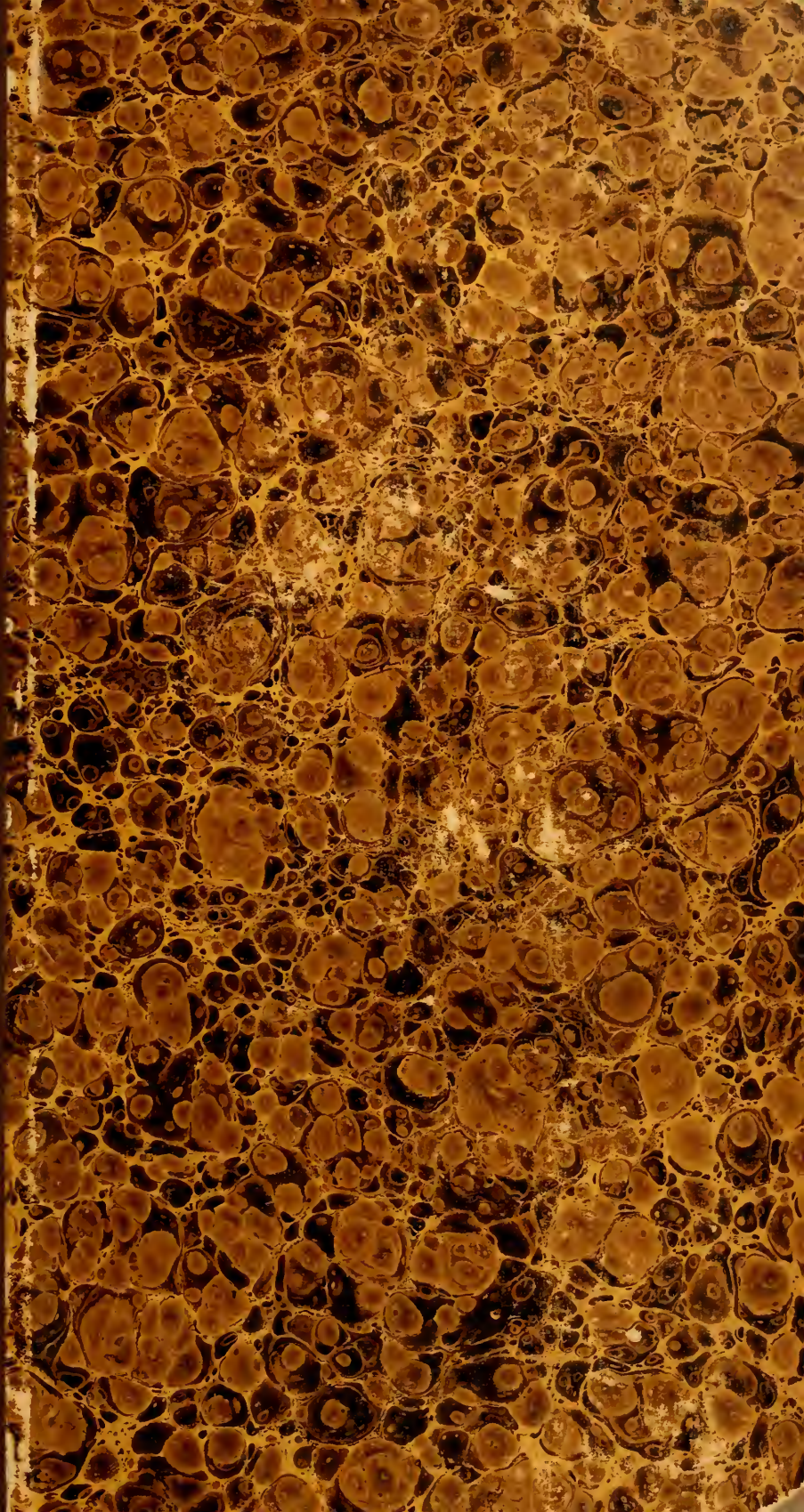

THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

PUBLISHING COMMITTEE:

J. F. JUDGE, A. G. WETHERBY.
G. W. HARPER, J. W. HALL, JR.,
R. B. MOORE.

VOLUME I.

APRIL, 1878, TO JANUARY, 1879.

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INDEX TO VOLUME I.

THE JOURNAL

OF THE

CINCINNATI SOCIETY OF NATURAL HISTORY.

VOL. 1. CINCINNATI, APRIL, 1878. No. 1.

THE JOURNAL.

The Cincinnati Society of Natural History, organized for the purpose of advancing Science, and diffusing knowledge, at last finds itself located in its own building, with a sufficient annual income to enable it to do earnest work in promoting the objects for which it was established. As one of the important means for accomplishing such work is the publication of its proceedings, in permanent and authoritative form, the Society has determined to publish a quarterly journal, under the title of "THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY." It is proposed that each number shall be issued as nearly quarterly as may be found practicable, and that four numbers shall constitute a volume.

The Journal will contain a full report of the proceedings of the Society, all valuable papers read before or prepared for it, critical notices of scientific books and publications, etc.

One of the most fruitful sources of doubt in the determination of described species, in the various branches of Natural Science, is to be found in the too frequent habit of publishing the written diagnosis, without any suitable figures by which the absolute identity of the thing described can be determined. Recognizing this, it has been decided that all descriptions of new species shall receive proper illustration, either by wood-cut, lithographic plates, or such other methods as may appear best adapted to the character of the object to be illustrated.

It is confidently believed that this step will encourage investigation and careful work, and that with the large store of unexplored material, and of undescribed species in the department of palæontology in this immediate vicinity, there will be no scarcity of original matter with which to sustain the publication and justify the undertaking.

LIST OF OFFICERS

Since the Organization of the Society.

Presidents.

Dr. John A. Warder,	1870–75	Samuel A. Miller,	1875–76
Dr. W. H. Mussey,	1876–77	R. B. Moore,	1877–78

First Vice-Presidents.

Dr. W. H. Mussey,	1870–76	John M. Edwards,	1876–77
V. T. Chambers,	1877–78		

Second Vice-Presidents.

Ludlow Apjones,	1871–72	Samuel A. Miller,	1872–75
Horatio Wood,	1875–76	George W. Harper,	1876–78

Corresponding Secretaries.

Ludlow Apjones,	1870–71	L. S. Cotton,	1871–75
L. M. Hosea,	1875–77	John W. Hall, Jr.,	1877–78

Recording Secretaries.

Ludlow Apjones,	1870–71	Rev. R. E. Hawley,	1871–73
John M. Edwards,	1873–74	William Colvin,	1874–75
Prof. J. F. Judge,	1875–78		

Treasurers.

Robert Brown, Jr.,	1870–70	Horatio Wood,	1870–75
Dr. J. H. Hunt,	1875–76	S. E. Wright,	1876–78

Librarians.

Dr. H. H. Hill,	1871–74	John M. Edwards,	1874–76
J. C. Shroyer,	1876–78		

Custodians.

Dr. F. P. Anderson,	1870–70	John M. Edwards,	1870–73
R. B. Moore,	1873–77	Dr. J. H. Hunt,	1877–78

Curators of Mineralogy.

Dr. Edward S. Wayne,	1870–71	Dr. R. M. Byrnes,	1871–78

Curators of Botany.

Horatio Wood,	1870–71	William Owens,	1870–72
Miss M. J. Pyle,	1872–73	John Hussey,	1873–74
Paul Mohr, Jr.,	1874–76	Davis L. James,	1876–78

Curators of Palæontology.

Samuel A. Miller,	1871–74	John W. Hall, Jr.,	1874–77
E. O. Ulrich,	1877–78		

Curators of Conchology.

Dr. H. H. Hill,	1871–72	Dr. Charles A. Miller,	1872–75
Prof. A. G. Wetherby,	1875–78		

Curators of Entomology.

Lucius Curtis,	1871–72	A. G. Wetherby,	1872–73
V. T. Chambers,	1873–74	A. G. Wetherby,	1874–75
George W. Harper,	1875–76	John W. Shorten,	1876–78

Curator of Ichthyology.

Prof. D. S. Young, 1873–78

Curators of Comparative Anatomy.

Prof. W. H. Mussey,	1873–75	Prof. A. J. Howe,	1875–78

Curator of Archæology.

Dr. H. H. Hill, 1874–78

Curator of Ornithology.

Charles Dury, 1874–78

Curator of Mathematics and Astronomy.

Prof. Ormond Stone, 1876–78

Curator of Chemistry and Physics.

Prof. R. B. Warder, 1876–78

Curator of Herpetology.

Dr. August J. Woodward, 1877–78

Curator of Meteorology.

S. S. Bassler, 1877–78

Curator of Microscopy.

V. T. Chambers, 1877–78

Taxidermist.

Charles Dury, 1870–74

Trustees.

S. E. Wright,	1875–78	Julius Dexter,	1875–78
Dr. J. H. Hunt,	1875–76	R. B. Moore,	1876–78

CINCINNATI SOCIETY OF NATURAL HISTORY.

The Cincinnati Society of Natural History was organized, and a Constitution adopted, on the 19th day of January, 1870, at No. 6 West Fourth street, in the city of Cincinnati. The following persons were enrolled as original members : Dr. F. P. Anderson, Ludlow Apjones, Robert Brown, jr., Dr. R. M. Byrnes, J. B. Chickering, Robert Clarke, Lucius Curtis, V. T. Chambers, Julius Dexter, Charles Dury, C. B. Dyer, John M. Edwards, Dr. H. H. Hill, R. E. Hawley, Dr. W. H. Mussey, R. C. McCracken, Dr. C. A. Miller, S. A. Miller, Dr. William Owens, Henry Probasco, J. Ralston Skinner, Dr. John A. Warder, Dr. E. S. Wayne, Dr. E. Williams and Horatio Wood.

The Society was regularly incorporated on the 20th day of June, 1870, as shown by Church Record Book, No. 2. page 633, of the Records of Hamilton county, Ohio.

On the 2d day of February, 1870, the Society met, and proceeded to elect permanent officers, Mr. John M. Edwards having presided at the preliminary meetings. Dr. John A. Warder was elected president, which office he continued to fill, by re-election, to the satisfaction of the members, until April 6, 1875. Dr. W. H. Mussey was elected first vice-president, and was continued in the office until April 6, 1875. Mr. Ludlow Apjones was elected corresponding and recording secretary, and served as such until the regular election, held April 4, 1871. Mr. Robert Brown, jr., was elected treasurer ; Dr. F. P. Anderson, custodian ; Dr. Edward S. Wayne, curator of mineralogy ; and Mr. Horatio Wood, curator of botany.

The membership of the Society increased very rapidly, and during the summer arrangements were perfected for renting room No. 41 College Building, on Walnut street, above Fourth street, at one hundred dollars per year. The Society held its first meeting in College Building, on the evening of October 4, 1870. At this meeting, Mr. Robert Brown, jr., resigned the office of treasurer, and Mr. Horatio Wood was elected to fill the vacancy ; Prof. John M. Edwards was elected custodian in place of Dr. F. P. Anderson; and Mr. Charles Dury was elected taxidermist. The Society held meetings regularly every month, and at the meeting held March 8, 1871, had the pleasure of knowing that the trustees of the Cincinnati College had remitted the rent, and consented to the occupation of room No. 41 College Building, free of charge, save such as would be incurred for light and fuel, until such time as the trustees might find it necessary to use the room for other purposes.

At the annual meeting, held on the evening of April 4, 1871, the Treasurer reported that the total receipts of the Society to that date

amounted to $160 00, and that there had been expended $165 17, leaving a balance due the Treasurer of $5 17. The library was reported as containing thirty-five volumes. Previous to this meeting there had been procured for the Society five upright cases, all of which the custodian reported were well filled by the specimens of Natural History, which had been donated by members of the Society. At this meeting the officers were elected for the year, with the following changes: Mr. Ludlow Apjones was elected second vice-president; Mr. L. S. Cotton was elected corresponding secretary, and continued to be re-elected annually, and served until April 6th, 1875; Rev. R. E. Hawley, as recording secretary, in which position he served for two years. Mr. Horatio Wood was elected treasurer, and was continued in the office until he declined to serve longer, April 4, 1875. Dr. H. H. Hill, accepted the position of librarian, and was re-elected April 2, 1872, and April 1, 1873. Prof. John M. Edwards was elected custodian, and was continued in the position for two years. Dr. R. M. Byrnes was elected curator of mineralogy, which position he has held to the present time. The fine collection and careful arrangment of the minerals in the possession of the Society bear witness to the intelligent and faithful work of this officer. Mr. Samuel A. Miller was elected curator of palæontology, and was subsequently re-elected and continued in the curatorship until April 7, 1874; Dr. H. H. Hill, curator of conchology, who was re-elected the following year; Mr. Lucius Curtis, curator of entomology, who was continued in office until April 1, 1873; Dr. William Owens, of botany; and Mr. Charles Dury, taxidermist, who was twice re-elected, and continued in office until the position was abolished in April, 1874, and the curatorship of ornithology instituted.

The donations of specimens in the various departments of Natural Science, being numerous at every meeting, it was found necessary to provide additional cases for preserving the collections. At the meeting held June 6, 1871, five new upright cases, uniform with those previously in the possession of the Society, were procured.

At the meeting held September 5, 1871, the Society received from the Western Academy of Natural Science, three hundred and fifty-one dollars in money, 265 volumes of books, and the remnant of its collection, being all of its property and effects of every kind then remaining. The money was invested, and has remained at interest since that time. Mr. S. A. Miller read a paper on the "Silurian Island of Cincinnati," which was published the next day in the Cincinnati Enquirer.

At the meeting held on the second day of January, 1872, the Society received from Mr. Robert Buchanan, 111 volumes from his library, and three upright cases with drawers, containing fossils, shells and minerals.

This donation was a valuable acquisition to the Society, and was brought about through the generosity of Mr. Probasco and nine other gentlemen, who presented Mr. Buchanan with one thousand dollars as a partial compensation for his parting with his collection. The Society elected Mr. Robert Buchanan an honorary member at the meeting held the following month.

The Society assembled, for the February meeting, in rooms 46 and 48 College Building, which had been kindly placed at its disposal by the trustees of the Cincinnati College, and which the Society continued to occupy until it was able to purchase a building, and removed to 108 Broadway.

On the 5th day of March, 1872, at a regular meeting, Messrs. Robert Clarke, U. P. James, George Graham, D. E. Bolles, John L. Talbot, S. T. Carley, and Robert Buchanan, surviving members of the Western Academy of Science, were duly elected to life membership in this Society, in pursuance of the arrangement made at the time of receiving the donation from the Western Academy. Mr. S. A. Miller read a paper on the "Geological History of this Locality, from the Tertiary period to the present time,"—which was published in the Cincinnati Enquirer of the succeeding day—and was continued at a subsequent meeting of the Society, and published in the same paper on the 17th day of June following.

At the annual meeting held April 2, 1872, the report of the Treasurer showed the receipts to have been, from dues of members for the preceding year, $385, and from the Western Academy of Natural Science, $351 45. Mr. Samuel A. Miller was elected second vice-president, which position he continued to hold until the April meeting in 1875; and Miss M. J. Pyle was elected curator of botany.

At the meeting held June 4, 1872, Dr. Charles A. Miller was elected curator of conchology, in place of Dr. H. H. Hill, who resigned; and Mr. A. G. Wetherby was elected curator of entomology, instead of Mr. Lucius Curtis, who had also resigned.

The Society exhibited a large collection of specimens at the Cincinnati Industrial Exposition, held during the months of September and October of this and the following year. At both Expositions the display made by this Society attracted much notice, and the section devoted to its use was generally well attended by visitors.

At the meeting held November, 1872, Prof. W. H. Mussey presented to the Society a large number of skeletons, of domesticated and wild vertebrate animals. He had previously shown his generosity to the Society by contributing books, minerals and other valuable specimens, and has continued to be one of its most steadfast and liberal benefactors down to the present time.

At the annual meeting, held April 1, 1873, it appeared from the

Treasurer's report that there were 117 members of the Society, that the dues collected for the year amounted to $110 36, that the expenses had been $324 93, and that there remained in the Treasury the sum of $122 12, not including the funds received from the Western Academy of Science. At this meeting, Mr. John M. Edwards was elected recording secretary; Mr. R. B. Moore, custodian, which position he continued to fill until elected president, April 3, 1877; Dr. Charles A. Miller, curator of conchology, who was re-elected the following year; Mr. V. T. Chambers, curator of entomology; Mr. John Hussey, curator of botany: Dr. D. S. Young, curator of ichthyology, a position he has held ever since; Prof. W. H. Mussey, curator of comparative anatomy, who was re-elected the following year. At this meeting, a resolution was adopted providing for a committee to take charge of a building fund, having for its basis the promise of a contribution of $100 00 annually for five years from Mr. Julius Dexter, and of $25 00 per year for a like period from Prof. A. J. Howe, and Mr. Ludlow Apjones, and of the sum of $10 00 for a like period from Mr. A. E. Tripp and Mr. Horatio Wood. At the time of the writing of this article, the Treasurer's books show that Mr. Julius Dexter, and Mr. Horatio Wood, have each of them paid up the entire subscription; that Dr. Howe, and Mr. Tripp, have each paid three installments, and Mr. Ludlow Apjones two installments, of their respective subscriptions.

At the meeting held May 6, of this year, Mr. Charles H. Browning presented to the Society a magnificent collection of marine shells and corals, collected by his father, Lieut. R. L. Browning, U. S. Navy.

At the meeting held August 5, 1873, Mr. S. A. Miller read a criticism on that part of the first volume of the Ohio Geological Survey, relating to the Cincinnati Group of Rocks, and its fossil contents, which was published in the Cincinnati Enquirer on the seventh day of the month.

The annual meeting in 1874 was held April 7th, when it appeared, from the report of Mr. R. B. Moore, the custodian, that the Society had, in its collection, forty-five hundred specimens of minerals, two thousand palæontological specimens, five thousand shells, six thousand botanical specimens, four hundred entomological specimens, two thousand archæological specimens, and one hundred each of anatomical, ichthyological and ornithological specimens, making a grand total of twenty thousand two hundred specimens. He also reported that the library contained about one thousand volumes. The Treasurer's report showed that the Society had received during the year: members' dues, $553 95; interest, $21 08; while it had expended $456 34, leaving in the treasury the sum of $240 81. The report further showed that there had been collected of the subscriptions to the building fund, $315 00, and interest accrued on the same, $11 47; making the total building

fund $326 47. At this meeting, Mr. William Colvin was elected recording secretary; Mr. John M. Edwards, librarian, who was re-elected the following year; Mr. John W. Hall, jr., curator of palæontology, in which position he was continued until April 3, 1877; Mr. A. G. Wetherby, curator of entomology; Dr. H. H. Hill, curator of archæology, and has been continued in the position ever since; and Mr. Charles Dury, curator of ornithology, who continues to fill the curatorship.

No election for curator of botany having been made at the annual meeting, Mr. Paul Mohr, jr., was elected to the position. May 5, and was re-elected the succeeding year.

Mr. Charles Bodman was elected a member of the Society at the meeting held September 1, 1874.

The Society received a letter at the meeting held December, 1874, from a lady, eighty years of age, containing a present of $200 00, and signed, "A Friend of Science." It was ascertained, however, that the generous donor was Mrs. Abbe Warren, residing at No. 299 George street, in Cincinnati.

At the meeting held April 6, 1875, it appeared from the Treasurer's report that the receipts from members' dues were $558 30; from Mrs. Abbe Warren, donation $200 00; and interest on invested funds, $26 08; which, added to the balance in the treasury from the previous year, amounted to $1,025 19. The expenditures for the year amounted to $531 46, leaving a balance of $493 73; of this latter sum $400 00 had been placed at interest. In addition to this, the sum of $351 45, which was received from the Western Academy, was safely invested, and further that the building fund had during the year been increased by collection of subscriptions, and accrued interest, to the sum of $499 85; making a total of all funds to the credit of the Society, $1,345 03. At this meeting, Mr. S. A. Miller was elected president; Mr. Horatio Wood was elected second vice-president; Mr. L. M. Hosea, corresponding secretary, to which office he was re-elected the next year; Dr. J. F. Judge, recording secretary, in which office he has been continued to this time; Dr. J. H. Hunt, treasurer; Prof. A. G. Wetherby, curator of conchology, in which position he has since remained; Mr. George W. Harper, curator of entomology; and Prof. A. J. Howe, curator of comparative anatomy, since which time he has been annually re-elected to the position.

At the meeting held May 4, 1875, the president, Mr. S. A. Miller, read a "Review of the Glacial Theory, as presented in the Ohio Geological Survey," which was published in the July number of the *Cincinnati Quarterly Journal of Science.*

Prof. A. G. Wetherby read a paper, entitled "Descriptions of Lepidopterous Larvæ, with remarks on their habits and affinities," at the

meeting held October 5th, 1875, which was published in the *Cincinnati Quarterly Journal of Science*, for the same month. Prof. A. G. Wetherby read, at the meeting held December 7, 1875, a paper on the "Variations in form as exhibited by Strepomatidæ, with descriptions of new species," which was published in the month of January following, under the title of "Proceedings of the Cincinnati Society of Natural History." It is the only publication the Society has ever issued. At various times attempts have been made by members to have the Society definitely adopt the policy of a regular publication of its transactions, but without success, until the last, which has resulted in the present undertaking of publishing a journal of the Society quarterly, which is designed to embrace the proceedings of the Society, and such original papers of value as may be prepared for the Society by its members or others.

The next annual meeting was held April 4, 1876. The Treasurer's report showed that the receipts for the previous year had been, from members' dues, $347 54; from interest, $45 08; the expenditures amounted to $415 95, leaving a cash balance of $102 40. The building fund was reported as $555 63. At this meeting, Prof. W. H. Mussey was elected President; Mr. John M. Edwards, first vice-president; Mr. George W. Harper, second vice-president, who was in the succeeding year re-elected; Mr. S. E. Wright, treasurer, and continues in office to this time; Mr. J. C. Shroyer, librarian, who was re-elected the following April; Mr. J. W. Shorten, curator of entomology; and Mr. Davis L. James, curator of botany.

Prof. A. G. Wetherby, read a paper at the meeting held June 6, on the "Tulotoma," which was subsequently published in the *Quarterly Journal of Conchology*, Leeds, England.

At the meeting held October 3, Prof. Ormond Stone was elected curator of mathematics and astronomy, and Prof. R. B. Warder, curator of chemistry and physics, each being re-elected at the annual meeting the following year.

At the meeting held March 6, 1877, Dr. August J. Woodward was elected curator of herpetology, and re-elected at the annual meeting the next month.

At the meeting held on April 3, 1877, the Treasurer's report showed the financial condition of the Society to be as follows :

Cash in the Treasury, April 4, 1876, ...	$102 40
Received from Members' dues, ...	654 00
For Life Membership, ...	50 00
For Interest to credit of General Fund, ...	42 25
	$848 65
Expenditures during the year, ...	$350 02
Balance in the Treasury, ...	$498 63

Building Fund, April 3, 1877.

Balance in Fund April 4, 1876,	$555 63
Received Subscriptions,	200 00
Received Interest,	46 37
Total Building Fund,	$802 00

Total Funds.

Bearing Interest, or held in Cash, April 3, 1877.

General Fund,	$644 13
Endowment Fund,	551 45
Life Membership Fund,	50 00
Building Fund,	802 00
	$2,047 58

At this meeting, Mr. R. B. Moore was elected president; Mr. V. T. Chambers, first vice-president; Mr. J. W. Hall, jr., corresponding secretary; Dr. J. H. Hunt, custodian; Mr. O. E. Ulrich, curator of palæontology. Dr. A. J. Howe read a paper on the "Life of John Hunter," which was subsequently published in pamphlet.

Mr. S. S. Bassler was elected curator of meteorology, and Mr. V. T. Chambers, curator of microscopy, at the meeting held June 5, 1877. Prof. A. J. Howe read "A Biographical Sketch of Baron Cuvier," at the meeting held Aug. 7, which was afterwards published in pamphlet; and on the 2d of October, he read another paper, on "American Archæology," which was also published in pamphlet.

Mr. Charles Bodman, who was elected a member, September 1, 1874, died on the 10th day of May, 1875, leaving a will containing a bequest to this Society of fifty thousand dollars, which sum should have been paid to the Society at once, but the payment was delayed until the sixteenth day of July, 1877, depriving the Society of about two years' interest. There were no conditions or limitations attached to the bequest, and, consequently, when the money was received, it was absolutely at the disposal of the Society. The Society had previously appointed a board of trustees, one of whom is the treasurer, to receive the money, and make such investments as the Society should direct. The trustees, previous to entering upon the discharge of their duties, gave satisfactory bonds for the faithful performance of the trust. About eleven thousand, five hundred dollars was invested in the purchase and repairing of the property on the corner of Broadway and Arch streets, in the month of October following. The collection and other property of the Society was at once transferred from the rooms, 16 and 48 College building, to the new premises.

The Society held its first meeting in its own building, on November 6, 1877. At this meeting the following resolution was unanimously adopted:

"*Resolved*, that the members of the Cincinnati Society of Natural History tender the trustees of the Cincinnati College our heartfelt thanks for their generosity and kindness in furnishing this Society a room in their building, free of charge, since the organization of this institution."

The balance of the bequest from Mr. Charles Bodman has been properly invested in bonds and mortgages, and the Society now finds itself at home, in its own building, in affluent circumstances, and prepared to commence in earnest work for the advancement of science, and the diffusion of knowledge.

At the meeting held January 1, 1878, the Mechanics' Institute sent to the Cincinnati Society of Natural History a written proposition to donate the collection of minerals in its possession, known as the McClue Collection, which offer was accepted, and the collection was transferred to the Society's building. Prof. Claypole read a description of a new fossil, Glyptodendron Eatonense, which will appear in the *American Journal of Science and Arts* for April.

At the meeting held on February 5th, 1878, the Society authorized the publishing committee to publish a journal quarterly, to contain the proceedings and transactions of the Society. This arrangement, if permanently maintained, will be of great importance to the Society, and to students of natural science everywhere.

In view of the fact that the proceedings of this Society, as heretofore made public through the newspapers, have contained only meagre notices of the many donations and kindnesses of persons not members of the Society, and that several members have borne a large share of the labor necessary in arranging, classifying, and taking care of the collection in the Rooms of the Society, and in making the necessary arrangements for its display at the Cincinnati Exposition without any compensation, an honorable mention of their names at this time will not be regarded as out of place. It will, however, be impracticable to attempt to enumerate all of them here, but in a brief way to express the obligations of the Society to those whose names have appeared in the foregoing pages. The Society is also under many obligations to Major A. S. Burt, of the U. S. Army; Mr. John Robinson, Mr. Julius Dexter, Dr. E. S. Wayne, Hon. J. S. Gordon, Hon. T. A. Corcoran, the Cincinnati Zoological Society, and the Smithsonian Institution, for valuable contributions to its collections and library. Dr. H. H. Hill, Dr. R. M. Byrnes, Prof. A. J. Howe, Mr. R. B. Moore, and Dr. D. S. Young, among others, are also deserving of especial thanks for the many services rendered the Society.

The Cincinnati Society of Natural History is a charitable institution, devoting all its energies to the advancement of science and free education. The rooms are kept open to the public, so that all the advan-

tages of the museum may be enjoyed as well by those who are not members as by those who contribute annually the sum of five dollars toward its maintenance. In no event can any one profit by membership, beyond the nominal privilege of voting for the officers, and participating in the work of the Society.

CATALOGUE OF THE LEPIDOPTERA,

Observed in the vicinity of Cincinnati, Ohio, including Diurnals, Sphingidæ, Ægeridæ, Zygænidæ, Bombycidæ, Noctuidæ, Phalœnidæ, and Pyralidæ. By CHARLES DURY.

To Prof. A. R. Grote, of Buffalo, New York, Mr. W. H. Edwards, of Coalburg, W. Va., and Mr. H. Strecker, of Reading, Pa., my thanks are due for valuable aid in determination of specimens ; and to Prof. A. G. Wetherby, of Woodburn, Mr. Chas. G. Siewers, of Newport, Ky., and Mr. L. R. Freeman, who have reared and captured some of our rarest and least known species, and Mr. F. W. Langdon, E. Mills, Harold B. Wilson, Joseph & Davis, L. James, C. B. Dyer, L. Curtis, and others, for specimens.

PAPILIONIDÆ (Swallow-Tailed Butterflies).

1 Papilio ajax, Linn., common.
2 Papilio ajax, var Walshii, Ed., common.
3 Papilio ajax, var Telamonides, Feld., common.
4 Papilio ajax, var Marcellus, Bois., common.
5 Papilio philenor, L., common.
6 Papilio asterias, F., common.
7 Papilio troilus, L., common.
8 Papilio turnus, L., abundant.
9 Papilio turnus, var glaucus, abundant.
10 Papilio chresphontes, Cram., not common.

PIERIDÆ.

11 Pieris protodice, B. & L., abundant.
12 Pieris protodice, var Vernalis, Ed., rare.
13 Pieris rapæ, L., very abundant.
14 Anthocharis genutia, Bois, very rare.
15 Callidryas eubule, L., rare (extralimital).
16 Colias cæsonia, Stoll, rare.
17 Colias eurytheme, Bois, not common.
18 Colias philodice, Godart, common.
19 Terias nicippe, Cram., common.
20 Terias lisa, B. & L., not common.

NYMPHALIDÆ.

21 Danais archippus, Fabr., abundant
22 Argynnis idalia, Drury, very rare.
23 Argynnis cybele, F., abundant.
24 Argynnis aphrodite, F., not abundant.
25 Agynnis bellona, F., rare.
26 Euptoieta claudia Cram., not abundant.
27 Phyciodes harrisii, Scud., not common.
28 Phyciodes nycteis, Doub., common.
29 Phyciodes tharos, Drury, abundant.
30 Grapta interrogationis, F., common.
31 Grapta interrogationis, var umbrosa Lint, common.
32 Grapta comma, Harris, abundant.
33 Grapta comma, var Dryas, Ed., common.
34 Grapta progne, Cram., common.
35 Vanessa antiopa, Linn., common.
36 Pyrameis atalanta, L., abundant.
37 Pyrameis huntera, Drury, common.
38 Pyrameis cardui, Linn., common.
39 Junonia lavinia, Cram., rare (extralimital).
40 Limenitis ursula, F., abundant.
41 Limenitis disippus, Godt., abundant.
42 Apatura celtis, Bd., abundant.
43 Apatura clyton, Bd., common.

SATYRIDÆ.

44 Neonympha eurytris, F., abundant.
45 Debis portlandia, F., rare.

LYCANIDÆ.

46 Thecla halesus, Cram., very rare.
47 Thecla humuli, Haw., common.
48 Feniseca tarquinius, F., very rare.
49 Chrysophanus thoe, Bd. & Lec., not common
50 Chrysophanus americana, d'Urban, abundant.
51 Lycæna pseudargiolis, B. & L., common.
52 Lycæna pseudargiolis, var violacia, Edw., common.
53 Lycæna lygdamas, Doub., very rare.
54 Lycæna comyntas, Godt., abundant.

HESPERIDÆ.

55 Ancyloxypha numitor, F.
56 Pamphila zabulon, Bois & Lec., common.
57 Pamphila huron, Edw., rare.

58 Pamphila peckius, Kirby, common.
59 Pamphila cernes, B. & L., common.
60 Pamphila verna, Edw., not common.
60½ Amblyscirtes vialis, Edw., rare.
61 Pyrgus tessellata, Scud., rare.
62 Philisora catullus, Cram., common.
63 Eudamus pylades, Scud., rare
64 Eudamus bathyllus, Ab. & Sm.
65 Eudamus tityrus, Fabr., abundant.

SPHINGIDÆ (Hawk Moths).

66 Sesia axilaris, Grote, rare.
67 Sesia marginalis, Grote, common.
68 Sesia thysbe, Fabr., common.
69 Thyreus abbotii, Swain, rare.
70 Thyreus nessus, Cram., rare.
71 Deidema inscripta, Harris, rare.
72 Deilephila lineata, Fabr., abundant.
73 Darapsa chœrilus, Cram., rare.
74 Darapsa myron, Cram., common.
75 Chœrocampa tersa, Linn., rare.
76 Philampelus satellitia, Linn., not common.
77 Philampelus achemon, Drury, rare.
78 Macrosila carolina, Linn., abundant.
79 Macrosila quinquemaculata, Steph., common.
80 Macrosila chionanthe, Sm. & Ab., rare.
81 Macrosila jasminarum, Le Conte.
82 Sphinx cinerea, Harris, common.
83 Sphinx kalmeæ, Sm., rare.
84 Sphinx sordida, Hübn., rare.
85 Sphinx hylæus, Drury, common.
86 Sphinx plebia, Fab., common.
87 Sphinx plota, Strecker, rare.
88 Ceratomia quadricornis, Hüb., rare.
89 Daremma undulosa, Walk.
90 Smerinthus excæcatus, Sm., common.
91 Smerinthus astylus, Drury, rare.
92 Smerinthus myops, Sm., rare.
93 Smerinthus geminatus, Say, common.
94 Smerinthus, modestus, Harris, rare.
95 Smerinthus juglandus, Ab. & Sm., common.

ÆGARIDÆ.

96 Ægaria exitiosa, Say, common.
97 Ægaria tipuliformis, Linn., common.

ZYGÆNIDÆ.

98 Alypia octomaculata, Fab., common.
99 Psychomorpha epiminis, Drury, not common.
100 Eudryas grata, Fab., not rare.
101 Eudryas unio, Hübn., rare.
102 Glaucopis fulvicollis, Hüb., common.

BOMBYCIDÆ.

103 Hypropepia fucosa, Hüb., common.
104 Euphanessa mendica, Walker, common.
105 Utetheisa bella, Linn. abundant.
106 Callimorpha interrupto-marginata, Beaur., common.
107 Callimorpha lecontei, Bois., common.
108 Callimorpha vestalis, Packard, common.
109 Arctia virgo, Linn., rare.
110 Arctia parthenice, Kirby, rare.
111 Arctia phalerata, Harris, common.
112 Arctia phylira, Drury, very rare.
113 Arctia decorata, Saun., rare.
114 Arctia persephone, Grote, rare.
115 Arctia arge, Drury, rare.
116 Pyrrarctia isabella, Smith, common.
117 Leucarctia acrea, Smith, abundant.
118 Spilosoma virginica, Fabr., common.
119 Hypantria textor, Harris, common.
120 Hypantria cunea, Harris, common.
121 Euchates collaris, Fitch, common.
122 Ecpantheria, scribonia, Stoll, not common.
123 Halesidota carye, Harris, not common.
124 Halesidota tessellaris, Smith, common.
125 Orgyia leucostigma, Harris, common.
126 Lagoa crispata, Pack., rare.
127 Limacodes scaphea, Harris, rare.
128 Limacodes fasciola, Doub., common.
129 Limacodes spinuloides, H—S., rare.
130 Euclea quercicola, H—S., rare.
131 Euclea monitor, —— rare.
132 Parasa chloris, H—S., common.
133 Empretia stimulea, Clem., rare.
134 Phobetrum pithecium, Smith, rare.
135 Ichthyura inclusa, Hüb., common.
136 Datana ministra, Drury, common.
137 Datana perspicua, G. & R., common.
138 Datana integerrima, G. & R., common.

139 Datana angusi, Grote, not common.
140 Gluphisia trilineata, Packard, common.
141 Nadata gibbosa, Smith common.
142 Edema albifrons, Smith, rare.
143 Dasylophia anguina, Ab. & Sm., rare.
144 Cœlodasys unicornis, Smith, rare.
145 Cœlodasys cinereofrons, Pack., rare.
146 Cœlodasys biguttatus, Pack., rare.
147 Lochmæus biundata, Walk., rare.
148 Lochmæus unicolor, Pack., rare.
149 Cerura cinerea, —— common.
150 Apatelodes torrifacta, Ab. & Sm., rare.
151 Telea polyphemus, Linn, common.
152 Tropæa luna, Linn, common.
153 Samia cecropia, Linn, common.
154 Callosamia promethea, Drury, common.
155 Callosamia angulifera, Cat., not common.
156 Citheronia regalis, Fab., rare.
157 Eacles imperialis, Drury, common.
158 Hyperchirea varia, Walk., common.
159 Dryocampa rubicunda, Fab., common.
160 Adelocephala bicolor, Harris, not rare.
161 Anisota pellucida, Smith, rare.
162 Anisota stigma, Smith, very rare.
163 Gastropacha americana, Harris, rare.
164 Tolype velleda, Stoll, rare.
165 Clisiocampa americana, Harris, common.
166 Xyleutes robiniæ, Harris, common.

NOCTUIDÆ.

167 Pseudothyatira cymatopheroides, Grote, rare.
168 Pseudothyatira expultrix, Grote, common.
169 Habrosyne scripta, Grote, rare.
170 Charadra deridens, G. & R., rare.
171 Apatela occidentalis, Grote, common.
172 Apatela morula, Grote, common.
173 Apatela lobeliæ, Grote, abundant.
174 Apatela spinigera, Grote, rare.
175 Apatela connecta, Grote, rare.
176 Apatela americana, Harris, common.
177 Apatela rubricoma, Grote, not common.
178 Apatela luteicoma, Grote, common.
179 Apatela noctivaga, Grote, rare.
180 Apatela superans, Grote, rare.

181 Apatela afflicta, Grote, rare.
182 Apatela clarescens, Grote, not common.
183 Apatela hamamelis, Grote, rare.
184 Apatela dissecta, Grote, rare.
185 Apatela vinnula, Grote, not common.
186 Apatela lithospila, Grote, rare.
187 Apatela xyliniformis, Grote, rare.
188 Apatela oblinita, Grote, abundant.
189 Jaspidea lepidula, Grote, common.
190 Jaspidea teratophora, H—S., common.
191 Cerema cora, Hübn, very rare.
192 Microcœlia diphteroides, Guen., rare.
193 Microcœlia obliterata, Grote, rare.
194 Microcœlia fragilis, Guen., rare.
195 Agrotis baja, S. V., common.
196 Agrotis normaniana, Grote, common.
197 Agrotis c. nigrum, Linn, common.
198 Agrotis bicarnea, Grote, common.
199 Agrotis subgothica, Haw., common.
200 Agrotis herilis, Grote, common.
201 Agrotis plecta, Linn, common.
202 Agrotis badinodis, Grote, common.
203 Agrotis messoria, Harris, common.
204 Agrotis velleripennis, Grote, rare.
205 Agrotis gladiaria, Morr., common.
206 Agrotis annexa, Tr., common.
207 Agrotis ypsilon, Rott., common.
208 Agrotis sancia, Hübn., common.
209 Agrotis clandestina, Hartis, common.
210 Agrotis brunneicollis, Grote, rare.
211 Agrotis alternata, Grote, rare.
212 Agrotis cupida, Grote, rare.
213 Agrotis lubricans, Grote, rare.
214 Agrotis incivis, Guen., rare.
215 Agrotis prasina, S. V., rare.
216 Mamestra adjuncta, Guen., common.
217 Mamestra subjuncta, Grote, common.
218 Mamestra legitima, Grote, rare.
219 Mamestra lorea, H—S., rare.
220 Mamestra renigera, Grote, rare.
221 Mamestra laudibillis, Grote, rare.
222 Mamestra beami, Grote, rare.
223 Dianthœcia meditata, Grote, abundant.
224 Hyppa xylinoides, Guen., common.

225 Hadena loculata. Morr., rare.
226 Hadena devastatrix, Grote, rare.
227 Hadena sputatrix, Grote, not common.
228 Hadena apamiformis, Grote, rare.
229 Hadena cariosa, Guen., rare.
230 Hadena cristata, Grote, very rare.
231 Hadena mactata, Grote, rare.
232 Hadena miselioides, Guen., common.
233 Hadena modica, Grote, common.
234 Hadena arna, Grote, rare.
235 Hadena chalcedonia, Hübn, rare.
236 Perigea xanthioides, Guen., common.
237 Perigea luxa, Grote, common.
238 Dipterygia scabriuscula, Linn., common.
239 Homohadena badistriga, Grote, rare.
240 Actinotia ramulosa, Grote, rare.
241 Lapigma frugiperda, Guen., common.
242 Lapigma frugiperda, var. obscura, Reiley, common.
243 Prodenia commelinæ, Guen., rare,
244 Prodenia ornithogalli, Guen., common.
245 Trigonophora periculosa, Grote, rare.
246 Euplexia lucipara, Steph., common.
247 Nephelodes violans, Guen., common.
248 Tricholita semiaperta, Grote, rare.
249 Gortyna sera, Grote, not common.
250 Gortyna nitela, Guen., common.
251 Gortyna nebris, Guen, common.
252 Gortyna cerussata, Grote, not common.
253 Gortyna rutila, Guen., rare.
254 Scoleocampa liburna, Grote, not common.
255 Platysenta atricilata, Grote, rare.
256 Heliophila harveyi, Grote, rare.
257 Heliophila phragmitidicola, Grote, common.
258 Heliophila unipuncta, Haw., common.
259 Heliophila pseudargyria, Grote, common.
260 Caradrina miranda, Grote, rare.
261 Caradrina grata, Hübn., common.
262 Pyrophila pyramidoides, Grote, common.
263 Pyrophila glabella, Morr., very rare.
264 Orthodes cynica, Guen., common.
265 Orthodes necors, Grote, common.
266 Graphiphora incerta, Hufn., rare.
267 Chœphora fungorum, G. & R., rare.
268 Ipimorpha pleonectusa, Grote, rare.

269 Orthosia helva, Grote, common.
270 Orthosia ferruginoides, G. & R., common.
271 Eucirrœdia pampina, Guen., rare.
272 Scoliopteryx libatrix, Guen., abundant.
272½ Lithophane petulca, Grote, rare.
273 Lithophane bethunei, Grote, rare.
274 Lithophane cinerea, Reiley, rare.
275 Cuculia asteroides, Guen., rare.
276 Crambodes talidiformis, Guen., rare.
277 Nolaphana malana, Grote, common.
278 Aletia argillacea, Hübn., rare.
279 Ingura abrostoloides, Guen., rare.
280 Plusiodonta compressipalpis, Guen., common.
281 Hypsoropha hormos, Hübn., rare.
282 Telesilla cinereola, Grote, common.
283 Plusia ærea, Green, common.
284 Plusia thyatiroides, Guen., rare.
285 Plusia precationis, Guen., Common.
286 Chloridea rhexiæ, West, common.
287 Lygranthœcia lynx, Grote. rare.
288 Lygranthœcia arcifera, Grote, common.
289 Lygranthœcia spraguei, Grote, rare.
290 Lygranthœcia marginata, Grote, rare.
291 Heliothis armiger, Hübn., common.
292 Pyrrhia experimens, Grote, common.
293 Taracha aprica, Hübn., common.
294 Taracha candefacta, Hübn., rare.
295 Taracha erastrioides, G. & R., common.
296 Chamyris cerintha, Treits, common.
297 Eustrotia carneola, Grote, common.
298 Eustrotia apicosa, Grote.
299 Eustrotia muscosula, Grote, common.
300 Eustrotia musta, Grote, common.
301 Spragueia leo, Grote, common.
302 Galgula hepara, Guen., common.
303 Galgula subpartita, Guen., common.
304 Drasteria erechtea, Hübn., abundant.
305 Euclidea cuspida, Guen., common.
306 Parthenos nubilis, Hübn., common.
307 Catocola epione, West, common.
308 Catocola agrippina, Streck, rare.
309 Catocola lacrymosa, Guen., not common.
310 Catocola viduata, Guen., rare.
311 Catocola desperata, Guen., not rare.

312 Catocola retecta, Grote, common.
313 Catocola flebilis, Grote, not common.
314 Catocola robinsonii, Grote, abundant.
315 Catocola levettei, Grote, not abundant.
316 Catocola insolabilis, Guen., abundant.
317 Catocola angusi, Grote, rare.
318 Catocola residui, Grote, common.
319 Catocola obscura, Streck, common.
320 Catocola obscura, var simulatilis, Grote, common.
321 Catocola tristis, Edw., rare.
322 Catocola unijuga, Walk., rare.
323 Catocola junctura, Walk., rare.
324 Catocola amatrix, Hübn., common.
325 Catocola cara, Guen., abundant.
326 Catocola coccinata, Grote, rare.
327 Catocola ultronia, Guen., common.
328 Catocola parta, Guen., common.
329 Catocola marmorata, Edw., rare.
330 Catocola ilia, Guen., common.
331 Catocola innubens, Guen., common.
332 Catocola innubens, var. flavidalis, Grote, rare.
333 Catocola innubens var. scintillans, G. & R., common.
334 Catocola cerogoma, Guen., not common.
335 Catocola neogoma, Guen., common.
336 Catocola subnata, Grote, not common.
337 Catocola piatrix, Grote, common.
338 Catocola palæogoma, Guen., common.
339 Catocola palæogoma, var. phalanga, Grote, common.
340 Catocola habilis, Grote, common.
341 Catocola nebulosa, Edw., not common.
342 Catocola antinympha, Hübn., rare.
343 Catocola serena, Edw., not common.
344 Catocola illecta, Walker, rare.
345 Catocola polygama, Guen., common.
346 Catocola cratægi, Saund., rare.
347 Catocola amasia, West., rare.
348 Catocola grynea, Cram., common.
349 Catocola fratercula, G. & R., rare.
350 Catocola minuta, Edw., common.
351 Catocola amica, Hübn., common.
352 Catocola linella, Grote. rare.
353 Allotria elonympha, Hübn., rare.
354 Spiloloma lunilinea, Grote, common.
355 Panopoda rufimargo, Hübn, rare.

356 Panopoda carnicosta, Guen., rare.
357 Remigea hexastylus, Harvey, common.
358 Celiptera frustulum, Guen., common.
359 Parallelia bistriaris, Hübn., common.
360 Trama arrosa, Harvey, rare.
361 Eutoreuma tenuis, Grote, common.
362 Zale horrida, Hübn, rare.
363 Homoptera lunifera, Hübn., rare.
364 Homoptera edusa, Drury, common.
365 Homoptera saundersii, Beth., common.
366 Homoptera lunata, Drury, common.
367 Homoptera calcanthata, Ab. and Sm., rare.
368 Homoptera penna, Morr., rare.
369 Homoptera unilineata, Grote, rare.
370 Homoptera umbripennis, Grote, rare.
371 Homoptera undularis, Drury, common.
372 Phalænostola larentioides, Grote, common.
373 Homopyrallis discalis, Grote, common.
374 Homopyralis tactus, Grote, common.
375 Homopyralis tantillus, Grote, rare.
376 Pseudoglossa denticulalis, Harvey, common.
377 Epizeuxis americalis, Guen., common.
378 Megachyta lituralis, Hübn.
379 Litognatha litophora, Grote.
380 Pityolita pedipilalis, Guen., common.
381 Zanclognatha lævigata, Grote, common.
382 Zanclognatha marcidlilinea, Grote, rare.
383 Philometra longilabris, Grote, rare.
384 Philometra serraticornis, Grote, rare.
385 Rivula propinqualis, Guen., rare.
386 Palthis asopialis, Guen., common.
387 Phalænophana rurigena, Grote, common.
388 Renia discoloralis, Guen., common.
389 Renia belfragei, Grote, not common.
390 Tetanolita lixalis, Grote, rare.
391 Tetanolita plenilinealis, Grote, rare.
392 Bleptina caradrinalis, Guen., common.
393 Bomolocha manalis, Walk., rare.
394 Bomolocha albalienalis, Walk., rare.
395 Bomolocha sordidula, Grote, rare.
396 Bomolocha profecta, Grote, rare.
397 Bomolocha bijugalis, Walk., rare.
398 Bomolocha perangulalis, Harvey, rare.
399 Hypena humuli, Harris, common.

400 Platypena scabra, Fabr., rare.
401 Heterogramma indivisalis, Grote, rare,
402 Tortricodes bifidalis, Grote, rare.

PHALÆNIDÆ.

403 Plemria fluviata, Hübn., common.
404 Pterophora atrocolorata, Grote, rare.
405 Pterophora diversilineata, Hübn., common.
406 Phabalapteryx latirupta, Walk., common.
407 Rheumaptera lacustrata, Pack., common.
408 Odezia albavittata, Guen., not common.
409 Heliomata cycladata, Grote, very rare.
410 Heterophelps triguttata, H—S., common.
411 Hæmatopis grataria, Guen., common.
412 Lythria snoviaria, Pack., rare.
413 Semiothisa ocellinata, Guen., common.
414 Semiothisa notata, Guen., rare.
415 Calothysanis amaturaria, Pack., common.
416 Corycia vestaliata, Guen., common.
417 Acidalia punctofimbriata, Pack., rare.
418 Acidalia quadrilineata, Pack., rare.
419 Acidalia nivosata, Guen., common.
420 Acidalia enucleata, Guen., common.
421 Acidalia persimilata, Grote., rare.
422 Dyspteris abortivaria, H—S., rare.
423 Eucrostis chloroleucaria, Pack., rare.
424 Synchlora rubivoraria, Reiley, rare.
425 Synchlora rubrifrontaria, Pack., rare.
426 Aplodes latiaria, Pack., rare.
427 Geometra iridaria, Guen., rare.
428 Anisopteryx vernata, Steph., rare.
429 Hybernia tiliaria, Harris, rare.
430 Amphidasis cognataria, Guen., rare.
431 Paraphia subatomaria, Guen., rare.
432 Paraphia deplanaria, Guen., rare.
433 Tephrosia canadaria, Guen., common.
434 Cymatophora crepsucularia, Pack., abundant
435 Cymatophora pampinaria, Pack., abundant.
436 Bronchelia hortaria, Guen., not common.
437 Hyperitis nyssaria, Guen, rare.
438 Nematocampa filamentaria, Guen., common.
439 Angerona crocataria, Guen., abundant.
440 Antepione depontanata, Pack., rare.

441 Antepione sulphurata, Pack., rare.
442 Metrocampa perlata, Guen., rare.
443 Endropia hypocharia, H—S., not common.
444 Endropia filinearia, Pack., not common.
445 Endropia pectinaria, Guen., common.
446 Endropia obtusaria, Guen., rare.
447 Endropia plumbaria, Pack., rare.
448 Engonia, alniaria, Hüb., rare.
449 Caberodes confusaria, Guen., common.
450 Drepanodes puber, G. and R., common.
451 Metanema inatomaria, Guen., rare.
452 Tetracis crocollata, Guen., not common.
453 Entrapela transversata, Pack., abundant.

PYRALIDÆ.

454 Pyralis farinalis, Harris, abundant.
455 Pantographa lineata, G. & R., rare.
456 Asopia olinalis, Guen., common.
457 Asopia costralis, Fabr., common.
458 Botys flavidalis, Guen., common.
459 Botys langdonalis, Grote, not abundant.
460 Botys quinque-linealis, Grote, common.
461 Botys gentilis, Grote, abundant.
462 Botys marculenta, G. & R., common.
463 Botys plectilis, G. & R., not rare.
464 Botys penitalis, Grote, not abundant.
465 Botys illibalis, Hübn., common.
466 Botys ventralis, G. & R., rare.
467 Desmia maculalis, West, abundant.
468 Nomophila noctuella, S. V., common.
469 Crambus exsiccatus, Zeller, common.
470 Crambus vulgivagellus, Clem., not rare.
471 Crambus laqueatellus, Clem., not common.
472 Cryptolechia schlægeri, Zeller, not common.
473 Galleria cereana, Fabr., common.
474 Conchylodes platinalis, Guen., common.
475 Omphalocera cariosa, Led., rare.

HYALINA MILIUM.—Previous to December, 1876, Hyalina milium, Morse, had not been recognized as existing in this vicinity. At the time named, Mr. William Doherty found specimens of it near Newport, eKntucky, and other collectors have since found it at several places on the North side of the Ohio, near Cincinnati.

CONTRIBUTIONS TO PALÆONTOLOGY.

By S. A. Miller and C. B. Dyer.

