface has been in a slight degree worn and exfoliated, so that the little granules or bases of spines are nearly obliterated, leaving a striated surface, which is in some parts cancellated by concentric lines.

The figures 1 and 1 *a* represent two views of a specimen having the granulations preserved upon the shell.

Fig. 1 *b* is from a specimen with more extended hinge-line.

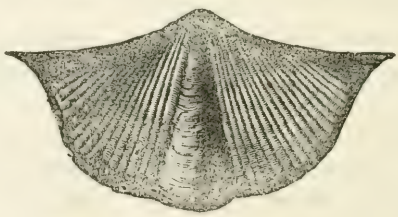
Fig. 2 *a* and 2 *b* are views of the specimen designated *S. congesta* as above.

These figures, reduced in size and beautifully executed, appear in MARCOU'S Explanatory Text, etc., pl. 3, f. 7, as *S. heteroclitus*, DEFRANC. It is scarcely necessary to say that this species has very little resemblance to *S. heteroclitus*.

SPIRIFER MEDIALIS.

Delthyris medialis, HALL: Report, 4th Geol. Dist. N.Y. 1843, p. 208, f. 8.

The figure below is of the dorsal valve entire at the extremities.



SPIRIFER MEDIALIS.

SPIRIFER ANGUSTA (n. s.).

SHELL extremely transverse; lateral extremities very attenuated; hinge-line about four times as long as the width of the dorsal valve: dorsal valve with a simple mesial fold, and about fourteen or fifteen simple narrow plications on each side; beak and cardinal margin incurved: ventral valve about two-thirds as wide as the dorsal valve, with a sharp well defined

mesial sinus; plications on each side very oblique; area equalling or exceeding the ventral valve, receding from the hinge-line towards the front of the shell, and thus narrowing the exterior area of the ventral valve.

This is a well marked species, the most conspicuous feature of which is the very narrow ventral valve, which, in the specimen figured is less than the area in width; while the dorsal valve is much wider in the middle, and curves somewhat gradually towards the extremities.

Geological position and locality. In shales of the Hamilton group: Covington, Genesee county.

Spirifer angusta.

Cyrtia biplicata (n. s.).

Pal. N.Y. Vol. iv.

Shell triangular pyramidal, about twice as broad as long; hinge not quite equalling the greatest width of the shell, subangular or a little rounded at the extremities: dorsal valve unknown: ventral valve extremely prominent at the beak, from which it declines abruptly to the sides and front, having a moderate sinus extending to the apex of the beak, and bounded on each side by a single ridge or plication; beak attenuate and pointed, not arched, removed from the hinge by the intervening high, slightly arcuate, triangular area; foramen very narrow and closed. Surface apparently smooth.

The specimen examined is not entire; but so far as can be determined, it presents the remarkable characteristic of a single sharply angular plication upon each side of the sinus. If other plications existed, they probably extended but little beyond the margin of the shell.

Geological position and locality. In limestones of the Upper Helderberg group, Erie county, N.Y.

CYRTIA HAMILTONENSIS (n. s.).

Pal. N.Y. Vol. iv.

SHELL more or less obliquely triangular pyramidal; hinge equalling the greatest breadth, and obtusely angular at the extremities: dorsal valve depressed, nearly flat; beak scarcely elevated above the hinge-line; mesial fold small, bounded on each side by deeper and wider grooves than those between the plications, with sometimes a faint narrow longitudinal depresssion in the middle: ventral valve very convex, most prominent near the beak, which is very variable in elevation, and either straight or a little arched from the hinge, sometimes twisted on one side; sinus distinct, rounded or angular; area variable, triangular, generally high, often wider than high, arcuate or plane, finely striate in both ways, the vertical striæ scarcely visible; foramen very narrow, usually perforate above by an oval or narrow ovate aperture, and has at its base a small transverse arcuate slit. Surface ornamented by six to eight simple rounded plications on each side of the mesial fold and sinus, and marked by very fine concentric lines of growth. Under a good lens minute granules may be seen on all parts of the exterior except the area and deltidium: interior minutely punctate.

This species may be distinguished from the *C. dalmani* of the Lower Helderberg limestones, by never showing the strongly imbricating lamellæ of growth which mark that species. It is, however, more nearly related to *Cyrtia (Spirifer) heteroclitus*, VON BUCH; and until we know the limits of the variation in that species, it will be very difficult to point out characters by which our shell can be distinguished from it.

Geological position and locality. In the shales of the Hamilton group: Shores of Seneca lake, Moscow, York, Darien, and Eighteen-mile creek.

CYRTIA HAMILTONENSIS.

Orthis umbonata.

Orthis umbonata, Conrad : Journal Acad. Nat. Sci. Philadelphia, Vol. viii, 1842, pa. 264, pl. 14, f. 21.

Shell semielliptical in outline, with a prominent beak, plano-convex : dorsal valve slightly concave below, convex at the umbo : ventral "valve profoundly ventricose, with a narrow longitudinal sulcus;" umbo extremely elevated; beak abruptly incurved; hinge-line greater than the width of the shell below, slightly rounded at the extremities.

Geological position and locality. In the shales of the Hamilton group : at Moscow, Darien, shore of Lake Erie, at Eighteen-mile creek, and generally distributed in Western New-York.

Orthis umbonata.

Orthis præumbona (n. s.).