Blastophycus, n. gen.

[Ety.—*Blastos*, a bud; *phukos*, sea weed.]

Plant having a bilobate form, with a protuberance or bud-like attachment at the junction of the branches. This protuberance is longitudinally rugose in the typical species, while the branches are smooth It would seem, however, that the genus should include both smooth and rugose species. We regard this protuberance at the junction of the branches, as of generic importance, and wholly separating it from all other known genera of sea plants. Whether it is considered a bud, shoot, frond or spore, it certainly evinces that the fossil can not be regarded as the rhizoma or root of another genus, and proves that it is in truth the representative ot a sea plant.

Blastophycus diadematus, n. sp. (Plate I., figs. 1 and 2.)

[Ety.—*Diadematus*, diademed.]

The general form of the plant is subovate, with a bud-like attachment at the larger end, covering the junction of the branches. The two branches forming the subovate part of the fossil are smooth, and appear to have been round in all the specimens examined. They unite beneath the bud, and gradually swell in size as they curve and form the larger end of an ovate figure, and then decline in size as they approach each other toward the smaller end of the figure, and finally lose themselves in the slab without again uniting.

The bud-like attachment resting upon the junction of the branches is somewhat hemispherical, with a small conical elevation on the top, from which numerous furrows radiate to the surrounding margin. It varies from the general hemispherical shape, by being slightly prolonged toward the interior of the plant, where the spaces between the furrows are correspondingly enlarged. The furrows curve a little, and the spaces between them are slightly rugose. The diameter of this attachment, in ten different specimens examined, was found to vary but little from half an inch, and the height measured a little less than half as much.

The specimens figured are from the collection of C. B. Dyer, who has another one nearly twice as long as the one illustrated. They were found at Cincinnati, in the lower part of the Cincinnati Group.

Trichophycus, n. gen.

[Ety.—*Trichos*, hair; *phukos*, sea weed.]

This genus of plants consists of simple branches or stems having

diagonal or longitudinal markings, as if made by the folding down of hair-like filaments. The markings readily distinguish it from all other genera of Silurian plants.

TRICHOPYCUS LANOSUS, n. sp. (Plate I., figs. 3 and 4.)

[Ety.—*Lanosus*, woolly.]

Plant consisting of a round, flexuous stem, having an enlargement or spheroidal swelling at one end, and being covered with diagonal and longitudinal lines, as if made by the folding down of hair-like filaments. Figure 3 illustrates well the appearance of the fossil and the enlargement at one end. Figure 4 represents part of three specimens lying together on a slab.

The specimens figured are from the collection of C. B. Dyer, and were found in the upper part of the Cincinnati Group, in Warren county, Ohio.

RUSOPHYCUS ASPER, n. sp. (Plate I., fig. 5, natural size; fig. 5*a*, magnified view.)

[Ety.—*Asper*, rough.]

This plant consists of long stems, flattened on the upper side, or having a longitudinal depression, which gives to them a subangular outline. The surface is made very rough by numerous papillæ, many of which are transversely elongated. The stems are found thrown across each other in various directions, but none of them have been observed to branch. We are inclined to think, however, that it is a branching fucoid, though it may really be, as observed, composed only of simple stems.

It is so easily distinguished by its surface markings, from all other species in this genus, that no comparison with any of them is necessary. We prefer to refer the species to this genus, rather than coin a new name for it, though we are free to say that, in our opinion, it is separated by generic differences from such forms as *R. pudicus*, and *R. bilobatus*.

The specimen figured is from the collection of C. B. Dyer, and was found at Cincinnati, in the lower part of the Group.

LICROPHYCUS FLABELLUM, n. sp. (Plate II., fig. 4.)

[Ety.—*Flabellum*, a fan.]

This species consists of numerous very long slender branches, springing from a common root or stem. Sometimes the branches appear to be lying together in a bundle, and at other times they are spread out like a fan. All of these little branches are transversely wrinkled. In one instance, where the root appeared to be about $\frac{1}{4}$ of an inch in di-

ameter, these little branches, about a line or a little less in diameter, radiated off so completely covering the surface, that at the distance of about three inches from the point of radiation, sixty-eight were counted in a quadrant. Sometimes they radiate from the root or stem in every direction so as to almost cover a circular space. After the branches leave the root they remain single, and seem to fade away in the slab at the distance of two, three or four inches, though there is little or no apparent diminution in size until at the point of disappearance.

The specimen figured is from C. B. Dyer's collection, and was found in the upper part of the Cincinnati Group, near Lebanon, Ohio. It shows the branches in a bundle before spreading, and about fifteen branches gently flowing off to the left, while the remainder continue in the fascicular condition, until they pass from view in the slab. Mr. S. T. Carley, of Bantam, Clermont county, Ohio, has a number of very fine specimens collected in that locality, from which part of the foregoing description was drawn.

The definition of the genus is broad enough to include this species, though it is so different from any that have been defined that no comparison with any of them is necessary.

MONTICULIPORA CALCEOLUS n. sp. (Plate I., fig. 11, natural size; fig. 11*a*, magnified view of the cells.)

[Ety.—*Calceolus*, a little shoe.]

This little coral, so far as our observation has extended, is always found in the shape of a little wooden shoe. For the purpose of describing it, we will regard the upper end, as shown in the figure, as the anterior, and the lower as the posterior ; and from the assistance furnished by a longitudinal microscopic section, kindly prepared for our use by Dr. J. H. Hunt, we are enabled, as we think, to define the manner of its growth.

We may suppose a single embryo from an egg, or in the form of a ciliated animalcule, floating free in the waters of an ocean ; then becoming a simple bryozoon, and secreting a single, calcareous, cup-shaped cell, and forming for itself an epithecal covering for its base. It now increases by gemmiparous reproduction, each little bryozoon attaching itself by a point to the parental extension of the epithecal covering, and gradually enlarging its cup-shaped cell by the side of its parent. We now have the commencement of this coral at the upper side of the anterior end. This method of growth at once forms a concave base, which is prolonged into a circular expanding cup. The bryozoa upon the lower side, instead of attaching themselves by a mere point to the epithecal covering now secrete this material for part of the side of each cup, and thus form each individual cell into a little

horn-shaped cavity, upon the concave side of which other bryozoa attach. The result of this method of growth is the extension of the expanding cup-shaped basal cavity, formed by the multiplicity of bryozoa, into a circular-horn shaped cavity, with the mouth at the posterior end as shown in the illustration.

The epitheca is thin and concentrically wrinkled. The corallites are subequal in size, the larger ones collected into groups. They are thin walled and arranged in diagonal lines, somewhat like the arrangement in *Monticulipora quadrata.* The calices are hexagonal,polygonal, round or otherwise variable in form (though the hexagonal ones seem to be the most common), and measure from 8 to 12 in the space of a line. The larger calices are sometimes gathered into tubercles, while other specimens are free from these elevations. Specimens vary from 1-5th to 3-5ths of an inch in length, and from 1-6th to 1-3d of an inch in width, and appear to have always been free from attachment to other substances.

This species we separate from all others by its form and method of growth. We regard it as belonging to the class bryozoa, because regular calcareous partitions or tabulæ are not found in the microscopic sections, and because we believe its method of growth was gemmiparous, and that each animal resided in a separate cell. It may be that the genus *Monticulipora* belongs to the true polyp corals, and if so, it may be that our species should be arranged in a new genus, but we prefer to leave it in this genus rather than attempt to found another without special study of all the Silurian forms.

This species is not uncommon on Mount Auburn, at an elevation of about 400 feet above low-water mark at Cincinnati.

Agelacrinus septembrachiatus, n. sp. (Plate I., fig. 9.)

[Ety.—*Septem*, seven; *brachiatus*, having arms.]

This species is founded upon a single specimen, which was found in the upper part of the Cincinnati Group, near Waynesville, Ohio, and is now in the collection of C. B. Dyer. Only a small part of the disk is visible, between the closely wrapped arms, where it appears to be composed of very small almost granular plates.

There are seven very long, strong arms, curved sinistrally, with the smaller ends drawn under as if in the effort of hugging yet more closely together. The plates are about three times as long up and down through the arms as they are in the direction of the length of the arms or across the arms, and they alternately interlock with each other.

It is distinguished from *A. vorticellatus* by having seven instead of five arms, and moreover the arms are comparatively longer and stronger. It is a rare and anomalous species.

GLYPTOCRINUS ANGULARIS, n. sp. (Plate I., fig. 10.)

[Ety.—*Angularis*. angular.]

The depression of the interradial spaces gives to this species, when not compressed, a strongly angular outline, the angular appearance of which is increased, by the peculiar downward angular extension of the basal plates below the junction of the column with the body. The radial plates are marked by a strong ridge, which connects them together, and which serves to ornament the surface and increase its angularity. The surface is further ornamented by the convexity of the interradial plates, which are sometimes produced into a conical form.

Sub-basal pieces small, pentagonal, and wider at the junction with the column than high. Basal pieces hexagonal, the two lower faces resting between the sub-basals, the two sides joined by the basal pieces themselves, and the two upper sloping sides supporting the first radials. Each basal plate is possessed of an angular or wedge-shaped tubercle, which projects below the point of union between the column and sub-basal plates. The first radial plates are a little larger than the basals, heptagonal, and wider than long. The second radials are smaller than the first, hexagonal, and wider than long. The third radials are about the same size as the second, hexagonal, and support on the two upper sides the secondary radial series. The first secondary radial is hexagonal, and longer than wide. The second secondary radial is heptagonal, and supports upon each of the upper sides a series of brachial pieces, the first two of which form part of the walls of the body.

The interradial spaces have a hexagonal plate resting between the upper sloping sides of the first radials, which is followed by two plates upon its upper sides, and these by three plates in a row between the lower part of the first secondary radial plates, and above these about a half dozen small plates fill the narrow termination of each space. Only two plates are observed—one above the other—in the inter secondary radial spaces, and none have been observed in the interbrachial spaces. The azygos interradial space, or anal area, is filled with a range of elevated plates, resting directly upon one of the basal plates, and extending to the top of the body, between which and the adjoining radial series on each side there are several smaller plates.

The arms are moderately long, round upon the outside, and composed of very short plates, bearing long strong pinnules. The vault is covered, at the top of the second brachial pieces, with a plate composed of numerous granular pieces, much resembling that of *G. decadactylus*.

The column is small and round at the body. Height and breadth of the body subequal.

This species is readily distinguished from all others, by its general

angular form, peculiarly prolonged basal pieces, and the absence of the usual sculptured ornamentation of the plates.

The specimen figured was found by E. Reinhardt, and is now, as well as those from which the description was drawn, in the collection of C. B. Dyer.

PALÆASTER SIMPLEX.* n. sp. (Plate I., fig. 6.)

[Ety.—*Simplex*, simple, plain.]

Pentagonal; rays longer than the diameter of the body, and uniformly tapering. The marginal plates rapidly diminish in size, from the body, toward the points of the rays, and change from a somewhat oblong shape to a nearly globular form as they approach the tips of the rays. The marginal plate, at the junction of the rays, is remarkably large and somewhat angular-ovate in form; the smaller end extends up between the adjoining marginal plates, which it supports on the upper sloping sides, while the larger end extends into the angle formed by the junction of the adambulacral plates. Only nine marginal plates, in addition to the one at the junction of the rays, are preserved on a single side of any ray in the specimen collected, but as the rays to this point have gradually contracted to less than half the width at the body, it is presumed that they extended but little farther.

There are twenty-two somewhat oblong adambulacral plates, arranged with their length across the rays, and their breadth in the direction of the length of the rays, between the oral plates and the end of the ninth marginal plate.

There are ten oral plates formed by the junction of the adambulacral rows, each one of which has an irregular, somewhat elliptical form, with a triangular extension into the oral opening.

No ambulacral plates are visible, and the ambulacral groove is so exceedingly narrow, that it could not have contained more than a single row of ambulacral ossicles.

The dorsal surface, madreporiform tubercle, and outer limits of the rays unknown, and likewise the ambulacral ossicles, though some small pieces of crinoidal matter in one of the rays may represent some of them.

The description is founded upon the ventral side of a single specimen, collected by W. J. Stevens, of Lebanon, in the upper part of the Cincinnati Group, near Raysville, Ohio, and now belonging to S. A. Miller's collection. The diameter of the body is about two fifths of an inch; length of a ray from the body to the ninth marginal plate, about half an inch; thus indicating the greatest distance from the tip

* The description of this species was read by S. A. Miller, before the Society, at the January meeting, 1877.

of one ray to the tip of another, in a perfect specimen, to be about two inches.

It is distinguished from other species by the narrowness of the ambulacral furrow, by the absence of any plates between the oral plates and the plate at the junction of the marginal plates, and by the peculiar form and position of the junctional plates.

PALÆASTERINA SPECIOSA, n. sp. (Plate I., fig. 7, dorsal view.)

[Ety.—*Speciosus*, beautiful.]

Pentagonal; rays obtuse at their apices; greatest distance from point to point about $2\frac{1}{2}$ inches; breadth of body between rays about $1\frac{1}{3}$ inches, and distance from tip of ray to next adjoining tip on either side about $1\frac{1}{2}$ inches.

The marginal plates are small and somewhat hemispherical, near the termination of the rays, they gradually enlarge and become square, and then rectangular as they approach the disk, until at the narrowest part of the disk or body of the fossil they are twice as long as wide. There are about 50 marginal plates between the apex of one ray and the next one adjoining, or in a perfect specimen of this size about 250.

The back or dorsal side is covered with numerous plates (probably in a complete specimen of this size there would be 1,000 or more), which are very prominent in the center or somewhat conical, and seem to have been joined together with deeply serrated edges. The plates have from three to eight of these indentations, which give them a beautiful star-like appearance.

The ambulacral grooves are narrow and deep, as shown by the sharp ridges on the back of the specimen. The small dorsal plates which cover the ambulacral pieces are exfoliated in some places, and show two rows of ambulacral plates coming evenly together, and forming the sharp ridge.

This specimen was collected by W. C. Barnhart, on Twin Creek, near Winchester, in Preble county, Ohio, in the upper part of the Cincinnati Group. It was sold to J. W. Harvey, and by him sold to C. B. Dyer, who placed it in his collection.

PALÆASTERINA APPROXIMATA, n. sp. (Plate I., fig. 8.)

[Ety.—*Approximatus*, near to; from its resemblance to *P. speciosa*.]

Pentagonal; rays more slender than in *P. speciosa*: greatest distance from point to point in the specimen figured 1.15 inches, and breadth of the body $\frac{1}{2}$ inch; another specimen from the collection of Mrs. M. P. Haines, of Richmond, Indiana, measures from point to point 2.5 inches, and has a breadth of body of 9-10th inch.

The marginal plates have about the same form, and are about as numerous as they are in *P. speciosa.* The adambulacral plates are arranged with their length across the rays. The oral plates are very prominent. The space between the marginal plates and the oral ones is filled with numerous small pieces. The ambulacral grooves are narrow. Ambulacral ossicles unknown.

The dorsal side is covered with small conical pieces, which give it a coarsely granular appearance. The madreporiform tubercle is prominent, conical and longitudinally striated.

This species is distinguished from *P. speciosa* by its narrower rays, more contracted body, and smaller dorsal plates.

We have examined two specimens belonging to Mrs. Haines, which were found in the upper part of the Cincinnati Group, near Richmond, Indiana, one of which shows the dorsal side and madreporiform tubercle, and the other the ventral side, from which part of the foregoing description was drawn. The specimen figured shows the ventral side, and was collected by D. R. Anderson, near Waynesville, Ohio, in the upper part of the Group, and is now in the collection of C. B. Dyer.

PROTASTER FLEXUOSUS, n. sp. (Plate II., fig 1, dorsal side; fig. 1*a*, ventral view).

[Ety.—*Flexuosus*, full of turnings.]

The disk is composed of very thin, small plates, the order of arrangement of which is not determined. The specimens examined differ in size, and show the disk varying in diameter from $\frac{1}{4}$ to $\frac{1}{2}$ an inch. The rays were very flexuous when living, and are found winding and turning and thrown in different directions, in different specimens.

Four series of plates are seen upon the dorsal side of each ray near the disk. The two inner series form an angular ridge, each plate is concave at the uniting surface, the arrangement is alternate, and the appearance, therefore, of the top of the ray, is something like the alternate arrangement of two series of hour-glasses. The outer series, or marginal plates, are spinous, the spines directed toward the point of the ray. A weathered ray shows three series of pores—one row between the inner series of plates, and one between the marginal plates and inner series, upon each side of the ray. The plates are a little the longest in the direction of the length of the ray, and in this direction there are about four to the line. The rays cross the disk on the dorsal side, and unite near the center of it, but the specimen figured, Plate II., fig. 1, has this part of the rays removed. Plate II., fig. 1*a*, illustrates the ventral side of a specimen, which is too indistinct to show the arrangement of the plates. Small pieces, showing the ventral side

of the rays, from other specimens, have two rows of spines springing from the marginal plates on each side of the rays.

This species has been found at different elevations from near low-water mark in the Ohio river to the top of the hills at Cincinnati. The specimens figured, as well as the fragments from which the foregoing description was drawn, are in the collection of C. B. Dyer.

PALÆASTER SPINULOSUS, n. sp. (Plate II., fig. 12, dorsal side; fig. 12*b*, ventral side; fig. 12*a*, magnified view of the madreporiform tubercle.)

[Ety.—*Spinulosus*, full of spines; from the spines on the adambulacral plates.]

Pentagonal; rays longer than the diameter of the body; marginal plates globular near the apices of the rays, but lengthened toward the junction with the body. Six of these plates measure from the body on a ray three tenths of an inch. Two wedge-shaped plates form the junction of the marginal plates with the body.

Adambulacral plates a little smaller than the marginal pieces, and possessed of two or three spines to each plate. These spines taper to a fine point, and are longer than the diameter of the plates. The oral pieces are not determined. The ambulacral plates have their greatest length across the rays, and are possessed of a sharp ridge in the middle which seems to be connected at one end with the adambulacral pieces.

The dorsal side is covered with plates united by angular extensions. They are of unequal size, and strongly tuberculated or spinous.

The madreporiform tubercle on its upper face is an oblate spheroid, much depressed, and marked by fine radiating striæ, which become more numerous by intercalation, without bifurcation.

So far as our observation has extended, the madreporiform tubercle in palæozoic asteroidea has the same form in specimens belonging to the same species, but is different in different species. It will, at least, be regarded, as of specific importance, in each genus. The specimen figured was found at Cincinnati, and is in Mr. Dyer's collection.

CYCLOCYSTOIDES MAGNUS, n. sp. (Plate II., fig. 8, natural size; fig. 8*a*. magnified view.)

[Ety.—*Magnus*, large.]

A flat circular body, of which only a ring, composed of twenty plates, is known. Eight specimens have been examined, which differ very little in size. One measured 9.10 inch in diameter, and the interior of the ring a little more than ½ inch.

The ring, though composed of twenty plates, may be divided into two parts, an outer rim and an inner or submarginal one. The outer rim is thin and bears upon the upper surface, two, three or four scars.

to each plate. Each scar consists of a central mammillary elevation, surrounded by an elevated ring, which resembles the attaching base for a spine; but there is some evidence that the inner rim was pierced, forming a connection between the canal surrounding the mammillary elevation and the interior of the disk, and we have no idea that the animal had spines upon this rim.

The inner or submarginal rim does not appear on the upper surface to have ever been connected from plate to plate, but to consist of twenty disunited pieces. The interior of this inner rim has a semicircular groove, which was the place of connection with the interior disk. The upper surface of the inner or submarginal rim, in good specimens, is strongly tuberculated.

In other words, we would describe this ring as consisting of twenty somewhat quadrangular plates, having a semicircular groove on the interior side, an elevated inner rim, disconnected on the upper surface, but probably united by a tubular channel, and strongly tuberculated, and an outer marginal rim, having mammillary elevations, surrounded by canals which are connected with the semicircular groove on the interior side by small pores penetrating the inner rim.

The specimen figured was found in the upper part of the Cincinnati Group, near Morrow, Ohio, and is now in Mr. Dyer's collection.

Cyclocystoides minus, n. sp. (Plate II., fig., 5.)

[Ety.—*Minus*, small.]

This is a flat circular ring, composed of nineteen plates. The specimen is weather-worn, and pressed a little out of shape, and is in Mr. Dyer's collection. The groove on the interior side of the plates is distinct. The outer rim is destroyed, and a groove is left on the inner rim, where the pores, which connected the outer rim with the interior semicircular groove, are quite distinct. The specimen is about 3-10ths of an inch in diameter, and was found near Morrow, Ohio, in the upper part of the Cincinnati Group.

Cyclocystoides parvus, n. sp. (Plate II., fig. 6.)

[Ety.—*Parvus*, little.]

This species consists of twenty-six marginal plates, and is about four tenths of an inch in diameter. It is a weather-worn specimen, from Mr. Dyer's collection, and is pressed a little out of its circular form. Only enough of the interior part of the ring is preserved, to enable us to count the plates. It was found near Morrow, Ohio, in the upper part of the Cincinnati Group.

CYCLOCYSTOIDES MUNDULUS, n. sp. (Plate II., fig. 7.)

[Ety.—*Mundulus*, neat, trim.]

This species consists of thirty-two marginal plates, and is a little less than one half inch in diameter. It is from Mr. Dyer's collection, and is somewhat weather-worn. A magnifier shows radiations, from a subcentral elevation to the interior side of the ring, which, no doubt, belong to the ornamentation of the interior disk. The surface markings of the outer rim are not preserved. It was found near Morrow, Ohio, in the upper part of the Cincinnati Group.

CYCLOCYSTOIDES BELLULUS, n. sp. (Plate II., fig. 10, natural size; fig. 10*a*, magnified view.)

[Ety.—*Bellulus*, beautiful.]

The specimen from which the following description is drawn, has been injured upon one side, so that all the marginal plates can not be counted; fourteen plates are distinct, and the injured space is of the length of four plates; we suppose, therefore, that it consisted of eighteen plates, forming a circle, the diameter of which is about six tenths of an inch. The outer rim is thin, and attached to the inner rim in a groove. It is ornamented by two, three, or four scars to each plate. These scars consist of elliptical, mammillary elevations, surrounded by a shallow canal. The inner rim is strongly tuberculated, and at the disconnected joints, each piece is striated about two thirds of the way from the margin to the middle of the rim. This rim appears to have had a tubular canal, as well as a semicircular groove, upon the inner and outer side. Pores are distinctly observed passing from the canal surrounding the mammillary elevations upon the outer rim, through the inner rim to the inner semicircular groove.

This species is distinguished from *C. magnus*, not only by the number of the marginal plates, but by the shape of the mammillary elevations, and ornamentation of the outer rim. It was found at Cincinnati, Ohio, and is in Mr. Dyer's collection.

In 1851, attention was first called to these fossil bodies by Prof. James Hall, in Foster and Whitney's Report on the Lake Superior Land District. He described and figured a specimen found in the Hudson River Group, having twenty-nine plates, without proposing any name for it. In 1858, Billings and Salter, in Canadian Organic Remains, Decade 3, founded the genus Cyclocystoides, and figured and described from the Trenton Group of Canada, *C. halli*, having 36 marginal plates, and *C. davisi*, from the Upper Llandovery rocks of England, having 48 or 49 marginal plates. In 1865, Prof. Billings figured and described, in Palæozoic Fossils, Vol. I., *C. huronensis*, having 60 marginal plates, and found on Lake Huron, in the Hudson River

Group. In a paper published in 1866, and now forming part of the Twenty-Fourth Annual Report on the New York State Museum of Natural History. Prof. James Hall named the species described by him in Foster & Whitney's Report, *C. anteceptus*, and described and figured *C. Salteri*, having 26 marginal plates. These four species are all that have been describ d heretofore.

We have described one species, *C. parvus*, having the same number of marginal plates possessed by *C. salteri*, but the species must be widely different from each other. *C. salteri* is much the largest, and had two rows of plates on the out side of the inner rim, which were surrounded by a granulose border, and is otherwise quite distinct from *C. parvus*.

From all the specimens, which we have examined, we are led to infer, that in each of the species, which we have described above, the submarginal rim was perforated by a tubular canal, and was grooved upon the outside and upon the inside; that from a central or subcentral point, some kind of a radiated structure, extended into the groove on the inside of the submarginal rim, and was connected by pores to the marginal rim; the marginal rim consists of the same number of plates as the submarginal, which were inserted into the groove and possessed little channels connected with the pores that penetrated within. We are not sure, however, that we are able to throw any light upon the fossil, beyond the descriptions and illustrations furnished above, and we have taken the occasion to refer to the literature upon the subject, because we have been unable to find indicated in our specimens either the structure pointed out by Billings and Salter or by Prof. Hall.

CODASTER PULCHELLUS, n. sp. (Plate II., fig. 13, natural size; 13*a*, magnified view of the summit).

[Ety.—*Pulchellus*, beautiful, little.]

This species is small, smooth, and obpyramidal. The point of attachment to the column is very small. There are three basal pieces, each one of which is elevated in the middle, and depressed on the uniting sides; this makes the base somewhat triangular. One of the basal plates is pentagonal, and the other two are hexagonal. The pentagonal plate has two upper sloping sides. The hexagonal plates have three upper sides, the middle ones being a little concave, and each supporting a radial plate, while the other three radials are supported between the upper sloping sides of the basal plates.

There are five radial plates, each one of which is sharply angular in the middle. This gives the fossil, above the basal plates, a marked pentagonal form. Two of the radials are pentagonal, the others are hexagonal.

The summit is more or less convex in different specimens. From the central pentagonal opening, five double series of pseudoambulacral pieces radiate to the angles of the pentagon. The number of pieces seem to differ from fourteen to twenty or more in a single series, in different specimens. A line of depression, commencing at the angle, of the central pentagonal opening, separates each double series. The pseudoambulacral pieces are removed from two of the rays and reveal a long single piece or frame, extending from the angle of the central pentagonal opening, to the angle of the pentagon, which has a ridge in the middle that separated the two series of pseudoambulacral plates.

The specimen illustrated was collected by Mr. Dyer, in the upper part of the Niagara Group, at Waldron, Indiana.

EUCALYPTOCRINUS TUBERCULATUS, n. sp. (Plate II., fig. 9 and 9*a*.)

[Ety.—*Tuberculatus*, tuberculated.]

The general form of the body is obconical, with a slight constriction at the top of the first radial plates. The whole surface is strongly tuberculated. Basal plates not observed. The first radial plates are hexagonal and longer than wide. The upper end of each of these plates is like the upper end of the first radials in *E. crassus*, but the lower end is prolonged below the point of junction, with the column instead of gently curving over into the pit for the column, or having a truncated appearance, as in the latter species. The second radials are somewhat quadrangular; the width at the base being a little the greatest. Three of the third radials are hexagonal, the other two are pentagonal. The sides differ very little in length. The first supraradials are either hexagonal or pentagonal, and about two thirds as large as the third radial. The second supraradials are much smaller, and support on the upper sides a small triangular plate, upon which the first arm-plates rest. The first interradials are large, nine or ten sided plates. The two lower sides rest upon the first radials, the next two are enclosed between the second radials, the next two between the third radials, the two upper sloping sides between the under sides of the first supraradials, and the two upper sides support two smaller interradials, which are long and narrow, and extend up as high as the fourth or fifth pair of arm-plates. This description applies to the two ten-sided interradials, the other three have only nine sides, as shown by Plate II., fig. 9, and differ in supporting one supraradial instead of two. The inter supraradial plate is single, has nearly the form of the two upper inter-radials when united, and reaches nearly as high upon the arm-plates.

This species, in general form, resembles *E. crassus*, but is readily distinguished by its large tubercles, and prolonged first radial plates.

It is more strongly tuberculated than *E. cælatus*, from which it is distinguished by its general form, as well as by the form and arrangement of the plates. Plate II., fig. 9*a*, represents the form and strongly tuberculated appearance of the species. Fig. 9 shows the plates of a slightly compressed specimen, from which most of the tubercles have been removed.

The specimens illustrated were collected by C. B. Dyer, in the upper part of the Niagara Group, at Waldron, Ind., and are now in his collection.

Microspongia, n. gen.

[Ety.—*Mikros*, small; *spongia*, sponge.]

A free calcareous sponge, destitute of an epitheca. The texture is finely porous, without large canals or openings on the surface. Spicules (?) very minute and needle-shaped.

Microspongia gregaria, n. sp. (Plate II., fig. 2.)

[Ety.—*Gregarius*, belonging to a flock.]

This is a small gregarious, globular, calcareous sponge, free and having no epitheca. Its structure is fibrous or minutely porous, and very compact. Weather-worn specimens show the fibrous structure, which is well illustrated in the figure. Microscopic sections, prepared by Dr. J. H. Hunt, reveal what we suppose to be spicules. They are minute needle-shaped bodies. This species is sometimes found in clusters, though it is by no means a common fossil. Specimens collected, vary in diameter, from less than one eight to more than one half an inch, and have been found at Cincinnati, and in the upper part of the Group. The specimen illustrated is from the collection of C. B. Dyer.

Spirifera (?) waldronensis, n. sp. (Plate II., fig. 3*b*, dorsal; fig. 3*c*, ventral; fig. 3*a*, basal; and fig. 3, cardinal view.)

Shell subquadrate and moderately ventricose; hinge line rather longer than the width of the shell; surface smooth or showing only concentric lines of growth.

Ventral valve somewhat pyramidal, with the apex, extending beyond the hinge area and truncated by a circular foramen: arcuate below the umbo, and curving rapidly to the base; area curving to the dorsal valve, and becoming linear in the extension of the hinge line.

Dorsal valve highly elevated in the middle, and rapidly descending to the margins, except at the cardinal angles, where it is flattened to produce the extension of the hinge line; apex incurved.

The interior is unknown, and the triangular fissure, which should mark the ventral valve, if the species is a true Spirifera, has not been observed.

The specimen figured is from the collection of Mr. Dyer, and was collected in the upper part of the Niagara Group at Waldron, Indiana.

CONULARIA FORMOSA, n. sp. (Plate I., fig. 12, natural size; fig. 12*a*, magnified view of a portion of the surface showing the tubercles.

[Ety.—*Formosus*, beautiful.]

This species in general form is pyramidal, somewhat quadrangular, angles furrowed, and sides somewhat rounded as in *C. trentonensis*. The surface is marked by rounded furrows, separated by obliquely transverse ridges, extending from each angle of the shell diagonally towards the mouth, and meeting those from the opposite angle in the middle of each side. These ridges are ornamented with small nodes or tubercles at the junction with the striæ, which cross the furrow on the side toward the apex of the shell. The rounded furrows are crossed by striæ, which are about twice as numerous as the transverse ridges, and which terminate on the ridge toward the mouth of the shell in a small tubercle. The longitudinal striæ do not cross the transverse ridges, nor are they continued in straight lines on the opposite sides (the magnified view is erroneous in this respect), but on the contrary the striæ, which cross the furrows, commence at the ridge toward the apex, at a point between the tubercles, and crossing the furrow toward the mouth terminate at the tubercles.

This species is readily distinguished from *C. trentonensis*, which it most resembles in general form, by the tubercles on the transverse ridges. Even badly exfoliated specimens may be distinguished by the aid of a pocket magnifier.

The specimen illustrated is from the collection of C. B. Dyer, and was found in the upper part of the Cincinnati Group, near Versailles, Ind., by Dr. W. H. H. Hunter. Another specimen, showing very prominent tubercles, was collected by Dr. C. A. Miller, on the top of the hills near the city of Cincinnati, and is now in S. A. Miller's collection.

SPIRORBIS CINCINNATIENSIS, n. sp. (Plate I., fig. 13, magnified nearly 7 diameters.)

The shell is discoidal, and consists of more than one volution. The diameter of the specimen figured, is a little less than a line, and is magnified to six lines, to show the markings more distinctly. It is slightly compressed at the aperture, which appears to have been round originally. The tube is round, except on the interior face, where it appears to be depressed, as if for another volution, which is not visible, in our specimen. The surface is marked by closely crowded, fine, transverse lines until they approach the aperture, when they become somewhat diagonal in their direction, and are followed by seven more

distant, coarser striæ, before reaching the aperture. The specimen figured is from the collection of C. B. Dyer, and was found near the top of the hills at Cincinnati, Ohio.

Walcottia, n. gen.

This genus consists of long, tapering, rugose, flexuous bodies, worm-like in form, but composed apparently of fucoidal matter. The fossils taper to a point at one end, and are enlarged at the other, or present the appearance of suddenly bending down and entering the rock. We are uncertain whether this fossil is of animal or vegetable origin; though, we think it is possible that it is the long lost borer of Silurian age, which has left so many holes in the corals and the rocks. The generic name is in honor of Mr. C. D. Walcott, the distinguished young geologist of Trenton Falls, New York.

Walcottia rugosa, n. sp. (Plate II., figs. 11 and 11*a*.)

[Ety.—*Rugosus*, rugose.]

This species consists of a slender, tapering, flexuous body, evenly rugose on each side. From the middle of the back, strong ridges run off, diagonally inclined toward the tapering end. These ridges are in pairs, one upon each side of the body, and form an angle at their junction on the top of the fossil.

The two specimens figured are on a slab, from the collection of C. B. Dyer, which appears to have been penetrated in several places by what are commonly called worm holes. Plate II., fig. 11, represents a specimen just entering one of these iron rust, or worm holes, while the balance of the body is in relief on the slab. Plate II., fig. 11*a*, represents part of the body of a specimen, one end of which appears to be lost in a worm hole, and the other not yet emerged. A specimen in S. A. Miller's collection, represents a track from one worm hole to another, 1½ inches apart. The track curves from one side of a direct line to the other, and has every appearance of having been made by such an object as fig. 11 represents. It was found in the excavation for Columbia Avenue, about 150 feet above low water mark, and Mr. Dyer's specimen was found near the top of the hills, at Cincinnati.

Pupa cincinnatiensis, n. sp.

By Chas. R. Judge.

Shell delicate, minute, shining, translucent, nearly colorless, smooth, very faintly marked by the striæ of growth, and by numerous microscopic wrinkles; apex obtuse; whorls 4½ to 5, convex separated by a deeply impressed suture; aperture semi-oval, having in the right hand

portion of the peristome a slight fold, slightly contracting the aperture at the margin ; peristome simple, heavily thickened near the margin, the callus extending over the parietal wall; aperture contracted by five prominent dentacles seated on the callus, one prominent on the parietal wall, two on the columella, the lower being the smaller of the two, and two on the other portion of the peristome, more deeply seated in the throat, and occasionally one or two very minute rudiments on the peristome. Length 1.56, diam. .84 mill.

This shell is found on both sides of the Ohio River, near Cincinnati, stationed in deep beds of damp leaves, in woods, somewhat close to the ground. It may most easily be mistaken for Pupa pentodon, but is much smaller and proportionally broader, and its aperture is obstructed by a less number of dentacles than are usually seen in specimens of the latter species.

There are specimens in my own cabinet, and in the collections of Jas. Lewis, M. D., Mohawk, N. Y., and of the Cincinnati Society of Natural History.

Read before the Cincinnati Society of Natural History, January 2, 1877.

ON THE TONGUE (LINGUA) OF SOME HYMENOPTERA.

By V. T. Chambers.

What do bees eat ? And how do they eat it ?

One would think that with the patient study and observation that these little creatures have received since first—it may be in Paleolethic or some previous *caudate* period—man tasted honey, these questions ought long ago to have been definitely settled. Over a century ago, Reaumer wrote : " Il est étonnant que ceux qui ont etudié les abeilles, n'ay ent pas été détenuinés par un infinité de faits, à chercher la bouche dont nous verront de voir la position ;" and thereupon he proceeded to settle it, as he no doubt supposed, for all time; but it is by no means settled yet. A long list of great names in entomology and microscopy might be made, it is true, of those who agree with Reaumer and Savigny, or at least who follow them, as to the structure of a bee's tongue, and consequently as to its mode of feeding, and the nature of its food to some extent. With the question as to what a bee eats we have nothing now to do except in so far as it affects the question of its mode of feeding, and therefore bears upon the structure of the mouth parts, which is the question for our present consideration.

"Il est étonnant" that this matter is not yet generally understood and agreed upon among Entomologists and Apiculturists, and it is still more astonishing what a mass of contradictory statements may be compiled from works of the highest authority upon the subject, and I plead this as my excuse for venturing to differ with some of the magnates of Entomology and Microscopy, and venturing upon the publication of my own observations on the subject; observations which may be repeated in a very little time, by any one who can catch a bee, and which when made will leave no doubt whatever in the observer's mind as to what the structure is, whatever may be his opinion as to how the structure is used. But before proceeding to detail my own observations, let us first consult what has been written by others, by way at least of showing how much confusion and difference of opinion exists on the subject. Thus Dr. Carpenter—than whom no higher authority in Microscopy is recognized—states that the tongue is a muscular organ, though Reaumer had long before stated that it does not contain a single muscle, being operated by the muscles of the mentum to which it is in part attached, and by its own elasticity; Cuvier also calls it membraneous and not muscular; Hogg (*Microscope*), says that it is cylindrical; Kirby and Spence say that it is flat; while Reaumer shows correctly that it is neither exactly, but is something between the two; Cuvier states that the larvæ of bees feed on "honey and the fecundated farina of flowers," and "that the perfect insect likewise subsists on honey." Yet Frederick Smith, perhaps the greatest living authority on *Hymenoptera*, states that he has taken the perfect insect in the act of feeding on bee bread, and some persons say that nectar is never found further back in the intestines than the honey, or sucking stomach, where they contend it is converted into honey, and is then disgorged, and that the adult bees never eat honey at all.

Savigny seems to be regarded as the first who denied that the tongue was a sucking tube; and yet, if I remember right, he does not in so many words deny it, but when commenting on the statement of Lamark, that the tongue is a tubular sucking instrument, by means of which the bee feeds, he states, in substance, that Lamark had not investigated the matter with sufficient care, and then proceeds to demonstrate the pharynx, epipharynx, and hypopharynx, under the labrum. There can, however, be little doubt that he regarded the aperture under the labium as the opening through which food passed into the œsophagus.

Newport (Art. Insecta, in the Cyclopedia of Anatomy and Physiology) states, that "the maxillæ and labium are the only organs of the *Apidæ* employed in feeding;" that "in the true *Apidæ*, which subsist entirely upon honey, they (the maxillæ) are drawn out to a great

length, and with the labium beneath form a tube through which the aliment is conveyed to the mouth, as in the hive and humble bees;" also that "when the maxillæ are extended to form a sucking tube with the labium, they are a little separated at their base, and inclose between them the cavity of the mouth, within which is a soft fleshy body, the lingua or true tongue, situated anterior to and serving as a valve to the pharynx." Again, he states that the labium "is the part employed in gathering honey. In *Apis*, *Bombus*, and *Anthophora*, it is a long, tapering and muscular organ, formed of an immense number of short annular divisions, and densely covered throughout its whole length with long erectile hairs. It is not tubular, but is solid;" also, that "the manner in which the honey is obtained, when the organ (labium) is plunged into it at the bottom of the flower, is by lapping or a constant succession of short and quick extensions and contractions of the organ, which occasions the fluid to be accumulated upon it, and ascend along its upper surface" (why not its under surface too?) "until it reaches the orifice of the tube formed by the approximation of the maxillæ above, and the labial palpi and this part of the ligula below. At each contraction a part of the extended ligula is drawn within the orifice of the tube, and the honey with which it is covered ascends into the cavity of the mouth, assisted in its removal from the surface of the ligula by the little bunch of hairs with which the elongated second joint of each labial papus is furnished. From the mouth the honey is passed on through the pharynx into the œsophagus, by a simple act of deglutition as in other animals."

Burmiester, on the other hand, states that the tongue is a pierced sucking instrument, and that the office of the so called sucking or honey stomach is simply to become inflated as a receptacle for the air which is drawn back out of the tube in the act of sucking. On the other hand again, Kirby and Spence, Dr. Carpenter, Shuckard and many others, state just as positively that the tongue is not pierced at all, and that the insect does not feed by suction. Reaumer, while admitting that it seems to be pierced, gives his reasons (derived from observing bees eat syrup on a glass, and other observations, not from dissections) for concluding that it is not pierced, and states that if it is pierced the aperture must be too small for use as a sucking tube. Previous to these observations, Reaumer, following Swammerdam, had believed that bees fed by suction through the tongue. After that he and Shuckard also believed that the nectar arose along the outer surface of the tube through the hairs with which it is clothed, after having just been lapped up by its terminal portion, until it reached "a sort of tube," formed by closing the labial palpi paraglossæ and maxillæ around the tongue. Kirby and Spence proposed to call the Hymenoptera, Lappers, from their mode of feeding, as distinguished from suctorial and mandibulate insects;

and lastly, Rev. Mr. Wood, in "Homes without Hands," states that the honey or sucking stomach "seems to discharge no other office than that of a vessel in which the juice can be kept while the bee is at work;" that "it is composed of an exceedingly delicate membrane, that seems incapable of exerting any influence on the substance contained in it;" notwithstanding which the nectar is, "during the short sojourn," while the bee flies home, "converted into honey, a substance quite unlike that from which it is formed;" an office very different from that suggested by Burmiester, as before stated; while Reaumer had long before suggested a similar office for—not the sucking stomach, which lies in the abdomen, but for what he calls the "membraneous sack," which lies in the tongue itself. Mr. Wood further states that the bee first laps up the nectar with the tongue, from which it then scrapes it off with its mandibles. Prof. Huxley (anatomy of invertebrates) calls the bee's mouth, "partly mastacatory, partly suctorial, or rather lapping."

These are the principal authorities to which I have now the means of reference. The recent publications of Brants, Menier and others I have not seen. Reaumer, Savigny, Newport, Kirby and Spence, and Carpenter, etc.!—one is almost compelled by such an array of authority to disbelieve his own eyes. Yet surely there is enough discrepancy in the accounts above mentioned, to authorize one to trust his own careful investigations, and to suspect that perhaps there has been already something too much of trusting to authority, and of repetition of unverified observations. And before proceeding to detail my own observations, I desire to call attention to what appears to me to be unreasonable and inconsistent in the observations of these authorities. I have given their views condensed, and in my own language generally, because the quotations would have required more space than I have to spare.

All recent authorities agree that, under the labrum, is what Savigny calls the epipharynx; and under that, what he calls the hypopharynx; and that under this, and closed by it, is the "os" or opening into the œsophagus, the true pharynx. The correctness of this statement is easily demonstrated by the dissection of a bee. These organs are very delicate and pretty, especially in the hive bee, and their form varies, if not with the species, at least often with the genus and family. It will be admitted by all, that in so far as the bee's food consists of solid or semi-solid matter, as pollen, or bee bread, it must, at least usually, be triturated by the mandibles, which close immediately before the pharynx, and must enter the œsophagus by it. Has a bee more than one opening into the œsophagus? It appears to be both a mandibulate and a suctorial insect. Is it really so? The majority of authors above referred to, deny that it is suctorial, alleging that all food enters by the opening under the labrum. Burmiester and some others admitting the existence of the structure under the labrum

assert also that the tongue is a tubular sucking instrument, but they do not explain how matters imbibed through it get into the œsophagus: and so, on the other hand, Reaumer and others, who deny that the tongue is a sucking tube, assert that the "membraneous sack which surrounds the tongue, is at times inflated with honey or nectar," which they say enters the œsophagus at the pharynx; but fail to explain how it advances from that point forward into the membraneous sack in the tongue. Let us look at the difficulties which face us, if the tongue is not a sucking tube; that just alluded to—the presence of nectar in the membraneous sack of the tongue, far in advance of the pharynx, at which the food enters—is one of them. Another is, how does the nectar rise along the outside of the tongue to the pharynx? Says Reaumer, giving figures of the position of the tongue, "it is lapped up." Certainly, not as a dog laps, laps the bee; a dog can make a spoon of its tongue, which extends only far enough beyond the lips to dip up water, which it throws back into the mouth. A bee can not make a spoon of its tongue, which tapers to a point, and is sometimes, when fully extended, more than four times as long as the head; and besides, the little opening under the labrum, could never, from its position, catch a drop, if by chance one could be thrown that way. Certainly, the bee does not lap in this sense, and the term "lappers" is inapplicable. Besides, the quantity of nectar which it would ordinarily find in the nectary of a flower, would be too small for this sort of lapping, and in a little flowret of a thistle, or iron-weed (*veronia*), there is *no room for any movement of the tongue, other than a vertical one, when the tongue is inserted and withdrawn.* I have many times watched bees of various species on these and other compositæ: the tongue is frequently withdrawn from one flowret and inserted in another adjoining it, but is motionless whilst in the flowret. But the lapping theory is aided, or is sought to be, by what may be called the capillary theory; that is, it is supposed that the nectar, after being lapped up by the hairy apical part of the tongue, ascends through the hairs of the outer surface till it reaches the maxillæ, labial palpi, etc., as before observed, and then ascends through what Reaumer calls a "sort of tube, made by the juxtaposition of these organs." Reaumer figures a tongue with the tip bent under so that the upper part of the hairy surface is applied to a drop of honey on a piece of glass: and again, with its position reversed so that the honey would run down from the tip, but up the apical part of the tongue; but even as figured, the honey would still have to ascend perpendicularly a little way before it would reach the "sort of tube" formed by the maxillæ tongue, etc., as aforesaid, and evidently after it reaches that "sort of tube," it could only ascend through it by capillary attraction; because the upper end of the tube is also open, there is no way of ex

hausting it of air, and suction is out of the question; and after, by capillary attraction, the fluid had ascended to the upper end of the "sort of tube," it still has a little distance to ascend to the labrum without assistance of any kind, because the upper or hinder end of the maxillæ does not quite extend as far back as the labrum. This phrase, "sort of tube," itself indicates that Reaumer, and those who use it after him, had no very definite idea of the thing or its mode of action. It is not thus that one writes of a thing that he has seen and examined and understood; but with vague ideas that a thing is or must be something like a tube, one may write of it as a "sort of tube." Again, in probing the depth of many flowers (since bees do not habitually find honey ready made on pieces of glass), a bee would find it impossible to bend its tongue as figured by Reaumer, and would be compelled to extend its tongue to its full extent, and then, as every one who has examined a bee's tongue has seen, and as Reaumer himself tells us, not only the maxillæ palpi and paraglossæ stand out from it, but the very hairs themselves do so. Where is the "sort of tube" formed by these organs then? Reaumer further tested the mode of feeding by holding a bee in his fingers whilst he placed a drop (it could not have been much larger than a pin-point) of honey on its tongue near the tip when he found that it spread upwards. A more inconclusive experiment he could hardly have tried, as we shall conclude when we consider the difficulty of making an accurate observation with a lens under the circumstances, the minute size of the drop, and the fact that it must, if large enough to spread at all, spread more or less in every direction. But Reaumer does not tell us that he ever found a particle of nectar on the outside of the tongue of a bee just taken from a flower. Has any one else? It seems, to me at least, that if the nectar was taken in this way the tongue would be constantly smeared with it, and the hairs agglutinated to its surface. All of Reaumer's experiments on this matter were made on bees in most unnatural conditions, and in the cases where he and others have observed bees lapping, or more properly *wiping*, the surfaces of flowers large enough to admit of this movement of the tongue, is it not probable that they were gathering pollen instead of nectar? But the lapping theory, and the theory which for want of a better name I shall call the "sort of tube" theory, if they explain satisfactorily the mode in which the honey bee and allied species gather nectar fail utterly when applied to the *Acutilingues*, *Andrena*, *Augochlora*, *Halictus*, *etc.* In these the tongue proper — the hairy tongue — is very short, while behind it is a long, smooth mentum, with the basal joints of the maxillæ closing tightly on it—there is no tube, nor "sort of tube," there. If the fluid ascends externally, it must after leaving the tongue ascend without the aid of lapping, or of capillary attraction, or any

aid whatever, this smooth surface, and again behind it the smooth basal parts of the trophi before it reaches the labium. Even in the hive and humble bees, there is a narrow, smooth place along the upper surface at the base of the tongue where the hairs are absent, and the fluid can there derive no aid from them in ascending. Reaumer's experiment in coloring the honey seems to me equally inconclusive. The mode suggested in "Homes without Hands," that of scraping off the nectar by the mandibles, I do not understand. I do not see how the tongue can, with its peculiar mode of articulation, be brought into a position in which the nectar can be scraped off so as to remain on the inner side of the mandibles next to the pharynx, and if once placed there it seems to me that it would naturally flow away from the pharynx toward the base of the mandibles, or down over the other organs of the mouth.

There are other reasons for supposing that the bee is a suctorial as well as a chewing insect. The sucking stomach it has in common with the suctorial orders, lepidoptera and diptera, though less developed than in those orders; those are not honey-making orders of insects. If the object of this organ is, as Burmiester states, to withdraw the air from the œsophagus and tube, it should be present in all these sucking instruments, and need not be looked for in those which do not feed by suction. But if, as Rev. Mr. Wood suggests, its sole office is to convert nectar into honey, it is strange that it should be more developed in orders that do not make honey than in bees. Prof. Owen (Anatomy of Invertebrates) states that "Hunter made experiments to determine the function of the apendiculated crop. 'I kept a fly,' he says, 'for twelve hours without food, and then gave it milk, and killed it, and found no milk in the crop, but it had got through almost the whole tract of the intestines: here the animal had immediate occasion for food, therefore the milk did not go into the crop.' Another time, Hunter killed his flies after they had drunk their fill, and found the crop full, as well as the stomach and intestines. He suspects, therefore, that the crop serves as a reservoir, and 'that when there is more food than what is immediately necessary, then it is thrown into the crop to be used in future.' The result of Hunter's first experiment, and the absence of the crop in the flea and some other suctorial insects, negatives the idea of Burmiester, that the crop in hymenoptera, lepidoptera, and diptera, promotes the suction of food by the voluntary power of self-expansion, if even the structure justified the idea; but on the contrary, they prove it to be a receptacle of nutriment."

But the fact that the sucking stomach is used to store food for the future use of the insect itself, does not prove that its object is the elaboration of honey, and is not inconsistent with Reaumer's suggestion that this is the office of the membraneous sack; and though Hun-

ter's experiments seem to negative Burmiester's suggestion of the office of the sucking stomach, they have no bearing on the structure of a bee's tongue. Again, the tongue is terminated by what Reaumer calls a "button," but which is really a flap or sucker-like expansion of the tube, which we shall see, further on, does exist, whatever may be its office. Its use in a sucking instrument can be perceived, but what is its use in a lapping one? Besides, as stated by Reaumer, the tongue certainly does seem to be tubular. One not accustomed to the appearance of objects under the microscope, would certainly pronounce it tubular. How is this appearance to be explained, if it is illusory? Some hairs have been called tubular, and this has been said to be an incorrect interpretation; yet it is in one sense correct, for the hair is tubular though the tube is filled with the "pith." A glass rod sometimes appears to be tubular, but this is an illusion caused by refraction. This can not cause the appearance of the bee's tongue, because though not flat, it is not cylindrical, and does not refract the light sufficiently to produce the illusion. If the tongue is not tubular, no explanation of its tubular appearance has been given. The extensible maxillæ of the beetle, *Chauliognothus pennsylvanicus*, *De Gur.*, present a nearly analogous structure; they are membraneous, cylindrical, and clothed with hairs very much as in the bee's tongue, but there is no appearance of a tube, simply because there is no tube.

In the bee's tongue there is an appearance of a tube. It can not be an optical illusion arising from refraction. *In fact nothing is easier of demonstration than that it is really a tube.* Reaumer came very near demonstrating it, but he stopped just at the critical point in his observation. As stated by him, and as observed by every one, who has ever observed a bee's tongue, when the tongue is extended to its full extent by pressure upon the mentum, the outer envelope of the tongue, which we shall call after Reaumer, the "hairy sheath," opens along its lower surface, from the base to about the opical third of its length, in the hive and humble bees, but, almost to the apex in *Zylocopa carolina*, and through this opening there protrudes, what Reaumer calls the "Membraneous Sack," and, in bees just taken from flowers, this sack is, as observed by Reaumer, usually full of nectar. Reaumer mentions, that he could see the nectar flow down into it, from the direction of the mentum. If he had pressed the tongue in the other direction, from the apical part towards the base, he would have seen, at least I have seen, the nectar flow in the other direction, along the slightly grooved upper surface of the mentum, beneath a membrane, which is in fact a continuation of the "hairy sheath," back under the labrum, *thus proving a direct communication between the opening under the labrum, and the membraneous sack, and showing that the membraneous sack is a prolongation of the œsophagus, or at*

least is continuous with it. But having extended the tongue, so that the sack protrudes as above described, Reaumer observed, as we may also, along the lower portion of the sack, something which Reaumer calls a "line extending along the whole length of the tube." It looks like a whitish or nearly colorless rod or tube, and *in fact is a tube.* If we observe closely the mouth parts of any of the higher *Hymenopterad* (bees and hive or fossorial wasps), we shall see just before the mentum (of most authors, labium of Kirby and Spence), and in fact connected with it by a more transparent portion of membrane, a piece which has not, so far as I know, received any name as a distinct part of the tongue, being considered as a part of the mentum. In fact it is a prolongation of that organ along its lower surface, though seeming to be separated from it by a more-transparent part, and it is placed just before the base of the labial palpi, each of which is affixed to a similar prolongation of the mentum. On each side it rises, curving around the base of the tongue, like a little horn, and in some species these little horns almost meet on top: a membrane continuous with the hairy sheath of the tongue passes over them, and back under the labrum, as before stated; and in the short-tongued wasps (*Vespidæ*, *Emunidæ*, *Crabronidæ*, and some others), on pressure upon it, fluids are seen to flow backwards and forwards between the mentum and the tongue, thus proving that a communication exists between them, similar to that above described for the bees. But in the wasps the tongue is not tubular; it is a sack capable of being inflated by either air or fluid coming from the mentum. Dr. Packard, in the Guide, mentions a *Polistes*, observed by him, in which the tongue was a barrel-shaped organ, seeming to have a hole or slit at its apex,—that is the appearance of the tongue in the short-tongued wasps, when not fully extended. When retracted the tongue is not inflated, and folds down on each side of a median line and in expansion passes through the barrel-shaped form, which looks as if it was open at the end, to the form of a furcate inflated sack, and the appearance of the opening at the apex is seen to be caused by the fold at the furcation. But in most wasps and bees the little piece that I have mentioned in front of the mentum, besides the ascending horn-like projection around each side mentioned above, has also a little tooth projecting in front on its lower surface, and attached to this tooth, or rather as a continuation of it, is the colorless rod, Reaumer's line along the length of the tongue, above mentioned. This is found in both the long and short tongued bees (*Apis*, *Bombus*, *Zylocopa*, *Megachile*, *Osmia*, *Cœlioxys*, *Epeolus*, *Nomada*, *Augochlora*, *Halictus* and *Colletes* (and in the long-tongued wasps (*Amophila*, *Odynerus*, *Tachytes*, etc.) It is a colorless, corneous projection from the under surface of the little piece in front of the mentum, not in itself tubular, but in the bees forming a tube by curving up its sides until they meet

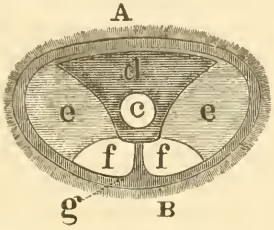
above. *In Amophila*, and the other wasps, the tongue can not be said properly to be tubular, as the hairy sheath is imperforate at its apex, and the colorless rod *only curves up its sides towards the base*, forming what may be called a trough near the base, while towards the apex they are not curved up, but widened out, giving to the tongue its furcate-spatulate form, and split up at its apex (the rod I mean) into many little forks, bifurcate and trifurcate, resembling minature hay forks. When the specimen has been macerated in alcohol or glycerine, the hairy sheath may be readily scraped off, and the structure of the rod shown as above. In the bees, on the other hand, the sides of the rod curve up throughout its entire length, forming by their coalescence above a distinct tube. In *Colletes*, and some of the short-tongued bees, and in most (all?) of the long-tongued bees, this rod suddenly dilates at its apex, but instead of spreading out into the spatulate form of *Amophile*, the dilated part also curves up its sides, and forms the sucker-like expansion or disk at its end—the "button" of Reaumer. In the *Acutilingues*, however, it narrows all the way to the apex, and there is no "button." In all (so far as I have examined), the sides do not coalesce above *at the base*, so that the *tube there opens into the membraneous sack, by an unclosed slit along its upper surface.* Its apex perforates the hairy sheath at its apex; or, perhaps, I would describe it more correctly by saying that the hairy sheath is open along its whole under surface, simply closing around the sack and tube, not including the tube at the apex, attached to it near the apex, and opening beneath, to allow it to pass out for the greater portion of its length, when fully extended. The tongue therefore consists of the hairy sheath, to which is attached along its inner surface, the membraneous sack, which is itself continuous with the œsophagus, and which is attached to the tubular rod. Along the upper surface of the sack, immediately beneath the hairy sheath, pass two parallel trachea, each of which supplies the basal part of the membraneous sack with a number of minute tracheal ramifications, which *may have* something to do with the change of the nectar into honey, if that change takes place in the sack, instead of in the sucking stomach. Reaumer was very near the demonstration of the presence of the tube. He said that the tongue *seemed* to be tubular, but instead of dissecting it, he trusted to observations on its mode of feeding,—generally in non-natural circumstances—and convinced himself, by reasoning thereupon, that the tongue is not tubular, or that if it is, its orifice is so small that it can be of no practical use. I will add here that the perforation in the tongue of the hive bee, at its narrowest part immediately before the apex, measures about 1.500th of a line, and that of the pharynx is very little larger; and a continuous flow of fluid through the tube, it seems to me, would fill the œsophagus much more quickly, and would more quickly exhaust the little

nectary of a plant than any of the modes of lapping, scraping, or capillary attraction before mentioned. Not having seen the nectar ascending from the nectary through the tube—an almost impossible observation,—I am not prepared to state positively that this is the bee's mode of feeding. All that I assert positively is, that the tongue contains a tube capable of being the instrument of imbibition, and that it appears to me to be far more reasonable that liquid food is imbibed through it than that it is carried back to the pharynx on the outside of the tongue, in any way that has been as yet suggested. Solid food of course could not be taken in this way except such minute grains of it as might be found floating in the fluid, and imbibed with it. And yet, I possess a specimen of the separated tube, mounted for microscopic observation, in which a large part of the tube is filled with minute pollen grains and other debris. In many of the smaller bees, however (*Andrenidæ, etc.*), the perforation of the tube, at its apex does not exceed 1.1000th of a line, and it is difficult to perceive how the bee's wants can be supplied through such a tube: yet we have seen that it is equally difficult to understand how, after passing the short, hairy tongue proper (*lingua*), its fluid food can ascend the smooth outer surface of the remainder and much longer portion of the mouth organs, before it reaches the labium; and the basal joints of the maxillæ are so closely fitted to the mentum, and the formation of the palpi is such that the formation of Reaumer's "sort of" tube is here seen to be an impossibility.

But to return to Reaumer, I have stated that he was near the demonstration of the tube. If while "the membraneous sack and line along the length of the tongue" (that is the tubular rod) were protruded, he had, with a needle or two, separated the rod from its base, and had scraped off the adhering remains of the sack, and had then placed the rod on a glass slip of the microscope, in a drop of water, under a thin cover glass, and observed it through the microscope, its tubular nature would at once have been demonstrated by the contained air bubbles, which, under a little pressure, he might have seen chase each other to and fro in the tube, and out at either end; and if still incredulous, he might, after removing the thin cover glass, and placing the glass slip with the tube upon it, still in the drop of water, under a dissecting microscope; have held the tube steadily by placing a finger of the left hand on it, and with a small scalpel or knife blade, in the other hand, pressed against the end of the finger holding the tube in its place, he might have succeeded in making transverse sections of the tube itself, which would have removed all remaining doubt. By simply cutting the tube, or the tongue, across, and holding one piece of it in the forceps, its structure will be perceived.

There is, however, one remaining subject of uncertainty. The tube,

when examined with a power of fifty or more diameters, appears to be densely clothed internally with long fine hairs. Sometimes I have seen in it two parallel rows of air-bubbles, almost contiguous, and seeming to be separated only by a thin partition of fine hairs, and the interpretation that I at first gave to this appearance, was that the under surface of the tube was clothed internally with short fine hairs converging towards a median line, and pointing toward the apex. Some transverse sections of a humble-bee's tongue exhibit this appearance almost conclusively. I am not, however, fully convinced, that this is the true interpretation of that which certainly is seen.



Transverse Section of a Bee's Tongue.

A, upper surface; *B*, lower surface; *c*, orifice of tube; *d*, tubular rod; *e*, membraneous sack, not inflated; *f*, vacant spaces; *g*, connection of hairy sheath and tubular rod below.

In accordance with the usual custom, I have called one part of the mouth organs the *mentum*. Entomologists generally, so far as I am acquainted with the literature of the subject, call that part *mentum*, and that which I have called, as we call it in common parlance, the tongue, they call *labium*. Kirby and Spence, however, suggest that the part usually called the mentum, is really homologous with the *labium* of other insects, and should receive that name; and they were led to this conclusion by the belief, that "if the matter was carefully investigated," the tongue would be found to be attached to the upper surface of the head (at the mandibles, as I understand them), and not to the mentum. The researches above detailed, lend a partial confirmation to this view; for, as we have seen, the tongue is a compound organ, the tubular rod being a prolongation of the little piece before mentioned, which is placed before and connected with the mentum, while the hairy sheath and sack are continuous with the œsophagus, which passes along the upper side of the head, between the mandibles and under the labrum. I have now before me, a specimen in which the tube having been separated from the mentum, the hairy sheath membrane has been removed along the upper surface of the mentum and head behind the mandibles, back to the occipital foramen, exhibiting the pharynx closed by the hypopharynx in the membrane; the epipharynx (Savigny) being removed with the labrum. In the hive-bee, the pharynx is

so accurately closed by the hypopharynx, that it is decidedly more difficult of demonstration, than the tubular nature of the tongue.

Note upon the Habit of some Bees of Slitting the Corolla with the Tongue to Reach the Nectary.

That humble bees frequently pierce the corolla of flowers, near its base, with their proboscis, which they then insert into the opening thus made, has been long known, and frequently mentioned. In the correspondence, in *Nature*, if I am not mistaken, frequent reference to it will be found. Indeed, I believe it is the usual way taken by these bees to reach the nectary, when the corolla is too long for the tongue to reach the nectary from the mouth of the corolla, unless, indeed, the flower is a very large one, large enough for the bee to enter its mouth and reach the nectary in that way.

It may be that the same practice by hive bees (*Apis mellifica*) is also well known, and likewise, I may have heretofore seen an account of it, but if so, it has escaped my memory ; and as it may be news to some of our members, besides myself, I take this opportunity to record an observation on the subject, which I made a day or two since.

A large bush of *Weigelia rosea* was literally covered with flowers in all stages, from the unopened buds, to those that were withered and ready to fall, and great numbers of bees swarmed over them, humble bees, hive bees and mason bees, and sweat bees (*Andrenidæ*) were there in abundance. The older flowers were each pierced near the base by a longitudinal slit, made by hive or humble bees, which previously visited them, and whenever one of these bees alighted on one of these flowers, it, without attempting to enter the corolla, went immediately to the base of the flower, and inserted its proboscis into the slit already made; or, if the flower was a fresh one, having no slit, it proceeded immediately to make one. This was instantly effected, without trouble, by the humble bees, but seemed to give the hive bees some trouble — probably because the blades of the maxillæ, which are used to make the slit, are weaker or more flexible than in humble bees. Of the numerous hive bees observed, only a single one attempted to enter the mouth of the corolla, and it came out without going further than just within the opening. On the other hand, the mason bee and *Andrenidæ* went, in every instance, straight into the mouth of the flower, and never attempted either to make a slit or to use one that was already made. Yet one of these mason bees (*Megachile*) was fully as large as the hive bees.

THE JOURNAL

OF THE

CINCINNATI SOCIETY OF NATURAL HISTORY.

VOL. 1. CINCINNATI, JULY. No. 2.

PROCEEDINGS OF THE SOCIETY.

The annual meeting of the Society was held April 2d, 1878. After reading the annual reports, the following officers were chosen for the ensuing year:

President,	V. T. Chambers.
1st Vice-President,	Prof. J. F. Judge.
2d Vice-President,	L. S. Cotton.
Corresponding Secretary,	J. W. Hall, Jr.
Recording Secretary,	Florien Giauque.
Treasurer,	S. E. Wright.
Librarian,	J. C. Shroyer.
Custodian,	Dr. J. H. Hunt.

The following are the Curators elected for the same term:

Curator of Mineralogy,	Dr. R. M. Byrnes.
Palæontology,	E. O. Ulrich.
Conchology,	Prof. A. G. Wetherby.
Entomology,	J. W. Shorten.
Botany,	D. L. James.
Comparative Anatomy,	Prof. A. J. Howe.
Ornithology,	Charles Dury.
Archæology,	Dr. H. H. Hill.
Astronomy and Mathematics,	Prof. Ormond Stone.
Chemistry and Physics,	Prof. R. B. Warder.
Herpetology,	F. W. Langdon.
Meteorology,	Prof. G. W. Harper.
Microscopy,	F. Eckstein.

On motion of Prof. Stone, it was resolved that the incoming President be requested to deliver an address before the Society at the close of his term of office.

On motion of Dr. Howe, the following preamble and resolution were adopted:

"WHEREAS, there being a prevailing opinion in the Society that its interests can be served, and the public entertained by a series of lectures, to be delivered by members of the society, in the library room of its building; therefore, be it

"*Resolved*, That a committee of three be appointed by the chair to consider the expediency of such a course, and if thought feasible, to carry the idea into execution as early as practicable."

The chair stated its intention of naming the committee at a future time.

The following was unanimously adopted:

Resolved, that the special thanks of the Society are due, and are hereby tendered, to the retiring President, for his attention to the interests of the Society during his term of office.

The following donations were received by the Society:

From Chas. Dury, skin of purple grakle, a mounted American widgeon, six specimens of Vivipara intertexta, Say, egg of California quail, also of herring-gull, four spiders, a centipede, and a beetle.

From Zoological Society of Cincinnati, five species of exotic birds.

From Chicago Academy of Science, Annual Address of the President.

From Zoological Society, Fourth Annual Report.

From St. Louis Academy of Science, Transactions.

From Frank J. Thompson, egg of emu.

From F. W. Langdon, mounted specimen of pin-tail duck.

From Reading Society of Natural Science, Annual Report, by E. H. Ruffner.

From publishers, Canadian Entomologist, and Annual Report of the Entomological Society of Ontario.

From Rev. Murray Bailey, ovum of conch-shell.

From Dr. A. E. Heighway, an Indian bow-case and quiver.

The Society met May 7th, 1878, President Chambers presiding. After the approval of the minutes, Mr. M. D. Burk was elected a member.

Prof. Jas. T. Whitaker read a paper on "Life a Form of Motion," which has since appeared in pamphlet.

On motion, by Mr. S. A. Miller, it was ordered that each member be entitled to one copy of the JOURNAL.

Mr. Mickleborough exhibited a fine collection of Star Fishes and Echinoderms, arranged in a handsome case.

Dr. John A. Warder made some remarks on the early blooming of many plants this season.

Donations were acknowledged as follows:

From a lady, specimens of branchipus vernalis.

From Chas Dury, two eggs of the murre, and one egg of the thick-billed guillmot.

From J. F. James, fifteen specimens of mounted plants, and three eggs of the quail.

From John Mickleborough, twelve specimens of Pterina insueta, 4 specimens of Murchisonia gracilis, a specimen of Poteriocrinus polydactylus.

From J. W. Shorten, a snake.

From Mrs. H. B. Moorehead, thirty species of English shells.

From J. G. Browne, one tooth of fossil elephant.

From Dr. Heighway, one scimiter, from South America.

From Prof. O. Stone, Proceedings of the Cincinnati Observatory.

From the St. Louis Academy of Science, its proceedings.

From H. B. Banning, "The Fur-bearing Animals, etc., of the Northwest."

From the Entomological Society of Ontario, its Annual Report.

From Academy of Science, Philadelphia, its proceedings.

From Minnesota Academy of Natural Science, the Bulletin of the Society.

The Society met June 4th, 1878, the President in the chair. The minutes were read, amended and approved.

Mr. J. M. Harper was elected to regular membership.

Two papers by S. S. Scoville, M.D., of Lebanon, O., were read: One describing a large boulder, the largest in Southern Ohio; the other on certain earth works in that vicinity, belonging to the age of the Mound Builders.

Prof. Ormond Stone made some remarks on double stars, and observations being made upon them.

After this, a lively discussion arose concerning the boulder described by Dr. Scoville, and boulders in general, glacial action, and related matters.

Prof. Wetherby called attention to the *Cionella morsei*, Doherty, and said that it was only a synonym of *C. subcylindrica.*

Mr. E. O. Ulrich, read by title the descriptions of three new genera, and eleven new species of fossils.

The donations were as follows :

From G. W. Homslier, one large and one small stone ax, twenty-three arrow heads of stone, one stone bark-peeler, two perforated ornaments, and one whistle.

From J. W. Hall, Jr., one heron, and two lepidopterous insects.

From Dr. O. D. Norton, a photograph illustrating the Darwinian theory.

From E. O. Ulrich, specimens of four new species of fossils from the Cincinnati Group.

From Dr. D. S. Young, two towhee finches, and one butcher bird.

From Dr. Wm. Knight, one cocoon of a lepidoptera.

From Mr. Langdon, two eggs of mocking bird.

From J. W. Shorten, a large number of specimens of several species of Coleoptera.

From F. B. Plympton, of the *Cincinnati Commercial*, a copy of "Voyage of the Challenger," by Sir Wyville Thompson.

From Chas. Dury, a razor-billed auk.

From the Historical Society of Cincinnati, "Crystallization of Salt from Salt Lake, Utah."

From R. B. Moore, a lot of alive fresh-water shells for the Aquarium.

From E. O. Ulrich, specimens of goldfish.

A LARGE BOULDER IN SOUTHERN OHIO.

By S. S. Scoville, M.D., Lebanon, Ohio.

About two and a half miles southeast of Lebanon, Warren County, Ohio, may be seen a boulder, which, for size, we venture to say, is the largest found in Ohio so far to the South. Prof. Orton, in his reports, mentions a large one, but it is much less in size, and further to the North. Our rock is situated in latitude 39° 25′ 4″, and longitude, say 84° 6′. It seems to be a quartoze granite. In shape, it might be considered an irregular ovoid. Upon quite a careful measurement, we find the dimensions as follows: length, 21 feet; width, 16 feet; height above ground, 8 feet. Indications show that it extends at least 4 feet beneath the ground. It would most likely cube 14 feet. Supposing the weight to be 190 lbs. to the square foot, and we would have for the entire weight of this stone, 521,360 lbs., or something more than 260 tons. The rock rests upon ground sloping 3 or 4 degrees towards the north. It lies within what may be regarded as a belt of boulders, which extends, say 2 miles north and south, and 1 mile in width. Within this belt are found numerous rocks, from 300 to 40,000 lbs. in weight.

Annual Precipitations of Rain and Melted Snow, in inches and hundredths of an inch, for a period of 42 *years, from* 1835 *to* 1876 *inclusive, with other Meteorological data.* By R. B. Moore.

Rooms of "Cincinnati Society of Natural History," Cincinnati; Lat. 39° 6′, N. Long. 84° 26′ W. Elevation above Tide, 597 ft.; above low water Ohio River, 167 ft.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Totals.
1835	3.82	1.75	1.86	3.37	7.57	7.34	2.46	6.54	2.32	4.35	6.61	3.20	52.15
1836	2.97	4.34	4.18	4.54	9.01	2.14	7.42	5.54	4.77	3.71	4.41	4.36	57.39
1837	0.80	3 43	3.70	2.00	3.79	4 38	3.83	5.91	3 14	4.16	2.52	5.05	42.71
1838	1.90	1 64	0 56	4.74	8.57	7.55	2.47	3.76	0.71	3.55	3.12	0.85	39.45
1839	4.56	2.75	2.69	2.38	4.46	1.96	2.97	0.56	3.24	0.13	2.20	1.72	29.62
1840	1.13	4.68	3.62	4 78	6.08	6.84	4.45	3 73	1.56	4.74	2.50	3.20	47.34
1841	5.56	0.82	2.34	4.75	2.16	1.51	5.33	2.71	2.94	2 46	4.92	5.56	41.05
1842	2.75	6.09	3.02	2 97	3.04	5.67	2.35	4.22	2.95	1.90	3.76	2.57	41.29
1843	3.51	3.54	2 97	6.15	3.54	4 52	2.92	5.89	6.73	4.16	4 26	3.00	51.22
1844	3.10	1.04	4.50	3.13	7.00	6.16	3.50	3.65	1.26	4.32	3.18	1.10	41.94
1845	3.03	1.66	5.46	1.08	1.89	11.50	3.06	6.88	7.51	2.03	1.68	0.60	46.38
1846	3.59	3.20	2.26	3.51	5.17	7.53	3.93	6.10	2.50	2.19	4 26	9.25	53.52
1847	4.71	4 06	5.37	2.12	4 30	7.63	8 25	3.20	3.87	9.57	3.95	8.15	65.18
1848	4.58	2.81	6.72	0 55	5.13	1.86	6.95	3.90	1.53	3 62	2.60	9 43	49.68
1849	6.48	2.04	4.70	3.65	3.61	4.90	8.90	4.41	2.68	3.86	2.42	5.32	52.97
1850	5.20	6 28	6.62	4.27	1.86	5.00	6 30	7.20	2.22	1.05	2.54	6.22	54.76
1851	0.65	6.15	3.04	1.80	3.30	2.10	3.25	2.55	0.43	2.60	3.25	3.37	32.49
1852	2.03	5.20	5.16	5.80	3.15	5.25	2.05	4.35	4.15	2.75	4.57	9.89	54.35
1853	1.53	5.14	2.14	7.70	2.21	1.90	4.81	2.16	4.70	3.78	3.30	0.73	40.10
1854	4.10	5.57	8.33	2.97	7.29	4.84	2 32	3.18	2.12	3 01	3.66	3 38	50.69
1855	3.71	1 58	3 66	3.05	5.24	8.10	4.35	4.25	2.98	1.31	5.22	3.28	47.00
1856	1.00	2.49	1.51	0.72	1.23	2.24	3.43	0.61	3.62	1.74	2.09	2.19	22.87
1857	0.54	1.98	0.76	2.72	5.53	3.08	2.50	2.92	0.75	4.92	5.36	3.82	34.88
1858	2 06	1.74	1.05	4.34	8.32	5.69	3.01	7.97	0.85	4.66	2.57	6.41	48.67
1859	2.57	5.92	4.38	7.53	2.32	3.22	1.24	3.79	2.10	1.27	4.45	3.75	42 54
1860	1.43	1.56	0.41	5.31	3.68	1.55	7.96	0.92	4.33	1.28	3.53	1.85	33.81
1861	2.57	1.81	2.08	3.88	5.91	3.80	3.62	7.10	2.94	3.73	3.63	1.09	42.19
1862	4.74	2.36	5 84	6.30	3.82	3.02	3.00	1.49	0.93	0.80	3.97	3.01	38.78
1863	5 55	3.05	4.37	2.13	2.84	3.11	3.21	2.99	3.10	3.85	2.05	3.80	40.05
1864	1.85	0.99	0.90	2.43	2.34	3.43	1.25	3.42	8.64	2.90	3.40	2.94	34.50
1865	2.45	2.43	4.43	3.89	7.72	2.59	7.77	2 26	5 76	0.86	0.56	3.89	44.58
1866	2.74	1.26	5.06	2.03	0.94	4.44	6.94	2 75	10.55	1.85	3.06	1.98	43.60
1867	1.41	3.56	2.71	2.74	3.80	3.73	1.60	1.57	0.47	2.05	2.20	3.07	28.91
1868	3.72	0.57	4.87	2.72	6 09	5.60	1.21	4.04	7.19	1.22	1.70	2.07	41.60
1869	1.60	2.51	5.06	2.87	5.93	3.60	5.36	1.20	3.20	2.75	3.30	2.46	39.84
1870	5.33	1.55	3.26	1.59	1.74	4.84	2.38	0.58	0.30	2.77	1.50	2.17	28.03
1871	2.34	3.53	3 75	1.23	4.56	2.04	4.30	5 22	1.08	0.98	3.40	3.31	35.64
1872	0.85	1.75	1.59	5.56	2.48	3.20	8.00	3.19	1.39	2.64	1.00	0.89	32.54
1873	2.15	2.69	1.96	2.13	2.95	3.12	2 84	3.02	1.68	2.64	2.14	5.46	32.78
1874	3.37	4.40	3.03	5.23	1.15	2.25	3.47	1.05	1 69	0 98	4.42	2.34	33.38
1875	1.70	1.23	3.37	0.88	2.82	4.93	9.49	2.64	4.85	2.87	3.80	3 19	41.04
1876	9.49	2.92	5 07	3.26	1.25	6.67	6.91	6.38	3 17	4.26	2.36	0 88	52.62
Means.	3.05	3.10	3.75	3.51	4.24	4.34	4.09	3.73	3.08	2.86	3.21	3.55	42.51

For 1856, being exceptionally low, those taken at College Hill are given for comparison. January, 1.588; February, 2.340; March, 0.655; April, 1.158; May, 2.390; June, 1.525; July, 0.325; August, 0.426; September, 2.710; October, 1.218; November, 3.118; December, 3.580. Total, 21.043.

Quantities for seasons and periods: Winter, 9.70; Spring, 11.50; Summer, 12.16; Autumn, 9.15. From 1835 to 1840, 44.26; 1840 to 1845, 44.57; 1845 to 1850, 53.57; 1850 to 1855, 46.48; 1855 to 1860, 39.19; 1860 to 1865, 37.86; 1865 to 1870, 39.70; 1870 to 1875, 32.44; and for 1875 to 1877, 46.83. If divided in seven year periods, would be as follows: 1st, 44.29; 2d, 49.90; 3d, 47.49; 4th, 37.75; 5th, 39.03; 6th, 36.58. The greatest amount in any one year, 1847, was 65.18; the next greatest was in 1836, 57.39. The least amount in any one year, 1856, was 22.87; and the next least amount was in 1839, 29.62. The greatest amount in any one quarter was in 1847, the last quarter, 21.67; the next greatest amount in one quarter, was June, July and August, in 1845, 21.44. The least amount in any one quarter, April, May and June, of 1856, was 3.46; and August, September and October, of 1862, was 3.22. The greatest amount in any one month, June, 1845, was 11.50; the next greatest, September, 1866, 10.50. The least amount in any one month, October, 1839, was 0.13; the next least, September, 1870, 0.30. The greatest amount of rainfall, August 21, 1861, was 3.35 in two hours; the greatest snowfall, January 15, 1863, was 21 inches.

The annual amount of snow varies from 7.1 up to 50, and occurs invariably in December, January and February, and generally in November and March. Means, November, 1.7; December, 6.3; January, 5.6; February, 6.2; March, 2; Total, 21.8. The precipitations are well distributed through the seasons, having occurred every month during the series, 10 winter, 9 spring, 4 summer, and 13 autumn months, have been less than 1 inch, while 10 months have been over 9 inches, 11 over 8 inches, 30 over 7 inches, 59 over 6 inches, 104 over 5 inches, leaving 254 months receiving from 1 to 5 inches. Temperature: January, 32.10°; February, 34.10°; March, 42.35°; April, 54.30°; May, 63.60°; June, 72°; July, 76.26°; August, 74.50°; September, 66.30°; October, 53.50°; November, 42.60; December, 34.50°; Winter, 33.73°; Spring, 53.08°; Summer, 74.25°; Autumn, 54.13°; Total, 53.80°. Extreme changes of temperature, 1859, December 6th, 52° in 24 hours, and December 31st, 1863, 55° in 14 hours. Mean average annual temperatures range from 51° to 56° and varies from 18° below to 110° above.

The results herein embodied were obtained from the collections of Mansfield, Drake, Ray, Lea, Harper, Phillips, Farmers' College, and U. S. Signal Service Office, Cincinnati. While those of Prof. Harper are preferred as means, those of R. C. Phillips, civil engineer, for a portion of the same time, are of special interest, taken at lower elevation, and more nearly central in lower plane of the city; they average higher, owing to locality. This series, taken at elevations not materially different from this room, may be *considered reliable*, and as *filling a want*, that of *uniformity*, not likely to occur again, as they will be regularly and uniformly taken and properly arranged hereafter. Our city, situated at intersection of longitudinal and transverse valleys, its lower plane mostly surrounded by an amphitheatre of hills, has local and eddying currents, with an atmosphere heavily charged at times from the consumption of soft, bituminous coal. These occasionally effect locally, both radiation and condensation; while changes and variations of both temperature and precipitations are great, the averages are very nearly the means, 43.3 inches, for the whole Ohio Valley, 214,-000 square miles; the indications are secular changes in a series of years, but until we have more full and complete reports from other districts, for comparison with our own, the great problem of what ratio of less precipitations, with all its paramount influence on agriculture, commerce and manufactures, remains unsolved. In the cause of Science and Philanthrophy, we cheerfully accord our best efforts toward a full, complete and reliable meterological record.

TO SOCIETIES AND COLLECTORS.

The Cincinnati Society of Natural History is very desirous of making exchanges in all its departments. Every society of this character soon accumulates a large quantity of good material, in duplicate, which become a burden instead of a benefit, unless there is some systematic way of disposing of the surplus stock. We desire to offer, at the present time, either to private collectors or public institutions, the following exchanges:—

1. Palæontology.—It is well known that the Cincinnati Group, Lower Silurian, as it is exposed at and near this locality, contains the best preserved specimens that can be obtained anywhere. Several hundred species have already been described, and we have any amount of material for description in the future numbers of this Journal. We

can send about one hundred and fifty species from this unrivaled locality; all of them will be thoroughly identified and properly labeled. In each collection will be sent vertical and longitudinal sections, for microscope, of several species of the "corals." We have, also, in this department, perfect casts, in duplicate, of the celebrated fossil horn cores of the Bison latifrons (Leidy); the original cores belong to us. They were found in Adams county, in 1869, in coarse gravel, fifteen feet below the surface; they each have a portion of the skull attached, one portion showing a part of the brain cavity. The dimensions are as follows: length of right core, 2 feet, 8 inches; length of left core, 2 ft., 7 inches; breadth of forehead, 1 ft., 4 inches; spread of cores in direct line, 6 ft., 1 inch; circumference at base, 20½ inches; circumference at 24 inches from base, 9½ inches; weight, 32 and 34 lbs. They are of moderate curvature, deeply corrugated, nearly perfect, in a good state of preservation, and have been most successfully molded. They are offered in exchange, at the nominal value of twenty dollars. Books or specimens of natural history will be received in exchange, at above rate.

2. Mineralogy.—In this department we have a very large and valuable collection of duplicates. Persons desirous of making exchanges would greatly assist in "making up a box" by sending a list of what is desired, and also inclosing with application, a list of what they can furnish. This suggestion applies equally to all the departments.

3. Conchology.—We have a good selection, in duplicate, of marine shells. Our list of land and fresh-water shells is quite complete, especially so from this locality. They will be carefully named.

4. Books.—In our library, we have a very large number of Newberry's *Ohio Geological Survey*, complete in 4 vols., with maps: Vol. I., Geology; Vol. I., Palæontology; Vol. II., Geology; Vol. II., Palæontology. Also, *Ohio Agricultural and Centennial Reports*; 1 set *Pennsylvania Geological Reports*; 2d report, by Leidy; 1 set *Cuvier's Animal Kingdom*, 3 vols.

We have some specimens in entomology, archæology, and botany. We desire specimens for these departments, as also for microscopy, ichthyology, herpetology, and comparative anatomy in general. Persons wishing to exchange will please communicate with the corresponding secretary, J. W. Hall, Jr., 108 Broadway, who will promptly hand the matter over to the proper curator.

A CLASSIFIED LIST OF LOWER SILURIAN FOSSILS, CINCINNATI GROUP.

By John Mickleborough and A. G. Wetherby.

ANIMAL KINGDOM.

SUB-KINGDOMS:

1. VERTEBRATA. L. *veretebræ*, joints of the backbone, or spine.
2. ANNULOSA. L. *annulus*, a ring.
3. ANNULOIDA. L. *annulus ;* Gr. *eidos*, form.
4. MOLLUSCA. L. *mollis*, soft.
5. MOLLUSCOIDA. L. *mollis ;* Gr. *eidos.*
6. CŒLENTERATA. Gr. *koilos*, hollow ; *enteron*, intestine.
7. PROTOZOA. Gr. *protos*, first ; *zoon*, animal.

The remains of vertebrate animals have not yet been found in this formation. The other sub-kingdoms are well represented.

SUB-KINGDOM ANNULOSA.

Class Crustacea. L. *crusta*, a crust or shell.
Sub-Class Entomostraca. Gr. *entoma*, an insect ; *ostrakon*, shell.
Order Trilobita. Gr. *treis*, three ; *lobos*, lobe.

Genus *Calymmene*, Brongniart. Gr. *kekalymmene*, concealed. Named on account of the uncertainty of its zoological affinities.

1 Calymmene senaria, Conrad. L. *senarius*, six.
2 Christyi, Hall.

Genus *Acidaspis*, Murchison. Gr. *akis*, *akidos*, a point or barb; *aspis*, a shield.

3 Acidaspis Cincinnatiensis, Meek.
4 ceralepta, Anthony. Gr. *keras*, a horn ; *leptos*, slender.
5 crossota, Locke. Gr. *krossotus*, fringed.
6 O'Nealli, S. A. Miller.
7 anchoralis, S. A. Miller. L. *anchoralis*, anchor-like.

Genus *Asaphus*, Brongniart. Gr. *a*, not ; *saphes*, certain. Referring to the uncertain zoological relations of these crustaceans.

8 Asaphus gigas, DeKay. Gr. *gigas*, a giant.
9 megistos, Locke. Gr. *megistos*, greatest.

Genus *Ceraurus*, Green. Gr. *keras*, horn ; *oura*, tail.

10 Ceraurus Icarus, Billings. Mythological name.
11 perforator, Billings. L. *per*, through ; *foro*, I bore.
12 pleurexanthemus, Green. Gr. *pleura*, side; *ex*, out; *anthos*, a flower or ornamentation.

Genus *Dalmanites*, Emmerich. Named in honor of Dalman.

13 Dalmanites breviceps, Hall. L. *brevis*, little; *caput* (*cepi*), head.
14 Carleyi, Meek.
15 callicephalus, Hall. Gr. *kallos*, beauty; *kephale*, head.
16 Achates, Billings. Mythological name.

Genus *Proëtus*, Steininger. Gr. *pro*, before; *etos*, a year.

17 Proëtus parviusculus, Hall. L. diminutive of *parvus*, small.
18 Spurlocki, Meek.

Genus *Lichas*, Dalman. Mythological name.

19 Lichas Trentonensis, Conrad.

Genus *Triarthrus*, Green. Gr. *treis*, three; *arthron*, a joint.

20 Triarthrus Becki, Green.

Genus *Trinucleus*, Lhwyd. Gr. *treis*, three; *nucleus*, kernel.

21 Trinucleus concentricus, Eaton. L. *con*, together; *centrum*, the centre.
22 bellulus, Ulrich. L. *bellulus*, diminutive of *bellus*, pretty.

Order Phyllopoda. Gr. *phullon*, a leaf; *pous*, *podos*, a foot.

Genus *Beyrichia*, McCoy. Named in honor of M. Beyrich.

23 Beyrichia falcigera, Hall and Whitfield. L. *falx*, a scythe; *gero*, I carry.
24 oculifera, Hall. L. *oculus*, an eye; *fero*, I carry.
25 regularis, Emmons. L. *regularis*, formed into bars.
26 ciliata, Emmons. L. *cilium*, the eye-lash, hence fringed.
27 Chambersi, S. A. Miller.
28 Duryi, S. A. Miller.
29 Richardsoni, S. A. Miller.
30 striato-marginata, S. A. Miller. L. *stria*, a ridge; *margo*, the margin.
31 Cincinnatiensis, S. A. Miller.

Order Ostracoda. Gr. *Ostrakon*, *a shell.*

Genus *Leperditia*, Ronault. Gr. *lepis*, a scale; *dis*, *dittos*, double.

32 Leperditia cylindrica, Hall. L. *cylindrus*, a cylinder.
33 Byrnesi, S. A. Miller.
34 minutissima, Hall. L. *minutissimus*, smallest.

Genus *Cythere*, Müller. Gr. *Kuthere*, surname of Venus.

35 Cythere Cincinnatiensis, Meek.

36 irregularis, S. A. Miller. L. *irregularis*, irregular.

INCERTA SEDES.

Genus *Plumulites*, Barrande. L. *plumula*, dim. of *pluma*, a feather.

37 Plumulites Jamesi, Hall and Whitfield.

NOTE.—This genus has been referred to the *Cirripedia*.

Genus *Anomaloides*, Ulrich. Gr. *anomalos*, irregular; *eidos*, form.

38 Anomaloides reticulatus, Ulrich. L. *reticulatus*, net-like.

Class ANNELIDA. L. *annellus*, a little ring; Gr. *eidos*, form.

Order ERRANTIA. L. *erro*, I wander.

Genus *Walcottia*, Miller and Dyer. Proper name.

39 Walcottia rugosa, Miller and Dyer. L. *rugosus*, wrinkled.

Genus *Nereidavus*, Grinnell. L. *Nereis* (*idis*), mythological; *avus*, ancestor.

40 Nereidavus varians, Grinnell. L. *varians*, changing.

Genus *Eotrophonia*, Ulrich. Gr. *eos*, early; *Trophonia*, a genus of existing annelids.

41 Eotrophonia setigera, Ulrich. L. *seta*, a bristle; *gero*, I carry.

Genus *Protoscolex*, Ulrich. Gr. *protos*, first; *skolex*, a worm.

42 Protoscolex Covingtonensis, Ulrich.

43 simplex, Ulrich. L. *simplex*, simple.

44 ornatus, Ulrich. L. *ornatus*, ornamented.

45 tenuis, Ulrich. L. *tenuis*, slender.

Genus *Scolithus*, Haldeman. Gr. *skolex*, a worm; *lithos*, a stone.

46 Scolithus linearis, Haldeman. L. *linearis*, linear.

NOTE.—Scolithus has sometimes been placed in the vegetable kingdom. The borings, or tracks, called Helminthites, by Salter, are the only record of their existence.

Order TUBICOLA. L. *tuba*, tube; *colo*, I inhabit.

Genus *Conchicolites*, Nicholson. L. *concha*, a shell; *colo*, I inhabit.

47 Conchicolites corrugatus, Nicholson. L. *corrugo*, I wrinkle.

48 flexuous, Hall. L. *flexuosus*, tortuous.

49 minor, Nicholson. L. *minor*, less.

50 striatellus, Nicholson. L. *stria*, a ridge.

Genus *Serpulites*, Nicholson. L. *serpula*, a little snake.

51 Serpulites Jamesi, Nicholson.

Genus *Spirorbis*, Swainson. L. *spira*, spire; *orbis*, a circle.

52 Spirorbis Lovelandensis, James.
53 Cincinnatiensis, Miller and Dyer.

Genus *Tentaculites*, Schlotheim. L. *tentacula*, feelers.

54 Tentaculites Sterlingensis, Meek and Worthen.
55 Richmondensis, S. A. Miller.
56 tenuistriatus, Meek and Worthen. L. *tenuis*, slender; *stria*, a ridge.

NOTE.—Prof. Nicholson and others regard *Tentaculites* as *Tubicolous Annelides*, while M. Barrande assigns this genus to the *Pteropoda*.

SUB-KINGDOM ANNULOIDA.

Class ECHINODERMATA. Gr. *echinos*, a hedgehog; *derma*, skin.

Order CRINOIDEA. Gr. *krinon*, a lily; *eidos*, form.

Genus *Glyptocrinus*, Hall. Gr. *gluptos*, sculptured; *krinon*.

57 Glyptocrinus decadactylus, Hall. Gr. *deka*, ten; *daktulos*, a finger.
58 Baeri, Meek.
59 Dyeri, Meek.
60 Dyeri, var sublevis, S. A. Miller. L. *sub*, somewhat; *levis* smooth.
61 sub-globosus, Meek. L. *sub*, somewhat; *globosus*, spherical.
62 O'Nealli, Hall.
63 Parvus, Hall. L. *parvus*, little.
64 Fornshelli, S. A. Miller.
65 Shafferi, S. A. Miller.
66 angularis, Miller and Dyer. L. *angularis*, angular.

Genus *Heterocrinus*, Hall. Gr. *heteros*, irregular; *krinon*.

67 Heterocrinus constrictus, Hall. L. *constrictus*, contracted.
68 constrictus var. compactus, Meek. L. *compactus*, compact.
69 exilis, Hall. L. *exilis*, thin.
70 exilis var. exiguus, Meek. L. *exiguus*, small, or slender.
71 simplex, Hall. L. *simplex*, simple.
72 simplex var. grandis, Meek, L. *grandis*, large.
73 juvenis, Hall. L. *juvenis*, young.
74 heterodactylus, Hall. Gr. *heteros*, irregular; *daktulos*, a finger.

75 Heterocrinus laxus, Hall. L. *laxus*, loose.
76 sub-crassus, Hall. L. *sub*, somewhat; *crassus*, thick.

Genus *Anomalocrinus*, Meek and Worthen. Gr. *anomalos*, irregular; *krinon*.

77 Anomalocrinus incurvus, Meek and Worthen. L. *in*, in; *curvus*, curved.

Genus *Poteriocrinus*, Miller. Gr. *poterion*, a wine cup; *krinon*.

Sub-genus *Dendrocrinus*, Hall. Gr. *dendron*, a tree; *krinon*.

78 Poteriocrinus Cincinnatiensis, Meek.
79 Dyeri, Meek.
80 polydactylus, Shumard. Gr. *polus*, many; *daktulos*, a finger.
81 posticus, Hall. L. *posticus*, behind.
82 Casei, Meek.
83 caduceus, Hall. L. *caduceus*, a herald's staff.

Order Cystoidea. Gr. *kustis*, a bladder; *eidos*, form.

Genus *Lepocrinites*, Conrad. Gr. *lepis*, a scale; *krinon*.

84 Lepocrinites Moorei, Meek.

Genus *Agelacrinites*, Vanuxem. Gr. *agele*, crowd; *krinon*.

85 Agelacrinites Cincinnatiensis, Roemer.
86 pileus, Hall. L. *pileus*, a felt hat.
87 vorticellata, Hall. L. *vortex*, whorled.
88 Holbrooki, James.
89 septembrachiatus, Miller and Dyer. L. *septem*, seven; *brachiatus*, armed.

Genus *Lichenocrinus*, Hall. Gr. *leichen*, lichen; *krinon*.

90 Lichenocrinus, Dyeri. Hall.
91 crateriformis, Hall. L. *crater*, a bowl; *forma*, form.
92 tuberculatus, S. A. Miller.

Genus *anomalocystites*, Hall. Gr. *anomalos*, irregular; *kustis*.

93 Anomalocystites balanoides, Meek. Gr. *balanos*, an acorn; *eidos*.

Genus *Hemicystites*, Hall. Gr. *hemi*, half; *kustis*.

94 Hemicystites stellatus, Hall. L. *stellatus*, star-shaped.
95 granulatus, Hall. L. *granum*, a grain.

Genus *Cyclocystoides*, Billings and Salter. Gr. *kuklos*, a circle; *kustis*, a bladder; *eidos*.

96 Cyclocystoides magnus, Miller and Dyer. L. *magnus*, great.
97 minus, Miller and Dyer. L. *minus*, less.
98 parvus, Miller and Dyer. L. *parvus*, small.
99 mundulus, Miller and Dyer. L. *mundulus*, neat.
100 bellulus, Miller and Dyer. L. *bellulus*, beautiful.

Order ASTEROIDEA. Gr. *aster*, a star; *eidos*, form.

Genus *Palæaster*, Hall. Gr. *palaios*, ancient; *aster*.

101 Palæaster Dyeri, Meek.
102 granulosus, Hall. L. *granum*, a grain.
103 incomptus, Meek. L. *incomptus*, unadorned.
104 Jamesi, Dana.
105 Shafferi, Hall.
106 simplex, S. A. Miller. L. *simplex*, simple.
107 Clarki, S. A. Miller.
108 spinulosus, Miller and Dyer. L. *spinulosus*, full of little spines.

Genus *Palæasterina*, McCoy. Gr. *palaios*, ancient; *aster*, a star.

109 Palæasterina approximata, Miller and Dyer. L. *approximatus*, near to.
110 speciosa, Miller and Dyer. L. *speciosus*, strikingly beautiful.

Genus *Stenaster*, Billings. Gr. *stenos*, narrow; *aster*.

111 Stenaster grandis, Meek. L. *grandis*, large.

Order OPHIUROIDEA. Gr. *ophis*, a serpent; *oura*, tail; *eidos*.

Genus *Protaster*, Billings. Gr. *protos*, first; *aster*.

112 Protaster granuliferus, Meek. L. *granum*, a grain; *fero*, I bear.
113 flexuosus, Miller and Dyer. L. *flexuosus*, tortuous.

SUB-KINGDOM MOLLUSCA.

Class CEPHALOPODA. Gr. *kephale*, a head; *pous*, a foot.

Order TETRABRANCHIATA. Gr. *tetra*, four; *bragchia*, a gill.

This order is divided into two divisions, *Nautilidae* and *Ammonitidæ*. The *Cephalopoda* of the Cincinnati epoch belong to the family Nautilidæ. The following table from Woodward is an interesting exhibit of ancient and modern forms of the two families.

	Nautilidæ.	Ammonitidæ.
Shell straight in . .	Orthoceras . .	Baculites.
bent on itself in .	Asoceras . .	Ptychoceras.
curved . . .	Cyrtoceras . .	Toxoceras.
spiral . . .	Trochoceras . .	Turrilites.
discoidal . .	Gyroceras . .	Crioceras.
discoidal and produced in	Lituites . .	Ancyloceras.
involute in . .	Nautilus . .	Ammonites.

Family *Orthoceratidæ*. Gr. *orthos*, straight; *keras*, a horn.

Genus *Orthoceras*, Breynius. Gr. *orthos*, *keras*.

114 Orthoceras amplicameratum, Hall. L. *amplus*, large; *camera*, an arch.
115 Carleyi, Hall and Whitfield.
116 Duseri, Hall and Whitfield.
117 junceum, Hall. L. *junceus*, a rush.
118 Ortoni, Meek.
119 turbidum, Hall and Whitfield. L. *turbidus*, disturbed.
120 Byrnesi, S. A. Miller.
121 Duryi, S. A. Miller.
122 Fosteri, S. A. Miller.
123 Halli, S. A. Miller.
124 Harperi, S. A. Miller.
125 Mohri, S. A. Miller.
126 transversum, S. A. Miller. L. *trans*, across; *verto*, I turn.
127 Cincinnatiensis, S. A. Miller.

Genus *Ormoceras*, Stokes. Gr. *ormos*, a chain or necklace; *keras*, a horn.

128 Ormoceras tenuifilum, Hall. L. *tenuis*, fine; *filum*, a thread.

Genus *Endoceras*, Hall. Gr. *endon*, within; *keras*.

129 Endoceras annulatum, Hall. L. *annulatus*, ringed.
130 approximatum, Hall. L. *ad*, *proximo*, I come near.
131 proteiforme, Hall. Gr. *proteuo* (*protos*), to be first; *forma*.
132 subcentrale, Hall. L. *sub*, *centrum*, centre.
133 magniventrum, Hall. L. *magnus*, great; *venter*, belly.

Family *Gomphoceratidæ*. Gr. *gomphos*, a club; *keras*.

Genus *Gomphoceras*, Sowerby. Gr. *gomphos*; *keras*.

134 Gomphoceras eos, Hall and Whitfield. Gr. *eos*, dawn.

Family *Phragmoceratidæ*. Gr. *phragmos*, a partition; *keras*.

Genus *Phragmoceras*, Broderip. Gr. *phragmos ; keras.*

135 Phragmoceras Hector, Billings. Mythological.

Family *Lituitidæ.* L. *lituus*, a trumpet.

Genus *Trocholites*, Conrad. Gr. *trochos*, circular; *lithos*, a stone.

136 Trocholites ammonius, Conrad. L. *Ammon*, a name of Jupiter. Fossil named from resemblance to the horns on the statue.

Family *Trochoceratidæ.* Gr. *trochos*, a wheel; *keras.*

Genus *Trochoceras*, Barrande. Gr. *trochos ; keras.*

137 Trochoceras Baeri, Meek and Worthen.

Family *Cyrtoceratidæ.* Gr. *kurtos*, curved; *keras.*

Genus *Cyrtoceras*, Goldfuss. Gr. *kurtos*, curved; *keras.*

138 Cyrtoceras Vallandighami. S. A. Miller.
139 magister, S. A. Miller. L. *magister*, a leader.
140 ventricosum, S. A. Miller. L. *ventricosus*, bulging out.
141 amœnum, S. A. Miller. L. *amœnus*, charming.

Class Gasteropoda. Gr. *gaster*, stomach; *pous, podos*, foot.

Order Prosobranchiata. *Proson*, before; *bragchia*, a gill.

Family *Muricidæ.* L. *murex, muricis*, a shell-fish.

Genus *Fusispira*, Hall. L. *fusus*, a spindle; *spira*, a spire.

142 Fusispira subfusiformis, Hall. L. *sub, fusus, forma.*
143 terebriformis, Hall. L. *terebra*, an augur; *forma.*

Order Rhiphidoglossa. *Rhipis, rhipidos*, a fan; *glossa*, tongue.

Family Bellerophontidæ. Mythological.

Genus *Bellerophon*, Montfort. Mythological.

144 Bellerophon bilobatus, Sowerby. L. *bis*, twice; Gr. *lobos*, a lobe.
145 Mohri, S. A. Miller.

Genus *Bucania*, Hall. Gr. *bukane*, a trumpet.

146 Bucania expansa, Hall. L. *expansus*, spread.
147 bidorsata, Hall. L. *bis*, twice; *dorsum*, ridge.
148 costata, James. L. *costatus*, ribbed.

Genus *Carinaropsis*, Hall. L. *carina*, a keel; Gr. *opsis*, appearance.

149 Carinaropsis patelliformis, Hall. L. *patella*, dish; *forma.*

Genus *Cyrtolites*, Conrad. Gr. *kurtos*, curved; *lithos*, stone.

150 Cyrtolites carinatus, S. A. Miller. L. *carina*, a keel.
151 compressus, Conrad. L. *compressus*, pressed.
152 Dyeri, Hall.
153 ornatus, Conrad, L. *ornatus*, adorned.
154 elegans, S. A. Miller. L. *elegans*, beautiful.
155 magnus, S. A. Miller. L. *magnus*, great.

Genus *Microceras*, Hall. Gr. *micros*, small; *keras*, horn.

156 Microceras inornatum, Hall. L. *inornatus*, unadorned.
157 minutissimum, Ulrich. L. *minutissimus*, least.

Family *Pleurotomariidæ*. Gr. *pleuron*, side; *tome*, notch.

Genus *Murchisonia*, D'Archiac. Named in honor of Sir R. J. Murchison.

158 Murchisonia augustata, Hall. L. *augustus*, narrow.
159 Milleri, Hall.
160 gracilis, Hall. L. *gracilis*, slender.
161 bellicincta, Hall. L. *bellus*, pretty; *cinctus*, banded.
162 perangulata, Hall. L. *per*, through; *angulus*, angle.
163 uniangulata, Hall. L. *unus*, one: *angulus*.
164 decurta, Hall. L. *decurtus*, cut short.