Shell plano-convex : dorsal valve slightly convex, much shorter than the opposite, height and width about as three to four, rounded at the cardinal extremities : ventral valve extremely gibbous and highly arcuate; umbo rising much above the hinge-line; beak small, strongly incurved; mesial portion often flat and sometimes depressed beneath the umbo. In some specimens, a narrow slightly depressed line extends from near the beak to the base of the shell. Surface marked by fine radiating and concentric lines, which, under a magnifier, give it a finely cancellate appearance.

This shell has a general resemblance in form to *Orthis umbonata;* but it is a much larger species, has the beak proportionally more slender, the cardinal extremities rounded, and the mesial sinus of the ventral valve (a marked feature in *O. umbonata*) rarely defined and never conspicuous.

Geological position and locality. In the dark shales of the Hamilton group : Shores of Seneca lake below Lodi.

ORTHIS SUBUMBONA (n. s.).

SHELL somewhat plano-convex : dorsal valve nearly flat; cardinal extremities rounded : ventral valve very convex, gibbous, length and height nearly equal; hinge-line scarcely equal the greatest width of the shell; beak little extended above the hinge-line, abruptly incurved. Surface concentrically striated.

This shell resembles the *Orthis præumbona;* but is much smaller, less elongated, the length and width being nearly equal, and the beak much shorter and more abruptly acute.

Geological position and locality. In calcareous layers in the shales of the Hamilton group : Shores of Seneca lake and of Lake Erie.

ATRYPA ASPERA.

Atrypa (*Terebratula*) *aspera*, SCHLOTHEIM : Petrefactenkunde, pa. 263, pl. xviii, f. 3.
Atrypa spinosa, HALL : Geol. Rep. 4th Dist. 1843.

There is propably no specific difference between the European species and those from the Hamilton group of New-York. Specimens from the shales of the Hamilton group in Iowa present some variation in form and characters from those of New-York, while they approach more nearly the European specimens in my collection.

ATRYPA HIRSUTA (n. s.).

SHELL somewhat depressed orbicular in the young state, becoming trilobate and more gibbous in older specimens; sinus and mesial elevation strongly marked towards the front; valves nearly equally convex; beak of ventral valve perforated. Surface marked by from thirty-six to forty simple well defined radiating striæ or plications, which are crossed by fine concentric striæ and a few distant imbricating lamellæ of growth. Entire surface covered by extremely fine hair-like spines, which, on removal, leave a finely granulated surface.

The shells are usually denuded of the spines, and present the general appearance of young individuals of *A. reticularis;* but the plications are

finer, and under a magnifier they present the granulated surface which sufficiently distinguishes them from all other species in our strata.

Geological position and locality. Shales of the Hamilton group : Moscow, Livingston county ; and Darien, Genesee county.

SPIRIFERÆ OF THE CHEMUNG GROUP.

Spirifer textus (n. s.).

Pal. N.Y. Vol. iv.

Shell large, somewhat thin, semicircular or sub-semicircular, one-third to one-half as long as broad ; height often greater than the length ; hinge equalling the greatest width of the shell, and terminating in more or less salient angles at the extremities : dorsal valve convex, most prominent near the front, rising in the middle into a rounded mesial fold, which diminishes regularly and somewhat rapidly from the front ; beak, together with the narrow area, distinctly arched : ventral valve much more convex, very prominent at the umbo, from which it slopes at an angle of about 100° towards the lateral margins, and more abruptly to the front ; mesial sinus deep, rapidly increasing from beak to front, where it occupies about one-fourth of the anterior margin, terminating in a broad projection with a rounded extremity ; beak angular, far removed from the hinge by the high intervening area, nearly straight or slightly arched towards the extremity ; area very large and high, plane below ; foramen large triangular, about two-thirds as broad as high. Surface marked by about twenty simple depressed and rounded plications on each side of the mesial fold and sinus : plications crossed by fine irregular undulating concentric lines of growth. Entire surface delicately and beautifully marked by minute elongated pits, so disposed as to present under a magnifier the appearance of twilled cloth.

This fossil has been regarded as identical with *S. cuspidatus* of Martin ; but the much greater number of plications, as well as the peculiar surface

character, not mentioned in the description of that species, are sufficient to entitle this one to rank as a distinct species.

If we may rely upon the figures and descriptions of the best European authorities, our specimens have as many as eighteen or twenty more plications than *S. cuspidatus.*

Geological position and locality. In the fine-grained sandstone of the age of the Chemung group, at the "Knobs," near New-Albany, Indiana.

SPIRIFER CARTERI (n. s.).

Pal. N.Y. Vol. iv.

SHELL somewhat semicircular, generally more than half as long as wide; extremities nearly rectangular, in young individuals more salient : dorsal valve convex; mesial fold smoothly rounded, sometimes marked by a faint longitudinal depression along the middle; beak and area incurved : ventral valve the more convex, most prominent a little below the beak; mesial sinus rather deep, rounded, and extending quite to the apex of the beak; area high, arcuate, longitudinally and transversely striated; foramen large, triangular; beak obtusely angular and arched : lateral slopes of the valves marked by about nineteen or twenty simple rounded somewhat depressed plications on each side of the mesial fold and sinus; plications crossed by concentric lines of growth.

This species is known to me only in casts, and as impressions of the exterior shell. Some of the specimens show, under a magnifier, in addition to the surface markings mentioned above, faint traces of a peculiar ornamentation resembling very nearly in character that of the *S. textus.*

This fossil differs from that just named, in having comparatively a much smaller, less elevated, and more arcuate area : the beak is more arched, and the lateral slopes of the area less angular. The impression left in the matrix indicates it to have been a thinner shell than *S. textus.*

Geological position and locality. In the Waverly sandstone of the age of the Chemung group : Licking county, Ohio.

PRODUCTI OF THE HAMILTON AND CHEMUNG GROUPS.

The number of species of Productus in the shales and shaly sandstones of the Hamilton and Chemung groups is greater than usually supposed. The following, with one or two exceptions, have been in my collection for many years, awaiting the completion of the fourth volume of the Palæontology of New-York. Among these are several forms which have externally the characters of *Strophalosia*; but I have been unable to discover any cardinal area in any of them, while in several species it is quite certain that no such area could have existed. Several of these species have a wide geographical distribution, but the larger number are very restricted in their range so far as at present known.

These forms are interesting, as being the earliest representatives of that type of Brachiopoda which so peculiarly marks the Carboniferous period; and we shall probably yet find that the number of species marking each of these groups is scarcely less than the number marking each of the subordinate divisions of the Carboniferous limestone.

Productus truncatus (n. s.).

Pal. N.Y. Vol. iv.

Shell small; hinge-line usually equalling the greatest width of the shell : dorsal valve concave near the margin, elevated in the middle, and abruptly depressed or truncate towards the beak : ventral valve ventricose, most elevated just below the umbo, and sloping abruptly to the front; beak incurved, truncate (often impressed) at the extremity; margin near the hinge marked by a few strong wrinkles gradually becoming obsolete on the body of the shell, which is crossed by undulating striæ of growth, and sometimes apparently with radiating striæ. Surface ornamented with several interrupted rows of

spines; a single row just below and parallel to the hinge margin.

This little shell is very abundant in the calcareous shales, where the ventral valve is preserved, while I have seen but a few imperfect specimens of the dorsal valve. The abruptly gibbous form, and truncated or impressed beak and umbo, are characteristic features. In some larger specimens with truncated beaks, from other localities, there are a few elongated spiniferous ridges near the base. It is possible that these may be distinct species.

Geological position and locality. In the calcareous shales near the base of the Hamilton group : Schoharie and Onondaga counties, and shore of Lake Erie above Buffalo, New-York.

PRODUCTUS ——.

Pal. N.Y. Vol. iv.

Strophomena pustulosa, HALL : Rep. 4th Geol. Dist. N.Y. 1843, p. 180, f. 4.

This small species of productus is scarcely larger than the *P. truncatus*, but the surface characters and extension of the hinge-line give the shell a very different aspect.

PRODUCTUS NAVICELLA (n. s.).

Pal. N.Y. Vol. iv.

SHELL subelliptical, length greater than the width; hinge-line less than the width of the shell : ventral valve extremely gibbous in the middle, abruptly bent downwards in front; beak extremely incurved; umbo projecting beyond the hinge-line nearly one-third the entire length of the shell. Surface marked by concentric undulating striæ and interrupted longitudinal ridges, which are garnished with small, round, abruptly projecting spines, and sometimes with spines between the ridges.

The distinguishing features of this species are the elongated form, short hinge-line, and extremely incurved beak and umbo. The spines are small and rigid, rising abruptly from the surface, and not always upon the short interrupted ridges, though usually so.

In general form and elevation of the beak and umbo, this species is not

unlike the variety of *P. undiferus* figured by DE KONINCK (*Recherches sur les Animaux fossiles*, pl. xi, f. 5 a, b, c); but the hinge-line is less extended, and the surface exhibits no regularly radiating costæ as in that species.

Geological position and locality. Shales of the Hamilton group : Moscow, N.Y.

PRODUCTUS SPINULICOSTÆ (n. s.).

Pal. N.Y. Vol. iv.

SHELL semiorbicular, width and length about equal; hinge-line generally a little less than the greatest width of the shell : dorsal valve marked with spiniferous ridges, which are sometimes continuous from the middle to the base of the shell : ventral valve extremely gibbous in the middle; beak incurved. Surface marked by fine concentric lines, which are sometimes crowded and wrinkled on the body of the shell, ornamented with several rows of short radiating interrupted ridges, each one of which is furnished with a small spine : a row of four or five spines along the hinge-line below the margin, which are often continued along the sides of the shell, and sometimes along the front, entirely or partially independent of the spiniferous ridges.

The distinguishing characters of this species are the nearly semiorbicular form, and somewhat regular alternating distribution of the radiating elongated spiniferous tubercles. The length and breadth is from one-half to three-fourths of an inch.

This species bears some resemblance to the smaller forms of *P. murchisonianus* given by DE KONINCK (pl. xvi, f. 3 *d*, *e*); but I regard it as distinct. The *Strophomena membranacea* of VANUXEM, referred by DE KONINCK to the same species, is entirely distinct from the one under consideration. The figures of DE VERNEUIL (Russia and the Ural Mountains, Vol. ii, pl. xviii, f. 4) are much more like a species found in the shales and limestones of the Hamilton group in Illinois, Missouri, etc., and which I regard as quite distinct from those of New-York. The present species bears some resemblance to fig. 99, pl. xxv, PHILLIPS, Pal. Fossils, but not to the other figures of that author cited by DE KONINCK.

Geological position and locality. In calcareous bands in the Hamilton group : Shores of Cayuga lake, etc.