Genus *Pleurotomaria*, De France.

165 Pleurotomaria ambigua, Hall. L. *ambiguus*, doubtful.
166 carinata, James. L. *carina*, a keel.
167 Halli, S. A. Miller.
168 sub-conica, Hall. L. *sub; conus*, a cone.
169 subtilstriata, Hall. L. *subtilis*, fine; *stria*, a ridge.
170 tropidophora, Meek. Gr. *tropis*, *tropidos*, a keel; *phero*, I bear.
171 Ohiocensis, James. (For *trilineata*, which was pre-occupied.)

Genus *Trochonema*, Salter. Gr. *trochos*, circular; *nema*, a thread.

172 Trochonema umbilicatum, Hall. L. *umbilicus*, the navel.

Genus *Raphistoma*, Hall. Gr. *rapho*, I sew; *tome*, a notch.

173 Raphistoma lenticulare, Conrad. L. *lenticularis*, like a lentil.
174 planistria, Hall. L. *planus*, even; *stria*.

Family *Turbinidæ*. L. *turbo*, a top.

Genus *Cyclora*, Hall. Gr. *kuklos*, a circle; L. *os*, *oris*, mouth.

175 Cyclora ? Hoffmani, S. A. Miller.

176 Cyclora minuta, Hall. L. *minutus*, small.
177 parvula, Hall. L. *parvulus*, dim. of *parvus*, small.
178 depressa, Ulrich. L. *depressus*, depressed.

Genus *Cyclonema*, Hall. Gr. *kuklos*, a circle; *nema*, thread.

179 Cyclonema bilix, Hall. L. *bilix*, a double thread.
180 conicum, S. A. Miller. L. *conus*, a cone.
181 fluctuatum, James. L. *fluctuatus*, waved.
182 Montrealensis, Billings.
183 percarinatum, Hall. L. *per*, *carina*.
184 Phædra, Billings. Mythological.
185 pyramidatum, James. L. *pyramidatus*, pyramidal.
186 varicosum, Hall. L. *varicosus*, full of veins or ridges.
187 ventricosum, Hall. L. *ventricosus*, swollen.
188 minus, James. L. *minor*, less.
189 transversum, Ulrich. L. *transversus*, transverse.

Genus *Holopea*, Hall. Gr. *holos*, entire; *ope*, aperture.

190 Holopea paludinaformis, Hall. L. *paludina*, a river snail; *forma*.
191 obliqua, Hall. L. *obliquus*, awry.

Class Petropoda. Gr. *pteron*, a wing; *pous*, *podos*, a foot.

Order Thecosomata. Gr. *theke*, a sheath; *soma*, body.

Family *Conulariidæ*. L. *conulus*, a little cone.

Genus *Conularia*. L. *conulus*.

192 Conularia papillata, Hall. L. *papilla*, a nipple.
193 Trentonensis, Hall.
194 formosa, Miller and Dyer. L. *formosus*, beautiful.

Class Lamellibranchiata. L. *lamella*, a plate; Gr. *bragchia*, gill.

Division Asiphonata. Gr. *a*, not; *siphon*, a tube.

Family *Ambonychiidæ*. Gr. *ambon*, the umbone; *onuchs*, a talon.

Genus *Ambonychia*, Hall.

195 Ambonychia costata, James. L. *costatus*, ribbed.
196 Casei, Meek and Worthen.
197 bellastriata, Hall. L. *bellus*, pretty; *stria*, a ridge.
198 obtusa, Hall. L. *obtusus*, blunt.
199 radiata, Hall. L. *radiatus*, having rays.
200 retrorsa, S. A. Miller. L. *retrorsus*, turned back.

Genus *Anomalodonta*, S. A. Miller. Gr. *anomalos*, irregular; *odous*, *odontos*, a tooth.

201 Anomalodonta gigantea, S. A. Miller. Gr. *gigas*, large.
202 alata, Meek. L. *alatus*, winged.

Family *Arcidæ*. L. *arca*, a chest.

Genus, *Megambonia*, Billings. Gr. *megas*, great; *ambon* (L. *umbo*).

203 Megambonia, Jamesi, Meek.

Genus *Tellinomya*, Hall. Gr. *telline*, a shell-fish; *myax*, a mussel.

204 Tellinomya Cincinnatiensis, Hall.
205 gibbosa, Hall. L. *gibbosus*, humped.
206 Hilli, S. A. Miller.
207 levata, Hall. L. *levatus*, polished.
208 obliqua, Hall. L. *obliquus*, awry.
209 pectunculoides, Hall. L. *pectunculus*, dim. *pecten*., a small scallop; Gr. *eidos*, form.
210 cingulata, Ulrich. L. *cingulus*, a girdle.

Genus *Cyrtodonta*, Billings. Gr. *kurtos*, curved; *odous*, a tooth.

211 Cyrtodonta (Cypricardites) Hindi, Billings.

Family *Trigoniidæ*. Gr. *treis*, three; *gonia*, an angle.

Genus *Lyrodesma*, Conrad. Gr. *lura*, a lyre; *desma*, ligament.

212 Lyrodesma planum, Conrad, L. *planus*, even or flat.
213 Cincinnatiensis, Hall.
214 postriatum, Conrad. L. *post*, after; *stria*, a ridge.

Division Siphonata, Gr. *siphon*, a tube.

Family *Cyprinidæ*. Gr. *Kupris*, Venus.

Genus *Cycloconcha*, S. A. Miller. Gr. *kuklos*, circle; *kogche*, a mussel.

215 Cycloconcha mediocardinalis, S. A. Miller. L. *medius*, the middle; *cardinalis*, relating to the hinge.

Genus *Cypricardites*, Conrad. Gr. *Kupris*, Venus; *kardia*, heart.

216 Cypricardites carinata, Meek. L. *carina*, a keel.
217 Hainesi, S. A. Miller.
218 Sterlingensis, Meek and Worthen.
219 sub-truncata, Hall. L. *sub*, somewhat; *truncatus*, cut off.
220 ventricosa, Hall. L. *ventricosus*, swollen, inflated.
221 quadrangularis, Whitfield. L. *quatuor*, four; *angulus*,corner.

Genus *Clidophorus*, Hall. Gr. *kleis*, a bolt; *phero*, I bear.

222 Clidophorus fabulus, Hall. L. *fabula*, a small bean.
223 planulatus, Conrad. L. *planula*, a small plane.
224 major, Ulrich. L. *major*, greater.

Family *Anatinidæ*. L. *anatinus*, pertaining to a duck.

Genus Cuneamya, Hall and Whitfield. L. *cuneus*, a wedge; Gr. *myax*, a mussel.

225 Cuneamya Miamiensis, Hall and Whitfield.
226 scapha, Hall and Whitfield. L. *scapha*, a skiff.
227 curta, Whitfield. L. *curtus*, cut off.
228 ampla, Ulrich. L. *amplus*, large.

Family *Pteriniidæ*. Gr. *pteron*, a wing.

Genus *Pterinea*, Goldfuss.

229 Pterinea demissa, Conrad. L. *demissus*, lowered.
230 insueta, Conrad. L. *insuetus*, unusual.
231 corrugata, James. L. *corrugatus*, wrinkled.
232 Welchi, James.

Family *Mytiliidæ*. L. *mytilus*, a mussel.

Genus *Anodontopsis*, McCoy. Gr. *a*, not; *odous*, a tooth; *opsis*, appearance.

233 Anodontopsis, Milleri. Meek.
234 unionoides, Meek. L. *unio*, a pearl; *eidos*, form.

Genus *modiolopsis*, Hall. L. *modiolus*, a small measure; *opsis*, appearance.

235 Modiolopsis anodontoides, Conrad. Gr. *a*, not; *odous*, *eidos*.
236 Cincinnatiensis, Hall and Whitfield.
237 concentrica, Hall and Whitfield. L. *con*; *centrum*, the center.
238 curta, Hall. L. *curtus*, shortened.
239 faba, Conrad. L. *faba*, a bean.
240 modiolaris, Conrad. L. *modiolus*, a measure.
241 nasuta, Conrad. L. *nasutus*, long nosed.
242 pholadiformis, Foster and Whitney. Gr. *pholàs*, a borer: *forma*, form.
243 terminalis, Hall. L. *terminalis*, pertaining to the boundary.
244 truncata, Hall. L. *truncatus*, cut short.
245 Versaillesensis, S. A. Miller.

Family, *Orthonotidæ*. Gr. *orthos*, straight; L. *nota*, a mark.

Genus, *Orthonota*, Conrad.

246 Orthonota pholadis, Conrad. Gr. *pholas*, a boring mollusk.

Genus *Orthodesma*, Hall and Whitfield. Gr. *orthos*, straight; *desma*, ligament.

247 Orthodesma contractum, Hall. L. *contractus*, contracted.
248 parallelum, Hall. L. *parallelus*, parallel.
249 rectum, Hall and Whitfield. L. *rectus*, straight.
250 curvatum, Hall and Whitfield. L. *curvatus*, curved.
251 Mickelboroughi, Whitfield.
252 subovale, Ulrich. L. *sub*, somewhat; *ovalis*, oval.

Genus *Sedgwickia*, McCoy. In honor of Prof. Sedgwick.

253 Sedgwickia compressa, Meek. L. *compressus*, pressed.
254 divaricata, Hall and Whitfield. L. *divaricatus*, spread apart.
255 fragilis, Meek. L. *fragilis*, fragile.
256 neglecta, Meek. L. *neglectus*, slighted.
257 lunulata, Whitfield. L. *lunula*, a small moon.

Family *Cardiomorphidæ*, Hall. Gr. *kardia*, a heart; *morphe*, form.

Genus *Cardiomorpha*, De Koninck.

258 Cardiomorpha obliquata, Meek. L. *obliquatus*, awry.

SUB-KINGDOM MOLLUSCOIDA.

Class Brachiopoda. Gr. *branchion*, arm; *pous*, *podos*, foot.

"These arms were formerly supposed to take the place of feet. They are, however, essentially breathing organs; consequently the term *Branchiobranchiata* (arm-breathers) has been proposed for the erroneous one of *Brachiopoda* (arm-footed)."—Woodward.

Prof. E. S. Morse has furnished evidence, from a study of the embryonic forms of the *Brachiopoda*, to show that this class is nearly related to the *Annelida*.

Order Arthropomata. Gr. *arthron*, a joint; *poma*, a lid or cover.

Family *Orthidæ*. Gr. *orthos*, straight.

Genus *Orthis*, Dalman.

259 Orthis bellula, James. L. *bellulus*, beautiful.
260 borealis, Billings. L. *borealis*, northern.

261 Orthis centrilineata, Hall. L. *centrum*, centre; *lineatus*, lined.
262 Clytie, Hall. Mythological.
263 costata, Hall. L. *costatus*, ribbed.
264 testudinaria, Dalman. L. *testudo*, a tortoise.
265 testudinaria var. cyclus, James. Gr. *kuklos*, a circle.
266 var. jugosa, James. L. *jugosus*, mountainous.
267 var. multisecta, James. L. *multus*, much; *sectus*, cut.
268 emacerata, Hall. L. *emaceratus*, thin.
269 var. Meeki, S. A. Miller.
270 dichotoma, Hall. Gr. *dicha*, asunder; *temno*, I cut.
271 disparilis, Conrad. L. *disparilis*, dissimilar.
272 Ella, Hall.
273 erratica, Hall. L. *erro*, I wander.
274 fissicosta, Hall. L. *fissus*, split; *costa*, a rib.
275 insculpta, Hall. L. *insculptus*, engraven.
276 Morrowensis, James.
277 occidentalis, Hall. L. *occidentalis*, western.
278 orthambonites, Pander. Gr. *orthos*, straight; *ambon* (L. *umbo*), umbone.
279 pectinella, Hall. L. *pecten*, a comb.
280 Jamesi, Hall.
281 perveta, Conrad. L. *perretus*, very old.
282 plicatella, Hall. L. *plico*, I fold.
283 retrorsa, Salter. L. *retrorsus*, turned back.
284 sinuata, Hall. L. *sinuatus*, curved.
285 subquadrata, Hall. L. *sub*, *quadratus*, square.
286 triplicatella, Meek. L. *tris*, three; *plico*, I fold.
287 (Zygospira?) sectastriata, Ulrich. L. *sectus*, cut; *stria*, ridge.
288 biforata, Schlotheim. L. *biforus*, having two openings.
289 biforata, var. lynx, Von Buch. L. *lynx*, a lynx.
290 var. laticostata, James. L. *latus*, broad; *costa*, a rib.
291 var. dentata, Pander. L. *dentatus*, toothed.
292 var. acutilirata, Conrad. L. *acutus*, sharp; *lira*, a ridge.
293 var. crassa, James. L. *crassus*, thick.
294 var. cypha, James. Gr. *kuphos*, bent.
295 var. acuminata, James. L. *acuminatus*, sharpened.

NOTE.—The opinions of the ablest Palæontologists were received in making most of the varieties here noted. *O. profundo-sulcata*, Owen; *O. inflata*, James; *O. prolongata*, James, and *O. annieana*, James, are considered synonyms of species above named.

Family *Rhynchonellidæ*. Gr. *rhugchos*, a beak.

Genus *Rhynchonella*, Fischer.

296 Rhynchonella capax, Conrad. L. *capax*, large.
297 dentata, Hall. L. *dens*, a tooth.
298 perlamellosa, Whitfield. L. *per*; *lamella*, a thin plate.

Family *Spiriferidæ*. L. *spira*, a spire; *fero*, I carry.

Genus *Trematospira*, Hall. Gr. *trema*, a foramen; *spira*.

300 Trematospira quadriplicata, S. A. Miller. L. *quatuor*, four; *plico*, I fold.
301 granulifera, Meek. L. *granum*, a grain; *fero*.

Genus *Zygospira*, Hall. Gr. *zugon*, a yoke; L. *spira*.

302 Zygospira Cincinnatiensis, James.
303 modesta, Say. L. *modestus*, small.
304 modesta var. Kentuckyensis, James.
305 Headi, Billings.
306 concentrica, Ulrich. L. *concentricus*, having a common center.

Family *Strophomenidæ*. Gr. *strophos*, bent; *mene*, crescent.

Genus *Strophomena*, Rafinesque.

307 Strophomena alternata, Conrad. L. *alternus*, alternating.
308 Alternata, var. alternistriata, Hall. L. *alternus*; *striatus*, ribbed.
309 var. fracta, Meek. L. *frango*, I break.
310 var. loxorhytis, Meek. Gr. *loxos*, oblique; *rhutis*, wrinkle.
311 var. nasuta, Conrad. L. *nasutus*, long nosed.
312 squamula, James. L. *squamula*, a little scale.
313 declivis, James. L. *declivis*, sloping.
314 Philomela, Billings. Mythological.
315 tenuilineata, Conrad. L. *tenuis*, fine; *lineatus*, lined.
316 rhomboidalis, Wilckens. Gr. *rhombos*, a rhombus; *eidos*.
317 Ulrichi, James.

NOTE.—*S. tenuistriata*, Sowerby; *S. rugosa*, Hisinger; and *S. gibbosa*, James, are considered synonyms of *S. rhomboidalis*.

Genus *Streptorhynchus*, King. Gr. *streptos*, twisted; *rhugchos*, beak.

318 Streptorhynchus plano convexus, Hall. L. *planus*, even; *convexus*, convex.
319 planumbonus, Hall. L. *planus*; *umbo*, the umbones.
320 filixtextus, Hall. L. *filum*, a thread; *textus*, woven.

321 Streptorhynchus sulcatus, DeVerneuil. L. *sulcatus*, furrowed.
322 sinuatus, Emmons. L. *sinuatus*, curved.
323 nutans, James. L. *nuto*, I bend.
324 subtentus, Conrad. L. *subtentus*, somewhat distended.
325 Hallianus, S. A. Miller.

NOTE.—*S. neglectus*, James, is regarded as a synonym of *S. filixtextus*, Hall; *S. elongatus*, James, and *S. vetustus*, James, of *S. planumbonus*, Hall; *S. plicatus*, James, and *S. approximatus*, James, of *S. subtentus*, Conrad.

Genus *Leptæna*, Dalman. Gr. *leptos*, straight or narrow.

326 Leptæna sericea, Sowerby. L. *sericeus*, silken.
327 var. aspera, James. L. *asper*, rough.

Order LYOPOMATA. Gr. *luo*, I loosen; *poma*, a lid.

Family *Craniidæ*. Gr. *kranos*, a helmet.

Genus *Crania*, Retzius.

328 Crania Dyeri, S. A. Miller.
329 Lœlia, Hall. Mythological.
330 multipunctata, S. A. Miller. L. *multus*, many; *pungo*, I puncture.
331 scabiosa, Hall. L. *scabiosus*, scabby.
332 reticularis, S. A. Miller. L. *reticulum*, a little net.
333 parallela, Ulrich. L. *parallelus*, parallel.
334 percarinata, Ulrich. L. *per*, through; *carina*, a keel.
335 socialis, Ulrich. L. *socialis*, associated.

Genus *Schizocrania*, Hall and Whitfield. Gr. *schizo*, I separate; *kranos*.

336 Schizocrania filosa, Hall. L. *filum*, a thread.

Genus *Pholidops*, Hall. Gr. *pholeo*, I bore; *ops*, appearance.

337 Pholidops Cincinnatiensis, Hall.

Family *Discinidæ*. L. *dis*, asunder; *scindo*, I split.

Genus *Discina*, Lamark.

338 Discina tenuistriata, Ulrich. L. *tenuis*, fine; *stria*, a ridge.
339 sublamellosa, Ulrich. L. *sub*, somewhat; *lamella*, a small plate or seal.

Genus *Trematis*, Sharpe. Gr. *trema*, a foramen.

340 Trematis millepunctata, Hall. L. *mille*, a thousand; *pungo*, I puncture.
341 punctostriata, Hall. L. *pungo*; *stria*, a ridge.
342 terminalis, Conrad. L. *terminalis*, pertaining to the boundary.
343 Dyeri, S. A. Miller.

Family *Lingulidæ*. L. *lingula*, a little tongue.

Genus *Lingula*, Bruguiere.

344 Lingula Covingtonensis, Hall and Whitfield.

Genus *Lingulella*, Salter.

345 Lingulella attenuata, Sowerby. L. *attenuatus*, thin.
346 Norwoodi, James.
347 riciniformis, Hall. L. *ricinus*, a tick; *forma*.
348 Van Horni, S. A. Miller.
349 Cincinnatiensis, Hall and Whitfield.

Genus *Leptobulus*, Hall. Gr. *leptos*, thin; *obolus*, a coin.

350 Leptobulus lepis, Hall. L. *lepis*, a scale.

Class Polyzoa. Gr. *polus*, many; *zoon*, an animal.

Order Gymnolœmata. Gr. *gumnos*, naked; *laimos*, throat.

Family *Escharidæ*. Gr. *eschara*, a grate.

Genus *Ptilodyctia*, Lonsdale. Gr. *ptilon*, a feather; *dictuon*, a net.

351 Ptilodyctia acuminata, James. L. *acuminatus*, sharpened.
352 elegantula, Hall. L. *elegans*, beautiful.
353 emacerata, Nicholson. L. *emaceratus*, reduced.
354 falciformis, Nicholson. L. *falx*, a sickle; *forma*.
355 fenestelliformis, Nicholson. L. *fenestella*, a little window; *forma*.
356 fragilis, Billings. L. *fragilis*, fragile.
357 flagellum, Nicholson. L. *flagellum*, a whip or young branch.
358 flexuosa, James. L. *flexuosus*, winding.
359 granulosa, James. L. *granum*, a grain.
360 Hilli, James.
361 maculata, Ulrich. L. *maculatus*, spotted.
362 nitidula, Billings. L. *nitidulus*, somewhat shining.
363 parallela, James. L. *parallelus*, parallel.
364 perelegans, Ulrich. L. *per*, through; *elegans*, elegant.
365 plumaria, James. L. *plumarius*, resembling feathers.
366 Shafferi, Meek.

Genus *Helopora*, Hall. Gr. *helos*, a nail; *poros*, a pore.

367 Helopora arctipora, Nicholson. L. *arctus*, narrow; *poros*.
368 dendrina, James. Gr. *dendron*, a tree.
369 Meeki, James.
370 parvula, James. L. *parvulus*, very small.
371 tenuis, James. L. *tenuis*, slender.

Family *Tubuliporidæ*. L. *tubulus*, a little tube; *poros*.

Genus *Ceramopora*, Hall. Gr. *keramos*, a tile; *poros*.

372 Ceramopora alternata, James. L. *alternatus*, alternating.
373 ? Beani, James.
374 incrustans, Hall. L. *incrustans*, incrusting.
375 irregularis, James. L. *irregularis*, irregular.
376 Nicholsoni, James.
377 Ohioensis, James.

Genus *Cyclopora*, Prout. Gr. *kuklos*, a circle; *poros*.

378 Cyclopora Jamesi, Prout.

Genus *Callopora*, Hall. Gr. *kallos*, beautiful; *poros*.

379 Callopora Cincinnatiensis, Ulrich.

Family *Crisiidæ*. Gr. *krisis*, a dividing.

Genus *Alecto*, Lamouroux. Mythological.

380 Alecto auloporoides, Nicholson. Gr. *aulos*, a tube; *poros*, *eidos*.
381 arachnoidea, Hall. Gr. *arachne*, a spider's web; *eidos*.
382 confusa, Nicholson. L. *confusus*, disorderly.
383 frondosa, James. L. *frondosus*, like a leaf.
384 nexilis, James. L. *nexilis*, wreathed.

Genus *Hippothoa*, Lamouroux. Mythological.

385 Hippothoa inflata, Hall. L. *inflatus*, inflated.
386 delicatula, James. L. *delicatulus*, delicate.

Family *Reteporidæ*. Gr. *rete*, a net; *poros*, a pore.

Genus *Retepora*, Lamark.

387 Retepora angulata, Hall. L. *angulatus*, having angles.

SUB-KINGDOM CŒLENTERATA.

Class Polypi. Gr. *polus*, many; *pous*, *podos*, foot.

Order Alcyonaria. Mythological.

Family *Graptolitidæ*. Gr. *grapho*, I write; *lithos*, a stone.

Genus *Graptolithus*, Linnæus.

388 Graptolithus gracilis, Hall. L. *gracilis*, slender.

Genus *Climacograptus*, Hall. Gr. *klimax*, a ladder; *grapho*.

389 Climacograptus typicalis, Hall. Gr. *tupikos*, typical.

390 bicornis, Hall. L. *bicornis*, having two horns.

Genus *Megalograptus*, S. A. Miller. Gr. *megas*, great; *grapho*.

391 Megalograptus Welchi, S. A. Miller.

Genus *Dictyograptus*, Ulrich. Gr. *dictuon*, a net; *grapho*.

392 Dictyograptus reticulatus, Ulrich. L. *reticulatus*, reticulated.

Order Zoantharia. Gr. *zoon*, an animal; *anthos*, a flower.

Family *Cyathophyllidæ*. Gr. *kuathos*, a cup; *phullon*, a leaf.

Genus *Palæophyllum*, Billings. Gr. *palaios*, ancient; *phullon*.

393 Palæophyllum divaricans, Nicholson. L. *divarico*, I spread.

Genus *Streptelasma*, Hall. Gr. *strepho*, I twist; *elasma*, a plate.

394 Streptelasma corniculum, Hall. L. *corniculus*, a little horn.

Family *Favositidæ*. L. *favus*, a honey-comb.

Genus *Alveolites*, Lamark. L. *alveolus*, a hollow vessel.

395 Alveolites granulosus, James. L. *granulosus*, full of granules.

Genus, *Chætetes*, Fischer. Gr. *chaite*, a bristle.

396 Chætetes approximatus, Nicholson. L. *ad; proximo*, I come near.

397 Briareus, Nicholson. Mythological (a giant with a hundred arms).

398 calyculus, James. L. *calyculus*, a little bud.

399 Cincinnatiensis, James.

400 clavacoideus, James. L. *clava*, a club; Gr. *eidos*, form.

401 clathratulus, James. L. *clathra*, a grate.

402 corticans, Nicholson. L. *cortex*, bark.

403 crustulatus, James. L. *crustula*, dim. of *crusta*, a crust.

404 Dalei, Edwards and Haime.

405 delicatulus, Nicholson. L. *delicatus*, slender.

406 discoideus, James. Gr. *diskos*, a disk; *eidos*, form.

407 Fletcheri, Edwards and Haime.

408 filiasa, D'Orbigny. Probably not found in this group.

409 frondosus, D'Orbigny. L. *frondosus*, full of leaves.

410 gracilis, James. L. *gracilis*, slender.

411 Jamesi, Nicholson.

412 lycoperdon, Say. Gr. *lukos*, a wolf; *perdo*, to break wind.

Note.—This species, *lycoperdon*, formerly included many corals which are now described under other specific names.

413 Chætetes mammulatus, Edwards and Haime. L. *mamma*, a teat.
414 Newberryi, Nicholson.
415 nodulosus, Nicholson. L. *nodus*, a knot.
416 O'Nealli, James.
417 Ortoni, Nicholson.
418 papillatus, McCoy. L. *papilla*, a nipple.
419 pavonia, D'Orbigny. L. *pavo*, or *pavonia*, a genus of recent polyps.
420 petechialis, Nicholson. L. *petechiale*, a small spot.
421 petropolitanus, Pander. Gr. *petros*, a stone; L. *politus*, adorned.
422 pulchellus, Edwards and Haime. L. *pulchellus*, beautiful.
423 quadratus, Rominger. L. *quadratus*, quadrate.
424 rugosus, Edwards and Haime. L. *rugosus*, wrinkled.
425 sigillaroides, Nicholson. L. *sigillum*, a seal; *eidos*.
426 subpulchellus, Nicholson. L. *sub; pulchellus*, beautiful.
427 calceolus, Miller and Dyer. L. *calceolus*, a little shoe.
428 compressus, Ulrich. L. *compressus*, compressed.
429 subglobosus, Ulrich. L. *sub*, somewhat; *globosus*, round.
430 granuliferus, Ulrich. L. *granum*, a grain; *fero*, I bear.
431 rectus, Ulrich. L. *rectus*, straight.
432 venustus, Ulrich. L. *venustus*, graceful.

Genus *DeKayia*, Edwards & Haime. Proper name.

433 DeKayia minuta, Ulrich. L. *minutus*, minute.
434 aspera, Edwards and Haime. L. *asper*, rough.
435 aspera var. attrita, Nicholson. L. *attritus*, rubbed.

Genus *Columnopora*, Nicholson. L. *columna*, a column; *poros*, a pore.

436 Columnopora cribriformis, Nicholson. L. *cribrum*, a sieve; *forma*. (Houghtonia) Huronica, Rominger.

Genus *Favistella*, Hall. L. *favus*, a honey-comb; *stella*, a star.

437 Favistella stellata, Hall. L. *stellatus*, starred.

Genus *Favosites*, Lamark. L. *favus*.

438 Favosites Gothlandica. Lamark.

Genus *Stellipora*, Hall. L. *stella*, a star; *poros*.

439 Stellipora antheloidea, Hall. Gr. *anthele*, a flower; *eidos*.
440 polystomella, Nicholson. Gr. *polus*, many; *stoma*, a mouth.
441 plana, Ulrich. L. *planus*, even.

Genus *Tetradium*, Dana. Gr. *tetradeion*, four.

442 Tetradium minus, Safford. L. *minus*, less.
443 columnare, Hall. L. *columna*, a column.

Family *Poritidæ*. Gr. *poros*, a pore.

Genus *Protarea*, Edwards and Haime. Gr. *potos*, first; *araios*, porous.

444 Protarea vetusta, Edwards and Haime. L. *vetustus*, old.

Family *Milleporidæ*. L. *mille*, a thousand; Gr. *poros*.

Genus *Fistulipora*, McCoy. L. *fistula*, a pipe; Gr. *poros*, a pore.

445 Fistulipora flabellata, Ulrich. L. *flabellum*, a fan.
446 robusta, Ulrich. L. *robustus*, strong.
447 ?multipora, James. L. *multus*, many; Gr. *poros*.

Genus *Crateripora*, Ulrich. Gr. *krater*, a cup; *poros*.

448 Crateripora erecta, Ulrich. L. *erectus*, erect.
449 lineata, Ulrich. L. *lineatus*, lined.
450 expansa, Ulrich. L. *expansus*, expanded.

SUB-KINGDOM PROTOZOA.

Class Rhizopoda. Gr. *rhiza*, a root; *pous*, *podos*, a foot.

Order Spongida. Gr. *spoggos* (L. *spongia*), a sponge.

Genus *Astylospongia*, Roemer. Gr. *a*, not; *stulos*, a pillar; *spoggos*.

451 Astylospongia foveolata, James. L. *fovea*, a pit; *latus*, broad.
452 tumida, James. L. *tumidus*, swollen.

Genus *Microspongia*, Miller and Dyer. Gr. *mikros*, small; *spoggos*, a sponge.

453 Microspongia gregaria, Miller and Dyer. L. *gregarius*, of a flock.

Genus *Stromatopora*, Goldfuss. Gr. *stroma*, spread out; *poros*.

454 Stromatopora papillata, James. L. *papilla*, a teat.
455 Lyoni, James.
456 Cincinnatiensis, James.

INCERTA SEDES.

457 Pasceolus, Billings. L. *pasceolus*, a purse.
458 Claudei, S. A. Miller.
459 Darwini, S. A. Miller.

Note.—*Pasceolus* has been referred by some authorities to the *Sponges*, and by others to the *Cystidians*.

VEGETABLE KINGDOM.

SUB-KINGDOMS:

I. PHŒNOGAMIA. Gr. *phaino*, I appear; *gamos*, marriage; also called Flowering Plants.

II. CRYPTOGAMIA. Gr. *kruptos*, hidden; *gamos*; also called Flowerless Plants.

The geological record of the Cincinnati epoch has not furnished any evidence of the existence of Phœnogamous plants.

SUB-KINGDOM CRYPTOGAMIA.

Class ACROGENS. Gr. *akros*, the summit; *gennao*, to produce.

Order EQUISETACEÆ. L. *equus*, a horse; *seta*, stiff hair.

Genus *Sphenophyllum*, Brongniart. Gr. *sphen*, wedge-shaped; *phullon*, a leaf.

460 Sphenophyllum primævum, Lesquereux. L. *primus*, first; *ævum*, age.

Order LYCOPODIACEÆ. Gr. *lukos*, a wolf; *pous*, *podos*, foot.

Genus *Psilophyton*, Dawson. Gr. *psilos*, naked; *phuton*, a plant or tree.

461 Psilophyton gracillimum, Lesquereux. L. *gracillimus*, most slender.

Genus *Protostigma*, Lesquereux. Gr. *protos*, first; *stigma*, a dot.

462 Protostigma sigillaroides, Lesquereux. L. *sigillum*, a seal; *eidos*, form.

Class THALLOGENS. Gr. *thallos*, a green branch; *gennao*, to produce.

Order ALGÆ. L. *alga*, sea weed.

Genus *Buthotrephis*, Hall. Gr. *buthos*, the depth of the sea; *trepho*, I grow.

463 Buthotrephis gracilis, Hall. L. *gracilis*, slender.
464 gracilis var. crassa, Hall. L, *crassus*, coarse.
465 ramulosa, S. A. Miller. L. *ramulosus*, full of little boughs.
466 succulosa, Hall. L. *succus*, juice, from the succulent branches.

Genus *Palæophycus*, Hall. Gr. *palaios*, ancient; *phukos*, a sea weed.

467 Palæophycus tubulare, Hall. L. *tubulus*, a little tube.

Genus *Rusophycus*, Hall. Gr. *rusos*, wrinkled; *phukos*.

468 Rusophycus bliobatum, Hall. L. *bis*, twice; Gr. *lobos*, a lobe.

469 pudicum, Hall. L. *pudicus*, virtuous or unadorned.

470 asperum, Miller and Dyer. L. *asper*, rough.

Genus *Blastophycus*, Miller and Dyer. Gr. *blastos*, a bud; *phukos*.

471 Blastophycus diadematum, Miller and Dyer. L. *diadematus*, wearing a diadem.

Genus *Trichophycus*, Miller and Dyer. Gr. *thrix* (*gn. trichos*), hair; *phukos*.

472 Trichophycus lanosum, Miller and Dyer. L. *lanosus*, woolly.

Genus *Licrophycus*, Billings.

473 Licrophycus flabellum, Miller and Dyer. L. *flabellum*, a fan.

Genus *Conostichus*, Lesquereux. Gr. *konos*, a cone; *stichos*, a row.

474 Conostichus truncatus, Ulrich. L. *truncatus*, cut short.

Genus *Arthraria*, Hall. Gr. *arthron*, a joint.

475 Arthraria biclavata, S. A. Miller. L. *bis*, twice; *clava*, a club.

Nullipores—These were *algæ* having calcareous secretions. They differ from corals in having no pores or cells.

ADDENDA.

19 *a* Lichas Harrisi, S. A. Miller.

108 *a* Palæaster longibrachiatus, S. A. Miller. L. *longus*, long; *brachiatus*, armed.

CLASSIFICATION.

ANIMAL KINGDOM:

SUB-KINGDOMS: I. VERTEBRATA; II. ANNULOSA; III. ANNULOIDA; IV. MOLLUSCA; V. MOLLUSCOIDA; VI. CŒLENTERATA; VII. PROTOZOA.

ANNULOSA.

Class CRUSTACEA; Sub-Class ENTOMOSTRACA.

I. Order TRILOBITA; Genera *Calymmene*, *Acidaspis*, *Asaphus*, *Ceraurus*, *Dalmanites*, *Proëtus*, *Lichas*, *Triarthrus*, *Trinucleus*.

II. Order PHYLLOPODA; Genus *Beyrichia*.

III. Order OSTRACODA; Genera *Leperditia*, *Cythere*.

Class ANNELIDA.

I. Order ERRANTIA; Genera *Walcottia*, *Nereidavus*, *Eotrophonia*, *Protoscolex*, *Scolithus*.

II. Order TUBICOLA; Genera *Conchicolites*, *Serpulites*, *Spirorbis*, *Tentaculites*.

ANNULOIDA.

Class ECHINODERMATA.

I. Order CRINOIDEA: Genera *Glyptocrinus*, *Heterocrinus*, *Anomalocrinus*, *Poteriocrinus*.

II. Order CYSTOIDEA; Genera *Lepocrinites*, *Agelacrinites*, *Lichenocrinus*, *Anomalocystites*, *Hemicystites*, *Clyclocystoides*.

III. Order ASTEROIDEA; Genera *Palæaster*, *Palæsterina*, *Stenaster*.

IV. Order OPHIUROIDEA; Genus *Protaster*.

MOLLUSCA.

Class CEPHALOPODA; Division NAUTILIDÆ.

I. Order TETRABRANCHIATA.

Family *Orthoceratidæ*; Genera *Orthoceras*, *Endoceras*.

Family *Gomphoceratidæ*; Genus *Gomphoceras*.

Family *Phragmoceratidæ*: Genus *Phragmoceras*.

Family *Lituitidæ*; Genus *Trocholites*.

Family *Trochoceratidæ*: Genus *Trochoceras*.

Family *Cyrtoceratidæ*; Genus *Cyrtoceras*.

Class GASTEROPODA.

I. Order PROSOBRANCHIATA.

Family *Muricidæ* ; Genus *Fusispira*.

II. Order RHIPHIDOGLOSSA.

Family *Bellerophontidæ* ; Genera *Bellerophon*, *Bucania*, *Carinaropsis*, *Cyrtolites*, *Microceras*.

Family *Pleurotomariidæ* ; Genera *Murchisonia*, *Pleurotomaria*, *Trochonema*, *Raphistoma*.

Family *Turbinidæ* ; Genera *Cyclora*, *Cyclonema*, *Holopea*.

Class PTEROPODA.

III. Order THECOSOMATA.

Family *Conulariidæ* ; Genus *Conularia*.

Class LAMELLIBRANCHIATA.

Division ASIPHONATA.

Family *Ambonychiidæ* ; Genera *Ambonychia*, *Anomalodonta*.

Family *Arcidæ* ; Genera *Megambonia*, *Tellinomya*, *Cyrtodonta*.

Family *Trigoniidæ* ; Genus *Lyrodesma*.

Division SIPHONATA.

Family *Cyprinidæ* ; Genera *Cycloconcha*, *Cypricardites*, *Cuidophorus*.

Family *Anatanidæ* ; Genus *Cuneamya*.

Family *Pterineidæ* ; Genus *Pterinea*.

Family *Mytiliidæ* ; Genera *Anodontopsis*, *Modiolopsis*.

Family *Orthonotidæ* ; Genera *Orthonota*, *Orthodesma*, *Sedgwickia*.

Family *Caraiomorphidæ*; Genus *Cardiomorpha*.

MOLLUSCOIDA.

Class BRACHIOPODA.

I. Order ARTHROPOMATA.

Family *Orthidæ* ; Genus *Orthis*.

Family *Rhynchonellidæ* ; Genus *Rhynchonella*.

Family *Spiriferidæ* ; Genera *Trematospira*, *Zygospira*.

Family *Strophomenidæ* ; Genera *Strophomena*, *Streptorhynchus*, *Leptæna*.

II. Order LYOPOMATA.

Family *Craniidæ* ; Genera *Crania*, *Schizocrania*, *Pholidops*.

Family *Discinidæ* ; Genera *Discina*, *Trematis*.

Family *Lingulidæ* ; Genera *Lingula*, *Linguletta*, *Leptobulus*.

Class Polyzoa.

III. Order Gymnolœmata.

Family *Escharidæ;* Genera *Ptilodyctia Helopora.*

Family *Tubuliporidæ;* Genera *Ceramopora, Cyctopora, Cuttopora.*

Family *Crisiidæ;* Genera *Alecto, Hippothoa.*

Family *Reteporidæ;* Genus *Retepora.*

CŒLENTERATA.

Class Polypi.

I. Order Alcyonaria.

Family *Graptolitidæ;* Genera *Graptolithus, Climacograptus, Megalograptus, Dictyograptus.*

II. Order Zoantharia.

Family *Cyathophyllidæ;* Genera *Palæophyllum, Streptelasma.*

Family *Favositidæ;* Genera *Alveolites, Chætetes, DeKayia, Columnopora, Faristella, Favosites, Stellipora, Tetradium.*

Family *Poritidæ;* Genera *Protarea?*

Family *Milleporidæ;* Genera *Fistulipora, Crateripora.*

PROTOZOA.

Class Rhizopoda.

Order Spongida; Genera *Astylospongia, Microspongia, Stromatopora, Paseolus?*

VEGETABLE KINGDOM:

SUB-KINGDOMS: I. PHŒNOGAMIA; II. CRYPTOGAMIA.

CRYPTOGAMIA.

Class Acrogens.

I. Order Equisetaceæ; Genus *Sphenophyllum.*

II. Order Lycopodiaceæ, Genera *Psilophyton, Protostigma.*

Class Thallogens.

III. Order Algæ; Genera *Buthotrephis, Palæophycus, Rusophycus, Blastophycus, Tricophycus, Licrophycus, Conostichus, Arthraria.*

OBSERVATIONS ON FOSSIL ANNELIDS, AND DESCRIPTIONS OF SOME NEW FORMS.

By E. O. Ulrich.

Somewhat more than a year ago, the palæontologists in the vicinity of Cincinnati were considerably disturbed by the announcement then made, that fish jaws had been discovered in large numbers in rocks of the Cincinnati group. Two of the collectors here sent specimens of the supposed fish jaws to Dr. Newberry, and in a letter to me, he stated that he considered them to be identical with Pander's Conodonts. In the *Ohio Palæontology*, Vol. II., we find that Dr. Newberry attempts to solve the mystery surrounding the Conodonts by advancing the theory that they were the teeth of Cyclostomous fishes, and compares them with the teeth of *Myxine* and *Bdellostoma*, to which he considers them to bear great similarity.

Pander and Agassiz considered the Conodonts to be the teeth of small Selachians.

Prof. E. S. Morse, one of the best living authorities on the structure of invertebrate animals, said they bore a strong resemblance to the teeth of mollusks, and might have belonged to the progenitors of some of our living forms.

Prof. W. Stimpson, one who had given special attention to the *Crustacea*, after examining a large number of Conodonts, gave the opinion that they might very well be the lingual teeth of mollusks, but they could not have formed the dentition or spinous armament of any Crustacean.

Prof. Owen (*Palæontology*, p. 116) discusses their structure and affinities at considerable length, and concludes that "they have most analogy with the spines, hooklets, or denticles of naked mollusks or annelids."

Dr. Newberry (*Palæontology of Ohio*, Vol. II., p. 42), gives very good reasons for excluding the theory, that they are the teeth of sharks. He however truly remarks that after excluding that theory, the range of possibility in their affinities is still very great. They may as suggested by Owen and Morse, be the teeth of mollusks, for they strongly resemble them in their peculiar and varied forms, and their chitonous composition. After a study of their inferior margins no doubt can be entertained, that they were implanted in soft tissue, like the teeth of mollusks or the hooks of annelids.

In support of the view that they belong to the Annelida, we find an article in the *American Journal of Science and Arts*, by Mr. G. Grinnell, of Yale College Museum, in which that gentleman states that he had received a number of specimens from Cincinnati. After an exam-

ination he concluded that they were the hard chitonous parts (hooks) of annelids. He coins for them the generic name, *Nereidavus*, from *Nereis*, an existing genus, and to which he considers them probably related.

Through the kindness of Prof. Wetherby, I have been enabled to examine several species of the genus *Neries*, and among them the *Nereis pelagica*, Lin., a species especially mentioned by Mr. Grinnell, and found a striking resemblance between their jaws or hooks, and the little Conodonts that are so common in our rocks.

On account of the great diversity of opinion with regard to the zoological affinities of these remains, which have been expressed by undoubted authorities, it would be rash for me to assert that they are the chitonous jaws of annelids. They present so little from which accurate conclusions can be drawn, and for that reason all the theories that have been advanced to solve the enigma are based on some points, of which they give a possible, and in some cases an altogether probable explanation. Without, then, going farther into the merits of the above theories, we will, for the present, accept the one which seems to afford the most probable explanation, and assume that the Conodonts and Nereidavus are the hooklets of species of annelids.

In that case, we can easily imagine that the ocean beneath which the Cincinnati group was deposited, at times swarmed with innumerable worms, which have, so far as we at present know, left no traces of themselves excepting their jaws, tracks, and possibly a few rude impressions of their bodies.

Where the number is so great of one group of these annelids, we can scarcely suppose that it was the only one existing, but it stands more to reason to suppose that other groups flourished, which had no parts capable of being fossilized, and therefore left no traces excepting, perhaps, their burrows ; and still others again, possibly large groups, which the palæontological collector has as yet not unearthed, but some of which he will undoubtedly bring to light in the future. The first evidences that we have of vermes, are from the Huronian group. These were named *Arenicolites*, by Salter, and are simply circular holes, appearing in twos on the surface of sandstones, and bearing much resemblance to the burrows of the worm Arenicola. The next we find in *Nereidavus* and the *Conodonts*, which have been found in nearly all the formations from the Trenton to the Coal Measures.

In the Cincinnati group, we find that besides the *Nereidavus*, Miller and Dyer have described, in the first number of the JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY, another form, for which they erected the Genus *Walcotia*, and named *W. rugosa*. The fossils to which they attached this name are casts, which are not very rare in the quarries about Cincinnati, having short linear depressions diverg-

ing from a median line in a backward direction, the depressions probably representing the casts of the pedal appendages. This genus I believe will be found to be nearly related to *Nereidavus*, if not identical with it, but this can not be ascertained from the material collected to the present time. The next evidences recorded are from the Carboniferous of Illinois, from where Meek and Worthen described their *Anthracerpes typus* ; these gentlemen at first referred the genus to the *Myriapoda*, but afterwards admitted its affinites with the worms. This, I believe, is the entire list (if we except *Scolithus*, which are considered to be worm burrows by some palæontologists) of the recorded genera and species of worms found in the American Palæozoic rocks, and all must admit that it is a very short one, but I propose to lengthen it somewhat by adding several forms. The circumstances under which they were found, are as follows: About two months ago, while geologizing back of Covington, in company with Mr. Dickhaut, we discovered a spot in which great numbers of the minute bryozoan *Arthoclema tenuis*, James, and two specimens of *Arthoclema shafferi*. Meek, were found almost in their original perfection. Associated with these, and well preserved, were numerous specimens of *Serpulites dissolutus*, a very frail species, described by Billings, from the Trenton rocks of Canada.

That these fragile fossils aré found in such a state of preservation, shows conclusively that the strata were deposited rapidly and under very favorable circumstances. Having ascertained this fact, we need not be surprised at finding fossils, which, under less favorable conditions would have been totally destroyed, or preserved only in unrecognizable fragments.

The fossils alluded to are described below, and I believe they can not be referred to any other class of animals than to the true worms.

I have determined the following new genera and species. *Protoscolex*, n. g., with four species: The *P. covingtonensis*, *simplex*, *ornatus*, and *tenuis; Eotrophonia*, n. g., with one species, *E. setigera*.

Protoscolex, n. g.

Body ranging from a medium to a great length, of nearly uniform width throughout its length; body divided transversely by more or less narrow, simple or papillated segments. Anterior and posterior ends obtusely pointed, and, probably because the specimens are fossil, are not distinguishable from each other. No setæ or appendages of any kind.

Type, *P. covingtonensis*.

Protoscolex covingtonensis, n. sp. (Plate IV., fig. 2.)

Body long and very slender, of uniform width, the chitonous sub-

stance composing the segments, quite thick, so as in some instances to resist compression ; extremities terminating rather abruptly.

Segments smooth, very narrow, of equal width on all parts of the body, strongly convex, and from twelve to fourteen in the space of one line.

Length of body variable according to age, and in a specimen having a diameter of one third of a line, the length is one and one eighth inches. The usual width, however, is a little more than one half of a line.

This is a neat species, and several fine specimens have been obtained of it, south of Covington, at an elevation of about 100 feet above low water mark.

PROTOSCOLEX ORNATUM, n. sp. (Plate IV., fig. 1.)

Body long, slender, of uniform width, with the two extremities obtusely pointed or rounded.

Segments having a width equaling one eighth that of the body in the compressed condition, about nine occupying the space of one line; the entire body is ornamented with from one to two rows of small papillæ on each segment, arranged respectively in either one row running across the body in the median line of a segment, or one row near each edge of the segments.

The entire length of the species is doubtful, no specimen having been found that is positively known to be complete. The largest specimen examined is 2½ inches in length, and it is possible that this was the entire length, since one extremity shows the original termination very well, while the other extremity, which appears to be somewhat contracted, but it is too much contorted for satisfactory determination, would seem to be the other termination.

The wider and papillated segments in these species will amply serve to distinguish it from the *P. coringtonensis.*

Locality and Position.—Same as the last.

PROTOSCOLEX TENNIS, n. sp. (Plate IV., fig. 3.)

Body very long and exceedingly slender, of uniform width. Extremities tapering gradually and pointed. Annulations obscure smooth, somewhat convex, with about four in the space of one line.

This species reaches a length of six inches, with a breadth of one half a line. The smallest complete specimen seen is a little more than two inches in length, and has a width of about one fourth of a line.

This form is easily distinguished from any of the preceding, by its proportionally greater length and wider segments. The latter are usually very obscure, which is not so in the others.

Locality and Position.—Same as the last.

PROTOSCOLEX SIMPLEX, n. sp. (Plate IV., fig. 4.)

Body of medium length, slender; of nearly uniform width; divided into segments, having a width equal to one third that of the body; the segments are smooth, slightly convex, and are a little wider near the middle of the body than they are near the ends.

Anterior? extremity sub-conical, and like the posterior end is composed of a small segment of the body; the latter extremity is more obtuse than the former.

Several specimens of this species have been found, and among them one found by Mr. Dickhaut and the author, which appears to be a complete individual. No markings can be seen in any of the specimens by which the anterior and posterior extremities could be positively determined.

It would be difficult to confound this species with any of the others herein described; it is distinguished from *P. covingtonensis*, which it resembles mostly, by the greater length, much more narrow, and convex segments in that species.

Locality and position.—Same as the last.

Associated with the above described forms were, what can scarcely be considered otherwise than the setæ of marine worms. They were found in considerable numbers, and well preserved, while of the animals to which they belonged not another trace was observed. It is probable that they belonged to several species, but I will class them under one name, since the differences observed in different specimens are not sufficient for satisfactory determination.

I propose for the specimens the name

EOTROPHONIA SETIGERA, n. gen. et sp. (Plate IV., fig. 5.)

The animal was provided with three series of tufts of setæ, one probably on the back, and one on each side. A single tuft on each side very likely, was situated at the junction of each segment, as in *Trophonia*. Each segment appears to have been about one line wide, since the setæ tufts are placed at that distance apart.

The tufts are composed of from twenty to forty or more hairs, all directed obliquely outwards, and, if the direction was the same as in the existing species, *Trophonia affinis*, forwards. The setæ are about two lines in length, and the two side series are from three fourths of a line to one line apart.

The length of the entire animal is unknown.

DESCRIPTIONS OF SOME NEW SPECIES OF FOSSILS, FROM THE CINCINNATI GROUP.

By E. O. Ulrich.

Incerta Sedes.

Anomaloides, n. gen.

The above generic name is proposed for the reception of certain hollow, compressed, conical bodies, having much of the form of the rays of the Asteroidea. Upon examination, however, they are found to have no surface which can be called either ventral or dorsal, since they are composed uniformly of elongated, cylindrical, spine like bodies, which are placed parallel with each other, and perpendicular to the surface.

The fragments from which this description is taken are in all so peculiar, and so different from anything heretofore known, that it would be exceedingly difficult, and probably premature for me to attempt to point out the affinities of the genus from the specimens at hand. At present, however, I believe they are to be looked for in the Echinodermata.

Anomaloides reticulatus, n. sp. (Plate IV., figs. 6, 6*a* and 6*b*.)

The thirty-five fragments before me were found on a spot about two feet square, and it may be possible that they all belonged to one individual, but that seems scarcely probable. They are all hollow, and the envelope is composed of an aggregation of sub-cylindrical or rather club-shaped stems, which are placed parallel with each other, and perpendicular to the surface; their inner ends are acutely pointed, while that end which shows on the exterior surface is rounded, and with a minute pit on the top, for the articulation of two very fine and small spines. The distribution of these club-shaped plates is very regular, being arranged in curved or flexuous transverse, and diagonally intersecting lines; and on account of their cylindrical form, there are a great number of interstices, which may be referable to pores, analogous to those in the Asteroidea.

Two of the specimens are compressed, conical in form ; one is two inches in length, and the greatest breadth is three-fourths of an inch ; its two edges run nearly parallel for about one and one-fourth of an inch, from where it tapers rapidly to a point. These specimens may represent rays. Another specimen appears to be part of a disk, and judging from its form it seems possible that it was supplied with three such rays, as those described. Two other fragments were observed, in which

some small specimens of Bellerophon bilobatus were found within the envelope of plates.

Locality and Position.—From the Cincinnati Group at Covington, Ky., at an elevation of about 275 feet above low water mark in the Ohio river. Found by Mr. H. Dickhaut and the author.

TUBULIPORIDÆ.

Genus Callopora, Hall.

Callopora cincinnatiensis, n. sp. (Plate IV., figs. 8, 8*a* and 8*b*.)

Polyzoary growing, usually in solid, though sometimes hollow branches, that do not bifurcate equally, but at variable distances send off short spurs, and are digitate at their extremities.

Cells very small, not contiguous, with the intertubular space thick, and occupied by from one to three rows of subangular interstial tubuli; cell apertures circular, about eight occupying the space of one line, and are generally separated once and a half times their diameter. Surface presenting no maculæ nor regular tuberosities, but is sometimes raised into low monticules, with no particular arrangement.