PRODUCTUS EXANTHEMATUS (n. s.).

Pal. N.Y. Vol. iv.

SHELL semioval; hinge line scarcely equalling the greatest width of the shell : dorsal valve one-third wider than high, slightly concave, entire surface pustulose.

A single valve only of this species has fallen under my observation; but the characters are so distinct from either of the other species, that I cannot hesitate to separate it from them.

A specimen from Bakeoven, Illinois, occurring in limestone of the age of the Hamilton group, is very similar if not belonging to this species. I presume it to be the one referred by Messrs. NORWOOD and PRATTEN to P. *subaculeatus;* while another form, with elongated pustulose ridges, is probably the one referred by the same authors to *P. murchisonianus.* The spiniferous ridges in the latter species are often continuous for more than half the length of the shell above the base, in which character it is similar to *P. spinulicostæ;* but the absence of an area, as well as other characters, render it impossible to regard either of these as identical with *P. murchisonianus.*

Geological position and locality. Shales of the Hamilton group : Shore of Seneca lake, Ontario county.

PRODUCTUS SUBALATUS.

Pal. N.Y. Vol. iv.

Productus subalatus, HALL : Iowa Geol. Report, 1857.

SHELL semielliptical, with the cardinal extremities alate : ventral valve gibbous in the middle, depressed in front, and much expanded laterally towards the cardinal extremities; beak abruptly incurved, the umbo projecting above the hinge-line; the cardinal margin marked by more or less distinct folds or wrinkles, becoming obsolete on the middle of the shell, which is crossed by irregular or undulating concentric striæ. In some individuals, indistinct longitudinal striæ are visible. Surface ornamented by numerous strong rounded tubular spines, the bases of which remain irregularly distributed. Some well preserved specimens show a distinct row of spines near the cardinal margin, while

those nearest the beak are small, and actually upon the edge of the shell, as in *Chonetes*.

The characteristic features of this species are the great expansion on the hinge-line, and the auriculate or alate cardino-lateral margins; also the strong, round spines, without ridges or tubercles.

In some specimens, the spines near the beak and umbo are distributed somewhat regularly in radiating lines. The number of spines varies from ten or twelve to thirty or forty; and it is only in rare instances that they are preserved near the beak.

Geological position and locality. Shales of the age of the Hamilton group : Rock Island, Illinois, and various localities in Iowa.

Productus hirsutus (n. s.).

Pal. N.Y. Vol. iv.

Strophomena membranacea, Vanuxem : Rep. 3d Geol. Dist. N. York, p. 178, f. 4 and 5.

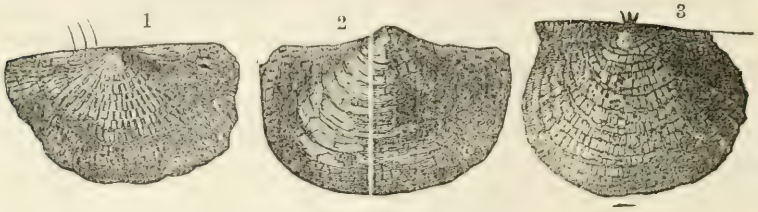
Not *Productus membranaceus*, Von Buch.

Leptæna membranacea, Phillips.

Shell semielliptical, often oblique; hinge-line usually a little longer than the greatest width of the shell : ventral valve moderately gibbous, with cardino-lateral extremities not distinctly separated from the body of the shell, expanded with a marginal or submarginal row of strong spines. Surface concentrically striated and covered by closely arranged, delicate, hair-like spines, except a small space on each side of the umbo, which is sometimes destitute of these appendages.

This species has the ears less distinctly separated from the body of the shell than *P. lachrymosa*, and the hinge-line more extended. It was identified by Mr. Vanuxem with the european *P. membranacea;* and the shell, with the spines removed and preserving the strong concentric striæ, has a membranaceous texture. In its slender spines it resembles *P. murchisonia*, but the greater extension of the hinge-line, absence of area and more closely arranged spines are marked differences. The interior of the ventral (dorsal) valve differs most extremely from the figure given by de Koninck.

Geological position and locality. Shales of the Chemung group: Allegany and Chemung counties, New-York.



PRODUCTUS HIRSUTUS.

PRODUCTUS SPECIOSUS (n. s.).

Pal. N.Y. Vol. iv.

SHELL semiglobose, hinge-line less than the greatest width of the shell, extremities rounded or obtusely angular: dorsal valve very regularly concave, flattened somewhat at the hinge extremities, and the ears marked by a few concentric wrinkles; hinge furnished with a small bifurcate dental process: ventral valve ventricose, extremely arcuate, regularly and symmetrically diminishing from the base to the beak, which is incurved beyond the hinge-line; ears not flattened, narrow, scarcely distinct from the body of the shell; basal margin sinuate, but the shell without a mesial depression. Surface marked by fine concentric striæ and thickly studded with regularly arranged, small, somewhat elongated, spiniferous tubercles. Casts of the shell finely and closely punctate.

This species is distinguished from all its associates by the symmetrical form and extremely ventricose character of the ventral valve, its regular convergence from front to beak and the sinuate basal margin. The spiniferous tubercles were doubtless furnished with slender, bristle-like spines.

Geological position and locality. Calcareous bands in shaly sandstones of the Chemung group: Chautauque county, N.Y.

Productus lachrymosus.

Pal. N.Y. Vol. iv.

Strophomena lachrymosa? Conrad : Jour. Acad. Nat. Sci. Philadelphia, 1842.

Shell semielliptical : ventral valve moderately gibbous, flattened along the middle; cardinal extremities abruptly depressed and flattened, ornamented with one or more rows of spines; beak elevated above the hinge-line. Surface marked by very elongated spiniferous tubercles, which sometimes have an appearance of bifurcation.

This is the only species known to me, which I am able to refer to the description and figure of Mr. Conrad. In a single well preserved specimen, the centre of the shell is moderately gibbous, a little depressed in the centre, with the ears abruptly flattened, not salient, the sides straight, etc. This species being from the same locality as that described by Mr. Conrad, I have presumed that it may be the same, notwithstanding the want of strict agreement with his figure and description.

Geological position and locality. In the arenaceous shales of the Chemung group : Chemung Narrows, N.Y.

Productus arctirostratus (n. s.).

Pal. N.Y. Vol. iv.

Shell somewhat elliptical : dorsal valve deeply concave; ears broad, with a few strong concentric wrinkles, irregularly marked towards the margin of the shell by strong radiating striæ, which are furnished with delicate spines : ventral valve very gibbous or ventricose and arcuate; beak attenuate, much elevated and curved over the hinge-line; a broad, shallow mesial depression extends from the most prominent part of the umbo to the base; ears abruptly separated from the body of the shell, contracted and somewhat deflected. Surface marked by strong radiating striæ or plications, crossed by fine concentric lines, and garnished as in the other valve by numerous fine bristle like spines.

This shell in its delicate spines bears some resemblance to *P. hirsutus;* but the hinge-line is proportionally shorter, the beak much more attenuate, the umbo narrower, more ventricose and much more incurved; while the surface is strongly striated longitudinally.

Geological position and locality. Calcareous sandstone of the Chemung group : Steuben county, N.Y.

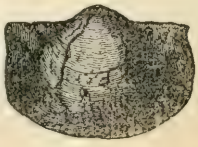
PRODUCTUS RARISPINÆ (n. s.).

Pal. N.Y. Vol. iv.

SHELL semielliptical, length and height nearly equal; hinge-line about equalling the greatest width of the shell : ventral valve extremely gibbous or ventricose; lateral extremities abruptly deflected, and marked by two or three strong concentric folds which become obsolete upon the body of the shell; mesial region broadly flattened or slightly depressed. Surface marked by fine concentric striæ, and sometimes apparently by fine radiating striæ, the cardino-lateral margins or ears having a few strong spines irregularly disposed : a few scattered spines also mark the mesial depression.

This species differs from the last in the greater gibbosity of the ventral valve, the deflected cardinal extremities, the broad flattened or depressed mesial region and the scattered spines. It bears some resemblance to DE KONINCK'S figures of *P. orbignianus*, but it has fewer spines and no defined sinus.

Geological position and locality. Shales of the Chemung group : Allegany county, N.Y.



PRODUCTUS RARISPINÆ.

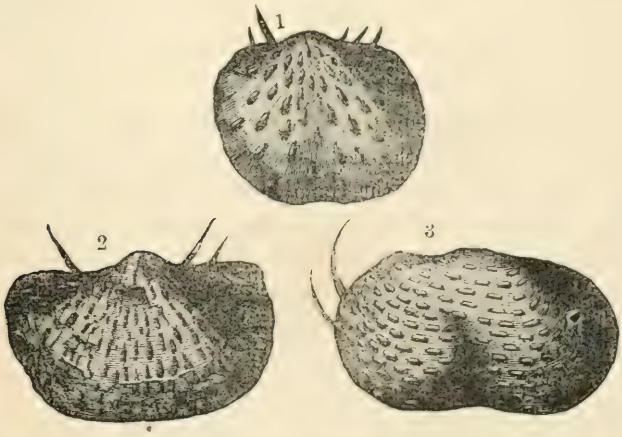
Productus boydii (n. s.).

Pal. N.Y. Vol. iv.

Shell varying from semielliptical to transversely broad-oval; hinge-line usually shorter than the width of the shell, and rounded at the extremities : ventral valve ranging from moderately convex to gibbous in the middle and umbonal regions, marked down the centre by a shallow and sometimes well-defined sinus. Surface concentrically striated and ornamented by numerous radiating lines of tubercles, which in perfect specimens are surmounted by strong curved spines; cardinal and lateral margins garnished with a row of strong curved spines; vascular impression bilobed, deeply striated, reaching to the middle of the shell : surface of cast finely punctate.

This species is readily distinguished by the strong, rather distant spiniferous tubercles, which are often arranged in distinct radiating lines; by the shallow mesial sinus in the ventral valve, short hinge-line and strong curving spines. Although in form the proportions of height and width vary extremely, the general surface characters are always reliable, and there are no gradations which pass to other species.

Geological position and locality. Shaly sandstones of the Chemung group : Allegany county, N.Y.



Productus boydii.

PRODUCTUS NEWBERRYI (n.s.).

SHELL semielliptical in outline, somewhat contracted at the cardinal extremities : dorsal valve moderately concave, a little more depressed just below the beak ; surface marked by fine closely arranged concentric striæ and numerous spiniferous ridges arranged in radiating lines, which are sometimes continuous on the lower half of the valve : ventral valve regularly convex, gibbous, not strongly arched; beak small, projecting little beyond the hinge-line ; surface marked as in the dorsal valve.