In longitudinal sections, the tubules are seen to have somewhat flexuous walls, and to be nearly vertical in the middle of the polyzoary; they then gradually bend outwards, so as to make an angle of forty-five degrees with the surface. In the intercellular tubuli, the diaphragms are quite numerous and close, while in the true tubes they are few and remote.

This species is the only recorded representative of the Genus *Callopora* in the Lower Silurian. The genus is, however, well represented in all the strata from the Niagara to the Coal Measures. There is no form in the Cincinnati group with which *C. cincinnatiensis* could be confounded, unless it be with a certain variety of *Chætetes fletcheri*, in which there are a great number of intertubular cells; they are readily distinguished by the smaller and circular cell apertures in this species; the cell mouths in *C. fletcheri* are angular, and the intertubular cells are not so numerous; the growth in the two forms is also very different.

Locality and Position.—This is a very rare species, and but few specimens of it have been found. The specimens examined were found by Mr. Fred. Braun and the author, in the Cincinnati Group, at Cincinnati O.

Chætetes venustus, n. sp. (Plate IV., figs. 7 and 7*a*.)

Polyzoary composed of large, hollow branches, bifurcating at variable distances, and sometimes irregularly thickened; branches growing from a broad expansion, which is covered on the lower side by a heavy

and strongly wrinkled dermatic crust. Branches from 3 to 10 lines in diameter, the inner or inferior side lined with a very thick epitheca; the substance of polyzoary surrounding the hollow part from 1 to 3 lines in thickness.

Surface smooth, or carrying low, broad monticules, distant from each other about $1\frac{1}{2}$ lines; their summits occupied by large maculæ, consisting of from 30 to 80 minute tubuli. Tubules arranged in regular, alternating series, about six in the space of one line, with apertures rhomboidal in outline, and in the perfect state, slightly raised and arched. Intertubular spaces thin, and almost completely destitute of minute cells, excepting the cellulose maculæ before mentioned.

Sections show tubules prostrate at first, and then bending rectangular to the surface. Diaphragms in these, straight, and generally twice the diameter of a tube apart. Diaphragms in the minute tubes close together.

This species is very distinct from any species of the genus heretofore described. From *C. jamesi*, to which it bears some resemblance, it is distinguished by the regular arrangement of its cells, and the cellulose maculæ; the latter are not represented in that species.

Locality and Position.—In the lower part of the Cincinnati Group, at Covington, Ky., from low water mark to 100 feet above that elevation. It is also found at Frankfort, Ky.

PTILODICTYA PERELEGANS, n. sp. (Plate IV., figs. 16 and 16*a*.)

Polyzoary frequently and alternately branched, sharp edged, the branches being acutely elliptical in cross section, about one quarter of a line in thickness centrally, and one and a quarter line wide. Cells covering the surface on both sides, with the exception of a rather broad non celluliferous border lining the branches. The bases of the cells on the two aspects of the frond are separated by a thin laminar axis. Cell-mouths circular, with a conspicuously elevated rim, arranged in transverse rows, as well as in very regular intersecting diagonal lines, which form an angle of about thirty degrees with the sides of the branches; about seven cells in the space of one line measuring both longitudinally and transversely.

Intertubular spaces quite as wide as the cell-openings, and ornamented, when perfectly preserved, by slightly raised and flexuous lines. The non-poriferous border occupies, on each side, about one seventh of the entire width of a branch, and is marked with very fine, and but slightly waved striae, the direction of which forms an angle of about fifteen degrees with the margin of the branches.

This beautiful species is allied to *P.* (*Stictopora*) *elegantula*, of Hall, but that species does not branch so frequently, has the cell-mouths

val, and larger, while the intertubular species are thinner than they are in this species; the direction of the striae on the non-poriferous margin of Hall's species, forms a much larger angle with the edge of the branch than it does in P. *perelegans.*

Locality and Position.—In the upper part of the Cincinnati Group, near Clarksville, O. Type specimen found by Mr. F. Fornshell.

OPHIUROIDEA.

Protasterina, n. gen.

Rays five, slender, flexible, and extending much beyond a circular and minutely granular disk, which is provided with short, slender, and outwardly directed spines; inner ray pieces regularly alternating, of an hour-glass shape, and interlocking along the median line, which is therefore not straight but zigzag; outer ray pieces elongated, directed obliquely outwards, so as to partly overlap each other; two rows of large pores between the inner and outer ray pieces; in the type species these pores appear to have been occupied by loosely-fitting, sub-pyramidal plates, some of which have a deep depression in the top, as though they were perforated; their true nature, however, is very uncertain. Oral pieces ten, each pair being formed by two of the outer ray pieces.

Type, *P. fimbriata.*

This genus is allied to Protaster, of Forbes, but differs from it in the following particulars:

1. The disk of Protaster is composed of distinct imbricating plates, which carry no spines.

2. The inner ray pieces do not interlock, but are set opposite to each other, with the impressed mesial line straight.

3. The oral plates are formed by the extension of the inner ray ossicles, and not of the outer ray pieces.

4. That genus has four rows of pores, while in Protasterina there are but two rows.

The rays of Tæniaster, of Billings, bear some resemblance to those of Protasterina, but in that genus there is no disk, and the ambulacral ossicles are set opposite to each other, while the two rows of pores are situated within those pieces. Mr. Billings placed his genus with the Asteroidea, while Protasterina clearly has the characters of the Ophiuroidea.

Protaster fimbriata, n. sp. (Plate IV., fig. 9, 9*a*, 9*b* and 9*c*.)

Disk of medium size, circular. Dorsal side of disk, and rays to margin of disk, covered with a granular integument. Ventral surface of

disk provided with a large number of outwardly directed, short and slender spines. Oral pieces ten, sub-rhomboidal in outline, arranged in pairs, each pair being formed of two of the marginal series of ray plates ; on the lower inner edge there are five spines, and extending from each pair, over the mouth, is a bundle of rather long ones.

Rays apparently very flexible, contracted towards the month ; six series of plates are exposed on the ventral side of each ray. The two middle series alternate regularly, and interlock along the mesial line; they are about twice as long in the direction of the ray, than measuring transversely; each piece is contracted in the middle on the inner side to admit the wide ends of the two pieces immediately opposite, and on the outer side to form a pore like impression, between them and the outer series of plates; four of these plates in each range of each ray are included within the disk, and the series terminate abruptly at a distance of one and a half lines from the inner end of the oral plates; from the margin of the disk to the extremity of the ray there are about sixteen pieces in each range. The pores mentioned above, are occupied by a series of loosely fitting, obtusely conical or pyramidal plates, some of which distinctly show a deep depression in the top, and may have been perforated. Outer or marginal pieces flat, placed on edge, and directed obliquely outward so as to overlap each other; the two free edges, *i. e.*, the one toward the point of the rays, and the one seen on the ventral surface, are lined with from ten to twelve short club-shaped spines, varying somewhat in length. The marginal and middle series of plates, articulate by means of corresponding prolongations from the sides of the plates. These prolongations arise from near that end of the plate which is directed towards the mouth.

Dorsal side of rays composed of two rows of alternating and interlocking plates, which near the disk are very deeply sculptured, and about as wide as long, becoming gradually less excavated, and longer in proportion to the width, toward the point of the rays; on each side they articulate with the upper edge of the oblique marginal series of plates.

Breadth of disk, .60 inch; breadth of arm at margin of disk, .16 inch; length of same from oral plates, .88 inch. This species is related to *Protaster flexuosus*, of Miller and Dyer, described in the first number of this Journal.

Locality and Position.—The specimens examined are in the cabinet of the author, and were found by him at an elevation of 100 ft. above low water mark in the Ohio river, at Covington, Ky.

DISCINIDÆ.

Genus Discina.

Discina tenuistriata, n. sp. (Plate IV., fig. 10.)

Shell under medium size, thin and circular.

Upper valve depressed convex, with the apex placed about three fourths of the semi-diameter from the posterior margin. Lower valve flat or slightly convex, with the apex central; foraminal impression or slit narrow and well defined, extending from the center of the valve about two thirds of the distance to the margin.

Surface of both valves marked by very fine and sharp concentric striae, which are somewhat irregular, since a number of them are branched, two or more running into one. All the striae show through the shell on the interior. No radiating lines were observed.

Diameter of lower valve, 1 c. m.; length of foraminal slit, 3 m. m.; width of same, .5 m. m.; height of upper valve, 2 m. m.

This shell resembles *Discina circe*, Billings, but differs from that form in having the lower valve quite flat, the apex of the upper valve nearer the center, and in being much more finely striated, twenty-six of the concentric striae occupying the space of 4 m. m., while in that species there are not half that number in the same space.

Locality and Position.—Found in the lower part of the Cincinnati Group, back of Covington, Ky., at an elevation of one hundred and fifty feet above low water mark at Cincinnati, Ohio.

DISCINA SUBLAMELLOSA, n. sp. (Plate IV., fig. 11.)

Shell above the medium size, extremely thin, nearly circular, or sometimes broadly oval, the length ranging in that case to one fourth greater than the breadth.

Upper valve much depressed, with the apex varying in its position, from nearly marginal, to one sixth the length of the valve from the posterior margin; a low and broad mesial ridge is observed, running in a curved direction, from near the anterior margin to the apex, the line being deflected toward the left lateral margin.

Lower valve not observed.

Surface of dorsal valve, ornamented by rather strong, lamellose, concentric striæ, with from six to seven in the space of five millemeters: some of the specimens also show a few heavy, radiating lines, placed on the low mesial ridge.

Length of medium sized specimen, 13 m. m.; width a little less; the convexity can not be exactly ascertained, since all the specimens examined are somewhat compressed, but I do not doubt, that it is less than 3 m. m.

Discina circe, of Billings, is remotely related to this form, but the nearly marginal apex, the strong and few concentric lines, and the heavy radiating striæ, as well as the mesial ridge in *D. sublamellosa*, will serve to distinguish them.

Locality and Position.—In the Cincinnati Group, near Covington,

Ky., at an elevation not exceeding 125 feet above low water mark at Cincinnati, O.

CRANIDÆ.

Genus Crania, Retzins.

Crania parallela, n. sp. (Plate IV., fig. 13.)

Shell under medium size, sub-rectangular in outline; upper valve quite convex, with the apex placed generally about one fourth the length of the valve, from the posterior margin.

Surface marked, according to age of the specimen, by, from seven to fifteen parallel, raised lines, crossing the shell from side to side; these lines are generally uniform, but sometimes a few stronger ones are placed among them; with a magnifier, the shell is seen to be covered with minute tubercles, a line of them always cresting each of the parallel striæ; these tubercles form regular longitudinal rows, giving to the surface the appearance of being striated in the direction from the anterior to the posterior margin.

Under valve unknown.

The impressions of the anterior muscles are nearly united in a transversely sub-elliptical scar; posterior abductor scars distant, not well defined in the specimens observed.

Length of large specimen, 7 m. m.; width, 5 m. m.; convexity of upper valve, 1.5 m. m.

In the rectangular outline, it is not unlike *Crania multipunctata*, Miller, but the distinct puncta, and the absence of other surface markings on that shell, will serve to distinguish them.

Locality and Position.—I found the specimen on slabs of crystaline limestone, at Covington, Ky., at an elevation of 100 feet above low water mark at Cincinnati, O.

Crania percarinata, n. sp. (Plate IV., fig. 12.)

Shell under medium size, ovate to sub-circular in outline. Upper or dorsal valve very convex, the apex usually situated about one third of the length of the shell from the posterior margin; margins thickened.

Surface marked by three strong carina, close together, running longitudinally across the middle of the shell, with greatest prominence at the center, and becoming gradually less strong toward the ends; sometimes there is another ridge near the lateral margin.

Crossing the shell laterally are fine, thread-like striæ, which curve backward and forward, very much like the striæ in *Murchisonia*; near the margin of the valve are a few, slightly stronger concentric lines.

Ventral valve unknown.

The interior of the dorsal valve shows the anterior impressions of

the muscles to be nearly united, and situated near the center; the posterior pair are widely separated, and placed near the margin. Length of specimen, 6 m. m.; breadth, 5 m. m.; convexity of upper valve, 2 m. m.

The peculiar surface ornamentation of this species will distinguish it from all the others found within the Cincinnati rocks.

Locality and Position.—Found associated with *C. parallela*, at Covington, Ky.

Crania socialis, n. sp. (Plate IV., fig. 14.)

Shell small, outline varying from subquadrate to subovate, and from two to three times as wide as long; Dorsal valve very convex, or sometimes nearly flat on the top, with the shell immediately surrounding the margin almost vertical, thereby imparting to the valve an angular appearance; apex nearly marginal, quite constant in its position, not prominent. Frequently found adhering to crinoid columns.

Surface, with from four to seven strong corrugations or ridges, running parallel with the length of the shell, which in most cases correspond with the annulation of the crinoid stem to which it is attached.

No markings were observed on the interior of this valve, excepting the corrugations, which show through from the exterior.

Length of medium sized specimen, 2.5 m. m.; width, 6 m. m.; convexity, 2 m. m.

This form is apparently gregarious in its habits, one specimen of crinoid stem before me, from the collection of Mr. R. B. Moore, having more than twenty specimens crowded within the space of one inch. It differs from *Crania scabiosa*, Hall, to which it is most nearly related, in form, and position of the apex, as well as in the surface markings.

Locality and Position.—Found most common in the lower 200 ft. of the Cincinnati Group, though ranging to about 350 above low water mark at Cincinnati.

TRINUCLEIDÆ.

Genus Trinucleus.

Trinucleus bellulus, n. sp. (Plate IV., fig. 15.)

Body small, nearly flat, and symmetrical. Cephalic shield about three times as wide as long, subquadrate, with a distinct thoracic ring at the base, which is straight, with the posterior angles acutely angular or slightly rounded, and without any long spines; glabella prominent, pyriform and produced posteriorly, into a long spine, reaching to the pygidium; cheeks not as prominent as the glabella, triangular, and finely punctate; marginal fillet wide, marked in front by from three to

four rows of deep, rounded pores or punctures; the rows increase by implantation as they approach the posterior lateral margins, where they number from six to seven.

The thorax consists of six articulations; axial lobe depressed, convex, narrow, and carrying on each side between the segments two rows of minute punctures; lateral lobes flat, and three times as wide as the central lobe; pleuræ straight, and furrowed on the outer half.

Pygidium small, acutely semi-elliptic, being about four times as wide as long, and broadly rounded in outline behind, with a raised and thickened margin; axial lobe very small, and composed of four obscurely defined segments; lateral lobes each with three segments.

Length of largest known specimen, 6 m. m.; length of cephalic shield, 3.5 m. m.; breadth of do., 7 m. m.; length of thorax, 1.25 m. m.; breadth of do., 4.5 m. m.; length of pygidium, .75 m. m.; breadth of do., 4 m. m.

This pretty little species is related to *T. concentricus*, of Eaton, but may be readily distinguished by its small size, the absence of the long spines from the posterior angles of the shield, and the presence of four rows of punctures on the sides of the middle lobe of the thorax, as well as by the differences in the cephalic shield, which is comparatively much longer, more rounded in front, and not straight, but curved backwards at the base in that species. It might be urged, that the specimens from which the description was drawn, are the young of Eaton's species, but I have compared them with young specimens of *T. concentricus*, and found that the differences stated are constant in both the young and mature stages.

Locality and Position.—Found in the lower part of the Cincinnati Group, back of Covington, Ky., at an elevation of 100 feet above low water mark at Cincinnati.

DESCRIPTION OF A NEW GENUS AND ELEVEN NEW SPECIES OF FOSSILS,

With Remarks upon others well known, from the Cincinnati Group.

By S. A. Miller.

Ptilodictya magnifica, n. sp. (Plate III., fig. 1, natural size, fig. 1*a*, magnified view.)

[Ety.—*Magnificus*, magnificent.]

This polyzoary consists of a thin, explanate, tuberculated frond, which rapidly and irregularly expands from the neck, that evidently connected it to a flattened base, which was attached to some other object.

The neck is striated longitudinally, terminates with a rounded point, at the base, and is prolonged as a central axis for a distance into the frond. The upper part of the frond possesses no central axis. The lower part of the neck is not celluliferous, farther up small distant cells appear between the striæ, these, as we ascend become larger and more numerous, and finally, when the neck may be said to assume the character of a central axis, the cells upon it are arranged between perpendicular, elevated striæ, into rows, which intersect each other diagonally. These perpendicular striæ, however, do not extend to either side of the axis, nor beyond it.

Both sides of the frond are alike celluliferous and tuberculated. The presence of the tubercles destroys the regularity and diagonal arrangement of the cells, which commence at the top of the neck, and hence they are found, on different parts of the frond, arranged crosswise, more or less sharply diagonal, or curving to accommodate themselves to the irregular order and dispersion of the tubercles. The cell mouths are not uniform in shape, many of them are elliptical or somewhat diamond shaped, others are round or oval. The walls between the cell mouths are moderately thick. The cells will number from eight to twelve in a line. The edges of the frond are sharp and perforated, by the apertures of minute cells, for a short distance from the neck. Above this part, however, the cells appear to preserve their size, almost or quite to the margin.

The tubercles are conical, dispersed without order, and usually about a line distant from each other. The summits are solid, or occupied by very minute cells.

The neck and central axis are each about a half line in diameter; the remainder of the frond, between the tubercles, has only about twice the thickness of ordinary foolscap paper. The specimen figured has a length of 1 6-10 inches, and a width of nearly an inch, but it is not complete either in its length or width. Another specimen, having about the same length, and uniformly expanding from the neck upward for a short distance, has a width of 6-10 inch at the distance of 6-10 inch from the point of the neck; above this, the expansion is not so rapid, and at the distance of an inch, the width has only increased to $\frac{3}{4}$ inch.

The specimen figured is from the collection of Mrs. M. P. Haines, of Richmond, Indiana, and was found in the upper part of the Cincinnati Group. I have collected specimens of the same species, on the tops of the hills, at Cincinnati. The range of the species may, therefore, be considered as co-extensive with the upper half of the Group, though good specimens may be very rare.

Bases of *Ptilodictya*, having nearly the form of bases of *Heterocrinus*, radiately lined from the point of attachment outwards, are frequently

collected, at various elevations, in the Cincinnati Group. There is some difference in the appearance of these bases, but all seem to have the radiating striæ. The striæ, on the neck of this species, evinces, that it was possessed of one of these flattened bases, but we are unable at the present time to determine whether it was one of the coarser or finer lined ones.

Palæaster longibrachiatus, n. sp. (Plate 3, fig. 4.)

[Ety.—*Longibrachiatus*, having long arms.]

Pentagonal; rays more than twice as long as the diameter of the body, and tapering to an acute point at the apices; breadth of the body between rays, about six tenths of an inch; length of rays, about one and three tenths inches.

The marginal plates are small, spheroidal, very gradually enlarging from the tip of the rays toward the body, and much resembling a string of small beads gradually swelling in size. Thirty-two marginal plates are visible, in the specimen illustrated, on one side of a ray, and a perfect specimen would probably show two or three more. Two marginal plates form the junction of the rays instead of one, as in other species. In this respect, it agrees with *Stenaster*, but the arms show adambulacral plates, for which reason we regard it as a *Palæaster*. The adambulacral plates, toward the point of the rays, are of the same form, but a little larger than the marginal plates; near the body, however, the marginal plates are the largest. No adambulacral piece is visible within four plates of the two junctional pieces. The ambulacral groove is exceedingly narrow.

Dorsal surface and madreporiform tubercle unknown.

The specimen illustrated was found near Clarksville, in the upper part of the Cincinnati Group, and now belongs to the collection of Mr. J. H. Harris, of Waynesville, Ohio.

Palæaster clarkei, n. sp. (Plate III., fig. 5.)

Pentagonal; rays half the length of the diameter of the body, and rapidly tapering to a point. Marginal plates not very distinctly shown in the specimen, but probably do not exceed half a dozen on each side of a ray. Three series of interlocking pieces are shown, upon the dorsal side of each ray, between the marginal plates.

Length of a ray, 1-15th of an inch; diameter of the body, 2-15ths of an inch; and greatest distance from the apex of one ray to that of another, 4-15ths of an inch.

The madreporiform tubercle and ventral side unknown.

This very small Palæaster was found on Vine street Hill, in Cincin-

nati, by Robert Clarke, Esq., in 1846, and was by him recently donated (with a large collection of shells, minerals and fossils) to the Cincinnati University. It is the smallest species known from our rocks, and quite distinct in every feature shown. The specific name is in honor of the collector.

Glyptocrinus dyeri, *var.* sublævis. (Plate III., fig. 2.)

[Ety.—*sublævis*, somewhat smooth.]

The beautiful specimen illustrated, and from which this description is drawn, agrees in every substantial particular, except as to surface markings, with *G. dyeri;* Prof. Meek found only from nine to eleven pieces, in each secondary radial series, in the *G. dyeri*, but other specimens have shown fourteen or fifteen pieces. The variety under consideration shows as many pieces as the latter specimens. It bears no evidence on the surface of ever having been sculptured. The plates are smooth, with a slightly elevated line at the junction of the pieces.

It is distinguished from *G. dyeri*, only by the absence of the radiating costæ which ornament the plates. If these have been defaced, then the variety must fail. The appearance of the specimen, however, is against such a supposition.

The specimen was broken, at the top of the vault, into two pieces. The fracture was afterward filled with carbonate of lime, and the two pieces as thoroughly cemented together as if the specimen had never been broken. A ridge around the specimen marks the place of the fracture, and has every appearance of the elevations on some specimens of septaria.

The specimen belongs to the collection of Mrs. M. P. Haines, and was collected near the top of the Hills, in Eden Park, in the City of Cincinnati.

Cyrtolites magnus, n. sp. (Plate III., fig. 10.)

[Ety.—*Magnus*, large.]

Shell consisting of three or more volutions, very gradually increasing in size and rolled in the same plane. Each outer volution embraces one third or more of the inner one. Dorsal side sharp and well defined. Greatest convexity of each whorl near the inner side, which is sub-angular. Transverse section of a whorl sub-triangular. Umbilicus alike on either side, rather wide and deep, and showing about one third of each inner turn.

The surface of the shell, in the specimen examined, has been too much eroded to determine the external markings.

The greatest diameter of the shell is 1 1-10th inches; convexity

about 3-10ths of an inch, though it was probably expanded more at the aperture, which is not preserved in our specimen.

The description is founded upon a single specimen collected by Mrs. Warren Shumard, in the upper part of the Cincinnati Group, near Richmond, Indiana, and presented by her to Mrs. M. P. Haines, from whom it was received for definition and illustration.

MURCHISONIA MULTIGRUMA, n. sp. (Plate III., fig. 3; fig. 3*a*, basal view.)

[Ety.—*Multigrumus*, much heaped up.]

Shell medium size or rather large; turbinate above, with about five angular whorls; apical angle from 75 deg. to 80 deg.; base of the shell very much produced, and forming the wall of the left side of the aperture. Body whorl constitutes more than half the shell.

Surface of the upper whorls apparently smooth—at least no markings have been determined on them; base of the body whorl marked with coarse, backward-curving striæ, which terminate in the columellar lip or wall of the aperture.

No umbilicus.

This species is not uncommon in the upper part of the Cincinnati Group, ten miles east of Maysville, Kentucky. I collected it, also, at Versailles and Richmond, Indiana, though good specimens are rare.

It most resembles Safford's *M. sumnerensis*, and with the latter, and *M. milleri*, *M. perangulata*, and *M. sororcula*, forms a closely-linked group. The whorls in *M. sumnerensis* are gently concave on the upper side, and banded below the suture, while in our species, the upper face of the whorls is plane to the suture. The base of the shell in our species is more produced, and the body whorl more strongly marked with backward-curving striæ than Safford's species.

AMBONYCHIA RETRORSA, n. sp. (Plate III., fig. 6.)

[Ety.—*Retrorsus*, turned back.]

Shell small, equivalve, very convex and rapidly bending from the front backwards. Very high in the umbonal region, and rapidly sloping in all directions, most rapidly, however, toward the front. Beaks pointed, incurved, and rising high above the cardinal margin. Anterior side truncated, and rounding rapidly into the base below; basal margin prolonged and rounded posteriorly; posterior margin moderately convex. Hinge line straight, and rapidly descending posteriorly. Surface of each valve ornamented with about fifty-five fine radiating costæ.

Length of the specimen illustrated, from the points of the beaks, to the most extended part of the basal margin posteriorly, about fifty-three

one-hundredths of an inch; length of the cardinal line about thirty one-hundredths of an inch; convexity about thirty one-hundredths of an inch.

This shell is distinguished from other species by its high incurved beaks, closely truncated, anterior margin, and numerous radiating costæ.

The specimen illustrated was collected by Mr. George L. Vallandigham, at one of the quarries on the hills back of the city of Cincinnati.

Cyrtoceras amœnum, n. sp. [Plate III., fig. 8.]

[Ety—*Amœnus*, pleasant, welcome.]

Shell large, gently arched, and very gradually tapering; section slightly elliptical, the dorso-ventral diameter being a little more than the transverse. Body chamber contracted toward the front. Septa moderately arched. In the specimen figured, the body chamber is followed by six thin chambers before reaching what appear to represent the mature size; another specimen shows only five of these thin chambers between the body chamber and the mature sized shell chambers. Where on the back of a shell the septa are nearly 2-10ths of an inch distant, the transverse diameter of the shell is 1 3-10ths inches, and the dorso-ventral diameter 1 5-10 ths inches. Measuring on the side, however, the transverse diameter of the shell is equal to the thickness of almost nine shell chambers. Siphuncle small, and situated very close to the margin on the dorsal or outer side of the shell. Outer shell and surface unknown.

The specimen illustrated has a dorso-ventral diameter of 1 4-10ths inches, and transverse diameter a little over 1 2-10ths inches. It contains twenty three chambers, including the thin ones, between the body chamber and the broken end in a length of 2½ inches.

I collected the specimens at Richmond, Indiana, in the upper part of the Cincinnati Group, and near the top of the bluffs which abut the river.

Angellum, n. gen.

[Ety.—*Aggos*, a pail; *ellus*, diminutive.]

Shell equivalved, elongated from the cardinal line toward the base and sub-cylindrical; umbones prominent; beaks incurved over the cardinal line; more or less winged posteriorly; surface marked by concentric lines.

Surface of the shell, hinge line and muscular impressions not determined.

Several casts of the interior have been found in the upper part of the Cincinnati Group, not referable to any genus known to the author; they are quite perfect, and seem to deserve a name, but it is not without

some doubt and hesitation that we have ventured upon proposing a new generic appellation.

ANGELLUM CUNEATUM, n. sp. (Plate III., fig. 11.)

[Ety.—*Cuneatus*, wedge-shaped.]

Shell medium size, equivalve, much elongated from the cardinal line to the base, middle part sub-cylindrical, where width and depth are sub-equal; lower half wedge-shaped; umbones high, angular, and prominent anteriorly; beaks acuminate and incurved over the cardinal line; hinge line straight, short, and nearly at right angles to the longer axis of the valves. The cast is a little convex on the anterior side, where there is some evidence of a byssus, and slightly winged on the posterior margin. Surface marked by concentric lines.

The specimen illustrated I collected in the upper part of the Cincinnati Group, at Richmond, Indiana.

CYTHERE IRREGULARIS, n. sp. [Plate III., fig. 7, dorsal view; fig. 7*a*, side view, ventral margin uppermost.]

[Ety.—*Irregularis*, irregular.]

Valves smooth, or minutely granular, highly convex anteriorly, and rapidly declining to the posterior end. Ventral margin forming a broad curve. Dorsal margin slightly depressed at the sulci in the valves. Deep sulcus in the middle of each valve extending from the dorsal margin half way across the valve. Small sulcus near the posterior end of each valve extending about half way across the middle part of the valve.

Anterior end of the shell subreniform. Posterior end rounded and wedge-shaped. Narrow border all around the margins of the valves. No visible eye-tubercle.

Length of a large specimen, 0.17 inch; height, 0.10 inch; convexity, 0.10 inch.

This species is distinguished by its subreniform anterior end, wedge-shaped posterior, and deep central sulci.

The honor of first collecting and calling attention to this peculiar form belongs to Mr. George L. Vallandigham, who found it near the top of the hills at Cincinnati, associated with *Cythere cincinnatiensis*. He collected several specimens, and presented them to the author for illustration and description.

LICHAS HARRISI, n. sp. (Plate III., fig. 9.)

The specimen illustrated shows the under side of the pygidium

part of eleven thoracic articulations, and part of the head and hypostoma.

The glabella appears to be broad, very moderately convex, and separated by a furrow from smaller posterior and lateral lobes.

The length of eleven thoracic articulations, and the pygidium, is two and six tenths inches; length of thorax, one and four tenths inches; length of pygidium, one and two tenths inches. The estimated length of the head is eight tenths of an inch. The diameter of the middle lobe of the body, at the head, is one and fifteen hundredths inches; at the pygidium, seven tenths of an inch. The lateral lobes, at the pygidium, have a diameter of eighty-five one-hundredths of an inch. From these measurements, we infer a perfect specimen will have a length and breadth each of more than three inches. Middle lobe of the thorax broadly convex; lateral lobes depressed; margins falcate.

Pygidium transversely, somewhat elliptical; margin deeply laciniated; axis marked by two articulations, the anterior one narrow, and the posterior one long and terminating in a point. There is a line marking a partial division of the latter, near the anterior part, into two articulations. The lateral lobes are each composed of three articulations; the posterior one somewhat pear-shaped; middle one slightly expanded in the central part, and broadly rounded below; anterior one more expanded in the middle, and more sharply rounded below.

The surface strongly pustulose, corresponding punctures showing on the under side of the crust; striated band on the margin of the under side, covering half the lateral lobes.

This species is remarkable for its large size, and broad, middle, thoracic lobe, which rapidly contracts toward the pygidium.

The specimen illustrated was found in the upper part of the Cincinnati Group, near Waynesville, Ohio, and is now in the collection of Mr. I. H. Harris, in whose honor we have proposed the specific name. Fragments, of what is supposed to be the same species, have been found near the top of the hills at Cincinnati.

PHOLIDOPS CINCINNATIENSIS, Hall, 1859. (13th Rep. of Regents, etc., p. 92.)

During the past year, Mr. George L. Vallandigham has collected several specimens of this species, showing both valves, and as the ventral valve has never been described we propose now to define it.

It has about the same size and form of the dorsal valve, but has a little less convexity, and not quite as many sub-imbricating lines of growth. The apex is directly opposite the apex of the dorsal valve. Immediately in front of the apex, the valve is pierced by a small, round aperture.

It differs from the dorsal valve, in that it possesses this aperture, is a little less convex, the apex a little more depressed, the imbricating lines a little less distinct, and numbering only four or five instead of six or seven.

The following is the definition of the genus by Prof. Hall, founded upon the dorsal valve:

"Shells small, patelliform; apex sub-central, excentric or terminal. Surface marked by concentric lamellæ of growth, which are more expanded on the posterior side. Interior a shallow, oval cavity, with bilobed muscular impressions; the margin flattened or slightly deflected, and entire."

Twelve species have been described, ranging from the Trenton to the Hamilton Group, as follows: One from the Trenton, one from the Hudson River, one from the Cincinnati, two from the Niagara, one from the Lower Helderberg, two from the Oriskany, one from the Schoharie, and three from the Hamilton Group.

When Prof. Hall established the genus, he regarded these fossils as really univalve, like *Patella*. He said, however, in *Palæontology of New York*, Vol. III., p. 489, that it is not easy to determine whether these small shells are bivalve brachiopods, or univalve, like *Capulus*. Later, in 1867, *Palæontology of New York*, Vol. IV., pp. 31, 413, Plate III., he showed that these fossils are bivalve brachiopods, but he had found no evidence of a foramen in either valve. Our specimens clearly show an aperture for a minute pedicle fibre of attachment, and prove that the substance of the shell of the ventral valve did not attach to any other object. We think this fact should remove the fossil from the family *Craniidæ*, but on account of the calcareous character of the shell, we are not prepared to place it in the *Discinidæ*.

ERRATA:

Page 95, 3d line from bottom, for PROTASTER, *read* PROTASTERINA.

Page 102, 12th line from bottom, for J. W. Harris, *read* I. W. Harris.

THE JOURNAL

OF THE

CINCINNATI SOCIETY OF NATURAL HISTORY.

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PROCEEDINGS OF THE SOCIETY.

The Cincinnati Society of Natural History held its regular monthly meeting, July 2, 1878.—President V. T. Chambers in the Chair. The minutes were read and approved.

The following named persons, having been previously proposed, were unanimously elected to regular membership: C. G. Lloyd, Columbia Street, Newport, Ky.; Dr. Chas. S. Metz, and Charles F. Lowe. Madisonville, Ohio.

L. S. Cotton, Esq., having briefly called attention to the advantages to be derived from the meetings of scientific bodies in our city, offered the following resolution, which was unanimously adopted:

Resolved, That a Committee of three be appointed to confer with other Societies and the authorities of this city, to obtain their co-operation in extending an invitation to the *American Association for the Advancement of Science* to hold its annual meeting for 1879 at Cincinnati, and to report to this Society at its next meeting. The Chair named the following members as such Committee, L. S. Cotton, R. B. Moore, and Julius Dexter.

Donations were acknowledged as follows: Flint Arrow heads, from Dr. J. J. Temple; one pair moccasins, one bullet pouch, one bow and one ornamented quill, all taken from a Comanche brave killed in New Mexico, from Dr. H. Ludington; two pamphlets from Hon. M. Sayler; a fine stalactite, from a Cave near the C. S. R. R. Bridge over the Kentucky River, by E. A. Ferguson ; Eggs of Carolina Dove, Upland Plover, and Carolina Rail, from Charles Dury ; Report upon Forrestry, 1877, by F. B. Hough, from Department of Agriculture; Report of the Central Park Menagerie, New York, 1877 ; Monthly Weather Reports from War Department.

Society met August 6th, 1878,—President Chambers in the Chair.

Dr. J. A. Warder read a paper on "The Variation of Leaves." Prof. A. J. Howe, one on "Harvey and the Circulation of the Blood;" and Dr. C. L. Metz, a paper with a map, on the "Prehistoric Monuments of the Little Miami Valley."

Dr. Howe, from the Committee on Course of Lectures, reported progress.

A resolution was adopted inviting the *American Association for the Advancement of Science*, to meet in this city in 1879.

The following donations were received: Eight specimens of *Pentrimites robustus*, and one of *P. pyriformis*, from Charles Dury; one stone ax, from E. O. Ulrich; two hundred and forty-one foreign botanical specimens from Prof. E. S. Wayne; a bird's nest with eggs, from Dr. H. H. Hill; three specimens *Hemiptera*, from J. W. Shorten; one pair of very old moccasins, made of bark thread, found in Saltze's Cave, near Mammoth Cave, Ky.; also specimens of eyeless crabs from Judge Alfred Yaple.

OBSERVATIONS ON CINCINNATI BIRDS.

By Frank W. Langdon.

Since the publication of "A Catalogue of the Birds of the vicinity of Cincinnati,"* by the writer, numerous additional facts relating to the Ornithology of this locality have been brought together, the more important of which form the subject of the present paper.

With respect to the various sources from which these additions have been derived, especial acknowledgments are due to Mr. Charles Dury, of Avondale, well known for his varied accomplishments as a naturalist and collector, who has kindly placed at my disposal a series of notes, embracing interesting observations on upwards of fifty species of Ohio Birds. Want of space will prevent the reproduction here of Mr. Dury's notes in full, and I have, therefore, selected chiefly those relating to species not previously recorded here, or of especial interest for other reasons.

Mr. John W. Shorten, of Cincinnati, Mr. Edgar R. Quick, and Dr. Rufus Haymond, of Brookville, Ind., and the several other naturalists elsewhere mentioned, have contributed notes and information of value.

In the numbering and arrangement of the species, the following notes correspond to the original catalogue.

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* A Catalogue of the Birds of the vicinity of Cincinnati, with notes, by Frank W. Langdon. Salem, Mass., Naturalist's Agency. April, 1877.

3. TURDUS PALLASI, Cab.—*Hermit Thrush.*—Mr. Dury notes a nest and eggs of this species taken here by Mr. G. Holterhoff, May 10, 1877. This is a fact of much interest, as considerably extending the southern limit of its breeding range; the southernmost record previous to this being Massachusetts, where it is only occasionally found breeding, according to Baird, Brewer and Ridgway, in "North American Birds."

4. TURDUS SWAINSONI, Cab.—*Olive-backed Thrush.*—This species, previously given by me as "not common," I have since found abundant in woodland for a few days, in the latter part of September, 1877. They were quite shy, and sought refuge in dense thickets at the slightest alarm, but when all became quiet, they would re-appear and resume their occupations of bathing in a small stream near by, and searching for insects along its banks.

7. MIMUS POLYGLOTTUS, Boie.—*Mocking Bird.*—The Mocking bird may fairly be considered a regular, though rare, Summer resident with us, as several instances of its breeding here are reported to me; in some cases the young being taken and reared as cage birds.

13. POLIOPTILA CÆRULEA, Scl.—*Blue-gray Gnatcatcher.*—Two nests observed near Madisonville, early in May, 1878. One contained five fresh eggs, on May 7th, and differs from a nest taken by Mr. E. R. Quick, at Brookville, Ind., in lacking the soft, cottony lining; its interior being composed of fine grasses and hair. Both are beautiful structures, built on the upper side of a limb, and covered externally with lichens like the nest of the humming bird. Their situation varies from twelve to fifty feet from the ground.

14. LOPHOPHANES BICOLOR, Bp.—*Tufted Titmouse.*—This species is a constant resident with us, but much more conspicuous in its habits during the Fall and Winter, and therefore *apparently* more numerous at those seasons. One was recently observed by me to alight on a small tree-trunk and deposit something from its bill in a crevice; and on examination I found a good-sized chunk of walnut kernel therein, which remained for two or three days, until wanted, I presume. Dr. Bachman, quoted by Baird, Brewer and Ridgway, relates a similar habit of a specimen kept in confinement by him, and it seems probable that the habit of hoarding food may furnish this and allied species with a considerable portion of their Winter sustenance.

15. PARUS ATRICAPILLUS, L.—*Black-capped Titmouse or Chicadee.*—Mr. Dury notes two specimens of this Titmouse, taken by himself in the Winter of 1872-3. It is easily overlooked, as it bears a close resemblance to our common Chicadee (*P. Carolinensis*), which, with good reason, is by some authorities considered as merely a southern variety of *atricapillus.*

22. TROGLODYTES AEDON, V.—*House Wren.*—Referring to this species.

Mr. Dury writes that it "has always been very common until the introduction of imported sparrows."—"Only a few seen in Avondale in 1877." Mr. Walter Douglass, of Mt. Auburn, tells me that, in 1875, he took three nests, containing respectively, eight, six, and five eggs; in 1877, however, he did not see a single specimen.

Its distribution, even before the introduction of the European sparrow, must have been extremely local, as my own identification of the species rests upon a single specimen taken several years ago at Madisonville.

ALAUDA ARVENSIS, Linn.—*European Skylark.* (Not previously recorded.)—Mr. Armin Tenner tells me that this species has become acclimatized in the suburbs of Cincinnati, and that in June, 1877, he found its nest containing young. As Mr. Tenner was familiar with the species in Europe, there can be no doubt of the correctness of his identification, and the birds therefore, is as much entitled to a place in our fauna as is the European sparrow or any other imported species.

30. PROTONOTARIA CITRÆA, Bd.—*Prothonotary Warbler.*—Several specimens obtained at St. Mary's Reservoir (130 miles north of Cincinnati) by Mr. Dury, who also took a nest containing one egg. Although probably a migrant with us, it has not yet been identified in this vicinity.

31. HELMITHERUS VERMIVORUS, Bp.—*Worm-eating Warbler.*—Additional specimens observed. One in June, 1877, by Mr. Dury, which contained an egg ready to lay; others in August, 1877, and in May and June, 1878, at Madisonville.

36. HELMINTHOPHAGA PEREGRINA, Cab.—*Tennessee Warbler.*—In 1877 I found this species literally abundant at Madisonville, from Sept. 8th to 30th, and stragglers were seen until after the 15th of October. Mr. Dury also observed it in large numbers at Avondale. His experience coincides with my own as to its comparative rarity previous to 1877.

In May of the present year I took several additional specimens, but it could not be said to be abundant. Its sharp, shrill song, at this season, resembles that of the Cerulean Warbler, but is more energetic, and merely a repetition of one or two notes, without the peculiar termination of the song of the latter species. Its usual note in the Fall is a faint "tchip," but I have occasionally taken it in full song at that season.

37. DENDRŒCA ÆSTIVA, Bd.—*Summer Warbler, Yellow Warbler.*—A common Summer resident, and, with the exception of *D. coronata*, the first warbler seen in the Spring; making its appearance about the middle of April. A nest discovered on the 2d of June, was situated ten or twelve feet from the ground, in a Quince tree, and contained four well-grown young which completely filled the nest. These young, when

fledged, were of a soiled whitish color beneath, which soon became tinged with yellowish; above ashy green, the primaries and secondaries darker, margined with yellowish. By the 7th of June, they were able to follow the parents in search of food.

40. DENDRŒCA CÆRULEA, Bd.—*Cerulean Warbler.*—Young taken while following their parents through the tree-tops early in July, 1877.

41. DENDRŒCA CORONATA, Gr.—*Yellow-rumped Warbler.*—A very common migrant. Specimens taken as early as March 4th, when small streams were frozen over, and as late as November 29th, during a brisk snow storm. A few individuals may Winter here occasionally, as many do in Southern Illinois according to Mr. Ridgway.

49*a*. DENDRŒCA DOMINICA, *var.* ALBILORA, Ridgway.—*White-browed Yellow-throated Warbler.*—Specimens of *D. dominica*, from Madisonville, sent to Mr. Ridgway for examination, are pronounced by him to be var. *albilora*. So far as known, the typical *dominica* is confined to the West Indies and South Atlantic coast of the U. S.; var. *albilora* to the Mississippi Valley.

53. DENDRŒCA PINUS, Bd.—*Pine-creeping Warbler.*—Taken by Mr. E. R. Quick, at Brookville, Ind., in May, 1878.

55. SIURUS NÆVIUS, Coues.—*Short-billed Water Thrush.*—Taken May 10th (1878), at Madisonville. This specimen flew up from a marshy tract in a wheat field, and when first startled, uttered a curious note resembling the "*weep-wit*" of the Solitary Sandpiper, but more subdued.

58. OPORORNIS FORMOSUS, Bd.—*Kentucky Warbler.*—This species has been present in unusual numbers during the past two seasons (1877 and '78). It has, heretofore, been considered as rather a rare bird, but is a regular Summer resident, and doubtless breeds here, although its nest and eggs have not yet been discovered. Dense woods, with an undergrowth consisting chiefly of Spicewood bushes, are its favorite, and so far as my observation goes, its only resorts during the Summer. Its song closely resembles that of the Golden-crowned Thrush (*S. auricapillus*), but lacks its characteristic *sharpness*, the notes being full and rounded.

64. MYIODIOCTES CANADENSIS, Aud.—*Canadian Fly-catching Warbler.*—Taken in September, 1877, at Madisonville.

66. PYRANGA RUBRA, V.—*Scarlet Tanager.*—The previously expressed opinion that this species probably breeds here, has been confirmed, its eggs having been taken at Glendale by Mr. Bonsal Porter, from whom I have obtained a specimen.

69. TACHYCINETA BICOLOR, Cass.—*White-bellied Swallow.*—By an error this species was marked as breeding in my original catalogue. This I desire to correct, as I am only positive of its occurrence here in

the Spring. Mr. Dury, however, notes several nests and eggs taken at St. Mary's Reservoir, where it breeds in "snags and stumps."

76. VIREO PHILADELPHICUS, Cass.—*Brotherly-love Vireo.*—Taken at Madisonville, in September, 1877. I am indebted to Mr. J. W. Shorten for another specimen taken in the Spring of 1876, at the same locality.

79. VIREO SOLITARIUS, V.—*Blue-headed or Solitary Vireo.*—Specimens in the collections of Mr. Dury and Dr. R. M. Byrnes.

82. COLLURIO LUDOVICIANUS, Bd.—*Loggerhead Shrike.*—This species appears to be more common than usual this season. Two nests have been taken at Valley Junction, by Mr. Harry Hunt, and one at Madisonville by Mr. William Settle, to whom I am indebted for specimens. These nests each contained six young, which were probably hatched about the third week in April. An adult specimen in my collection appears to represent the typical *ludovicianus*, and does not differ appreciably in color from a Florida example, but the bill of the latter is considerably larger, in accordance with the laws of Geographical Variation as elucidated by Allen.*

86. ÆGOITHUS LINARIA, Cab.—*Red-poll Linnet.*—This and the following species were taken by Mr. Dury, at Avondale, during the winter of 1869-70.

90. PLECTROPHANES LAPPONICUS, Selby.—*Lapland Longspur.*—A single individual, taken by Mr. Wm. H. Whetsel, at Madisonville, Dec. 11th, 1877, is now in my collection. It has also been taken by Mr. Dury, at Avondale, as above stated.

93. COTURNICULUS PASSERINUS, Bon.—*Yellow-winged Sparrow.*—Specimens taken by Mr. Dury, who states that it is a rare Summer resident in this vicinity.

95. MELOSPIZA LINCOLNI, Bd.—*Lincoln's Finch.*—Included in "Catalogue Birds Cincinnati" on authority of Dr. Wheaton, who gives it as a migrant in his list of the "Birds of the State, 1874." By an oversight, however, the quotation marks were omitted in the catalogue, and I take the present opportunity to make the proper correction. It has yet to be identified here.

103. ZONOTRICHIA LEUCOPHRYS. Bp.—*White-crowned Sparrow.*—Mr. Dury notes the occurrence of this species in numbers during *Christmas week*, 1877.

107. EUSPIZA AMERICANA, Bon.—*Black-throated Bunting.*—Dr. Kirtland, in 1838 (*Ohio Geological Survey*), considered the occurrence of this bird in Ohio as "doubtful." It is now one of our most abundant Summer residents, and its monotonous song may be continually heard

* See "Geographical Variation in North American Birds," by J. A. Allen.—Proc. Boston Soc. Nat. History, vol. xv., p. 212, June 19, 1872.

along fences and hedge-rows, from daylight to dusk, and occasionally even at midnight.

112. PIPILO ERYTHROPHTHALMUS, Vieillot.—*Towhee Finch, Ground Robin.*—Mr. O. M. Meyncke, of Brookville, Ind., informs me that several instances of the nesting of this species *in bushes*, have come under his observation. He also found one nest situated on the top of a stump about six feet high, overgrown with parasitic vines.

113. DOLICHONYX ORYZIVORUS, Sw.—*Bobolink.*—Present in limited numbers for a few days in May, 1878.

121. CORVUS CORAX, Linn.—*Raven.*—Dr. Rufus Haymond, in a list of the "Birds of Franklin Co., Ind." (Ind. Geol. Report, 1869), says: "The Raven was once numerous in this section, yet now so rare that I have seen but one during the past twenty years."—In Atwater's History of Ohio (1838), the Raven is mentioned as a constant resident of the State.

146. COLAPTES AURATUS, Sw.—*Golden-winged Woodpecker, Flicker.*—Unusually abundant during the Fall of 1877. A beautiful albino has been taken at Valley Junction, by Mr. Harry Hunt, and is now in his collection. It is of a delicate cream color, but the red nape shows plainly, and the pectoral crescent obscurely.

147. CONURUS CAROLINENSIS, Kuhl. — *Carolina Paroquet.* — Mr. Joseph Settle tells me that Paroquets occurred in large numbers near Madisonville, during the Summers of 1837, '38 and '39. Few were seen in 1840, and none after that year. He describes them as a "green bird," appearing in flocks, like Blackbirds, making a loud, chattering noise, and destroying a considerable amount of fruit. Mr. Dury notes, on the authority of Giles Richards, Esq., their occurrence in large numbers at Matson's Mills, near Venice, Butler Co., Ohio; Mr. Richards pointing out the identical sycamores in which they had nested many years ago.

148. STRIX FLAMMEA, L. *var.* AMERICANA, Coues.—*Barn Owl.*—Mr. Dury's collection contains two specimens taken here; the only positive record of its occurrence in Ohio.

151. OTUS VULGARIS, *var.* WILSONIANUS, Less.—*Long-eared Owl.*—Full fledged young of the year taken by Mr. Dury, at Avondale, in July, 1878—the first evidence of the breeding of this species in this vicinity. The stomach of this specimen contained portions of a Robin and two beetles (*Copris carolina*).

SYRNIUM CINEREUM, Aud.—*Great Gray Owl.*—Identified by Mr. Dury in Clark Co., Ohio.

157. CIRCUS CYANEUS, Lacep. *var.* HUDSONIUS, Ridgway.—*Marsh Hawk.*—Mr. Shorten has in his possession an adult female of this species, taken near Covington, Ky., in November, 1877.

158. NAUCLERUS FURCATUS, Vig.—*Swallow-tailed Kite.*—A single specimen recorded by Dr. Haymond, in his list of the Birds of Franklin Co., Ind., 1869. (Indiana Geological Report).

167. BUTEO PENNSYLVANICUS, Bp.—*Broad-winged Hawk.*—The stomach of a specimen of this Hawk taken at Madisonville, in April 1877, contained the greater portion of the skeleton and hair of a small Wood-mouse (*Arvicola austerus*), a lizard (*Eumeces?*) about six inches long, and ten or twelve small beetles, with numerous elytra of the same. I have also dissected two or three individuals of this species whose eyes were infested with numerous parasitic worms, about three-quarters of an inch in length, which were found in the region of the nictitating membrane, or third eyelid.

168. ARCHIBUTEO LAGOPUS, Gr. *var.* SANCTI-JOHANNIS, Ridgway.—*Rough-legged Buzzard, Black Hawk.*—Mr. Dury mentions a specimen taken near Clifton some years ago.

175. ZENAIDURA CAROLINENSIS, Bon.—*Turtle Dove.*—A nest of the Carolina Dove was discovered *on the ground* in the Little Miami "bottoms," May 5, 1877, by my brother, Clifford C. Langdon. It contained one young bird and an egg. The nesting of this species on the ground is very unusual in wooded sections, but is said to be of frequent occurrence on the Western plains, owing to the absence of trees. (*Vide* North American Birds, B. B. & R. vol. iii., p. 384-6).

179. ORTYX VIRGINIANUS, Bp.—*Quail.*—"Bob White" was protected by law in Ohio, from January 1, 1876, until November 15, 1877—nearly two years; and consequently appeared in unusual numbers during 1877. This law was a result of the exertions of the Cuvier Club of Cincinnati, and is the one at present in force, allowing the taking of Quail during only six weeks in the year (November 15 to January 1).

184. ÆGIALITIS MELODUS, Cab.—*Piping Plover.*—Chiefly confined to the seacoast and Great Lakes. One specimen taken on the Ohio River, near Cincinnati, by Mr. Dury.

194. EREUNETES PUSILLUS, Cass.—*Semipalmated Sandpiper.*—I am indebted to Mr. Shorten for three specimens of this species, taken by him on the Little Miami, near Madisonville, May 25, 1878—the first I have seen from this locality. Two of these are females, and present the curious anomaly of being larger and brighter colored than the male—peculiarities so characteristic of the Phalaropes.*

Whether the duties of incubation are performed by the male, as in the latter group, would be an interesting subject for investigation.

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* See "Biography of Wilson's Phalarope," by E. W. Nelson,—Bulletin of the Nuttall Orn. Club, April, 1877,—Also foot-note by J. A. Allen, *ibid.* p. 42.

214. TANTALUS LOCULATOR, L.—*Wood Ibis.*—In view of the rarity of this species here, the following account of its occurrence by Dr. Haymond merits repetition:—"These large and curious birds occasionally visit the Whitewater Valley in the month of August. Some years ago, I kept one (which had a broken wing) about six weeks. In that time it became very tame, learned its name and would come when called.

We fed it upon living fish, which it would swallow with amazing rapidity, except catfish, which required labor and time to dispose of. It died from having eaten a Mackerel which had been placed in a basin to soak."*

218. ARDEA CANDIDISSIMA, Gmelin.—*Little White Egret.*—Mr. Dury notes the capture of a specimen on the Reading Road, near Avondale, several years ago.

221. NYCTIARDEA GRISEA, Steph. var. NÆVIA, Allen.—*Night Heron, Qua-bird.*—A fine male of this species, taken near Covington, Ky., in April, 1878, has been placed in the museum of this Society through the kindness of J. W. Hall, Jr. It is a bird of very unusual occurrence in this vicinity, although exceedingly abundant in many localities, East and North, during the breeding season, and a common resident in the Southern States. It is said to breed in some parts of Ohio, and its rarity in this portion of the State is doubtless owing to absence of the swampy woods which are its favorite breeding resorts.

223. ARDETTA EXILIS, Gr.—*Least Bittern.*—Through Mr. Shorten, I learn that a specimen of this diminutive Heron was picked up alive in the streets of Cincinnati, in September, 1877.

224. GRUS AMERICANUS, Ord.—*Whooping Crane.*—Additional specimens of this magnificent bird are reported; one, in the collection of Mr. Lucius Curtis, taken near Carthage (Dury); another, taken May 30, 1877, at West Elkton, Preble county, Ohio, by Dr. W. C. Robertson (Shorten).

236.—ANSER ALBIFRONS, Gm. var. Gambeli, Coues.—*American White-fronted Goose.*—Specimen shot near Miamitown, Ohio (Dury).

261. PELECANUS TRACHYRHYNCHUS, Lath.—*White Pelican.*—Of occasional occurrence on the Ohio river during the migrations, and I learn of the capture of three or four specimens in as many years. Dr. J. H. Hunt has seen a specimen in the gray or immature plumage, taken at the mouth of the Great Miami.

262*a*. GRACULUS DILOPHUS, var. FLORIDANUS, Coues.—*Florida Cormorant.*—Mr. Dury has favored me with an exceedingly interesting account of the former abundance of this species at St. Mary's Reservoir, in which he says: "On the south side of the Reservoir, about seven

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* Indiana Geol. Survey, 1869.—Birds of Franklin Co., page 229.

miles from Celina, was the 'Water Turkey' Rookery. Here I used to go to shoot them, with the natives who wanted them for their feathers; I have helped kill a boat load."

"One season I climbed up to their nests and got a cap full of eggs. The nests were made of sticks and built in the forks of the branches. The trees [which were all dead] were mostly oaks, and covered with excrement. I found from two to four eggs or young to a nest. The young were queer little creatures—looked and felt like india rubber." "The old birds flew around in clouds, and made their croaking notes, indicative of their displeasure at my presence." "Some of the trees had ten or twelve nests on them." "As the timber has rotted and blown down, the birds have become less and less numerous."

The above circumstances occurred during the month of June, 1867, since when, as Mr. Dury states, these birds have rapidly decreased in numbers. The many specimens examined by him were, without exception, *var. floridanus.*

My own observation of the species in Ohio is limited to a single specimen found floating in the Reservoir late in October, 1874, when its comrades had probably migrated. It has also been tolerably well identified on both Miamis during the migrations.

The St. Mary's Reservoir, alluded to in the foregoing notes, is a point of much interest, ornithologically, and a brief account of its main features may not be out of place in this connection.

This Reservoir, which is in reality a flooded wilderness, is an artificial body of water, eight miles in length, by from two to four miles in breadth, covering an area of about 17,000 acres of original forest and prairie in nearly equal proportions. It is situated about one hundred and thirty miles north of Cincinnati, in Mercer and Auglaize counties, and supplies the Miami Canal.

The construction of the Reservoir was begun in 1838, and completed about the year 1845, by throwing two parallel banks of earth, about eight miles apart, across a shallow valley lying east and west. It receives its principal supply from two small streams flowing through this valley, and its situation is such that one of these streams eventually reaches Lake Erie, through the St. Marys and Maumee rivers, while the other finds its way into the Ohio river by way of the Wabash. It is at once apparent that the creation of a body of water of this size, so peculiarly situated, and in a region possessing no natural lakes, can not fail to materially affect the bird-fauna of a large portion of the State, and although not, technically speaking, within the scope of the present paper, I have included some of Mr. Dury's observations at that locality, as possessing a special interest.

July 6, 1878.

THE PREHISTORIC MONUMENTS OF THE LITTLE MIAMI VALLEY.

By Charles L. Metz, M.D.

The aboriginal earthworks in this vicinity are so rapidly becoming more and more indistinct, from the effects of continued cultivation, the elements, the leveling of many for building sites, and the carting away of others for the purpose of making fills and grades, that in a few more years their sites will be obliterated and forgotten.

This has determined me to prepare a chart, giving the location of the works, and mounds, in Columbia township, and of those in Anderson and Spencer townships, situated near the Little Miami River.

They are principally situated in Groups, and are marked respectively, A, B, C and D, on the chart.

Group A.

Is situated partly in section 9, and partly in section 15, Columbia township, Hamilton county, Ohio, one mile west of Plainville station, on the Little Miami Railroad, and on the second bottom or plateau of the Little Miami river, on a narrow sandy ridge of a reddish color.

This ridge has an elevation, averaging from 10 to 25 feet above the general level of the plateau on which it is situated. It lies between the Wooster Turnpike, and the Little Miami Railroad and River, elevated about 200 feet above the latter. On this ridge the principle work of this group is situated.

Commencing at the east end of the ridge, and in a wood known as "Stites Grove," we find an earthwork (Group A, No. 1) consisting of a circle, central tumulus, and an oval-shaped tumulus impinging on the outer southeast edge of the circle. The following extract, from an article entitled "The Mound Builders," by Mr. Florien Giauque, published in the *Harvest Home Magazine*, August, 1876, describes this work as follows: "In the grove known as the 'picnic woods,' owned by Mr. Charles Stites, of Columbia, and on the top of this ridge, there is a circular enclosure, made by a ditch, and an earthen embankment outside of and immediately adjoining this ditch, and no doubt made of the material which was taken from it. From the bottom of this ditch to the top of the embankment, the present height is about 5½ feet; the diameter of the ditch from deepest cut on either side is 75 feet; the enclosing embankment, from crest to crest, is 105 feet; and the diameter of the entire work from outside to outside is about 145 to 150 feet. On the east, this embankment is enlarged into a regular mound, about 48 feet in diameter, and about 6 feet high above the adjacent ground. At the southeast part of the enclosure, there is left an entrance way

about 10 feet wide—that is, there is here neither ditch nor embankment —this entrance faces and is about 40 feet away from the edge of the terrace or bluff, which is here quite steep, and about 100 feet* (estimated) high above the river, which is here quite near the foot of the bluff. The edge of the terrace and ridge coincide here."

The ridge to the east of this work slopes gently until it reaches the general level of the plateau. On this slope numerous relics are found.

The above described work was explored by Mr. Giauque and others, and several fine relics were found. The finding of one he describes as follows:

"One of the trenches was begun about the north of the mound, and the writer (Mr. Giauque), while working here, hardly a foot below the surface of the mound, and about 7 feet from the centre of it, found a very fine relic. It is a tube 6 inches long, a little less than an inch in diameter, made of crinoidal limestone, highly polished, though somewhat coated and discolored in places by the oxide of iron which has collected on it during its long burial. The hole extends entirely through from end to end, but grows rapidly smaller near one end, being about $\frac{5}{8}$ths inch in diameter most of the distance, and about 3-16ths of an inch at the smaller end. This relic is in fact a cylinder for about $4\frac{1}{4}$ inches of its length, to a diamond shaped perforation."

I have measured the circumference of some of the larger trees growing on this work; an oak has $9\frac{1}{2}$ feet, beech $8\frac{1}{2}$ feet in circumference on the central tumulus, maple 6 3-10 feet, an oak 6 7-10 in circumference. North west of this work, and about 200 feet distant, at the foot of the sand ridge, and on the general level of the plateau, is a mound (Group A, No 2), which has been recently explored. Its diameter east to west is 45 feet, elevation 7 feet. An oak tree on its western slope has 8 7-10 feet, and a beech on its eastern slope 5 feet of a circumference. An interesting account of the exploration of this mound, by Mr. Giauque, was published in the *Harvest Home Magazine*, in the article from which I quoted above. The circumstances of the exploration are of considerable interest to the archæologist, and I make the following extracts from Mr. Giauque's article:

* * "About 11 feet from the outside, and 2 feet above the original surface, the shovel hitherto working pretty freely in clayey sand, struck the first big stone. It was a flat limestone, possibly brought from the neighboring hill, about half a mile away, as there were none nearer, and it was much reddened and softened by fire, the fossil shells in it being whitened, or more nearly calcined than the other parts. This, together with charcoal and ashes, pieces of bone, pieces of bowl-

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* The bluff is here 200 feet high.

der broken by fire, were very encouraging indications of a 'find.' Further digging showed that the rock struck was a part of a stone arch, rudely made of undressed limestone. * * *

"That part of the arch first found was removed, and under it was found a skeleton, the *tibia* (shin bone) being the first part of it discovered. The arch was then entirely uncovered, the earth removed between it and the skeleton, and the skeleton taken out. * * If the mound had been divided into four parts, by drawing a line through its centre from north to south, and another similarly from east to west, the arch would have been entirely within the northwest section of the mound, and the skeleton which it covered, lay with its head nearly towards the northeast (N. E. E.) Perpendicular sections of the mound, as dug away that day, showed from the bottom upwards.

"1. The skeleton resting on or near the original surface, which was a sandy clay, quite compact and hard.

"2. About a foot of sandy earth, possibly mixed with ashes, but no charcoal nor pieces of bowlder nor bone; and especially in places where the rock above had relieved it from pressure, quite loose and soft.

"3. The arch, hitherto so called for convenience, but perhaps hardly entitled to the name. This was made, as has been said, of undressed but flat limestone, averaging about 20 to 30, and 6 to 8 inches in length and breadth; 4 inches in thickness, and approximately most of them being about a medium between these extremes; the arch was about 7 feet long, and 5½ or 6 wide; its highest part being in a line with, and directly over, the body, and arching downward on either side till its edges on the right and left of the skeleton nearly reached the clay on which the skeleton lay. But the stones were not set up on edge, so that the structure, while really an arch in form, was probably not self-sustaining. * * * It contained three layers of stone, one over the other, making about a foot in thickness.

"4. A thin layer of sandy earth, about one inch on the highest part, and increasing in thickness toward the sides.

"5. Charcoal and ashes, the charcoal not plenty, nor in large pieces, this indicating that the fire had burned out before being covered up with earth. This fire was hot enough to color all the top rocks, as mentioned of the first one found.

"6. A layer of sand, about 15 inches thick, with pieces of fire-cracked bowlder, burnt limestone, and pieces of human bones, much decayed —or were they partially burned?

"7. Another layer of charcoal and ashes similar to the one below, about ¾ths of an inch thick.

"8. Clayey sand to the top, so soft as to be shoveled without loosening with a pick, and nowhere over 2½ feet thick. * * No ornaments or implements of any kind were found in this mound."

West and to the south of this tumulus, and on the same continuous sand ridge mentioned above, are four or five elevations or tumuli, with an average height of three to four feet, being from two to three hundred feet apart (Group A, No. 3). The ridge is here under cultivation, numbers of relics, flint chips, and broken bowlders, are ploughed up on this ridge.

Northwest of those tumuli, and on the general level of the plateau, ¼ mile distant, is a mound (Group A, No. 6), which has a circumference at base of 200 feet, and an elevation of 7 feet; it is as yet unexplored, but cultivated annually.

Four hundred yards to the northeast of this mound, and at the junction of the Wooster and Madison turnpikes, can yet be traced a circular work, which has a circumference of 600 feet (Group A, No. 7). 20 years ago, I am told by an old settler, that the circle had an elevation at that time of three feet, and that there was a mound four feet high in the centre; at present it is almost obliterated. Its northern side in places has an elevation of eight to twelve inches. On the south and eastern side, the work can be traced by the yellow color of the soil. The northeast side is occupied by the Madison turnpike.

Continuing on to the southwestward of the small tumuli, and along the previously described sand ridge, we come to what is known as the "Pottery Field" (Group A, No. 4). Here the ridge slopes gently to the south and southeast, with an elevation of from 60 to 80 feet above the level of the Little Miami river. This field is a plateau of about four acres in extent, sloping back to the higher ground. On this plateau, fragments of pottery are found in great abundance. Flint chips, arrow points, broken bowlders, burnt limestone, and the shells of the fresh-water muscles (*unio*) are found all over the surface. Human remains have been found in the adjoining ravines, and on the slopes; the graves were isolated and shallow, and the method of burial was not uniform. Bones of various wild animals are also found.

Two hundred yards north of the pottery field are several small tumuli (Group A, No. 5); the largest has a circumference at base of about 100 feet, height 5½ feet; this mound has been dug into, but not yet explored. The pottery field, and also the tumulus (Nos. 4 and 5) are situated in section 9, Columbia township, in what is known as Ferris' woods, in "Still Home Hollow." The largest trees on the pottery field measure as follows: A walnut, 15½ feet in circumference; an oak, 12 feet in circumference; a maple, 9½ feet in circumference; and an elm 12 feet in circumference.

A quarter of a mile farther west, in section 15, on the estate of Joseph Ferris, and just southeast of the family homestead, is a circular work, with an inside ditch and a central elevation. Its circumference is

about 200 feet; diameter from east to west, about 65 feet. This work is almost obliterated. It is distant from the river half a mile, and elevated above it about 80 feet (Group A, No. 8).

GROUP B.

The works comprising this group are situated, part in Sects. 15 and 21, Columbia township, and part in Sects. 14 and 20 of Spencer township. Immediately south of Red Bank station, L. M. R. R., commences a gravely ridge, having an average elevation of about 40 to 50 feet above the general level of the surrounding plateau, and extending in a southwesterly direction for three fourths of a mile along the course of the Wooster turnpike. On this ridge, and on the estate of Dr. O. M. Langdon, we have a tumulus (Group B. No. 1) and a circular excavation. The tumulus has an elevation of nine feet, and a circumference of 200 feet at base. It has not been explored, and is covered with young forest trees. 300 yards southwest of this tumulus, is the circular excavation (Group B, No. 2). Its diameter north to south is 40 feet, east to west 44 feet, depth 7 feet. An old settler related that 50 years ago remains of stakes or palisades could be seen surrounding this excavation. The southeast slope of the ridge near this excavation, is covered with huge conglomerate masses, under which are two small caves (Group B, two asterisks)—no evidence exist about them as to their having served as habitations.

Half mile west of this ridge is an elevated plateau sloping to southward, until it coincides with the first bottom of the Little Miami River. On this plateau, at its highest elevation just south of the Little Miami Railroad, and at the junction of Oak and Elmwood Avenues of the Linwood Land Co's. subdivision, was a mound (No. 3, Group B), recently removed in the grading done by the Land Co. The superintendent of the grading, informs me that there were two circular layers of human remains, one near the general level of the ground, and one three feet above the lower one; he gives its height as eight feet, and its circumference at base of 200 feet. The Hon. Judge Cox states to me that this mound was enclosed by a circular work that had a diameter of 800 feet.

South of this mound, distant 200 yards, was a mound which was explored 50 years ago (site marked by an asterisk). My informant, Mr. Riggle, remembers that in a kind of a stone coffin, as he describes it, were two skeletons lying side by side, with their feet to the east, and that their faces were covered with layers of mica.

The five acres west of those mounds, are known as the "Indian Burying Ground" (Group B, No. 4), now subdivided into lots by the Linwood Land Co. The square bounded by Elmwood, Walnut, Oak and Maplewood avenues, covers the greater part of the ancient ceme-

tery, and an excavation made anywhere within or near those boundaries will reveal human remains. The inhumation was usually at length, with head to east.

A short distance east of the Linwood Station, on the south side of the railroad, can yet be seen a portion of a mound remaining. This mound was removed to make way for the L.M.R.R. (Site marked by an asterisk.) Many relics were found in grading down these mounds, and leveling the ground over the cemetery, and are in the collections of Dr. H. H. Hill, and J. J. Hooker, of Cincinnati, and of the writer and others.

The hill northwest of Red Bank station, and distant about two hundred yards from it, has an elevation of about 150 feet. This hill is terraced on its eastern and southern slope; the terraces are five in number, and are undoubtedly the work of human hands. On the top of this hill is a mound (Group B, No. 5); its present elevation is about four feet, and has not been explored.

Southwest of this mound, and at about the same elevation known as "Linwood Hill," distant about 400 yards, is the site of a mound (marked by an asterisk, Group B); it has been graded down. I could learn nothing positive as to its dimensions; the Anderson house occupies its site. Still farther westward, a quarter of a mile distant, and at the same elevation on the Land Company's property, is a mound (Group B, No. 6) four feet high, and a circumference of 150 feet. It has not been explored.

One half mile north of Red Bank station, on the second bottom or plateau of Duck Creek, immediately southwest of the western end of the Cincinnati & Eastern Railroad trestle, is a mound eight feet high, and 200 feet in circumference at base (Group B, No. 7). It has not been explored, but is cultivated annually. Half mile to the northwest of this mound is another, with an elevation of five feet, and circumference of about 175 feet. It is on the same level as the foregoing one, and on the lands of the Dr. Duncan estate (Group B, No. 8).

Group C.

Is located altogether in Anderson township, and principally along the Batavia turnpike, commencing at Dry Run, and at a point where the turnpike crosses it. Coming west on the first bottom of the creek, and but a few yards distant from it, on the north side of the turnpike, is a mound. Its present height is eight feet; circumference at base, 250 feet. It is of very regular shape (Group C, No 1), and well preserved.

Ascending to the second plain or bottom of the river valley, which here has an elevation of thirty to forty feet above the first bottom, and is formed of drift gravel extending along towards the southwest for three quarters of a mile, and running back to the base of the

hills. On this plain, and on the north side of the turnpike, in a line with the first mound described above, are three mounds about 200 feet apart (Group C, Nos. 2, 3, 4). Nos. 2 and 3 have an elevation of about four feet. No. 4 has an elevation of ten feet, with a circumference of 250 feet at base. Neither of these have been explored; Nos. 2 and 3 are cultivated annually. South of the turnpike, and on the same level, are two mounds (Group C, Nos. 5 and 6); the largest, No. 6, has a height of five feet, and No. 5 a height of three and one half feet above the general level of the plain.

Four hundred yards southwest of the last two mounds, and on the same level, on the lands of the Martin estate, is situated the "big mound." This is the largest mound in this vicinity, and in the county. Its present elevation is about 39 feet, with a circumference of 625 feet at base (Group C, No. 7). It has been cultivated for the last thirty years, with the exception of the last two years, and is now overgrown with blackberry bushes. It was at one time covered with forest trees; a large oak on its top had a diameter of four feet; this I have from reliable authority. It has not been explored; the proprietor desires to let the dead rest, as he expresses it.

West of this mound, 300 yards distant, is a small mound annually cultivated, and now about three feet high (Group C, No. 8); north of this last mound, and on the first bottom of the Miami River, are the remains of a mound, this was cut away in the building of the turnpike (its site is marked by an asterisk). Bones and relics were found at the time, but I could learn nothing more than that fact. Continuing westward we reach the Odd Fellows' Cemetery at Newtown; in this cemetery is a mound (Group C, No. 9), with an elevation of ten feet; circumference at base 210 feet; it has not been explored. 300 yards northwest of this mound, on the Plainville road, was a mound; it has been recently removed, its material being used for the purpose of making a fill on the road. It contained bones, charcoal, etc., but not much attention was given it by its destroyers. It had a height of about seven feet, and a circumference of 150 feet (Group C, No. 10). Directly in front of the old M. E. Church, in Newtown, was a mound; it was removed, and the material used in the construction of the Plainville road (site marked by an asterisk). 3-4 mile south of Newtown, on the Clough Creek, Newtown road, on the lands of Col. Jewett, is a mound 15 feet high, and a circumference at base of 225 feet; it has not been explored (Group C, No. 11).

Mound No. 12, of this Group, is situated half a mile east of the Union Bridge, on the Batavia turnpike, and immediately in front of the old Turpin homestead. It has been much reduced in size; its present elevation is ten feet: its circumference, 175 feet at base.

GROUP D.

Nos. 1, 2, 3, 4, 5, of this Group, are situated in Anderson township, and on the lands of Mr. Michael Turner. Nos. 6, 7 and 8, of this group, are on the opposite side of the river, in Sections 29, 28, 23, 22, of Columbia township. No. 1 is the largest and most interesting work in the Miami Valley. An extract from an article by T. C. Dale, or Day, in *The Antiquities of the Miami Valley*, published in the November number of the *Monthly Chronicle*, in 1839, is as follows : "The site of this stupendous fortification, if we may so call it, is a few rods to the right of the road leading from Newtown to Milford, and about midway between them. It is situated on a ridge of land, that juts out from the third bottom of the Little Miami, and reaches within 300 yards of its bed. From the top of the ridge to low-water mark, is probably 100 feet. It terminates with quite a sharp point, and its sides are very abrupt, bearing evident marks of having once been swept by some stream of water, probably the Miami. It forms an extremity of an immense bend, curving into what is now called the third bottom, but which is evidently of alluvial formation. Its probable height is forty feet, and its length about a quarter of a mile before it expands out, and forms the third alluvial bottom. About 150 yards from the extreme point of this ridge, the ancient workmen have cut a ditch directly through it. It is thirty feet in depth, its length, a semi-circular curve, is 500 feet, and its width at the top is eighty feet, having a level base of forty feet.

At the time of its formation, it was probably cut to the base of the ridge, but the washing of the rains has filled it up to its present height. Forty feet from the western side of the ditch is placed the low circular wall of the fort, which describes in its circumference an area of about four acres. The wall is probably 3 feet in mean height, and is composed of the usual brick clay, occasionally intermixed with small flat river stone. It keeps at an exact distance from the top of the ditch, but approaches nearer to the edge of the ridge. The form of the fort is a perfect circle, and is two hundred yards in diameter. Its western side is defended with a ditch, cut through the ridge in the same manner as the one on the eastern side. Its width and depth is the same, but its length is greater by two hundred feet, as the ridge is that much wider than where the other is cut through. The wall of the fort keeps exactly the same distance from the top of this ditch as of the other, viz., forty feet. Its curve is exactly the opposite of that of the other, so as to form two segments of a circle. At the southeastern side of the fort there is an opening in the wall thirty-six yards wide; and opposite this opening is one of the most marked features of this wonderful monument. A causeway extends out from the ridge about

300 feet in length, and 100 feet in width, with a gradual descent to the alluvial bottom at its base.

The material of its construction is evidently a portion of the earth excavated from the ditches. Its easy ascent and breadth would induce the belief that it was formed to facilitate the entrance of some ponderous vehicle or machines into the fort. To defend this entrance they raised a mound of earth seven feet high, forty wide and seventy-five long. It is placed about 100 feet from the mouth of the causeway, and is so situated that its garrison could sweep it to its base. The whole area of the fort, the wall and causeway, are covered with large forest trees, but there is not a tree growing in either of the ditches, and there are but a few low underbrush on their side.

At present the circular wall is almost leveled, but can be readily traced by the color of the soil, and the large number of flat river stones. The ditches can be easily recognized. The mound is still prominent. It measures now, height 5½ feet, diameter 25 yards, circumference 75 yards. The causeway is cut through by the C. & E. R. R., the forest cut away, and the soil cultivated annually.

No. 2 of this Group is a large, circular embankment, with a diameter of about 125 yards. The material forming the embankment is evidently taken from within the enclosure. This work is a perfect circle, with an opening or gateway thirty feet wide to the south. It is about 300 yards distant from the first work of this Group. Two hundred yards to the south of this circle are two mounds, No. 4 on chart being the larger. It has a circumference at base of 250 feet, and an elevation of twelve feet. One hundred and fifty yards east of these mounds is another of very regular shape (Group D, No. 5, on chart); height, four feet, circumference, 150 feet. No. 6 of this Group is a small mound, situated in Section 22, Columbia township, on an elevated ridge known as Gravelotte, on the estate of T. R. Biggs. It is situated in a corner of a large embankment. Its height is 3 feet, circumference 150 feet. No. 7 of this group is located in section 29, Columbia township, ¼ of a mile west of Camden, just south of the Wooster turnpike. It is now only one third its former size, it being partly removed in the construction of the Wooster turnpike. Its present dimensions are, height nine feet, diameter seventy feet. In the southeast corner of Section 29, at the village of Camden, and 300 feet east of the south line of Mr. Galloway's residence, is the corner of an embankment which extends east and south to the river. It extends ¾ths of a mile east, until it reaches the bank of the river, which is here about 40 feet high, the other running south until it reaches the edge of the gravel ridge, and then runs east to the river. It incloses from 800 to 1000 acres of ground. This embankment, 50 years ago, was six feet high and twelve feet wide. It is now scarcely trace-

able, and is best discoverable in spring time, and just after ploughing, when it can be readily traced across the fields by the peculiar color of the soil.

In Section 30, Columbia township, on the lands of Mr. K. Bonham, is a mound, 8 feet high, and 200 feet circumference at base. In Section 34, on Norwood Heights, is located a mound that commands an extensive view of the surrounding country. Its height is nine feet, circumference 200 feet. It was probably a mound of observation.

Other mounds and earthworks will doubtless be discovered in this vicinity, as the forests are cut down, and the ground cleared; and those described and located in the present paper are but a few in the long chain of works extending up along the course of the Little Miami and the East Fork valleys.

In conclusion, I would say that to Mr. Chas. F. Low, Mr. Archer, of the Marietta & Cincinnati R.R., and to Mr. W. R. Kemper, my warmest thanks are due for their assistance in preparing the accompanying chart, and to Mr. F. W. Langdon, who kindly assisted me in carrying out investigations. To the archæologist a complete and speedy examination of this whole valley is of the utmost importance.

MADISONVILLE, HAMILTON CO., O., August 7, 1878.

THE MOUND BUILDERS ON THE LITTLE MIAMI.

By S. S. SCOVILLE, M.D.

In this communication, we call attention to some of the traces of this people, which may be observed along the Miami, from Foster's Crossing to Waynesville. At the former place, on the west side of the river, we have an Earthwork. At Deerfield, or South Lebanon, may be seen another, with adjacent mounds. One mile above South Lebanon, mounds are found which yielded lately some magnificent copper axes, and other interesting relics. In the vicinity of Morrow are mounds. At Fort Ancient, we have an Earthwork that rivals in grandeur anything to be found in Southern Ohio. Opposite this work, we have a terraced roadway, which may be traced for a quarter of a mile or more. Above Fort Ancient, two or three miles, and on east side of river, a terrace may be observed on the side of the hill. Above Freeport, two miles, on east side of the river, is to be seen the site of a town or dwelling place. Here, pottery was manufactured. Nearly a hundred human skeletons have been found and fragments of pottery are abundant. Mounds are found here. Between Freeport and Waynesville is an Earthwork. At the latter place are numerous mounds.

DESCRIPTION OF EIGHT NEW SPECIES OF HOLOCYSTITES FROM THE NIAGARA GROUP.

By S. A. Miller.

Prof. James Hall, of New York, in 1864, founded the genus *Holocystites*, and described four new species, and referred two previously defined ones to the new genus. The next year, Winchell and Marcy described another species. All these were casts.

The genus was defined as follows: "Body elongate, sub-cylindrical, elliptical or sub-ovate, composed of numerous (six or more) ranges of comparatively large plates, or of alternating series of large and small hexagonal or polygonal plates; apertures at or near the summit, one of them central or sub-central, the other eccentric; supported on a short pedicel: sessile arms, none; free arms, unknown; no evidence of pectinated rhombs."

We now propose to define eight new species of *Cystideans*, and refer them to this genus. They are all well preserved, and show fully the characters of the plates.

The following characters are possessed in common by these species, to wit: free arms, surrounding an ambulacral orifice; a mouth, eccentric or removed to the side; and all the plates of the body poriferous. Calling the side upon which the mouth is situated the ventral side, it will be noticed that the dorsal side is always the most ventricose.

Some of the species possess a third opening, which is called the anal aperture, and in three species, at least, this is found between the mouth and ambulacral orifice. All the species were possessed of columns, except, probably, *H. brauni*. We have illustrated part of the section of a column, showing the radiating lines upon the face of the plates, and two roots. One of the roots is coiled around a column, and terminates without branching, showing that it may have been a floater; the other terminates in clumsy branches. This genus would, therefore, seem to include species that were sessile, floating, or which possessed a column, and attached by branching roots to foreign objects. We have other roots, columns, and undescribed species from the same rocks, that may be illustrated in a future number of the Journal, and throw further light upon the subject.

The remarkable perfection of the specimens and their scientific importance, will justify a short statement of the history of their discovery. The credit of first discovering them is due to the zealous and indefatigable palæontologist, Mr. Fred. Braun. More than a year ago, he collected a number of specimens in the lower part of the Niagara Group, in Jefferson county, Indiana. They were found less than seventy-five

feet above known exposures of the Hudson River Group. Last summer, Mr. Braun and I collected, near Osgood, in Ripley County, Indiana, within less than thirty feet of the Hudson River Group (top of the Cincinnati Group) several species of these large *Cystideans*, with many roots and columns. As soon as opportunity occurs for illustrating these, more of them will be described. Later, Prof. A. G. Wetherby collected, near Osgood, several species in the same range, and within 30 feet of the Lower Silurian rocks. We are not informed as to the place where Dr. Washburn found his specimen, farther than it was some distance below the range of the Waldron beds. The plates of *Cystideans*, from the same range of rocks, at Dayton, Ohio, have been known for many years.

Associated with these *Holocystites*, in Ripley County, Indiana, I collected *Lichenalia concentrica*, *Calymene niagarensis*, *Orthoceras annulatum*, *Atrypa reticularis*, having the same characters as the Waldron specimens, and other fossils of the Niagara Group. I have been unable to find any indications of the existence of the Medina or Clinton Group, at any of the exposures examined, and from the observations made, and fossils collected, am fully convinced that the Niagara Group rests directly upon the Hudson River Group of rocks, all the way from Dayton, Ohio, in the meandering course of the exposure across the south-eastern part of the State of Indiana, to the Ohio river. It is true, that I have not traced out the line of junction of these two Groups the whole distance, nor the greater part thereof, but I have seen exposures, where the Groups come together, and have collected fossils in the rocks of both Groups, at a great many places near the line of junction. Moreover, the rocks have never suffered much disturbance, and have a very uniform westerly and north-westerly dip. In short, I have the utmost confidence in the correctness of the view expressed, notwithstanding the statement, which has been made, to the effect, that the Clinton Group intervenes. Certainly no one will have any doubt about the age of the rocks in which these fossils were collected.

HOLOCYSTITES BRAUNI, n. sp. (Plate V., fig. 1, natural size.)

The species is founded upon a single specimen, half of which is buried in a slab.

The body is elongate-subovate, apparently slightly constricted immediately above the junction with the column. The part of the column preserved is very large, and there are some appearances that render it possible that it is all preserved: that the species was sessile and rested close upon its support; and that the apparent constriction is caused by the expanding support or flange.

The basal (?) plates are, in part, anchylosed, which prevents a correct

determination of the number. Above these, the first range consists of more than twenty plates. The number cannot be exactly ascertained, but four undisturbed plates, shown in the illustration, cover $\frac{5}{8}$ths of an inch, where the circumference of the specimen is $3\frac{1}{4}$ inches. The plates are longer than wide, vary much in width, are somewha twedge-shaped, and arranged alternately; two of them are hexagonal and the other two are pentagonal. The second range consists of the same number as the first. Nine plates, in place, extend $1\frac{5}{8}$ inches, where the circumference, if preserved, would be $3\frac{1}{2}$ inches or more. These plates have no uniformity in shape or size; they are longer than wide, and vary from pentagonal to heptagonal. Above the second range the plates are not disposed with any regularity; they differ in size from $\frac{1}{8}$th to $\frac{3}{8}$ths of an inch, and vary, in form, from a triangle to a nonagon. If the plates were placed in ranges, there would be about ten between the basals and the first arm base or tentacle. Two strong arm bases are shown on the specimen. The apertures are unknown. The plates are perforated by numerous pores, having no order in their arrangement. The specimen has a length of 3 inches; diameter in the middle, $1\frac{3}{4}$ inches, and at the base $\frac{7}{8}$ths of an inch.

Collected by Frederick Braun, Esq., in whose honor the specific name is proposed, in the lower part of the Niagara Group, in Jefferson County, Indiana.

HOLOCYSTITES WETHERBYI, n. sp. (Plate V. figs. 2, 2*a*, 2*b*.)

Body sub-globose, or somewhat obovate; summit depressed convex; greatest diameter above the middle and at right angles to a line passing through the mouth and ambulacral orifice. The ambulacral orifice is surrounded by at least four arms (the specimen does not show the arm bases distinctly). The mouth is on the summit, but little removed from the ambulacral orifice. The other openings, which appear upon the summit, and are shown in the illustration, served some purpose not understood. The body is surrounded by four ranges of sixteen plates each. The two middle ranges are composed of hexagonal plates; the other two seem to be composed of both pentagonal and hexagonal plates; the plates are longer than wide. The plates upon the summit are not determined. There is a row of basal plates below the four ranges, composed, probably, of only eight plates, but the lines are too indistinct to allow them to be traced.

Each plate of the body is perforated with small holes, arranged in pairs, but we have been unable to detect any order in the arrangement, except so far as their arrangement in pairs is concerned. The anal aperture, if it existed, is unknown.

One of the supposed arms or tentacles is lying upon the summit of

the specimen illustrated. It has a length of one fourth of an inch, and tapers to an obtuse point. There are twenty-five distinct annulations shown upon it. The magnified view is intended to show these annulations. The column was evidently small.

Length of specimen one and six tenths inches; length of four ranges of plates on the anterior side, one and one tenth inches; breadth of same plates, eight tenths of an inch; greatest circumference, four inches; greatest diameter, one and four tenths inches.

Collected by Prof. A. G. Wetherby, in whose honor the species is named, in the lower part of the Niagara Group, in Ripley County, Indiana.

HOLOCYSTITES ORNATUS, n. sp. (Plate V., figs. 3, 3*a*, 3*b*.)

Body somewhat obovate, depressed on the anterior side. There are eight hexagonal plates in the first range; four of these on the anterior side are twice as long as wide; the others are nearly as wide as long. These plates are very much constricted, which indicates that the body was possessed of a small column. The fossil rapidly enlarges at the second range, which consists of eight plates, varying in form from pentagonal to heptagonal. The plates do not seem to be disposed in any determinable order above the second range, though if arranged in courses, there would be about ten between the column and the arm plates; neither have they any regularity in form or size. The ambulacral orifice is situated upon the summit, near the posterior margin; it is somewhat elongated, surrounded by seven plates, and four (possibly five) arm bases. The mouth is situated upon the summit, two plates distant from the ambulacral orifice; part of it is broken away in our specimen, but it seems to have been surrounded by five plates. A small anal opening exists in the top of a pustule between the ambulacral orifice and the mouth. The pustule is situated on the right side of the plate, adjoining the mouth and close to an arm base, being nearly in the centre of the summit.

The surface is very strongly granulose, or pustulose, and each plate is perforated by numerous pores. The pores open upon the summit of the granules, and where the granules are worn off, the plates show the pores, in pairs, passing through to the interior.

Length of specimen, one and five eighths inches; greatest diameter, a little over an inch.

Collected by Frederick Braun, Esq., in the lower part of the Niagara Group, in Jefferson County, Indiana.

HOLOCYSTITES PERLONGUS, n. sp. (Plate V., figs. 4, 4*a*.)

[Ety.—*perlongus*, very long.]

Body very long, sub-cylindrical, and very gradually enlarging from

the column upward about one third the length of the body. Summit rounded; central part covered with a large heptagonal plate; five plates abutting this central one are pentagonal and gradually slope off in all directions; the other two form part of the margin of the ambulacral orifice. The ambulacral orifice is situated on the left side of the summit, at the margin; it is sub-elliptical in outline and surrounded by five free arms. The thickening of the plates around this orifice gives the fossil the appearance of a slight prolongation to the left. The mouth is situated upon the anterior side two plates distant from the central one, at the apex, and separated by two plates from the ambulacral orifice. It is sub-elliptical and surrounded by five plates. The body is covered with fifteen or more irregularly disposed ranges of plates. The plates vary greatly, in size and shape. A range of large plates, eight in number, surrounds the body above the middle; part or all of these have nine sides; the next range below seems to be composed of twenty pentagonal plates, but the anterior side of the specimen examined is injured so as to prevent us from certainly ascertaining the number. The plates in other ranges vary in number, size and shape, so that we may say the plates, in the fifteen ranges, vary from seven in one range to twenty in another, and in form, from a triangle to a nonagon. The illustration shows their appearance on the posterior side.

The surface is strongly granulose and each plate is perforated with numerous pores. The pores open on the summit of the granules. No anal aperture. Column unknown.

The specimen illustrated has a length of four inches, and it would require one or more ranges of plates to complete it down to the column. The circumference, immediately below the mouth, where the plates are all preserved, is three and eight tenths inches; the diameter from the anterior to the posterior side nearly an inch, and the transverse diameter one and three tenths inches.

Collected by Prof. A. G. Wetherby, Frederick Braun, and the author, in the lower part of the Niagara Group, in Ripley County, Indiana.

Holocystites globosus, n. sp. (Plate V., figs 5, 5*a*, 5*b*.)

Body sub-globose. Basal pieces, apparently seven, but I am by no means certain that this is correct. Between the basals and the first range, on the posterior side, three small plates appear to be inserted, two of which are pentagonal, and the other triangular. The body is covered, between these pieces and the arms, with four ranges of eight plates each. In the first range, part of the plates are pentagonal, the others hexagonal; in the other three ranges the plates are hexagonal. The ambulacral orifice is situated at the apex, and is surrounded by

six plates arranged within four arm bases. The plates surrounding the orifice are narrow, pentagonal or hexagonal, and elevated so as to support the arm bases. Between the arm bases on the one hand, and the plates surrounding the ambulacral orifice and the first range below the arm bases on the other, a small pentagonal plate fills the area; these four plates with the four arm basals make eight plates in this range. The mouth is situated two plates distant from the ambulacral orifice, and just without a line drawn from one arm base to the next adjoining.

The body is quite ventricose, near the base on the posterior side, and is slightly swollen below the mouth, on the anterior side.

The surface is slightly granulose. All the plates are poriferous. No anal aperture.

The specimen illustrated is about one and one fourth inches in length, and about an inch in diameter. The greatest diameter is found in a line drawn from the left side to the right, cutting a line at right angles, passing through on the right side of the mouth and left side of the ambulacral orifice.

Collected by Frederick Braun, Esq., in the lower part of the Niagara Group, in Jefferson County, Indiana.

Holocystites pustulosus. n. sp. (Plate VI., figs. 1, 1*a*.)

[Ety.—*pustulosus*, full of pustules.]

Body somewhat obovate, and obscurely triangulated toward the summit. It is covered by numerous, somewhat irregularly disposed convex plates, which differ much in size and shape, and constitute about ten ranges; the larger plates approach the summit.

The ambulacral orifice is situated in the central part of the summit, directly in the rear of the mouth, and is surrounded by five strong arm bases.

The mouth is situated in a depressed area near the margin of the summit.

A small anal aperture is situated between the mouth and the ambulacral orifice, at the foot of an arm base, and to the right of a line drawn from the center of the mouth to the center of the ambulacral orifice.

Surface marked by strongly convex plates, covered by many pustules, and perforated by numerous pores. The pores open upon the summit of the pustules, and where the pustules are worn off, the pores may be seen in pairs, passing to the interior.

Length of specimen, two and two tenths inches; circumference, five and nine tenths inches; diameter from the anterior to the posterior

side, one and nine tenths inches; and transverse diameter about the same.

Collected by Dr. R. R. Washburn, in the middle or lower part of the Niagara Group, a few miles from Waldron, Indiana.

HOLOCYSTITES PLENUS, n. sp. (Plate VI., figs. 2, 2*a*.)

[Ety.—*Plenus*, full, large.]

Body large and sub-cylindrical. The upper part only of our specimen is preserved, and the right side of it is somewhat injured. The summit is convex and covered with large plates. One capping the apex is hexagonal; bounded on two sides, by plates reaching the ambulacral orifice, on two sides, by two large plates, supporting part of the arm bases, and on the remaining two sides, by two plates constituting part of the first range below the summit.

The ambulacral orifice is large, sub-pentagonal, and surrounded by five strong arm bases. It is situated upon the left side, at the margin of the summit, which is prolonged, in that direction, so as to produce a concave side on the left, below the arm bases, and to give the opposite or right side of the body a longitudinal convexity. The arms seem each to have rested upon three plates, and if this supposition is correct, the orifice is surrounded by ten pentagonal plates. Five plates fill the spaces between the larger plates supporting the arm bases and the first range of plates below the summit, one of which is described above as capping the apex, and another forms part of the mouth. A small anal aperture is visible, at the foot of the arm base, posterior to the mouth, and nearly in a line from the posterior part of the mouth to the upper part of the ambulacral orifice. The mouth is surrounded by five plates, and is separated from the ambulacral orifice, by a pentagonal plate, which, on one side, constitutes part of the mouth, and which is supported, upon two sides, by the adjacent plates forming the rear part of the arm bases, and upon the other two sides, by two plates, each of which forms part of the ambulacral orifice as well as part of the support for the arm bases.

The first range of plates below the arm bases passes up over the right side of the summit, having an inclination to the body of the fossil of about forty-five degrees. This range consists of eight large pentagonal plates, one of which forms the lower part of the mouth. The plates, in the next three ranges, are large, but seem to become more numerous, and to vary in form and size. The injury to the right side above mentioned, prevents us from accurately determining the number and form of the plates in these ranges.

The surface is slightly granulose, and all the plates are poriferous. The circumference of the specimen at the lower part of the second

range of plates below the arm bases is 5½ inches ; the diameter from the anterior to the posterior side, 1 85-100ths inches; transverse diameter, or diameter from the left to the right side one and one half inches.

Collected by Frederick Braun, Esq., in the lower part of the Niagara Group, in Jefferson County, Indiana.

HOLOCYSTITES ELEGANS, n. sp. (Plate VI., figs. 3 and 3*a*.)

[Ety.—*Elegans*, elegant.]

Body quite irregular in shape; from the column toward the summit, it is somewhat obconoidal, with one side much more rapidly expanding than the other; approaching the summit it becomes sub-quadrate. The summit is moderately convex. The body is covered by numerous plates, which, if regularly disposed, would constitute not less than ten ranges. They are so closely anchylosed, in our specimen, that they can not be accurately counted. Some of the ranges, and particularly those surrounding the sub-quadrate part of the body, must contain at least twenty plates, and probably more. None of the plates are very large.

The ambulacral orifice is very large, and situated a little anterior to the central part of the summit. It is surrounded by eight plates, five of which support arm bases.

The mouth is situated near the anterior edge of the summit, a little to the left of a line drawn through the middle of the body. No anal aperture discovered.

The surface is granulose and all the plates are poriferous. In addition to the minute pores which penetrate all the plates, there are a number of large circular openings irregularly dispersed over the summit, sides and posterior part, down to the column. Some of these openings are found at the junction of two or more plates, in other cases an opening passes through the central part of a single plate. None of of them seem to be pectinated, and we are at a loss to determine what function should be ascribed to them, or what name they should bear.

The round apertures, upon the summit of *H. Wetherbyi*, seem to be of the same character, but as they are not so numerous and are confined to the immediate locality of the larger apertures, their functions may have been different.

Length of specimen one and one half inches; circumference five and one tenth inches; diameter from the anterior to the posterior side one and six tenths inches; transverse diameter one and one half inches.

Collected by Frederick Braun, Esq., in the lower part of the Niagara Group, in Jefferson County, Indiana.

REMARKS ON SOME LAMELLIBRANCHIATE SHELLS OF THE HUDSON RIVER GROUP, WITH DESCRIPTIONS OF FOUR NEW SPECIES.

By R. P. Whitfield.

I lately received from Prof. J. Mickleborough, of Cincinnati, Ohio, several examples of Lamellibranchiate shells, collected from the softer clay layers of the Hudson River Group, in the vicinity of Clarksville, Clinton Co., Ohio, with a request that I would determine their specific relations.

On examination, I find some of them presenting features of considerable interest, as showing the great degree of compression, or distortion, they have undergone, during the consolidation of the material in which they were imbedded; and showing, what appears to me, proof of the great amount of vertical compression, or shrinkage, which had taken place in some of the softer layers of the formation before they became finally fixed or hardened. Sufficient, as the examples show, to produce an imperfect slaty lamination through the substance of the fossils.

One of the examples referred to, is a large specimen of *Cypricardites Sterlingensis* (?) M. & W., which in its perfect uncompressed condition, must have had a thickness, measured through the body of the valves, of at least one and one fourth inches, which has been reduced by compression to eleven sixteenths, or little more than half an inch. The specimen has been imbedded in the shale with the plane of the valves corresponding to the plane of stratification, thus bringing the compression nearly or quite vertical to the longer axis of the shell, thereby reducing the thickness to nearly one half its original dimensions, without materially distorting or altering the general outline of the shell; presenting in this condition, features, which would, under ordinary circumstances, be considered as of specific importance. All parts of the shell are proportionally reduced in one direction, while retaining their normal characters in the other. Other examples in the collection sent, seem to have been imbedded in an opposite direction to the one above mentioned; and these have been compressed in the direction of the longer axis of the shell, thus reducing the length of the shell very materially, while the thickness and height retain their normal proportions. Lamellibranchiate shells are particularly liable to this kind of distortion, especially when imbedded in argillaceous or shaly rocks, and require the exercise of considerable judgment in determining their specific relations, as they are liable to present very different characters, even when specifically identical. Where the

pressure is oblique to the axis of the shell, it is readily detected. Among those sent for identification, I find the following new forms, which are sufficiently marked to be characterized as species:

CYPRICARDITES QUADRANGULARIS, n. sp. (Plate VI., fig. 5.)

Shell rather above a medium size, somewhat quadrangular in outline and very erect, with prominent, incurved and sub-central beaks which overhang the proportionally large ligamental areas. Height of the shell, in the example used, slightly greater than the length in an anterior and posterior direction. Cardinal line short, less than half as long as the shell below. Valves moderately convex, and apparently quite prominent along the distinctly angular umbonal ridge; regularly convex anterior to the ridge, and slightly flattened on the postero-cardinal slopes. Anterior margin rounding from the hinge extremity to the postero-basal angle, with a nearly regular curvature; and from this point to the posterior extremity of the hinge has been nearly vertical, the border having only a slightly convex outline. Surface of the valves marked by closely arranged concentric lines of growth, which form slight undulations of the surface by their irregularity.

This species differs from any other of the Genus yet noticed, in the extremely erect form, prominent beaks and quadrangular aspect of the outline. The example used in description has been obliquely crushed, distorting the shell in such a manner as to shorten the right valve on the anterior side of the umbonal ridge, and the left valve on the posterior side; the entire length probably having been somewhat reduced, while the height has not been materially changed. Other individuals of the species may probably show the height and length to be nearly equal, or the length may possibly slightly exceed the height. The prominent beaks, elevated more than one fifth of the entire height of the shell above the hinge, together with the short cardinal line is a rather marked feature. In the general aspect, the species has much the appearance of the forms referred to the genus *Anodontopsis*, McCoy. But the existence of a distinct and well marked cardinal or ligamental area at once places it with *Cypricardites*.

Formation and locality: In the soft shales of the upper part of the Hudson River Group, Clinton Co., Ohio.

CUNEAMYA CURTA, n. sp. (Plate VI., figs. 6, 6*a*.)

Shell of medium size, rotund or sub-globose in general form, and abruptly cuneate posterior to the umbonal ridge when viewed from above. Height and length sub-equal in the example used, which shows evidence of considerable shortening by compression. Valves very ventricose, prominent on the umbones, with large closely incurved beaks, situated very near to the anterior end of the shell, but yet not quite

terminal. Cardinal line two thirds as long as the entire length of the valve in its present shortened condition, and margined by a very distinct and proportionally wide escutcheon like area of lanceolate form. Margin of the shell arcuate from the anterior extremity of the hinge, including the anterior and basal borders, the latter more sharply rounded in the unnaturally shortened condition of the specimen, than the anterior, while the posterior is somewhat more extended and again recurved to the extremity of the hinge just below the cardinal line. Anterior end of the shell marked by a rather large and distinct lunule. Surface marked only by concentric lines of growth, which are grouped to form slight undulations on the surface of the shell. Were it not for the distinctly formed lunule and escutcheon, we should be inclined to place this species under the genus *Leptodomus*, McCoy; but these characters readily distinguish it from the more typical forms of that genus, and ally it strongly with *Cuneamya*, from which it differs only in the extreme shortness of the shell. This has, however, been produced, to a considerable extent, by compression in the longer axis of the valves; and we should judge from the evidence furnished by the specimen, that this shortening has been equal to nearly one third of its present length. The rounded form and great rotundity of the valves are prominent features, and will serve to distinguish from any other described form.

Formation and locality: Found in the soft shales of the upper part of the Hudson River Group, in Clinton Co., Ohio.

ORTHODESMA MICKLEBOROUGHI, n. sp. (Plate VI., fig. 7.)

Shell of medium size, trapezoidal or sub-rhomboidal in outline, with angular, ventricose valves, which are twice as long as high. Beaks small, not very prominent, situated not more than one fifth of the entire length of the shell from the anterior end, incurved, approximate and sharply angular on the back. Cardinal line about three fourths as long as the shell, and distinctly arcuate; anterior end short, the point of greatest length being but little below the cardinal line, and the margin below this point directed obliquely backward, at an angle of from forty-five to fifty degrees with the cardinal line, to its junction with the basal margin; basal line sub-parallel to the cardinal line, and broadly sinuate at, or just posterior to, the middle of its length. Posterior end obliquely truncate, rapidly receding from the extremity of the hinge to the sharply rounded postero-basal angle. Posterior umbonal ridge prominent, angular throughout, but becoming more decidedly so near the beak and at the postero-basal angle, causing a downward projection of the shell margin; anterior umbonal ridge rounded, but quite defined; cardinal slope abrupt and slightly concave,

becoming nearly vertical along the umboes. Body of the valve broadly sinuate between the anterior and posterior umbonal ridges, and the anterior end abruptly stopping.

Surface of the shell marked by numerous, distinct, concentric undulations, with the appearance of fine, radiating lines, which seem to have formed elongated pustules along the posterior umbonal ridge in the more advanced stages of growth.

This species is a very marked one in its general form and rhomboidal outline, as well as in the general expression of the surface. It is closely related to *Orthodesma contracta*, Hall sp., from this same horizon, but may be readily distinguished by the shorter anterior end, more angular beaks, and by the longest point of the anterior extremity being situated near the cardinal line, instead of below the middle of the shell, as in that species.

Formazion and locality: In the Hudson River Group, at Cincinnati, Ohio. The specimen was found near the top of the hills back of the city, about 360 feet above low water mark of the Ohio river.

SEDGEWICKIA (?) LUNULATA, n. sp. (Plate VI., figs. 8, 8*a*.)

Shell small, irregularly sub-ovate in outline, and quite ventricose; with large, tumid, sub-central beaks: length equal to about once and a half the height. The hinge line on what we have considered the posterior side, is straight, and almost half as long as the entire length of the shell, but without any appearance of an escutcheon, and showing, to a slight degree, evidence of an external ligament, extending nearly its entire length. On the opposite (anterior) side of the beaks, the cardinal line slopes rapidly toward the base, contracting the height of this side to about half that at the beaks, and is deeply excavated, forming a very large and deep lunular cavity, below which the extremity is narrowly rounded to the basal line. Base nearly straight along the middle and for half the length of the shell, and rounding abruptly to the hinge on the larger (posterior) end.