This shell reaches the dimensions of one and a half to two inches in width, with a height about two-thirds as great. It approaches in character the *P. lachrymosa* of CONRAD, but is a larger shell, with more closely arranged spiniferous ridges, and more contracted hinge extremities as well as other differences.

Geological position and locality. In shaly sandstone and calcareous sandstone of the age of the Chemung group : Medina county, Ohio.

PRODUCTUS CONCENTRICUS.

Iowa Geological Report, 1857.

SHELL small, semielliptical in outline : dorsal valve deeply concave, sometimes almost geniculate in front; hinge extremities slightly contracted ; upper half of surface marked by strong concentric wrinkles, and somewhat distant spiniferous tubercles : ventral valve unknown.

This species is distinguished by the strong concentric wrinkles which mark the upper part of the shell. The spiniferous ridges are not unlike those of *P. spinulicosta* of the Hamilton group, but they are stronger and somewhat more distant. The deeply concave character of the dorsal valve, and consequent gibbosity of the ventral valve, are characters differing from all the others with this form and surface marking.

Geological position and locality. In the argillaceous sandstone of the age of the Chemung group : Burlington, Iowa.

TO BE CONTINUED.

[The continuation of this paper will be given in the succeeding Report of the Regents of the University upon the State Collections of Natural History for 1857.]

ON THE GENUS TELLINOMYA, AND ALLIED GENERA;

WITH ILLUSTRATIONS :

BY PROFESSOR JAMES HALL.

[From the Canadian Naturalist and Geologist : Conducted by E. Billings.]

In the investigations of palæozoic fossils, it often happens that the most important parts for the determination of the generic characters are obscured or entirely hidden by the adhering stony matter : this is particularly true of the Gasteropoda and Lamellibranchiata, and the generic characters are often necessarily derived from the external features of the shell. It is not always possible to make these determinations with such accuracy that further discoveries will not show the necessity of some modification. Were the descriptions of the genera and species of the lamellibranchiate shells of the palæozoic rocks left until the hinge and teeth, the pallial and muscular impressions, could be determined, comparatively few would be described.

In the first volume of the Palæontology of New-York, several new genera were proposed, and among them the Genus Tellinomya, which is the subject of the present notice. This genus was constituted to include several species, supposed to be related to each other from external characters : these characters were suggestive of *Tellina* and of *Mya*, and the name adopted accordingly.

In the specimens known to me at that time there were no visible teeth or crenulations in the hinge-line, and this fact was stated in the description. Subsequently I obtained some specimens which suggested other relations than those indicated by the generic name. No opportunity has occurred of correcting the original description; while in the mean time the species have been referred by palæontologists to other genera, and in some instances to those of very different character*.

* M. d'Orbigny refers the species of *Tellinomya*, described in the first volume of the Palæontology of New-York, to the Genus *Lyonsia* of Turton, a modern shell belonging to a very different family ; and to add still more to the confusion, the same author has placed the species *Modiolopsis* also under the Genus *Lyonsia*. In this reference he has been followed by *one* American author, who, " for a corrected

More recently the extensive collections of the Canada Geological Survey have furnished some beautiful examples, showing in a most perfect manner the structure of the hinge, and the muscular impressions of several species of this genus.

In the mean time, a specimen taken to London by SIR WILLIAM E. LOGAN has been noticed as a new genus by Mr. SALTER, under the name of *Ctenodonta*.

The shell upon which Mr. SALTER founded this genus is a species of *Tellinomya*, closely allied to the *T.? nasuta* of the Trenton limestone. Mr. WOODWARD, in his "Treatise," places the Genus *Ctenodonta* as synonymous with *Isoarca* of MUNSTER; while according to PICTET, it would be placed under the Genus *Nucula*.

The character of the hinge of *Tellinomya nasuta*, and of *T. dubia*, represented in the accompanying figures, shows that it bears a close relation to *Nucula*, and that it is identical with *Ctenodonta*.

The shells referable to this type have not the ventricose character, large and often subspiral beaks, of *Isoarca;* nor is the beak uniformly anterior, as in that genus. The species of *Tellinomya*, so far as known, are never cancellated, or otherwise ornamented, beyond the ordinary concentric lines of growth.

Having had an opportunity of examining the hinge, and the internal characters of at least six species, the following characters are deduced therefrom :

TELLINOMYA.

GENERIC CHARACTERS. Shell equivalve, equilateral or subequilateral, closed, smooth or marked by lines of growth; ligament external; hinge-line curved, sometimes subangular, with a continuous series of small curved transverse teeth, which diminish from the extremities to the beak, beneath which they are much smaller ; muscular impressions double, two anterior and two

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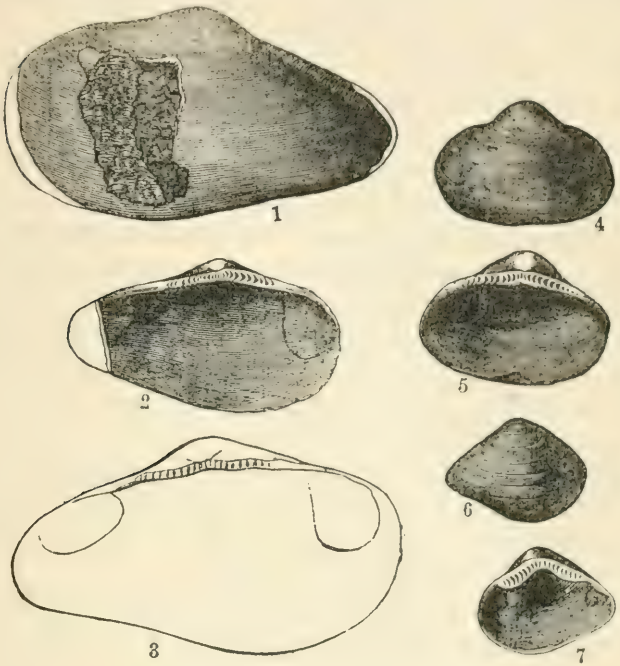
list of fossils belonging to the Lower Silurian," is in a great measure indebted to M. D'ORBIGNY !

I may mention here that the collections of the Canada Survey furnish some beautiful exhibitions of the hinge of *Modiolopsis*, which I hope to have the privilege of illustrating at no distant period.

M. D'ORBIGNY places *Nucula levata* under the Genus *Leda*, while he leaves the *N. donaciformis* under *Nucula*. Both these shells belong to the Genus *Tellinomya*.

posterior, one large and strongly impressed, the other smaller, lying above and between the larger one and the hinge-line ; pallial impression simple.



1, 2, 3 : *Tellinomya nasuta.* 4, 5 : *T. dubia.* 6, 7 : *T. cuneata**.

In the larger species known, the hinge-line is only slightly arcuate; while among the other species we find many variations in the curvature, and it sometimes becomes distinctly angular, as in *T. cuneata*. In some species the teeth on either side of the beak curve outwards from it, and in others inwards towards the beak on both sides. The teeth are often very minute immediately beneath the beaks.

The shells of this genus vary from elliptical to ovate and subtriangular forms, many of them being contracted on the posterior side ; they are usually of moderate thickness, though one species is very thick and strong. Some of the species have a distinctly impressed lunule. The lesser muscular impression is often a small pit placed directly beneath the hinge-line, and between it and the large muscular impression. The beaks are usually of medium size, pointed, rarely ventricose, approximate or in contact, never subspiral.

* The specimens above figured were collected at Pauquette's Rapids on the Ottawa River, in beds lying at the junction of the Trenton and Black-river limestones. E.B.

The relations of this shell are among the *Arcadæ*, and approximate to the *Nuculæ* in their general character, and to which genus they have usually been referred. They differ from that genus, however, in the absence of the ligamentary pit beneath the beak, and in the presence of an external ligament and double muscular impressions.

It is probable that most of the palæozoic species referred to the Genus *Nucula* belong to *Tellinomya*, except those of the Genus *Nuculites* of CONRAD, *Cucullella* of M'COY, which is distinguished by the presence of a septum in the anterior part of each valve. The place of *Tellinomya* may be regarded as between *Nucula* and *Nuculites*. In external characters it may prove difficult to separate *Tellinomya* from *Nuculites*, but the presence of the septum affords nearly the same degree of difference as that between *Cucullella* and *Arca*.

This species of the Genus *Cucullella* of M'COY are cited from Upper Ludlow rocks ; and the species of the Genus *Nuculites* of CONRAD are, with one exception*, from the Hamilton group, or rocks of the same age. We may therefore infer, with some reason, that the shells having crenulate hinge-lines, with the internal septum, occur in rocks of later date ; or, in other words, that they do not begin their existence before the Upper Silurian or perhaps the Devonian period, while the *Tellinomyæ* occur among the earliest forms of lamellibranchiate shells.

For the purpose of comparison with *Tellinomya*, and as exhibiting in some degree similar characters with that genus, as well as to show the marked identity of description in these two genera, I give below the generic characters of *Nuculites* and *Cucullella*, from the descriptions respectively of Mr. CONRAD and Professor M'COY :

NUCULITES.

CONRAD, 1841, Geol. Rep. of N. York, p. 49.

"Equivalved ; hinge with cardinal teeth as in *Nucula*, but apparently uninterrupted beneath the apex ; an interior rib like that of *Solecurtus*, but narrower, extends from the apex, either direct or slightly oblique, towards the base, never passing much beyond the middle of the valve."

"These shells have much the exterior aspect of *Nucula*, but the deep sinus in casts of some of the species, left by the interior rib, constitutes about the same amount of difference between the two genera as between

* This exception has been found to be destitute of teeth in the hinge.

Solen and *Solecurtus;* especially, as I believe to be the case, that the series of cardinal teeth is uninterrupted by a fosset, which in *Nucula* is a prominent character. This genus, so constituted, is restricted to the Silurian, and perhaps to the Carboniferous system."

CUCULLELLA.

M'Coy, Ann. Nat. History, 2d series, vol. vii, p. 50; British Pal. Fossils, p. 283, 1855.

"Generic Characters. Subrhomboidal, inequilateral, subequivalve; margin even; hinge-line entirely crenulated; muscular impressions two, with a simple pallial scar between them; a strong internal septum extends from before the beaks to the posterior margin of the adductor muscle, forming a deep slit in the casts; surface generally smooth, or nearly so."