Surface of the shell marked by rather large, concentric undulations, which become strongly developed as they approach the margins of the lunule; and also by finer intermediate lines of growth.

This species is undoubtedly congeneric with those forms described by Prof. Meek, from these same rocks, and referred with doubt to the genus *Sedgewickia*, McCoy, but we do not think them generical with the typical forms of that genus as illustrated by its author, taking the earliest species given; but as we know of no established genus to which they are more nearly related, and as they are not sufficiently well defined to afford a clear generic diagnosis, we prefer to place this one under the same generic designation, provisionally, rather than

attempt to form a new group on insufficient material. We are, however, quite confident, that when properly understood they will form a very distinct genus.

Formation and locality: Found in the soft shales of the upper part of the Hudson River Group, in Clinton Co., Ohio.

ON PRONUBA YUCCASELLA (RILEY), AND THE HABITS OF SOME TINEINA.

By V. T. Chambers.*

In the *Transactions* of the St. Louis Academy of Science, vol. 3, p. 568, which I have just received, is a paper which perhaps requires some response from me. It is entitled "Further Remarks on *Pronuba yuccasella*, and on the pollenization of yucca," and is from the pen of my friend, Mr. C. V. Riley, State Entomologist of Missouri, and chief of the U. S. Entomological Commission, popularly known as the "Hopper Commission," and like other things, from the same distinguished source, is marked by ability and accuracy, as well as by a somewhat *ex cathedra* enunciation of opinion. I will not, however, quarrel with him for that; he is the founder of the very interesting genus and species, *Pronuba yuccasella*, and naturally enough seems to feel a sort of paternal solicitude for his scientific progeny; and woe betide the unlucky wight who ventures to trespass on this, his own peculiar demesne, as others beside I, and notably Prof. Zeller and poor Mr. Boll, have feelingly discovered even in this very paper in the St. Louis *Transactions*. Indeed, in consideration of the punishment meted out to Prof. Zeller and Mr. Boll, I ought, perhaps, to thank Mr. Riley for letting me off with simply, as it were, an admonitory spank. But enough of this badinage. Entomologists are said to be a peculiarly waspish people, the aculeate hymenoptera of mankind. Do but look at one, and the barbed aculeus shows its threatening point. Lest, therefore, Mr. Riley should misapprehend the spirit in which I write, and be tempted to administer something more than an admonition, I desist.

In his 5th Report, as State Entomologist, Mr. Riley describes *Pronuba yuccasella* as "having the front wings uniformly silvery white." In vol. 3, of the *Bulletin* of the U. S. Geological and Geographical Survey of the Territories, I have mentioned the occurrence in Colorado of numerous specimens having the wings more or less spotted with black; and in the paper in the St. Louis *Transactions*, before mentioned, Mr. Riley denies that the spotted specimens belong to *Pronuba*, and states

*[Read at the November, 1877, Meeting of the Cincinnati Society of Natural History.]

that they belong to the species described by me, before that time, as *Hyponomeuta 5punctella.*

I found the specimens, spotted and unspotted, abundant when in Colorado, but I have none now in my collection. Of the many specimens observed by me then I kept but twenty-five, and on my return to Kentucky I found all of these but six ruined. These six I, through Dr. Hagen, donated to the Cambridge Museum, and at my request, Dr. H. submitted them to Mr. Riley for examination, who, admitting that a single female belongs to *P. yuccasella*, assigns the other five to *H. 5punctella*, as before stated. I am not, therefore, prepared now to assert positively that these five belong to *P. yuccasella.* I am, however, very confident that whatever they are, they are not *H. 5punctella.*

To refer these five, and all of the numerous spotted specimens observed by me in Colorado, to *5punctella*, would be to assert for that species, hitherto not observed to vary at all, a greater amount of variation than I have asserted to exist in *P. yuccasella.* The Colorado specimens referred by me to *P. yuccasella*, and by Mr. Riley to *H. 5punctella*, varied in the number of black spots on the wings from 0 to 13 ; and when all were present were arranged as in figure 1; but there was no variation whatever in the *position* of any spot. Of the six specimens now in the Cambridge Museum, and which have recently been inspected by Mr. Riley, one is unspotted, and is admitted to be *P. yuccasella ;* of the remaining five, one has a single spot, another has three spots, and the others are immaculate, as I learn from Dr. Hagen. I do not know the position of the spots in the two specimens; but when all the spots are present, at least in all the specimens examined by me in Colorado, which had the thirteen spots, their position was invariably as shown in fig. 1. No. 3 is the spot which is most often present. Nos. 6 to 13 inclusive are next in the frequency of their occurrence, whilst Nos. 1, 2, 4 and 5, are frequently absent. The number of the spots is thus very variable, but their position, when present, is constant; but a large proportion of the specimens were immaculate.

H. 5punctella was described by me from eight specimens received from Texas, and these are the only extant specimens. Mr. Riley has seen *one* of these eight, and has identified the five Colorado specimens with it, either by comparison with this one, or by comparison of them with my description of this species. In these eight specimens I observed no variation whatever in either the number or position of the spots, which are represented in fig. 2. A comparison of figs. 1 and 2 shows at a glance the difference in the positions of the spots. *No. 3 is the only spot which is common to the two species.* No specimen of *H. 5punctella*, seen as yet, has any spot but the five, and all of them have the five located as in fig. 2, and thus it has none of the thirteen

spots of the Colorado specimens, except No. 3, while none of the Colorado specimens have any of the spots of *5punctella*, except No. 3, even when the spots number as many as thirteen.* So the eight specimens scarcely varied as to size, while the Colorado specimens range from less than six lines in expanse of wings, to ten or more. The species thus resemble each other, and other *Hyponomeutidæ*, in being white with black spots, which are sometimes absent from the wings of the Colorado specimens; they differ in the number and position of the spots, in the fact that *H. 5punctella* is constant in this respect, while the Colorado specimens are exceedingly variable, not only as to the spots, but as to the size. No inference that the insects belong to the same species can be drawn from the fact that spot No. 3, at the end of the disc, is common to both; because it is common, not only to them, and numerous other species of *Tineina*, but also to many species of widely separated families of *Heterocera;* and this remark likewise applies to the row of spots around the apex (6 to 13, fig. 1), which, however, are absent in all the specimens of *5punctella*. It is, therefore, evident to me, that Prof. Riley is in error in referring the five Colorado specimens to *5punctella*. Is he equally wrong in denying that they belong to *P. yuccasella?* This question, however, can not be answered by argument, or by assertion, but only by examinations of specimens made; it may be by those "other observers," invoked by Prof. Zeller, for the study of *Pronuba*. I hope to have the opportunity to satisfy myself at least about it in Colorado next Summer, but until then must defer any attempt at a solution of the difficulty. Situated as I was, in Colorado, I could not, and did not, attempt to preserve any large collection of any one species, though in the case of this, the most abundant species that I found there, many were observed; of the comparatively few that I kept, many were destroyed before I reached home.

I have seen traces of *Pronuba* larvæ in seed pods of yuccas at various places in Colorado, but the only place where I collected the imago was *on the plains*, about nine miles north of Colorado Springs, and thence to five miles east of the mountains. It was there that I took the specimens referred by Mr. Riley to *5punctella*. Both the spotted and unspotted forms were found there, *in great abundance, always in company with each other—always in the flowers of the yuccas, never elsewhere—never engaged in feeding, always quietly reposing on the inside of the perianth.* I observed them as they sat in the flowers, and saw *no difference in their appearance, or in their position in repose, nor in their mode of flight when disturbed.* I took many specimens in collecting bottles, killed them, and examined the neuration of the wings of

* The sketch then made is now before me. It is unquestionably the wing of *P. yuccasella;* but unfortunately my notes do not show whether or not it was one of the spotted specimens.

one specimen, which must have *happened* to be a *Pronuba;* many of the specimens showed the unmistakable palpi of the female *P. yuccasella.* My specimens were not all examined however with equal care, and it is *possible* that a more careful examination of every one of the numerous specimens might have shown that there were some specimens of a *Hyponomeuta* among them. I did, however, make a careful examination of many specimens, because as soon as I saw the spotted form it occurred to me just as it did to Mr. Riley, can it be a *Hyponomeuta?* I will not deny the *possibility* that I may have been too easily convinced that it was not; and, as already stated, the point can only be settled by observation, not by argument. What, then, it may be asked, is the force of the facts above referred to in italics? I do not pretend that they are conclusive of the question, especially when opposed to the positive statements of so competent an observer as Prof. Riley. Nevertheless, those facts, and many others yet to be mentioned, do have a bearing on the question, and their bearing will be readily admitted by all who are familiar with the habits of the *Tineina*, and the extent to which unity of habit obtains among species of many genera, *Hyponomeuta* among them. Calling attention, therefore, to the sentences above, in italics, I will add that my collection was made in that neighborhood during the Spring and Summer, during which time the greater part of each day was spent in collecting; that at the place where these species were taken, there was no vegetation other than cacti, grass and yucca. From three to five miles distant, *on the mountains*, were willows, poplars, oaks, and pines. This wooded region was my daily collecting ground, but occasionally I wandered out on to the plains. In this wooded region I took many other species, among them *Anesychia mirusella*, Cham., and *Harpalyce* (Cham. *nec. Streph.*) *tortricella*, species allied to *Hyponomeuta*, *but never a specimen of Pronuba yuccasella, nor of the species referred by me to that species, and by Mr. Riley to Hyponomeuta 5punctella*, Cham. This is not surprising as to *P. yuccasella*, because this was not the locality in which it might be expected to occur; but it is surprising if Mr. Riley is right in refering them to *Hyponomeuta*, because it was *just the locality where one might expect to find Hyponomeuta.** But, on the other hand, out on the plains, three to five miles away from the wooded region, where there was no vegetation but grass, cacti, and yucca, in the flowers of yucca, in company with *P. yuccasella*, and bearing a resemblance so close to it as to require great care and discrimination to distinguish them, are found the specimens which Mr. Riley refers to *Hyponomeuta 5punctella.* There is nothing surprising in finding *P. yuc-*

* And where in fact other species of *Hyponomeuta* were found.

casella there, because that is just the place, and the circumstances and the time when it should be expected to appear. But it is very surprising if the species is a *Hyponomeuta*, because, for reasons presently to be given, that was just the place and the circumstances in which it ought *not* to be expected. And yet, if Mr. Riley is right, and the six specimens seen by him being the criterion, not only is a *Hyponomeuta* found there, in the very domicile of *P. yuccasella*, *but in numbers five to one greater than P. yuccasella itself!—and greatly more numerous than any other species was found anywhere in Colorado!* But why, it may be asked, ought not we to expect to find a *Hyponomeuta* in such place and circumstances.

I have alluded above to the unity of habit among species of this genus. Every species of it, of which the larva is known, feeds as larva on exogenous vegetation, is gregarious, and makes much web. Every collector of these and other *Tineina*, knows that the place to look for a moth is about the food plant of its larva. I was collecting them daily at a time when I could scarcely have failed to find the web and larvæ if they had been there. No trace of either was ever seen in the wooded region, nor was a single specimen of the imago found there; nor was any trace of the web or larva found on the plains where the moth was so abundant. If the larva feeds on either yucca, cacti or grasses, it can not be gregarious, nor make a web (which I must certainly have found had it existed); and, besides, if it feeds on either of these classes of endogenous vegetation, it is the *only species of this* (or I may say of any other well limited and established genus of *Tineina*, such as *Hyponomeuta*) *which feeds on an endogen*, *while all the other species feed on exogens*, and is, besides, *the only recorded instance of a Hyponomeuta ever seen in a flower of any color!* If these specimens, then, belong to *Hyponomeuta*, they differ *tota cœlo* in habits and habitat, both as larva and imago, from every other known species of the genus, and not only so, but they violate the unity of habit which prevails so largely among species of so many genera of *Tineina;* and, already closely allied in structure and ornamentation to *Pronuba yuccasella*, it further mimics it in habit and habitat! A most astonishing case of mimicry.*

But Mr. Riley proceeds: "The spots on *Hyponomeuta* are very variable, while some individuals of *5punctella* are immaculate, when at first sight they might be mistaken for *Pronuba*." He has not been particularly happy in the construction of this sentence. It lacks his

* Mr. Riley gives the expanse of the wings of *P. yuccasella* 1 in. for the male, and .90 for the female. My Colorado specimens ranged from six to ten lines: twenty specimens, male and female, of the immaculate and undoubted *P. yuccasella*, taken by me in yucca flowers, in Kentucky, range from ten twenty-fourths of an inch to twenty-one twenty-fourths of an inch. Curious that the imitation should extend not only to the habit, habitat and ornamentation, but even to the variation in size!

usual perspicuity, and leaves one in doubt whether it is meant to say that all *Hyponomeuta* are very variable, or only that *5punctella* is so. Either way I must dissent from the statement. The species of *Hyponomeuta* are not very variable in the number, and certainly not in the position of the spots. The Colorado species (if it is a *Hyponomeuta*) is an exceptional case. Some variability no doubt exists, as it does in almost all species (always in deference to Prof. Riley, excepting *P. yuccasella*). But when we consider the great number and small size of the spots in *Hyponomeuta*, the wonder is that there is not more variation, especially as to the position and size of the spots. In England three allied species of the genus are found feeding on the same plant (*euonymus*), yet there is no difficulty in distinguishing them. On the other hand, *P. yuccasella* is a single species of a somewhat anomalous genus, and notwithstanding the light which has been shed upon it by Mr. Riley, " dark lanthorn," much no doubt yet remains to be chronicled by " other observers," and I should much sooner expect a wide range of variation in such an extraordinary creature, than in any species of the well known *Hyponomeuta*.

But let us return to our alleged (by Mr. Riley) *5punctella*. We have seen where and under what circumstances it was found. How came it there? Its presence *in such numbers*, and *under all the circumstances*, these could not have been *accidental*. No doubt one frequently meets with a single specimen, or with a few specimens of a species at a considerable distance from any known food plant of the species; but then such specimens are as likely to be found in one place as in another; and are not found in great numbers, and only in the flowers of a single plant, and in company with a species which so closely resembles them; and, besides, such cases are sporadic, not epidemics as in the case we are discussing. The presence of such numbers of the supposed *Hyponomeuta*, five to one more numerous than *P. yuccasella* itself, in a particular locality, in the flowers of yucca, in company with the so-closely-resembling *Pronuba*, and in the absence of every other species, and at such a distance from every kind of vegetation upon which allied species of *Hyponomeuta* feed, either in the larvæ state, or as imago, in the absence too of all evidence that it feeds in any of its states upon yucca flowers, and even occupying the same position in repose in the flowers that the true *Pronuba* does, calls for some explanation different from that which might be satisfactory, if it was an instance of the chance happening of one or of a few specimens under ordinary circumstances. So also the total absence of the species in all of its states from the wooded region, when by every analogy drawn from the history of kindred species, it might be expected to occur, and the absence of all evidence that its food plants and habits as to food differ from

those of kindred species calls for a like explanation. What explanation can be offered? Does it aid in the fertilization of the flowers? Mr. Riley has hitherto claimed for *P. yuccasella* alone, the office of marriage priest to the yuccas. Does the larva feed in any way upon the plant? With all Mr. Riley's diligent observations upon yucca-feeding insects, he has failed to discover this larva, notwithstanding the abundance of the imago. Does the imago feed in the flowers? There is no evidence conducing to establish the fact. In no instance was it observed feeding, but always quietly reposing, like *P. yuccasella*, in the same position with it, and in company with it within the perianth. Was it there for protection? And does it again return to the wooded region where nobody ever saw it, to oviposit, where its invisible larvæ feed on invisible leaves, construct invisible webs, and in time produce moths which are never seen except in the flowers of the yucca, miles away?

But Mr. Riley has foreseen the difficulty; he has foreseen the necessity of accounting for the presence of the *Hyponomeuta* in yucca flowers, with *P. yuccasella*, and under all the circumstances above detailed. His explanation is that "white moths are *naturally* attracted to white flowers, and it is rash to assume, without careful examination, that all white moths found in yucca flowers are *Pronuba*." I have made no such assumption in so many words. If I have made any assumption, it extends no further than these particular moths. But, in point of fact, no white moths, other than these (including the true *Pronuba*) ever have been found there; that is a fact, not an assumption. "White moths are *naturally* attracted," etc., no doubt, if they are attracted at all. "Naturally" explains this phenomenon in the same way that the word "gravitation" explains why a stone falls. It is a word to cover our ignorance of a *vera causa*, and to my mind, the sentence just quoted from Mr. Riley reads much more like a deduction from some theory of "protective resemblance," or mimicry, than like an induction from observed facts; and whatever may be true of other moths, I assert, without hesitation, as to the *Tineina*, that white moths are *not* naturally attracted to white flowers; exactly the reverse is the case. *It is a most extraordinary circumstance to find a white moth of this family in a white flower, or on a flower of any kind.* If Mr. Riley is right in referring these specimens to *Hyponomeuta*, it is the first recorded instance in which a *Hyponomeuta* has ever been found in a flower, white or colored. Nay, further, excepting these Colorado species, and the European *Anesychia decemguttella* (to which I shall refer again further on), two, or at most three, species, no white moth of the family *Tineina* has ever been recorded as being found on or in a white flower. If a single such instance occurs, I have not been able to find a reference to it. But, again, *Blastobasis gigan-*

tella, Cham., is a large and conspicuous white moth, found within a few miles of the place where these specimens were taken, and found only upon the yucca, but always resting on the green leaf blades, never in the white flowers.

Coleophora argentella, Cham., and *Coleophora bistrigella*, Cham., are large, showy, silvery-white moths, found in the wooded region near where these specimens were taken, and at the same time. Why are they not naturally attracted to the white flowers? So as to *Coleophora basistrigella*, *C. artemesicolella*, *C. sparsipulvella* and *Bucculatrix staintonella*, all found in that same region, all white moths, but none of them ever found on white flowers. The fact is, the *Tineina* do not frequent flowers. In the course of ten years of active collecting, and of observations on this family, I have been frequently impressed with this fact; and as to the great majority of species, I have been led to doubt greatly whether they feed at all in the imago state. The few species that do frequent flowers, so far from seeking flowers of their own color, *exhibit a marked contrast with the color of the flowers on which they are found. Coleophora sparsipulvella* above mentioned, is found occasionally on the brown flower heads of *Helianthus. Glyphipteryx montisella*, which is bronzy-gray, mottled, with white and bright metallic tints, also feeds on the flowers of *Helianthus.* In the Mississippi valley, the purplish-bronze *Adela bella* is found on the white flowers of *Celastrus scandens;* the purplish-bronze *Butalis flavifrontella*,* *B. mututella*, and *Coleophora corruscipennella*, are found on the white flowers of asters. *Out of more than eight hundred species of Tineina already known in this country, these just named are the only species that have ever been found on flowers of any color. Pronuba yuccasella* is the only white moth that has been found in this country on a *white* flower, unless Mr. Riley is right in referring the specimens found by me to *Hyponomeuta.* The only other white moth found in this country on flowers is *Coleophora sparsipulvella*, above mentioned, and that is found, not on a white flower, but on the brown flower head of *Helianthus.* In every other instance, the moth is of a purplish-bronze color, contrasting strongly with the white flower. It is the dark moths that are attracted to the white flowers, so far as there is any natural attraction in the case. I have mentioned *Anesychia decemguttella*, a European species. It is sometimes found in England on the flowers, and sometimes on the leaves of *Lithospermum.* The moth is whiteish, marked with black. I do not know the color of the flowers of the *Lithospermum.* It makes no difference what their color may be; the insect does not frequent them because of their color,

* Since this was written, I have also taken this species on flowers of *white* clover.

but because *Lithospermum* is the food plant of the larva, just as *Pronuba yuccasella* frequents the yucca flowers—not because they and it are alike white, but because it there deposits its eggs, and lives there in the larval state. Thus there is not in the whole family of *Tineina* a single instance where a white moth is naturally attracted to a flower because it is white.

Thus far, these remarks apply only to American species. Let us now look to Europe. Running over the *five hundred and ninety species*, described as British, by Mr. Stainton, in the *Insecta Britannica*, vol. 3, in which notes of the habits of the species are also given, *only fourteen have been found on flowers of any kind. Anesychia decemguttella* above mentioned, is one of these, and is the only white one in the number; and we have just seen how and why it frequents the flowers of *Lithospermum*. Of the remaining thirteen, three are brownish golden species of *Micropteryx*, a genus known in this country only by a single little known and doubtful (?) species (*M. pomivorella*, Pack.) Two are greenish bronze species of *Asychna*, a genus not yet found in this country; two belong to *Coleophora;* both are of a greenish-bronze hue, and indeed, one of them, *C. fabriciiella*, has been recognized by Prof. Zeller as indentical with our flower-visiting species, *C. corruscipennella*, Clem., above mentioned; two of them belong to *Glyphipteryx*, and are related to our *G. montisella*, mentioned above as found on *Helianthus*, in Colorado; and three of them belong to *Adela*—greenish or golden-bronze species, allied to our *A. bella*, above mentioned, as being found on *Celastrus;* while the remaining species belong to *Nematois*, closely related in ornamentation, and otherwise to *Adela*.

Thus, out of about one thousand four hundred species of *Tineina* described from this country and Great Brtain, only twenty-two, including *P. yuccasella* (and twenty-three, if Mr. Riley is right as to my Colorado species), have been found on flowers of any kind; of these twenty-three, only four are white species; three of these four are found on white flowers; two of these, *P. yuccasella* and *Anesychia decemguttella*, frequent these flowers, not because of color, but because they are the food of the larvæ, and the remaining species referred by Mr. Riley to *Hyponomenta*, seems to be the only "white moth which is naturally attracted to white flowers." Truly it is a most provoking insect; if it is a *Hyponomenta*, I suggest for it the specific name *paradoxica*, since it can not be *5punctella*. If it frequents flowers of *yucca*, because it is white, and is *naturally* attracted by this color, it is the sole species out of fourteen hundred which does so! If the larva feeds on yucca, it (if it is a *Hyponomenta*) violates all the analogies and the unity of habit so prevalent in the genus and family, and is the only member of the

family that feeds on an endogen, is not gregarious, and makes no web. At any rate, I fear that the statement that "white moths are naturally attracted to white flowers," is a "rash assumption, made without sufficient examination," at least so far as the *Tineina* are concerned. On the contrary, the inevitable conclusion is, that very few *Tineina* visit flowers at all; that a very few of these are white, that a great majority are of dark hues, contrasting strongly with the colors of the flowers on which they are found, and that they all belong to the following genera: *Micropteryx*, *Adela*, *Nematois*, *Butalis*, *Gyphipteryx*, *Coleophora*, and *Asychna*, and visit the flowers to feed thereon, in the imago state, and that to these, we may add, *Anesychia decemguttella* and *Pronuba yuccasella*, which visit them to oviposit, and which feed thereon as larvæ. Must we add our paradoxical species, which visits them in greater numbers than all the rest, for some unknown purpose, which it is to be hoped Mr. Riley will explain? Further, it is well known to all collectors of *Tineina*, that the moths may be looked for, with certainty as to finding them, at the proper time, about the food plant of the larva, and not elsewhere; that the abundance of the imago about a plant, especially when it is as conspicuous elsewhere by its absence, as it is there by its presence, is almost conclusive that it feeds in some way on that plant; and that when the species of a genus, and *a fortiori* a family are numerous, and have similar habits; when, for instance, as in *Hyponomenta*, they are gregarious in the larvæ state, feeding on exogenous vegetation, and making webs, a species making no web, feeding on an endogen, with solitary larvæ, would to say the least of it, be regarded as an anomaly, if not a *lusus naturæ*. Certainly it would be a most wonderful creature if, in addition to these things, it mimicked in ornamentation, size, habit and habitat the species in whose habitat and company it is found, as closely as this species mimics *Pronuba yuccasella*.

On the other hand, if the species has the larval habits of *Hyponomenta*, that is, is gregarious, makes webs, and feeds externally on exogens, then its presence *in such numbers*, and under all the circumstances, in the yucca flowers, with *P. yuccasella*, and miles away from all exogenous vegetation, is no less anomalous and surprising. If the specimens belong to *Hyponomenta*, they are hedged round with inexplicable difficulties, which all vanish if they belong to *Pronuba*. The above remarks, as to the habits of *Tineina*, are not assumptions. They are well established facts, known to all students of the group. Neither can it be pretended that they are hasty generalizations, made without sufficient examination; for the relations of the *Tineina* to plants have received as much attention probably from specialists, as those of any other group of equal value among insects.

I have alluded above to the contrast between the ornamentation of the species above named, and that of the flowers which they frequent; but I do not wish to be understood as taking the position that there is no such thing as protective resemblance (the word mimicry seems objectionable) among insects. Every field entomologist knows that instances are common when the resemblance of an insect to its surroundings must in some degree protect it from its enemies, provided it has enemies of such kind as to make it need such protection, and provided those enemies have no better means of detecting its presence than poor human eyes afford, even when disciplined by years of habit and practice. Neither do I want to place myself in opposition to such naturalists as Wallace, Bates, Belt, Trimen, and a host of lesser lights who advocate some phase or other of a protective theory as connected with the evolution of species. It will not do, however, to assume because there is resemblance that there is necessarily protection from enemies in any given case, unless we know what the enemy is, and that the protection is necessary, and just how the resemblance operates to protect the species; and we have no reason to suppose that the species under discussion have any enemy from which they derive protection, either by their residence in yucca flowers, or by their resemblance to *Pronuba yuccasella.* It is a rash assumption that they frequent the flowers for protection, since there is no evidence that they have any enemy from which such protection is necessary; and since, if there is such an enemy, they would be exposed freely to its depredations; if they have the larval habits of *Hyponomeuta* on the first emergence of the imago from its pupa skin, in its web, in the wooded country, before it betakes itself to the plains and the yucca for protection; and, again, on its return to oviposit there. It must be a remarkable development of instinct which teaches a *Hyponomeuta* to forsake *en masse* the locality where the female oviposits, and the larva feeds, and betake itself to another habitat because it is white, and the flowers are white. Indeed, I find it difficult to believe that this species can have the larval habits of *Hyponomeuta*; and equally difficult to believe that a *Hyponomeuta* can differ so widely in habit and habitat from all other species of the genus for the sake of protection. or for any other reason. Beside, I find nothing in the natural history of *Tineina* to support any phase of a theory of mimicry or protection resemblance, whatever may be found in any other group of animals. Some dark-colored, nocturnal species, which hide in out-of-the-way places in daylight, may, thereby, escape some enemies, to fall perhaps into the jaws of others which love darkness like themselves. But great numbers of them are brilliant, gaily-colored little creatures, loving the sun light, resting upon palings, walls, trees and leaves, as if they sought to display their gay colors by the contrast.

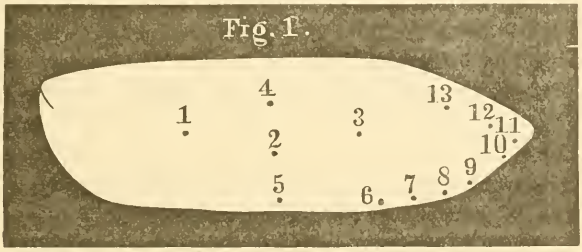
The species of *Hyponomeuta* are white, adorned with small black spots to set off their white ground color to greater advantage, like the patch of an Elizabethan dame, or a modern belle, and contrast strongly with the dark surfaces of palings, and the bark of trees, where they are usually found resting. Neither can it be claimed for many of the gaily colored *Tineina* that they have any such means of protection as a disagreeable smell or taste, since many of them fall victims to predacious *Diptera*, saltatorical spiders, and larvæ of *Hemerobious* and *Chrysopa*, which frequent the same localities and prey upon them.

But I have gone much more fully into this subject than I intended. It is not my purpose in what I have written to attempt to establish by arguments from analogy what is properly matter of occular demonstration. But the facts that I have alluded to, and the conclusions drawn from them, seem to me to have a bearing on the question, and as many of them have not heretofore been published in a connected form, I have taken advantage of Prof. Riley's paper, *not for purposes of controversy*, but as a text for these remarks on the habits of these little moths.

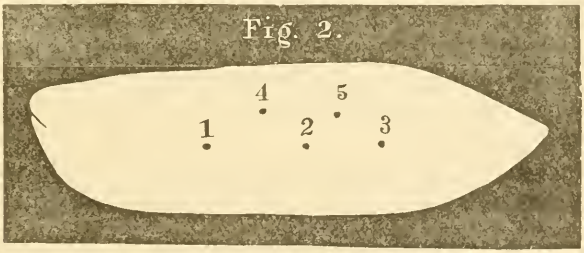
There are, however, one or two other points in Prof. Riley's paper, apart from the identification of these species, to which I wish to allude.

Dr. Baird has somewhere (I write now from memory) advanced the theory or hypothesis, that the birds of the West are larger, with greater development of *peripheral* parts, and greater depth or intensity of color, than the equivalent species in the Eastern States; and Dr. Packard, in Hayden's Report, for 1873, had suggested that the same rule applied to insects; and in a paper in the *Bulletin*, before referred to, I had come to a different conclusion as to the *Tineina*. Commenting on this, Mr. Riley writes: "Mr. Chambers' premise being at fault, there is of course no force in what he says against the general rule laid down by Baird and Packard." What premise, may I ask, is at fault? *If* I had based my conclusion on the single instance of *P. yuccasella;* and *if* all the specimens examined by me, and referred by me to that species, had belonged to *Hyponomeuta*, then my premise would most certainly have been at fault. But that was not my premise, nor anything like it. On the contrary, many of my specimens had the unmistakable palpi of the female *yuccasella*, and one of those seen by Mr. Riley is admitted by him to belong to that species. Mr. Riley writes as if my conclusion, adverse to the hypothesis above referred to, was based upon the solitary case of *P. yuccasella*, and then says my premise is false, while he utterly overlooks the fact that in the very same paper in which I discuss this hypothesis (*Bulletin*, v. 3, p. 147), I passed under review all the known species (some seventy odd in number) of *Tineina* of Colorado; and while admitting that two or three species (notably *Blas-*

tobasis gigantella, with its long, narrow wings, and strong flight) seemed to support the hypothesis, yet the testimony of the *Tineina* generally was against it, though "the *Tineina* as a family is not well adapted either to the proof or disproof of it." The entire known species of *Tineina* of Colorado formed my premise—not *P. yuccasella*, Riley, alone; and I submit that the premise is not invalidated by what Prof. Riley has written about *P. yuccasella*. "But," Prof. R. writes, "the



Colorado specimens (of *P. yuccasella*) are above the average size, which is *natural*, since the capsules of *Yucca augustifolia*, in which the Colorado specimens breed, are larger than in other species, etc." Just as *natural*, no doubt, as it is for white *Tineina* to be attracted to white flowers. Is the size of an insect to be measured by the size of its food plant? Is a codling moth from a big apple *naturally* larger than one from a small apple? Nobody denies that a deficient supply of food may tend to dwarf an insect, or a man, but is the supply in the capsule of any species of yucca small enough to dwarf the moth? Beside, Prof. Riley's explanation of the alleged slightly-greater



average size of the Colorado specimens—that it depends on the greater size of the seed capsules—does not in any way support the hypothesis (of Baird and Packard) alluded to, which has nothing to do with supply of food, in which respect western species certainly have no advantage over eastern ones, but is based upon supposed metereological and climatic causes; and Prof. Riley's language that "the Colorado specimens are, *if anything* a *little* larger," does not allow much for the in-

fluence of the supply of food, or indicate any very accurate measurement.

Prof. Riley seems to attach some importance to the fact that my remarks on the spotted form of *Pronuba* occur on "the very first page" of my paper in the *Bulletin*. I fail to see what difference it makes whether they occur on the first or the last. Prof. Riley is certainly familiar enough with the classification of the *Tineina* to know that *P. yuccasella* is the highest form treated of in that paper; and that arranging the species systematically, I began with the highest, *Pronuba*, and ended with the lowest, *Nepticula*.

Explanation of the Figures.—Fig. 1 shows the position of the spots in the Colorado species; fig. 2 shows the position of the spots in *Hyponomeuta 5punctella*.

The figures are not intended to show accurately either the form or neuration of the wings, only the position of the spots.

As to the Colorado species, I find in my notes the following statement in addition to what I have published in the *Bulletin* as before mentioned: "The vertex is somewhat roughened, the antennæ are not quite half so long as the wings, and have the apical half naked." In *Hyponomeuta*, and I believe also in *Pronuba*, the apical half of the antennæ is clothed with scales. I am not, however, certain as to this about *Pronuba*, of which I have no specimen now in my collection, and Prof. Riley makes no statement about it in his diagnosis of the genus. Nor do I know that my note applies to all the specimens examined by me. If it does, and the antennæ are clothed in *Pronuba*, the species taken by me would seem to differ in this respect both from that genus and from *Hyponomeuta*. In *Hyponomeuta* the antennæ are a little more than half as long as the wings, and the antennæ of *Pronuba* are said by Prof. Riley, in his diagnosis, to be not more than half as long as the wings. In *Hyponomeuta* the head is, as in the Colorado specimens, "somewhat roughened;" while in *Pronuba*, Prof. Riley says it is "sparsely haired."

ON THE DEFORMITIES OF SOME TENNESSEE HELICES.

By A. G. Wetherby.

During the past season, while engaged in making collections on the Cumberland table-land of Tennessee, various species of *Helix* were found in the cliff regions to exhibit wide variation from the normal type. An instance of this may be found in the *H.* (*Triodopsis*) *ap-*

pressa, Say. Beside the forms familiar to our collectors about Cincinnati, there occurs one in the southern part of Kentucky, and which seems to be distributed down the Cumberland plateau and its outliers nearly to Emery Gap, smaller in size, thinner in texture and very heavily ribbed, like the *H.* (*Patula*) *alternata*, var. *mordax*, inhabiting the same range. As is the case with the variety of this species inhabiting our neighborhood, it is occasionally found about old logs, but its favorite station seems to be among the broken rocks forming the talus of the mountain cliffs. Here, in wet weather, they may be collected by thousands, as they could have been at one time on certain stone walls, and in certain cellars of this city; localities that, owing to the active search of unsatisfied gormands, have been practically exhausted, a fate luckily never in store for these mountain fastnesses.

In Union county, Tennessee, and extending southward through the great eastern valley, we find a very different variety of the same species. The shells are much larger than either of the other varieties, entirely wanting the ribbed character, and exhibiting much fainter lines of growth than characterize the Cincinnati form. This variety I found this summer inhabiting the caves and rock crevices of Lookout Mountain, where it is removed from its normal range. In considering the causes which have led to these wide variations, we may possibly account for the larger growth of the Cincinnati and East Tennessse Valley varieties, by quoting the old theory of limestone regions. I have elswhere shown, however, that many of our common species reach their maximum growth in sandstone regions, though the larger size seems to be somewhat compensated by the paucity of individuals. Even this rule fails, in fact, in many cases. But as to the cause of the development of the ribs, and the unnatural flattening of the spire, it is quite impossible to offer any certain conjecture. However, the result of an hour's collecting, in one of the many *tali* along the eastern front of the Cumberland plateau, presented a few curious features. These specimens were hastily and indiscriminately picked up from among hundreds crawling over the rocks, thrown into alcohol, and not examined until my return. So soon, however, as I began looking at them more carefully, I was struck with the number and extent of the deformities which the shells exhibited. The number of specimens is 129, and the number of deformities 43, or 33⅓ per cent. Many of the specimens exhibit two deformities, one of which affects one part of the shell, another quite a different part. I have, therefore, tabulated the injuries as follows :

1. Number of deformities of spire, 17.
2. " " " " umbilical region, 15.
3. " " " " aperture, 18.

4. Number of deformities of peristome, 22.
5. " " " " under surface, 12.
6. " " " causing open umbilicus, 2.
7. " " " " double peristome, 2.
8. " " " " dwarf specimens, 2.

Under the first case the deformities consist of a depression of the spire, in some cases, and its unnatural elevation in others, caused by the crowding together of the whorls. In a few specimens, the center of the spire is depressed below the plane of the body-whorl. In such cases the injury to the shell occurred at a very early period, retarding the growth of the incipient whorls. After recovery, the healthy growth of succeeding whorls overtops the spire. Damage occurring to the fourth whorl has caused the downward growth of the fifth, elevating the spire abnormally, and throwing the last suture below the central line of its whorl in the region of the aperture. This case is not uncommon, and the abnormal form arising from it seems to be perpetuated. In many instances the spire has been roughened, and the whorls abnormally angulated at certain points, damage from which they have entirely recovered further along in their growth.

Under the second case, the deformities consist of the abnormal depression of the umbilical region or the reverse. A prevention of the reflection of the peristome over the umbilicus, leaving it entirely open in two cases, and partial elevation of its edge in others, though not enough to expose the aperture.

Under the third case, the deformities consist of the abnormal thickening and roughening of the lip; of undue sinuosities; and of doubling in the two cases tabulated above. This thickening, in many cases, causes callosities on the lower third of the peristome, near the umbilical region. In the normal condition of the shell there is a lamellar tooth on this part of the peristome, which, being irregularly deposited, gives rise to the deformity mentioned. This case, also, seems to be perpetuated, and to have given rise to a wide spread variety, familiar to all students of this species. The fourth case is the result of the first and third. Abnormal elevation or depression of the spire, causing an unnatural angle of the terminal whorl, together with a sinuous peristome, have given rise to many curious forms of aperture. Thus, it is sometimes very unnaturally lengthened horizontally and depressed vertically; sometimes very much elongated vertically, and correspondingly shortened in the opposite direction. The angle at which the outer plane of that portion of the peristome above the aperture meets that below, varies from a right to a very acute one. These causes give rise to a very great variety of forms in the aperture.

Under number five the injuries have been such as already stated in

the umbilical region, and various distortions, roughenings, and plications of the surface, resulting from fracture and repairs. In all these various cases the adult deformities have added the parietal tooth, the lamella to the peristome, and the widely reflected lip of the species. It now remains to discuss the causes of these injuries, and the probability of their genetic perpetuation. A talus of loose rocks, situated upon a declivity, is more or less constantly moving. If it has any period of comparative quiet, it is during the summer or dry season of the year. At all times there is more or less liability to damage, threatening the molluscan denizens of these protean retreats by the dropping of detached masses from the overhanging cliffs; and these masses are more apt to be detached during the wet season of the year, and especially in spring, after the freezing and thawing of winter, than at any other period. But this is precisely the time, also, when these creatures are most active, and have come from the deeper portions of the talus, a region of comparative safety, and are crawling over its surface.

In spring and winter, also, there is a sliding and moving of the whole mass by reason of the freezing and thawing, during the progress of which many of the shells are crushed and otherwise damaged. If, then, 33⅓ per cent. of specimens taken at random are so variously deformed, we may, perhaps, rightly infer that a long continuance and repetition of injuries of a like character, through many generations, would give rise to abnormal varieties. While accidental morphological characteristics are not likely to be perpetuated; and while general analogy stands in the way of the suggestion, the character of hermaphroditism, and the mutual fecundation of individuals abnormally alike, may present to such as choose to investigate this subject further, a key to some of the mysterious characteristics of this mountain molluscan fauna. At all events, we have numbers of specimens, entirely uninjured, exhibiting slight modifications of some of the characteristic deformities described above, and the constant repetition of accident renders the likelihood that its results will be persistently reproduced much more probable than in the accidental cases of deformity which we observe under ordinary circumstances.

Specimens are found with the spire very much elevated, the sutures abnormally impressed, and the general outline very different from that of the species in its ordinary form. Others are much flattened, more carinate on the body-whorl, and equally far removed from the types of the species. Beside, it is in these regions that we meet with the widest variation from the normal type, in many species, beside the one now under discussion. Here occur the carinate and flattened species of *Stenotrema*, the heavily ribbed and carinate species of *Patula*, and the only sharply carinate *Triodopsis*.

Among the first, the common habitat of the *S. spinosum* and *S. edgarianum* is between flat rocks, where I have often seen the former congregated by hundreds, the dead and living being found together in a common mass. Of similar habit, and associated with them, was the rare *P. cumberlandiana*, the rocks being apparently without any moisture, and the living snails having an epiphragm over the mouth of the shell, as during the winter period of hibernation. The least sliding of the rocks must damage numbers of specimens.

There is another evidence in favor of the inference which may be drawn from the facts given in this article. The species of *Stenotrema* not inhabiting such situations, exhibit none of these peculiarities. They vary in size, but there is no abnormal development or depression of the spire, nor any approach to the carinate types.

The *Patula* group presents the same fact, as the common *P. alternata* exhibits no wider variations in the mountain regions than characterize it elsewhere (the variety *mordax* not being included). Among the species of *Mesodon*, *Zonites*, *Triodopsis*, etc., the cases of abnormal variation are confined to coloration and size, and not to form, except in the case of the *T. obstricta* above noted.

Moreover, in regions remote from these influences, we do not find the number of varieties which here exist, and the species under any type, which are furthest removed from it, will be found in those localities where the liability to some accidental interruption of the ordinary process of growth becomes more frequent. While such circumstances of environment as may arise from sudden changes of climate, abundance or scarcity of food, the prevalence or absence of foes, and the multitude of other causes which are usually cited may have assisted in this work, I feel confident that we can trace to the more direct one of *habitat* the reason for many of the varieties in our Mollusca; nor would I confine these statements to the terrestrial tribes alone, but extend them to the numerous denizens of the mountain streams flowing through the same region, that have offered to the ambitious makers of species such an exhaustless fountain from which to multiply synonymy and confuse the true seeker after truth.

The wide range of varieties among the shells collected by Mr. Hemphill in the canons of Utah and Idaho, is very suggestive in this connection. There are, also, several species from mountain lands in Europe, of whose habits I know nothing, save that they are inhabitants of the Alps, Pyrenees and Carpathians, that differ so far from the type with which they are classed as to point in the same direction. Whether these cases are parallel or not, there is here abundant room for a speculation if for nothing more; and it seems that the weight of evidence is in favor of the suggestions which I have thus hastily indicated.

THE JOURNAL

OF THE

CINCINNATI SOCIETY OF NATURAL HISTORY.

VOL. 1. CINCINNATI, JANUARY. No. 4.

PROCEEDINGS OF THE SOCIETY.

The Cincinnati Society of Natural History held its regular monthly meeting, September, 3, 1878.—President Chambers in the Chair. The minutes were read and approved.

The following named persons, having been favorably reported upon, were elected to regular membership : R. H. Holbrook, S. S. L'Hommedieu, N. W. Lord and J. A. Thacker.

F. W. Langdon read, by title, a " Revised List of Cincinnati Birds." Prof. Stone made a verbal report on the late solar eclipse.

Donations were received as follows : From W. B. Foster, a valuable collection of fossils and minerals ; J. R. P. Brown, quartz crystals ; Chas. Dury, two eggs of Bullock's Oriole ; J. A. Hughes, three specimens of Orthoptera ; J. W. Shorten, eight coleopterous insects; Hon. M. Sayler, *The Mineral Resources of the West ;* Dr. O. D. Norton, a pipe.

A motion was made, and unanimously adopted, thanking Mr. W. B. Foster for the valuable collection he had just donated.

Society met, October 1, 1878,—the President in the Chair. The minutes were read and adopted.

Prof. Wetherby made a verbal report of his examination of the rocks along the Cincinnati Southern Railroad, near the Kentucky River, and in the vicinity of the Mammoth Cave, especially directing attention to the fossils he had found, and to the geological position of the strata. An animated discussion followed, in which the following persons took part : V. T. Chambers, Dr. Young, F. Braun, and J. Mickleborough.

Donations were announced as follows : From J. W. Hall, Jr., twenty specimen fossils of the Waverly Group ; Dr. Chas. Reed, an eight-

legged kitten ; F. Eckstein, thirty-three Histological Stides ; Dr. J. H. Hunt, three slides of Diatoms ; Chas. Dury, two specimens of skins of *Dendroeca virens ;* from the Natural History Society of Glasgow, its proceedings, Vol. 3, part 2 ; *American Inventor*, Vol. 1, Nos. 1–9, inclusive ; J. B. Pearce, Secretary of the Board, *2d Geological Survey of Pennsylvania*, books Q and R ; publishers, *Scientific American*, Vol. 39, Nos. 10 to 14 ; *Canadian Entomologist*, Vol. 10, No. 8 ; *Polytechnic Review*, Vol. 6, Nos. 10, 11 and 12 ; *Psyche*, Vol. 2, Nos. 47 and 48 ; *American Journal Microscopy*, Vol. 3, Nos. 1 to 9 ; *Proceedings Central Ohio Scientific Association*, Vol. 1, part 1 ; *Science Observer* for September ; *Quarterly Journal of Conchology*, Leeds, England, Vol. 1, Nos. 11 to 15.

Society met November 5, 1878,—the President in the Chair. The minutes were read and adopted.

Regular members were elected as follows : Dr. F. Kebler, Dr. R. Sattler and Mr. Edward M. Cooper.

Prof. A. G. Wetherby read a paper on "the Deformities of Some Tennessee Helices," also "a Description of a New Genus of Lower Silurian Crustacea."

S. A. Miller, Esq., called attention to a collection of Cystideans of remarkable beauty and size, including some new species, all recently found in the Niagara Rocks of Indiana.

The death of Mr. J. C. Shroyer, the librarian of the Society, was announced ; also the death of Hon. J. H. Klippert, long a corresponding member of this Society. On motion, a committee was appointed to draft resolutions pertinent to the occasion.

The Society met December 3, 1878,—Vice-President L. S. Cotton in the Chair. The minutes were read, corrected and approved.

Messrs. James Bindley and J. R. P. Brown were elected regular members.

Mr. E. O. Ulrich read a paper on a re-classification of fossil corals, and Mr. James F. James a catalogue of plants, ferns and fungi of the vicinity of Cincinnati.

A special meeting of the Society was held Jan. 23, 1879,—L. S. Cotton, Vice-President, in the chair. On motion of S. A. Miller, Esq., it was

Resolved, that a committee of ten, who take a special interest in the study of the Lower Silurian Rocks of South-western Ohio, South-eastern Indiana, and Kentucky, be appointed, by the chair, to report to this Society upon what seems to them to be the correct nomenclature of these rocks.

For the Committee's Report, see page 193.

NOTE TO THE PAPER "ON THE TONGUE (LINGUA) OF SOME HYMENOPTERA" (*ante* p. 40).

By V. T. Chambers.

I wish to correct one or two errors into which I have fallen in the paper above referred to. That paper contains numerous typographical errors, arising probably from want of skill or carelessness in correcting the proof-sheets, such for instance, as: *Reaumer* for *Reaumur*; *Burmiester* for *Burmeister*; *Hymenopterad* for *Hymenoptera*; *De-Gurn* for *DeGeer*; *Emunidæ* for *Eumenidæ*; *Amophile* for *Amophila*; and *Zytocopa* for *Xylocopa*; but these, though disfiguring the paper, are so palpable as scarcely to need correction.

A more important error is on page 43, where the pharynx is mentioned as being *under* the hypopharynx and epipharynx; instead of *under* read *above*, or perhaps more correctly, *behind*.

A still more important error is the statement on pages 49 and 50, that the diameter of the tube in the tongue of the hive bee, at its narrowest point, is *1-500th of a line*, and in some of the *Andrenidæ* is *1-1000th of a line*. For *line* in these passages read *inch*. I am at a loss to account for this misstatement. I have heard it objected that even the 1-500th of an inch is too small an aperture for effective use, but this is a mistake. In the greater number of *Lepidoptera*, *Diptera*, *Hemiptera*, *Homoptera*, the diameter of the suctorial organ will not be found to be greater than 1-500th of an inch. In a large *Aphis*, I found it to be about 1-1000th of an inch. The presence of pollen in the tube of a bee's tongue (a very common occurrence when the bee is killed immediately after being taken on a flower) demonstrates the fact that the capacity of the tube is large enough.

But further and more careful study have convinced me that it is only in the *Apidæ* that the tongue is a sucking tube, and that it is not so in the *Andrenidæ*. In these, while it is true that the rod is tubular, the tube gradually narrows toward the apex, and entirely disappears just before reaching it, so that the apex is a very fine, imperforate point in the *Acuti lingues*. Indeed, considering this fact, and the shortness of the hairy part (the true lingua or tongue), and the distance which the nectar would have to ascend along the smooth, outer surface, first of the mentum, and basal joints, when the tongue is fully extended before it reaches the pharynx; it is difficult to comprehend how these bees can take liquid food either by suction or by lapping. The only way that I can conceive it possible is that the nectar is first lapped up by the short, hairy tongue, and that the mentum and basal joints are then folded back so as to bring the tongue within reach of the

mandibles, by which it is scraped, after the manner suggested by Mr. Wood, and alluded to, *ante* p. 46. I confess though, that I do not understand how the tongue can be brought between the mandibles. That these bees *(Andrenidæ)* do take nectar from flowers is certain, however, both from seeing them in the act of probing for it, and from seeing it flow to and fro the pharynx and the tongue through the mentum. And although there is in the *Andrenidæ* no membraneous sack in the lingua, as there is in the *Apidæ*—at least none that can be made to protrude from the hairy sheath—and though the sheath is firmly attached to the tubular rod throughout its entire length, its hairs adhering to the rod so as to greatly obscure it, and probably give rise to erroneous interpretations of its character: yet the peculiar glands and organ which are found in the mentum and basal parts of the trophi of the *Apidæ*, and which are most probably connected with the elaboration of honey, are found more or less modified in the *Andrenidæ;* and indeed in the trophi of all of the aculeate *Hymenoptera* that I have examined. These organs are very pretty and peculiar structures, and their investigation will amply repay any of our microscopists who are looking for "fresh fields and pastures new." The field, however, is not strictly new, though comparatively untrodden, as, since the publication of the paper to which this note is additional, I have learned from Dr. Hagen, that Wolff and Fritz Müller have each been before me in demonstrating the tubular character of a bee's tongue, the former in *Apis*, and the latter in *Melipona*. The last edition of the *Encyclopædia Britannica* (art. *Bee*), however, persists in the error that a bee's tongue is not tubular, but is solid.

DESCRIPTION OF A NEW FAMILY AND GENUS OF LOWER SILURIAN CRUSTACEA.

By A. G. Wetherby.

[Read before the Cincinnati Society of Natural History, November 5, 1878.]

In the *American Journal of Science and Arts*, Vol. III. (3d series), p. 423, 1872, Prof. Meek published the description of a new fossil from the Lower Silurian rocks at Cincinnati, based upon two specimens found by Prof. G. W. Harper, of this city. One of these is now in the collection of Mr. C. B. Dyer, and the other in the Yale College museum. It was some years before further examples of this remarkable fossil came to light, but another specimen was finally discovered by Mr. Geo. Vallandigham, which is now in the collection of S. A. Miller, Esq., and still another, by Mr. W. J. Patterson (Plate I., fig. 5) now in his collection. These two specimens show few features in

addition to those given by Prof. Meek. More recently, a much larger and more perfect specimen (Plate I., figs. 3 and 4) was found by Dr. A. J. Newton, of Richmond, Indiana, which adds several interesting facts. Finally, the discovery, by the writer, of still another specimen (Plate I., figs. 1, 2, and 3), containing the entire posterior portion of the animal, enables us to clear up many of the remaining obscurities. It is now certain that this curious creature was not a *Cystidean*, but a *Crustacean ;* and that what Prof. Meek mistook for "plates" are in reality the tergal, pleural and sternal elements of the thoracic somites; and the supposed "column" of his specimens, a few segments of the abdomen, which is entire in the example found by the writer.