"These palæozoic shells have been confounded with *Nucula* (Sow., Phil. &c.), from which they differ in the absence of the ligamentary pit in the hinge, and in the anterior internal septum: they have also been confounded with *Cucullea*, from which they differ in wanting the hood-like plate of the posterior adductor, and having the septum in the anterior end; and with *Clidophorus* (Geol. Surv. of Great Britain), from which they differ in having the hinge crenulated as in *Arca*."

The Genus *Lyrodesma* of Conrad was constituted to receive a small shell which occurs in the shales of the Hudson-river group, and which, but for certain restrictions in the generic description, might include those here referred to *Tellinomya*.

LYRODESMA (Conrad).

Generic Characters. "Equivalved, inequilateral; hinge-line with eight diverging prominent cardinal teeth, transversely striated."

Mr. Conrad remarks that he "was fortunate enough to obtain two fine casts of this bivalve, with the teeth remarkably well represented." The figure given by Mr. Conrad, to illustrate this fossil, shows the hinge-line with a continuous series of eight teeth. The typical species is *L. plana*.

I have refered to this genus a small shell from the Utica slate, which is nearly equilaterial, with equally rounded extremities, and a few distinct teeth on each side of the beak. This shell, *L. pulchella*, does not differ

from *Tellinomya*, to which it must be referred*. The shells of the Genus *Tellinomya* are shown to differ from *Nucula*, *Isoarca*, *Nuculites*, and *Cucullella*.

In addition to the species described under this genus in the first volume of the Palæontology of New-York, may be added *T.* (*Nucula*) *levata*, *T.* (*Nucula*) *donaciformis*, *T.* (*Lyrodesma*) *pulchella;* and also the following species, described by Professor PHILLIPS (Memoirs Geological Survey of Great Britain, vol. 2): *Tellinomya* (*Nucula*) *coarctata*, *T.* (*Nucula*) *deltoidea*, *T.* (*Nucula*) *lingualis*, *T.* (*Nucula*) *rhomboidea.*

* Since the publication of this article in the Canadian Naturalist and Geologist, a note from Mr. CONRAD informs me that he never supposed the Genus *Lyrodesma* to be related to *Nucula*. the teeth being quite different from those of that genus. My reference, therefore, of *L. pulchella* was evidently erroneous, and is here corrected.

APPENDIX D.

MISCELLANEOUS.

HISTORICAL NOTICE.

In the Transactions of the Society for the Promotion of Agriculture, Arts and Manufactures, instituted in the State of New-York, Part iv, 1799, is a Sketch of the Mineralogical History of the State of New-York,

BY SAMUEL L. MITCHELL,

the Commissioner appointed to make a tour through the State of New-York, in the vicinity of Hudson's River.

It is deemed proper, in this connection, to record such an exploration of a part of the State at so early a day, as an interesting fact in the history of science. The volume which contains the report may be found in the New-York State Library.

DONATIONS OF MISCELLANEOUS ARTICLES.

1. Granular Gypsum, containing selenite, from Grand Rapids, Mich.
   Presented by G. J. S. Chesebro.

2. Indian Relic found on the farm of Edward Riggs, Esq., Argyle, Washington county.
   Presented by J. S. M'Claury, Walton, Delaware Co.

3. INDIAN RELIC found in excavating Second-street, Albany, April 1856, five feet below the surface.

4. WOOD FROM HALL OF INDEPENDENCE, Philadelphia, erected in 1714 : this piece taken out during repairs in 1855.

Presented by R. W. DAVIS, Philadelphia.

5. WOOD FROM THE CHARTER OAK, Hartford, Conn., which fell Aug. 21, 1856. Presented by E. A. SELKIRK, Albany.

6. PIECE OF A BOMB SHELL, found at Fort William Henry, about three feet below the surface, Nov. 1, 1856.

Presented by A. MELIUS, Albany.

7. A GUN, presented by Gen. PHILIP SCHUYLER to JOHN HENRY CLOCK, grandfather to CHRISTOPHER CLOCK of St. Johnsville, Montgomery county, N.Y., and has remained one hundred years in the CLOCK family. Its length is 7 feet 5½ inches, and its weight 16½ lbs. The inscription P. D. S. 1728, is supposed to be the initials of the father of Gen. SCHUYLER, and the date the time he received it. Presented by CHRISTOPHER CLOCK to LEANDER FOX, who presents it to the State of New-York for the Historical Collections, as a relic of olden times. March 31, 1856.

8. TWO LARGE SPECIMENS OF SULPHURET OF MERCURY, from the New Almedan Mine, California.

Presented by R. H. BACON, San Francisco.

The Regents are indebted to the following gentlemen for their assistance in procuring the remains of a fossil elephant, exhumed near Chittenango, in excavating the canal :

To JAMES STEWART, Esq., of Amsterdam, for a tusk, tooth, vertebræ, ribs, and bones of the foot.

To H. C. MERRICK, Esq., Civil Engineer of Cortland, for a tusk and ribs.

To Prof. A. K. EATON, of Clinton, for ribs, etc.

To CHARLES VAN EPPES, Esq., of Sullivan, for a tooth.

To JAMES COLEMAN, of Sullivan, for a tooth and ribs.

To Mr. ROBERT WILSON, of Chittenango, for a part of the underjaw.

DONATIONS TO THE NATURAL HISTORY LIBRARY.

FROM PROFESSOR JOSEPH HENRY,

Secretary of the Smithsonian Institution.

Owen's Geological Survey of Wisconsin, Iowa and Minnesota.

Foster and Whitney's Report on the Geology of the Lake Superior Land District.

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