From a study of the specimen found by Dr. Newton, we are able to determine the form of the somite in front of the one described by Prof. Meek; and also, owing to its excellent preservation, to correctly understand the parts of others, as well as the articulation of the thorax with the abdomen, and the nature of the somites of the latter; while the specimen discovered by myself exhibits most of these facts, and adds that of having the abdomen complete *with its appendages.*

It is now clear, that the part supposed by Prof. Meek to represent the body of the *Cystidean*, is the posterior somite of the thorax of a *Crustacean*, of which the body exhibits its proper division into thorax and abdomen, and that the specimen found by Dr. Newton is probably preserved to the cervical groove, separating the thorax from the cephalic segments, the former consisting of the two somites described at length below. No portion of the head, and none of the cephalo-thoracic appendages have been found.

Enoploura, nov. gen.

Body divided into two distinct regions, the thorax* and abdomen. Somites of the former consisting of well-defined tergal, epimeral, episternal and sternal elements, separated by distinct sutures. Tergal element of the last and sternal element of the preceding somite, not centrally anchylosed. Episternal element very largely developed, and strongly carinate on the median line, which forms the lower, outer angle of the somites. Epimera largely developed, and forming the lateral portions of the dorsal surface. Abdomen oval in section, dorsally and latero-centrally sub-carinate at the sutural lines; composed of fourteen somites, the terminal five bearing longitudinal median processes on the center of the sterna, while the sixth bears a large transverse process, arising from the epimeral region of either side, and con-

* At present, it seems best not to use the divisions cephalo-thorax and post-abdomen.

tinued over the sternal arch, and also a flattened and excavated longitudinal process, which extends forward over the sterna of the somites immediately in front. Somites of the post-abdomen short, with articular surfaces allowing great freedom of motion. Head and lateral appendages unknown.

This genus is characterized by the extraordinary development of the epimeral and episternal elements of the thoracic somites, by the vertical median processes on the ventral side of the last segments of the post-abdomen, the large anchor-like process preceding them, and by the alternate anchylosis and sutural separation of the thoracic sternal and tergal elements.

While the removal of this fossil from the *Cystidea* to the *Crustacea*, under a new class and genus, would be found a sufficient excuse by many writers, under cover of which to plunder this eminent author of his species, I shall retain his expressive name, and leave the species to his credit.

Enoploura balanoides, Meek.

Body concave ventrally, convex dorsally, and composed of somites divided into dorsal, lateral and ventral regions, by well-defined sutures. Surface irregularly granulose. Sternum of posterior segment of the thorax divided mesially, widened and excavated posteriorly, narrowed in front. Episterna largely developed, the lower part meeting the sternum, the upper flexed, nearly at right angles, and meeting the epimera. Epimera widened behind, slightly excavated on the interior angle, narrowed in front, and extending to the central lateral angle of the heptagonal tergum, where they join the epimera of the next somite. Tergum heptagonal, convex above, slightly carinate on the median line, somewhat excavated posteriorly. Sternum of next somite mesially anchylosed. Episterna as before, but more developed ventrally. Epimera trapezoidal, widest in the middle, and tapering to a point in front, which lies in the angle formed by the outer edge of the tergum and the inner edge of the episternum. Tergum not mesially anchylosed, narrowed behind, widened before, the anterior extremity being lost in all the specimens. Post-abdomen made up of fourteen distinct, short, loosely articulated somites, the first eight of which bear no appendages; ninth bearing a large transverse process, arising at the epimeral suture of either side, and bending forward so as to look toward the head of the animal; from the base of this process springs a longitudinal one, extending forward and overlying the sternal region of the somites immediately in front, which are somewhat crowded forward and flexed to receive it. The remaining somites bear longitud-

inal median projections of their sterna, which point outwards when the abdomen is flexed upward. Evidences of the tergal, pleural and sternal sutures of the abdominal segments remain. Lateral appendages, and anterior portion of body unknown.

Among the palæozoic representatives of the anomalous class to which our fossil belongs, those of most interest to us in this connection are the *Trilobita* and *Eurypterida*, forming, as they do, the most important evidence relating to the extinct *Crustacea*. It is not certain that either antennæ or feet have been found with the remains of the former, nor is anything known of other than the tergal and pleural portions of the somites. No sternal element or body-wall has been found, and no certain evidence of any appendages. The thoracic somites have the cuticular portion of the pleura folded inward, so that, in well-preserved specimens, it may be seen to cover a portion of their sternal surface. But as this hardened inner portion of the pleura never extends to the sternal region, and as no sternal arch is ever found, it is probable that this portion of the somites was perishable. In this aspect of the case, as well as in most others, the *Trilobita* threw no light on the affinities of the fossil herein described. The case is somewhat different with the *Eurypterida*. These giants of the *Merostomata* offer some suggestive facts which will now be briefly considered. The appendages, both in *Pterygotus* and *Eurypterus*, are carried by a comparatively short cephalo-thorax. This region of the body is followed by a large number (twelve or thirteen of abdominal segments) terminated by a long telson. None of these bear any appendages. A glance at any specimen or good figure of these genera, will show that if a comparatively small portion of the body were lost anteriorly, we should be left entirely to conjecture as to the nature of all the appendages, and it seems not unlikely that our fossil may be characterized by the same peculiarity. At all events, as these fossil Crustaceans combined characters belonging both to the *Merostomata*, and to the *Copepoda* among the *Entomostraca*, it is not unreasonable to suppose that *Enoploura* may have been equally indefinite in phylogenic relation. If, as seems clear from the investigations of Mr. Spence Bate and others, the normal number of segments in the typical Crustacean is twenty, we have but four somites of the body in our species as yet undescribed; but it must not be forgotten that among the *Entomostraca*, the number of somites may be greater or less than this, while the *Branchiopoda*, closely united to the lower *Podophthalmia*, through such forms as *Mysis*, have also a greater or less number of somites than the typical Crustacean; thus *Nebalia* has twenty-two, and *Apus glacialis* twenty-six, in the thoracico-abdominal region alone. Con-

sidering the early appearance of this Genus, and the anomalous character of many divisions of the class to which it belongs, it may be readily understood, that any seeming variations which this fossil presents, when compared with palæozoic *Crustacea* better known, instead of tending to rise doubts as to its zoological position, become striking evidences of the modifications which pertain to fossil as well as recent *Crustacea*, thus leading us to seek the true relations borne by these ancient races to the forms now living, and to their contemporaries of the palæozoic seas.

While a casual glance at this fossil calls to mind the forms of the pedunculate *Cirripedia*, there is no relation whatever between them, more than that which belongs to creatures of the same class. Nor is it attempted, at this time, to assign this fossil Arthropod to a nearer position than is suggested by the facts given in the description of the Genus hereby established. A thorough study of numerous specimens, and of those bearing remains of the appendages, is necessary before a closer relationship can be with certainty assigned. The two specimens found by Prof. Harper, occurred at about three hundred and fifty feet above low water of the Ohio river, at Cincinnati. Those found by Mr. Vallandigham, at about four hundred feet. Mr. Patterson's specimen was found at Oxford, Ohio, and Dr. Newton's in the upper part of the Hudson River Group, at Richmond, Indiana. The specimen found by the writer was from the same horizon as the last, near Osgood, Indiana. Mr. S. A. Miller has in his possession specimens of the same Genus, and apparently of the same species, from the Trenton rocks of New York. Mr. Braun, the well-known collector, has a slab containing several specimens, apparently of a different species, in which the number of abdominal segments is much greater, and two of which seem to exhibit remains of the lateral appendages. These specimens were found in Indiana. As the slab also contains several fine specimens of *Heterocrinus subcrassus*, they are probably from the upper part of the Hudson River Group. The range of the genus is, therefore, as at present known, from the Trenton through the Hudson River Group. It is not improbable that the forms in Mr. Braun's collection may, with careful study, give us additional facts in regard to this remarkable Crustacean, which is not only the type of a new Genus and Family, but, no doubt, of a new Order also.

The absence of pores, of pectinated rhombs, of any indications whatever of an ambulacral system, and the fact that these fossils accord in no way with any character of the *Cystideæ*, either figured or described, makes it somewhat remarkable that they should have been referred to the *Echinodermata*.

A REVISED LIST OF CINCINNATI BIRDS.

By Frank W. Langdon.

The favorable reception accorded to the original list[1] of the Birds of this vicinity, and the numerous additional facts relating to the subject that have accumulated since its appearance, have seemed to warrant the inference that its complete revision would be an acceptable contribution to the Natural History of this locality. It has, therefore, been thoroughly revised and remodeled, and the following list is believed to represent the present state of our knowledge of "Cincinnati Birds," so far as their local distribution is concerned, as well as the later conclusions of the most approved authorities in respect to classification and nomenclature.

For important additions to the list, and other information, I am especially indebted to Mr. Charles Dury, of Avondale, whose extensive ornithological collection contains many of our rarer species; Dr. R. M. Byrnes, Dr. J. H. Hunt, Dr. H. H. Hill and Mr. John W. Shorten, of Cincinnati; Dr. Rufus Haymond and Mr. Edgar R. Quick, of Brookville, Ind., and the several other naturalists elsewhere mentioned, have also contributed notes and observations of interest. Acknowledgements are likewise due to Professor J. M. Wheaton, of Columbus, O., whose writings on Ohio Birds are frequently referred to; to Mr. Robert Ridgway, of the Smithsonian Institution, who has kindly furnished me with various recent ornithological papers bearing on the subjects of classification and nomenclature; and to Mr. William H. Whetsel, of Madisonville, for interesting additions to my collection.

The collections and observations upon which the list is based, have been chiefly made at two or three points, in the territory lying between the Great and Little Miami Rivers, and within ten or twelve miles of the Ohio. These limits are only exceeded in the case of the thirteen species identified by Dr. Haymond and Mr. Quick, at Brookville, Ind.;[2] and as these are mainly migrants on the Whitewater, which, at its confluence with the Great Miami, approaches within twenty miles of Cincinnati, they are fairly entitled to a place in our list on inferential grounds at least.

Although not characterized by extraordinary topographical features, the south-western corner of Ohio presents a pleasing variety of surface

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1 "A Catalogue of the Birds of the vicinity of Cincinnati," with notes, by Frank W. Langdon.—Salem, Mass., The Naturalists' Agency.—April, 1877.

2 Brookville, Ind., is about forty miles northwest of Cincinnati.

and productions that is exceedingly favorable to the development and maintenance of a highly diversified fauna; and in respect to the number of species represented, its Avian-fauna will compare favorably with that of other North American inland localities in the same latitude. Moreover, it has been well established that river valleys, owing to their luxuriant vegetation, and, consequently, abundance of insect life, are favorite routes of migration with birds,—this being especially true of those valleys extending in a general north and south direction; situated therefore, as it is, in the midst of a highly cultivated section, and traversed by the fertile valleys of the two Miamis and the Whitewater—here converging toward the Ohio, this locality is doubtless one of the most prominent concentrating and distributing points in the Ohio Valley for many migratory species.

The classification and nomenclature have been brought down to date so far as practicable; the "Land Birds" being arranged in accordance with "North American Birds" by Baird, Brewer and Ridgway; the "Water Birds" according to Dr. Coues' "Key" and "Check List." The changes in nomenclature which have been required since the publication of these works, have been duly noted in the present list so far as the literature at hand would admit, and the authorities referred to in the accompanying footnotes.

The nomenclature of the higher groups is that proposed by Dr. Coues, and adopted by Baird, Brewer and Ridgway in "North American Birds." In this arrangement, Dr. Coues recognizes two primary groups of existing birds,—the Ratitæ or Struthious Birds and their allies, represented by the Ostriches, Apteryx, etc.; and the Carinatæ or birds with a keeled sternum, which includes all the remaining species of recent birds. These are further divided into minor groups, called orders and sub-orders for convenience, although not distinguished by characters that would be considered of ordinal value in other classes of vertebrates. Of the Carinate birds, under which head all our species come, there are fourteen of these orders, all of which are represented here excepting one—the Sphenisci or Penguins.

Species known to breed in this vicinity are designated by an asterisk (*); those *inferred* to do so, by an obelisk (†). The dates of arrival and departure are of course approximate, being the average of observations extending through several years.

LAND BIRDS.

List of Identified Species.

Class AVES: BIRDS.
Sub-class CARINATÆ: CARINATE BIRDS.
Order PASSERES: PERCHERS.
Sub-order OSCINES: SINGING PERCHERS.

Family TURDIDÆ: *The Thrushes.*

1. *TURDUS MUSTELINUS, Gmelin.—*Wood Thrush.* A common summer resident. April 20th to October 1st.

2. TURDUS FUSCESCENS, Stephens.—*Wilson's Thrush.*—A rare migrant in April.

3. TURDUS ALICIÆ, Bd.—*Alice's* or *Gray-cheeked Thrush.*—Spring and fall migrant. Rather common early in October, feeding on the berries of the sour-gum.

4. TURDUS SWAINSONI, Cabanis.—*Swainson's Thrush.*—Common migrant in April and September.

5. *TURDUS PALLASI, Cabanis.—*Hermit Thrush.*—A common migrant about April 10th, and October 15th. Nest and eggs taken May 10th, 1877 (*Dury*).[1]

6. *TURDUS MIGRATORIUS, Linnæus.—*Robin.*—Represented from February till December. Remains during the summer in limited numbers however, compared with the large flocks which pass north in February and March, and return in October and November.

7. *HARPORHYNCHUS RUFUS, Cabanis.—*Brown Thrasher.*—A common, but not abundant summer resident. April 10th to Sept. 20th.

8. *MIMUS POLYGLOTTUS, Boie.—*Mocking Bird.*—A rare summer resident. One specimen taken in winter,—January 1st, 1877.

9. *GALEOSCOPTES CAROLINENSIS, Cabanis.—*Catbird.*—Common summer resident. April 20th to October 1st.

Family SAXICOLIDÆ: *Bluebirds; Stonechats.*

10. *SIALIA SIALIS, Baird.—*Eastern Bluebird.*—A common resident. Less numerous in winter.

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1 See the writer's "Observations on Cincinnati Birds"—this JOURNAL, Vol. 1, No. 3, p. 111, Oct. 1878.

Family SYLVIIDÆ: *Sylvias.*

11. REGULUS SATRAPA, Lichtenstein.—*Golden-crowned Kinglet.*—Common winter visitant.

12. REGULUS CALENDULA, Lichtenstein.—*Ruby-crowned Kinglet.*—Migrant in April and October.

13. *POLIOPTILA CÆRULEA, Sclater.—*Blue-gray Gnatcatcher.*—A common summer resident. April 10th to August 15th.

Family PARIDÆ: *Titmice.*

14. *LOPHOPHANES BICOLOR, Bonaparte.—*Tufted Titmouse.*—A common resident.

15. PARUS ATRICAPILLUS, Linnæus.—*Black-capped Titmouse.*—Rare winter visitant. Two specimens only, 1872 (*Dury*).

16. *PARUS CAROLINENSIS, Audubon.—*Carolina Chicadee.*—A common resident.

17. *SITTA CAROLINENSIS, Latham.—*White-bellied Nuthatch.*—A common resident.

18. SITTA CANADENSIS, Linnæus.—*Red-bellied Nuthatch.*—An irregular winter visitant. Also observed in September and October, 1878.

Family CERTHIADÆ: *Creepers.*

19. CERTHIA FAMILIARIS, *var.* AMERICANA, Bonaparte.—*Brown Creeper.*—Winter resident; October to April.

Family TROGLODYTIDÆ: *Wrens.*

20. *THRYOTHORUS LUDOVICIANUS, *var.* LUDOVICIANUS, Bonaparte.—*Great Carolina Wren.*—Common resident. A vigorous and attractive songster.

21. THRYOTHORUS BEWICKII, *var.* BEWICKII, Bonaparte.—*Bewick's Wren.*—One specimen taken at Brookville, Ind., in April, 1877 ; three seen (*E. R. Quick*).

22. *TROGLODYTES ÆDON, Vieillot.—*House Wren.*—A common summer resident in some localities before the introduction of the European Sparrow. Avondale (*Dury*) ; Mt. Auburn (*Douglass*). Now quite rare.

23. TROGLODYTES PARVULUS, *var.* HYEMALIS, Vieillot.—*Winter Wren.* A common winter resident. October 1st to April 15th.

24. CISTOTHORUS PALUSTRIS, Baird.—*Long-billed Marsh Wren.*—Migrant in May and September.

Family MOTACILLIDÆ : *Wagtails.*

25. ANTHUS LUDOVICIANUS, Lichtenstein. — *Titlark.* — Migrant in March and November, in flocks.

Family SYLVICOLIDÆ : *American Warblers.*

26. *MNIOTILTA VARIA, Vieillot.—*Black-and-white Creeping Warbler.*—Common summer resident. May 1st to September 30th.

27. † HELMITHERUS VERMIVORUS, Bonaparte.—*Worm-eating Warbler.*—A rare summer resident. May to August.

28. HELMINTHOPHAGA CHRYSOPTERA, Cabanis.—*Golden-winged Warbler.*—Rare migrant; one specimen only (*Dury*).

29. †HELMINTHOPHAGA PINUS, Baird.—*Blue-winged Yellow Warbler.*—A rather common summer resident. May 1st to September 10th.

30. HELMINTHOPHAGA RUFICAPILLA, Baird.—*Nashville Warbler.*—Migrant in April, May and September.

31. HELMINTHOPHAGA PEREGRINA, Cabanis.—*Tennessee Warbler.*—Common migrant in May and September—October. Unusually abundant in the fall of 1877.

32. PARULA AMERICANA, Bonaparte.—*Blue Yellow-backed Warbler.*—Migrant in May and September. Not common.

33. PERISSOGLOSSA TIGRINA, Baird.—*Cape May Warbler.*—Rare migrant in May and September.

34. *DENDRŒCA ÆSTIVA, Baird.—*Yellow Warbler.*—A common summer resident. April 15th to August 10th.

35. DENDRŒCA CORONATA, Gray.—*Yellow-rumped Warbler.*—Common migrant. March and April—October and November.

36. DENDRŒCA MACULOSA, Baird.—*Black-and-yellow Warbler.*—Spring and fall migrant. Common in September.

37. *DENDRŒCA CÆRULEA, Baird.—*Blue Warbler.*—Common migrant and summer resident. April 20th to August 15th.

38. DENDRŒCA BLACKBURNIÆ, Baird.—*Blackburnian Warbler.*—Migrant in May and September. Very common during the latter month.

39. DENDRŒCA DOMINICA, *var.* ALBILORA, Ridgway.—*White-browed Yellow-throated Warbler.*—A rather common migrant along the Little Miami "Bottoms" in the latter part of April and early in May. Also taken in October at Brookville, Ind., by Mr. Quick.

40. DENDRŒCA PENNSYLVANICA, Baird.—*Chestnut-sided Warbler.*—Migrant in May and September. Quite common in the fall.

41. DENDRŒCA STRIATA, Baird.—*Black-poll Warbler.*—A rather uncommon migrant in May and September—October.

42. DENDRŒCA CASTANEA, Baird.—*Bay-breasted Warbler.*—Migrant in May and September. Very common in the fall.

The difficulty of distinguishing between this species and *D. striata* in the fall has been frequently commented on. In addition to the differences noted by the standard works on Ornithology, a comparision of

specimens of both species shows that the *chin*, or feathered space between the forks of the lower mandible, is considerably wider in *castanea* than in *striata*,—arguing a greater width of base of bill in the former species. The bill of *castanea* is generally the larger in every way, but its greater width at the base is especially evident. This character appears to be constant in a number of specimens from this and other localities, and being an anatomical peculiarity, it is, of course, much more reliable as a diagnostic mark than any slight differences in coloration.

43. DENDRŒCA CÆRULESCENS, Baird.—*Black-throatea Blue Warbler.*—Migrant in May and September. Rather common.

44. DENDRŒCA VIRENS, Baird.—*Black-throated Green Warbler.*—Common migrant in May and September—October.

45. DENDRŒCA PINUS, Baird.—*Pine-creeping Warbler.*—A rare migrant in April.

46. DENDRŒCA KIRTLANDI, Baird.—*Kirtland's Warbler.*—A specimen of this extremely rare warbler, taken in May, 1872, at Avondale, is now in Mr. Dury's collection.

47. DENDRŒCA PALMARUM, *var.* PALMARUM,[1] Baird.—*Yellow Red-poll Warbler.*—Migrant in April and October. Common along hedgerows and fences in the fall.

48. DENDRŒCA DISCOLOR, Baird.—*Prairie Warbler.*—A rare migrant in May.

49. *SIURUS[2] AURICAPILLUS, Bonaparte.—*Golden-crowned Thrush or Wagtail.*—Common summer resident. April 20th to September 15th.

50. SIURUS NÆVIUS, Coues.—*Small-billed Water Thrush.*—A rare migrant in May.

51. *SIURUS MOTACILLA, Bonaparte.—*Large-billed Water Thrush.*—Summer resident. April 10th to September 1st.

52. OPORORNIS AGILIS, Baird.—*Connecticut Warbler.*—One specimen only; May, 1876 (*Dury*).

53. †OPORORNIS FORMOSUS, Baird.—*Kentucky Warbler.*—Summer resident. Arrives early in May and remains until September.

54. *GEOTHLYPIS TRICHAS, Cabanis.—*Maryland Yellow-throat.*—A common summer resident. May 1st to September 15th.

55. GEOTHLYPIS PHILADELPHIA, Baird.—*Mourning Warbler.*—A rare migrant in May (*Dury*) and August (*Shorten*).

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1 See Ridgway on "Geographical Variation in Dendrœca palmarum."—*Bulletin of the Nuttall Orn. Club*, Nov. 1876.

2 See "Corrections of Nomenclature in the Genus Siurus," Coues.—*Bulletin Nuttall Orn. Club*, April, 1877.

56. *Icteria virens, Baird.—*Yellow-breasted Chat.*—Common summer resident. April 25th to September 1st.

57. Myiodioctes mitratus, Audubon.—*Hooded Warbler.*—A rare migrant in May (and August?).

58. Myiodioctes pusillus, Bonaparte.—*Green Black-capped Fly-catching Warbler.*—Spring and fall migrant; not common.

59. Myiodioctes canadensis, Audubon.—*Canadian Fly-catching Warbler.*—Migrant in May and September; rather rare.

60. *Setophaga ruticilla, Swainson.—*American Redstart.*—A common summer resident. May 1st to September 20th.

Family Hirundinidæ: *Swallows.*

61. *Progne subis, Baird.—*Purple Martin.*—A common summer resident. April 1st to September 5th.

62. *Petrochelidon lunifrons, Baird.—*Cliff Swallow.*—An abundant summer resident. April 20th till September 5th.

63. *Hirundo erythrogaster, *var.* horreorum, Coues.—*Barn Swallow.*—A very common summer resident. Arrives and departs with the preceding species.

64. Hirundo bicolor, Vieillot—*White-bellied Swallow.*—Migrant in April (and September?).

65. *Stelgidopteryx serripennis, Baird.—*Rough-winged Swallow.*—A common summer resident. April 15th till September 1st.

Nests in barns, bridges, etc., as well as in burrows along the banks of rivers and creeks.

66. *Cotyle riparia, Boie.—*Bank Swallow.*—An abundant summer resident. Arrives and departs about the same time as the preceding species.

In this vicinity the burrows of the *Bank Swallow*, appear to be exclusively confined to the river-bluffs, where it nests in large communities; while the burrows of the *Rough-winged Swallow* are frequently seen, in small groups of from three to a dozen, along the banks of the smaller creeks, as well as in the other locations above mentioned.

Family Vireonidæ: *Vireos* or *Greenlets.*

67. *Vireosylvia olivaceus, Bonaparte.—*Red-eyed Vireo.*—A very common summer resident. April 25th to October 1st.

68. Vireosylvia philadelphicus, Cassin.—*Philadelphia Vireo.*—A rare migrant in May and September.

69. *VIREOSYLVIA GILVUS, Cassin.—*Warbling Vireo.*—Common summer resident. May to September.

70. LANIVIREO SOLITARIUS, Baird.—*Blue-headed* or *Solitary Vireo.*—Rare migrant in May (*Byrnes, Dury*); and September (*Shorten*).

71. †LANIVIREO FLAVIFRONS, Baird.—*Yellow-throated Vireo.*—Common migrant in May and September; a few remaining through the summer.

72. *VIREO NOVEBORACENSIS, Bonaparte.—*White-eyed Vireo.*—A common summer resident. April 25th to September 20th.

Family AMPELIDÆ: *Waxwings.*

73. *AMPELIS CEDRORUM, Sclater.—*Cedar Waxwing.*—An irregular but often abundant migrant, and a summer resident in limited numbers. Appears during the fall and winter in large flocks, feeding on wild grapes and the berries of the sour-gum and cedar.

Family LANIIDÆ: *Shrikes.*

74. COLLURIO BOREALIS, Baird.—*Great Northern Shrike; Butcher Bird.*—Rare fall and winter visitant.

75. *COLLURIO LUDOVICIANUS, *var.* LUDOVICIANUS, Baird.—*Loggerhead Shrike.*—An uncommon summer resident. Arrives about March 15th, and remains until September.

75*a*. COLLURIO LUDOVICIANUS, *var.* EXCUBITOROIDES, Coues.—A well marked example of this variety taken at Madisonville, August 22d, 1878.

Family TANAGRIDÆ: *Tanagers.*

76. *PYRANGA RUBRA, Vieillot.—*Scarlet Tanager.*—Summer resident. More common however during the migrations in May and September.

77. *PYRANGA ÆSTIVA, Vieillot.—*Summer Redbird.* A rather common summer resident. May 1st to September 25th.

Family FRINGILLIDÆ: *Finches, Sparrows, etc.*

78. CARPODACUS PURPUREUS, Gray.—*Purple Finch.*—Migrant in fall, winter and spring, usually in flocks. Feeds largely on the buds of the slippery elm, its flesh being strongly flavored thereby.

79. *CHRYSOMITRIS TRISTIS, Bonaparte.—*American Goldfinch; Thistle Bird.*—A common resident. Less numerous during the winter, but appears about the 1st of March in large straggling flocks, sometimes containing a hundred or more individuals, which are then just beginning to assume their summer dress. These flocks soon break up into

smaller ones, and for the greater part of the year it is seen in small parties numbering from six to a dozen.

80. CHRYSOMITRIS PINUS, Bonaparte.—*Pine Linnet.*—Abundant in the winter of 1868-69 (*Dury*). Not observed since.

81. LOXIA CURVIROSTRA, *var.* AMERICANA, Baird.—*Red Crossbill.*—Occasional fall and winter visitant, 1868-9; 1874-5.

82. LOXIA LEUCOPTERA, Gmelin.—*White-winged Crossbill.*—Quite abundant during the winter of 1868-9 (*Dury*).

83. ÆGOITHUS LINARIUS, Cabanis.—*Lesser Redpoll Linnet.*—One specimen only; January 1869 (*Dury*).

84. PLECTROPHANES NIVALIS, Meyer.—*Snow Bunting.*—Occasional winter visitant. Not observed for several years.

85. PLECTROPHANES LAPPONICUS, Selby.—*Lapland Longspur.*—A rare and irregular winter visitant. Avondale (*Dury*); Madisonville, Dec. 1877 (*W. H. Whetsel*).

86. *PYRGITA DOMESTICA, Cuvier.—*European House Sparrow.*—Introduced in 1873. Has multiplied rapidly, and is now abundant everywhere within ten or fifteen miles of Cincinnati.

87. PASSERCULUS SAVANNA, Bonaparte.—*Savanna Sparrow.*—A common migrant in April and October.

88. *POOCÆTES GRAMINEUS, Baird.—*Grass Finch; Bay-winged Bunting.*—A common summer resident.

89. COTURNICULUS HENSLOWI, Bonaparte.—*Henslow's Bunting.*—One specimen, "Kentucky, opposite Cincinnati" (*Audubon*).

90. †COTURNICULUS PASSERINUS, Bonaparte.—*Yellow-winged Sparrow.*—A rare summer resident (*Dury*).

91. †CHONDESTES GRAMMICA, Bonaparte.—*Lark Finch.*—An uncommon summer resident.

92. ZONOTRICHIA LEUCOPHRYS, Swainson.—*White-crowned Sparrow.*—Migrant in April and October—November.

93. ZONOTRICHIA ALBICOLLIS, Bonaparte.—*White-throated Sparrow.*—Migrant with the preceding species.

94. JUNCO HYEMALIS, Sclater.—*Black Snow-bird.*—A common winter resident. October 25th to April 10th.

95. SPIZELLA MONTICOLA, Baird.—*Tree Sparrow.*—Common winter resident. November to April.

96. *SPIZELLA PUSILLA, Bonaparte.—*Field Sparrow.*—Common resident from March till November.

97. *SPIZELLA SOCIALIS, Bonaparte.—*Chipping Sparrow.*—A very common summer resident. Arrives about the middle of March and remains until November 1st.

98. *Melospiza melodia, Baird.---*Song Sparrow*---A very common resident.

99. Melospiza palustris, Baird.---*Swamp Sparrow.*---A common migrant in April and November.

100. Passerella iliaca, Swainson.---*Fox-colored Sparrow.*---Common migrant in March and November.

101. *Euspiza americana, Bonaparte.---*Black-throated Bunting.*---A very common summer resident. May to September.

102. *Hedymeles ludovicianus, Swainson.---*Rose-breasted Grosbeak.*---Migrant in May and September; not common. Marked as breeding on the authority of Audubon, who mentions taking its nest and eggs near Cincinnati.

103. *Cyanospiza cyanea, Baird.—*Indigo Bird.*—A very common summer resident. May—October.

104. *Cardinalis virginianus, Bonaparte.—*Cardinal Grosbeak*; *Redbird.*—A very common resident.

105. *Pipilo erythrophthalmus, Vieillot.—*To-whee Finch; Ground Robin.*—A common resident.

Family Alaudidæ: *Larks.*

106. *Alauda arvensis, Linnæus.—*European Skylark.*—Introduced. Breeds sparingly in the parks and suburbs of Cincinnati (*A. Tenner*).

107. Eremophila alpestris, Boie.—*Shore Lark.*—Occasional migrant in fall and winter.

Family Icteridæ: *Orioles.*

108. Dolichonyx oryzivorus, Swainson.—*Bobolink.*—Occasional migrant in May, usually in small flocks.

Breeds commonly at Columbus and Yellow Springs (*Wheaton*).

109. *Molothrus ater, Gray.---*Cowbird.*---Common summer resident. March---October.

110. *Agelaius phœniceus, Vieillot.---*Swamp Blackbird.*---A common summer resident. March 1st to October 15th.

111. *Sturnella magna, Swainson.—*Meadow Lark.*---A common resident. Less numerous in winter.

112. *Icterus spurius, Bonaparte.—*Orchard Oriole.*---Summer resident. May---August.

113. *Icterus baltimore, Dandin.---*Baltimore Oriole.*---A common summer resident. April 25th to September 1st.

114. Scolecophagus ferrugineus, Swainson.---*Rusty Grakle.*---An abundant migrant in March and November.

115. *QUISCALUS PURPUREUS, Bartram; *var.* ÆNEUS, Ridgway.---*Bronzed Grakle.*---A common summer resident. Represented from February 20th till November 10th.

Family CORVIDÆ: *Crows, Jays, etc.*

116. CORVUS CORAX, *var.* CARNIVORUS, Bartram.—*American Raven.* A former resident; not recently observed. (See *Haymond*,---Ind. Geol. Rept. 1869; and *Atwater*,---History of Ohio, 1838).

117. *CORVUS AMERICANUS, Audubon.---*Common Crow.*---Resident. Extremely abundant in winter, when it collects along streams in large flocks which are probably migrants from the north.

118. *CYANURA CRISTATA, Swainson.---*Blue Jay.*---A common resident.

Sub-order CLAMATORES: NON-MELODIOUS PASSERES.

Family TYRANNIDÆ: *Tyrant Flycatchers.*

119. *TYRANNUS CAROLINENSIS, Baird.---*Kingbird.*—A common summer resident. May—September.

120. *MYIARCHUS CRINITUS, Cabanis.---*Great-crested Flycatcher.*---A common summer resident. May 1st to September 15th.

121. *SAYORNIS FUSCUS, Baird.---*Pewee.*---Resident from April till October. An occasional straggler seen in February and March.

122. *CONTOPUS VIRENS, Cabanis.---*Wood Pewee.*---A very common summer resident. May 1st to September 30th.

123. EMPIDONAX PUSILLUS, *var.* TRAILLI, Baird.---*Traill's Flycatcher.*---A rare migrant in May and September. (Breeds at Columbus, Ohio *Wheaton*).

124. EMPIDONAX MINIMUS, Baird.---*Least Flycatcher.*---Migrant in May and September.

125. *EMPIDONAX ACADICUS, Baird.---*Acadian Flycatcher.*---A common summer resident. May 1st till September 30th.

126. EMPIDONAX FLAVIVENTRIS, Baird.---*Yellow-bellied Flycatcher.*—A rather common migrant in May and September.

Order PICARIÆ: "A POLYMORPHIC GROUP," comprising the *Kingfishers, Goatsuckers, Swifts, Hummers, Cuckoos and Woodpeckers.*

Family ALCEDINIDÆ: *Kingfishers.*

127. *CERYLE ALCYON, Boie.—*Belted Kingfisher.*—A common resident.

Family CAPRIMULGIDÆ: *Goatsuckers.*

128. *CHORDEILES POPETUE, *var.* POPETUE, Baird.—*Night Hawk.*—Summer resident. May—September. Observed migrating in large numbers about September 1st, at dusk. They did not fly in compact order, but in twos and threes, widely separated, as many as twenty-five or thirty being in sight at once; and all moving steadily toward the south-east before an approaching storm.

129. *ANTROSTOMUS VOCIFERUS, Bonaparte.—*Whippoorwill.*—An uncommon summer resident.

Family CYPSELIDÆ: *Swifts.*

130. *CHÆTURA PELAGICA, Baird.—*Chimney Swift.*—Abundant from April 15th till October 10th.

Family TROCHILIDÆ: *Humming Birds.*

131. *TROCHILUS COLUBRIS, Linnæus.—*Ruby-throated Humming Bird.*—A common summer resident. April 25th till September 20th.

Family CUCULIDÆ: *Cuckoos.*

132. *COCCYGUS AMERICANUS, Bonaparte.—*Yellow-billed Cuckoo.*—A common summer resident. May 1st to September 30th.

133. †COCCYGUS ERYTHROPHTHALMUS, Bonaparte.—*Black-billed Cuckoo.*—Rare summer resident.

Family PICIDÆ: *Woodpeckers.*

134. †CAMPEPHILUS PRINCIPALIS, Gray.—*Ivory-billed Woodpecker.*—"A former resident" of Franklin County, Indiana. (*Haymond*, Ind. Geol. Report, 1869.)

135. †PICUS VILLOSUS, Linnæus.—*Hairy Woodpecker.*—Resident. Less common than the following species.

136. *PICUS PUBESCENS, Linnæus.—*Downy Woodpecker.*—A common resident.

137. SPHYRAPICUS VARIUS, Baird.—*Yellow bellied Woodpecker.*—Fall, winter and spring visitant.

138. †HYLOTOMUS PILEATUS, Baird.—*Pileated Woodpecker: Black Woodcock.*—A former resident. Not recently observed.

139. *CENTURUS CAROLINUS, Bonaparte.—*Red-bellied Woodpecker.*—A common resident.

140. *MELANERPES ERYTHROCEPHALUS, Swainson.—*Red-headed Woodpecker.*—A common resident. Partially migratory in winter.

141. *Colaptes auratus, Swainson.—*Flicker; Golden-winged Woodpecker.*—A very common resident.

Order Psittaci: Cockatoos, Macaws and Parrots.

Family Psittacidæ: *Parrots.*

142. †Conurus carolinensis, Kuhl.—*Carolina Parroquet.*—Formerly an abundant summer resident. (See "Observations on Cincinnati Birds," this Journal, Vol. 1, p. 115).

Order Raptores: Owls, Hawks and Vultures.

Family Strigidæ: *Owls.*

143. Strix flammea, *var.* pratincola, Bonaparte.—*American Barn Owl.*—Two specimens taken *(Dury).*

144. †Otus vulgaris, *var.* wilsonianus, Lesson.—*Long-eared Owl.*—Fall, winter and spring visitant. Young of the year taken at Avondale in July, 1878, by Mr. Dury.

145. Otus brachyotus, Stephens.—*Short-eared Owl.*—Fall, winter and spring visitant.

146. †Syrnium nebulosum, Gray.—*Barred Owl.*—An uncommon resident.

147. Nyctale acadica, Bonaparte.—*Saw-whet*, or *Acadian, Owl.*—Rare visitant in winter. Three specimens taken.

148. *Scops asio, Bonaparte.—*Mottled Owl; Screech Owl.*—A common resident.

149. *Bubo virginianus, Bonaparte.—*Great Horned Owl.*—A rather common resident.

150. Nyctea scandiaca, *var.* arctica, Gray.—*American Snowy Owl.*—Occasional winter visitant.

151. Surnia ulula, *var.* hudsonia, Ridgway.—*Hawk Owl; Day Owl.*—Identified at Brookville, Ind., in January, 1878 (*E. R. Quick*).

Family Falconidæ ; *Falcons.*

152. Falco lithofalco, *var.* columbarius, Linnæus.—*Pigeon Hawk.*—A rare migrant in March and September—October.

153. *Falco sparverius, Linnæus.—*Sparrow Hawk.*—Spring, summer and fall resident, and occasionally seen in winter.

154. Pandion haliaetus, Cuvier.—*Fish Hawk ; Osprey.*—Rare spring and fall migrant.

155. ELANOIDES FORFICATUS, Ridgway. — *Swallow-tailed Kite.*—A former summer visitant.—(*Vide Haymond*, Ind. Geol. Report, 1869.)[1]

156. CIRCUS CYANEUS, *var.* HUDSONICUS, Ridgway.—*Marsh Hawk.*—A rare spring and fall migrant.

157. *NISUS FUSCUS, Kaup.—*Sharp-shinned Hawk.*—Summer resident; rare. (Breeds. *Dury.*)

158. *NISUS COOPERI, Bonaparte.—*Cooper's Hawk.*—A rather common summer resident.

159. ASTUR PALUMBARIUS, *var.* ATRICAPILLUS, Ridgway.—*American Goshawk.*—A single specimen, female in immature plumage, taken twenty miles east of Cincinnati, in November, 1878 (*Dury*).

160. *BUTEO PENNSYLVANICUS, Bonaparte. — *Broad-winged Hawk.*—Spring, summer and fall resident; not rare.

161. *BUTEO LINEATUS, Gmelin.—*Red-shouldered Hawk.*—Resident. With the exception of the Sparrow Hawk, this is our most common representative of the family.

162. *BUTEO BOREALIS, Vieillot.—*Red-tailed Hawk.*—A rather rare resident.

163. ARCHIBUTEO LAGOPUS, *var.* SANCTI-JOHANNIS, Ridgway.—*Rough-legged* or *Black Hawk.*—One specimen (*Dury*).

164. AQUILA CHRYSÆTUS, *var.* CANADENSIS, Ridgway.—*Golden Eagle.*—A rare migrant (*Dr. Hunt*).

165. HALIAETUS LEUCOCEPHALUS, Savigny.—*White-headed Eagle; American Eagle.*—Migrant. Four specimens taken and many others seen, in March, 1877, at Valley Junction, Ohio (*Dr. J. H. Hunt*).

Family CATHARTIDÆ: *American Vultures.*

166. *RHINOGRYPHUS AURA, Ridgway.—*Turkey Buzzard.*—A common summer resident. Nest containing young observed by Mr. L. R. Freeman, in Clermont County, Ohio.

167. CATHARISTA ATRATA, Gray.—*Black Vulture; Carrion Crow.*—Three specimens observed in December, 1876, at Madisonville; one taken.[2] Also identified on two previous occasions, *both in winter.*

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1 Dr. Wheaton's collection contains a specimen taken in Licking County, Ohio, August 22d, 1878, by Rev. C. H. Permort;—the only record of its occurrence in Ohio "for over twenty-five years."—See *Bulletin Nuttall Ornithological Club*, January 1879; p. 62.

2 For particulars of the capture of this specimen, see *Bulletin of the Nuttall Ornithological Club*, October, 1877; p. 109.

Order COLUMBÆ: COLUMBINE BIRDS.

Family COLUMBIDÆ: *Pigeons.*

168. ECTOPISTES MACROURA,[1] Coues.—*Wild Pigeon.*—The last large flight of Pigeons witnessed here, occurred in the fall of 1865, and continued during the greater part of two days. Flocks of from twenty-five to a hundred individuals are still occasionally seen, however, during the fall, winter and spring.

169. *ZENÆDURA CAROLINENSIS, Bonaparte.—*Carolina Turtle Dove.*—A common resident. Congregates in small flocks during the fall and winter.

Order GALLINÆ: GALLINACEUS BIRDS.

Family MELEAGRIDÆ: *Turkeys.*

170. †MELEAGRIS GALLOPAVO, *var.* GALLOPAVO, Linnæus.—*Wild Turkey.*—A former resident. Still common in some heavily wooded portions of the State.

Family TETRAONIDÆ: *Grouse.*

171. †CUPIDONIA CUPIDO, Baird.—*Prairie Chicken.*—A former resident. A few are yet found in north-western Ohio *(Wheaton).*

172. †BONASA UMBELLUS, *var.* UMBELLUS, Stephens.—*Ruffed Grouse; Pheasant.*—Resident. Several specimens taken at Brookville, Ind., in November, 1877 *(Quick).*

Family PERDICIDÆ: *Partridges.*

173. †ORTYX VIRGINIANUS, Bonaparte.—*Quail; Bob White.*—A common resident.

WATER BIRDS.

Order LIMICOLÆ: SHORE BIRDS.

Family CHARADRIIDÆ: *Plover.*

174. SQUATAROLA HELVETICA, Brehm.—*Black-bellied Plover.*—A rare spring and fall migrant.

175. CHARADRIUS FULVUS, *var.* VIRGINICUS, Coues.—*American Golden Plover.*—Migrant with the preceding.

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1 See *Birds of the Northwest*, p. 766; also, *Bulletin U. S. Geol. & Geog. Survey*, Vol. 4. No. 3, p. 628; for correction in nomenclature of this species.

176. *ÆGIALITIS VOCIFERA, Bonaparte.—*Killdeer Plover.*—A common migrant and summer resident.

177. ÆGIALITIS SEMIPALMATUS, Cabanis.—*Semipalmated Plover Ring-neck.*—An uncommon spring and fall migrant.

178. ÆGIALITIS MELODA, Bonaparte.—*Piping Plover.*—One specimen only; taken on the Ohio by Mr. Dury.

Family HÆMATOPODIDÆ: *Turnstones.*

179. STREPSILAS INTERPRES, Illiger.—*Turnstone.*—Identified on the Whitewater, near Brookville, Ind., by Dr. Rufus Haymond.

Family RECURVIROSTRIDÆ: *Avocets.*

180. RECURVIROSTRA AMERICANA, Gmelin.—*Avocet.*—Noted from the vicinity of Cincinnati by Dr. J. P. Kirtland.—*Ohio Geological Survey.* 1838.

181. HIMANTOPUS NIGRICOLLIS, Vieillot.—*Black-necked Stilt.*—One specimen noted by Mr. Dury.

Family SCOLOPACIDÆ: *Snipe*, etc.

182. *PHILOHELA MINOR, Gray.—*American Woodcock.*—Resident from March until November.

183. GALLINAGO WILSONI, Bonaparte.—*Wilson's Snipe*; *Jack Snipe.*—Migrant in March, April, October and November.

184. MACRORHAMPHUS GRISEUS, Leach.—*Red-breasted Snipe.*—Rare spring and fall migrant.

185. EREUNETES PUSILLUS, Cassin.—*Semipalmated Sandpiper.*—An uncommon migrant in May and September.

186. TRINGA MINUTILLA, Vieillot.—*Least Sandpiper.*—Migrant in May and August. Not common.

187. TRINGA MACULATA, Vieillot.—*Pectoral Sandpiper.*—Common migrant in March, April and October.

188. TRINGA ALPINA, *var.* AMERICANA, Cassin.—*American Dunlin.*—One specimen, November 1878 (*Dury*).

189. CALIDRIS ARENARIA, Illiger.—*Sanderling.*—Although chiefly a marine species, the Sanderling has been taken on the Ohio River near Cincinnati on several occasions, and specimens are in the collections of Dr. R. M. Byrnes and Mr. Charles Dury.

190. LIMOSA FEDOA, Ord.—*Great Marbled Godwit.*—Thirty-three shot in one day near the mouth of the Little Miami, some years ago, by Charles Weeks, Esq. (*Dury*). This is our only record of the species

here, although it is doubtless a frequent spring and fall migrant on the Ohio and its tributaries. That it has not been more frequently observed is probably owing to the lack of attractive feeding grounds in this vicinity.

191. LIMOSA HÆMASTICA,[1] Coues.—*Hudsonian Godwit.*—Specimens noted from the vicinity of Cincinnati (*Wheaton*, Ohio Ag. Rept. 1860.)

192. TOTANUS SEMIPALMATUS, Temminck.—*Semi-palmated Tatler: Willet.*—A rare spring and fall migrant.

193. TOTANUS MELANOLEUCUS, Vieillot.—*Tell-tale Tatler; Greater Yellow-legs.*—Spring and fall migrant. Not common.

194. TOTANUS FLAVIPES, Vieillot.—*Lesser Yellow-legs.*—A common spring and fall migrant. April, May and September.

195. TOTANUS SOLITARIUS, Audubon.—*Solitary Sandpiper.*—A very common migrant in May, August and September.

196. *TRINGOIDES MACULARIUS, Gray.—*Spotted Sandpiper.*—A common summer resident. May 1st to September 30th.

197. ACTITURUS BARTRAMIUS, Bonaparte.—*Bartram's Sandpiper; "Upland Plover."*—Rare spring and fall migrant (*Haymond*).

198. NUMENIUS LONGIROSTRIS, Wilson.—*Long-billed Curlew.*—A rare migrant. Three or four specimens known from this vicinity.

199. NUMENIUS BOREALIS, Latham.—*Esquimaux Curlew.*—Specimen taken near Cincinnati in September, 1878 (*Shorten*). Also recorded from this vicinity by Prof. Kirtland, 1838.

Order HERODIONES: HERONS, IBISES, etc.

Family TANTALIDÆ: *Ibises.*

200. TANTALUS LOCULATOR, Linnæus.—*Wood Ibis.*—One specimen taken on the Whitewater.—*Haymond*, Ind. Geol. Rept. 1869.

(See also the writer's "Observations on Cincinnati Birds," Vol. I., p. 117, this JOURNAL, for account of this specimen).

Family ARDEIDÆ[2]: *Herons.*

201. †ARDEA HERODIAS, Linnæus.—*Great Blue Heron.*—Common spring and fall migrant. March, April, August, September and October. Breeds commonly in the central and northern portions of the State, and Mr. Dury notes a nest observed by him in a large sycamore on the Great Miami.

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1 See *Birds of the Northwest*, p. 760, for this nomenclature.

2 Revised in accordance with Mr. Ridgway's "Studies of the American Herodiones."—*Bulletin U. S. Geol. & Geog. Survey*, Vol. 4, No. 1, pp. 219-251.

202. Herodias egretta, Gray.—*Great White Egret.*—A rather frequent visitant from the south in August and September.

203. Garzetta candidissima, Gmelin.—*Little White Egret.*—One specimen (*Dury*).

204. *Butorides virescens, Linnæus.—*Green Heron* : "*Fly-up-the-Creek.*"—A common summer resident. May—October.

205. Nyctiardea grisea, *var.* nævia, Allen.—*American Night Heron.*—A rare spring and fall migrant.

206. Botaurus minor, Boie.—*American Bittern.*—A rather common spring and fall migrant.

207. Ardetta exilis, Gray.—*Least Bittern.*—Rare spring and fall migrant.

Order Alectorides : Cranes, Rails, etc.

Family Gruidæ : *Cranes.*

208. Grus americana, Temminck. *Whooping Crane.* A rare migrant on the Ohio and tributaries. Two or three specimens known from this vicinity.

209. Grus canadensis, Temminck.—*Sand-hill Crane.*—Two specimens of this species are reported to have been taken in this vicinity. It has also been identified by Dr. Haymond, at Brookville, Ind.

Family Rallidæ: *Rails.*

210. Rallus elegans, Audubon.—*King Rail; Fresh-water Marsh Hen.*—A rare migrant. April, May and October.

211. Rallus virginianus, Linnæus.—*Virginia Rail.*—Migrant in May and October. Not common.

212. Porzana carolina, Cabanis.—*Sora Rail.*—Common migrant in April, May and September.

213. Porzana noveboracensis, Cassin.—*Little Yellow Rail.*—A rare spring and fall migrant.

214. Gallinula galeata, Bonaparte.—*Florida Gallinule.*—A rare migrant. A specimen in Mr. Harry Hunt's collection, taken at Valley Junction in April, 1876.

215. Porphyrio martinica, Temminck.—*Purple Gallinule.* A rare migrant in April and May. Four specimens taken in this vicinity in 1877. Has not been observed in the fall.

216. Fulica americana, Gmelin.—*Coot; Mud Hen.*—An uncommon spring and fall migrant. Thousands seen at St. Mary's Reservoir in October, where I have known them to disappear "between two days," at

the approach of a "cold snap" early in November. Those taken in this vicinity are merely stragglers from the main body.

Order LAMELLIROSTRES: GEESE, DUCKS, FLAMINGOES, etc.

Family ANATIDÆ: *Swan, Geese and Ducks.*

217. CYGNUS BUCCINATOR, Richardson.—*Trumpeter Swan.*—A rare migrant. One specimen taken (three seen) on the Ohio, near Cincinnati, in December, 1876 (*M. Wocher*).

218. CYGNUS AMERICANUS, Sharpless.—*American or Whistling Swan.*—A rare migrant on the Ohio and tributaries.

219. ANSER ALBIFRONS, *var.* GAMBELI, Cones.—*White-fronted Goose.*—A specimen taken at Miamitown, Ohio (*Dury*).

220. ANSER HYPERBOREUS, Pallas.—*Snow Goose.*—A rare migrant. Three specimens taken on the Little Miami, near Madisonville, in February, 1878.

221 ANSER CÆRULESCENS, Vieillot.—*Blue Goose.*—Migrant on the Ohio and tributaries. Identified at Brookville, Ind., by Dr. Haymond

222. BRANTA CANADENSIS, Gray.—*Common Wild Goose; Canada Goose.*—Spring and fall migrant.

223. BRANTA BERNICLA, Scopoli.—*Brant Goose.*—Franklin Co., Ind. (*Haymond*, Ind. Geol. Report. 1869).

224. ANAS BOSCHAS, Linnæus.—*Mallard Duck; Greenhead.*—A common spring and fall migrant, and an occasional winter resident.

225. ANAS OBSCURA, Gmelin.—*Dusky Duck.*—Spring and fall migrant. Much less common than the preceding.

226. DAFILA ACUTA, Jenyns.—*Pin-tail Duck.*—A common spring and fall migrant. October, November and April.

227. MARECA AMERICANA, Stephens.—*American Widgeon.*—Common migrant in March and November.

228. QUERQUEDULA CAROLINENSIS, Stephens.—*Green-winged Teal.*—Common spring and fall migrant.

229. QUERQUEDULA DISCORS, Stephens.—*Blue-winged Teal.*—Spring and fall migrant. Less common than the preceding.

230. SPATULA CLYPEATA, Boie.—*Shoveller Duck.*—Spring and fall migrant. Common.

231. *AIX SPONSA, Boie.—*Summer Duck; Wood Duck.*—A common migrant and an occasional summer resident.

232. FULIGULA MARILA, Stephens.—*Greater Scaup Duck; Big Blackhead.*—Franklin Co., Indiana (*Haymond*, Ind. Geol. Report, 1869).

233. FULIGULA AFFINIS, Eyton.—*Lesser Scaup Duck.*—A common migrant in November and March.

234. FULIGULA COLLARIS, Bonaparte.—*Ring-necked Duck.*—Migrant in March and November. Rather common.

235. FULIGULA FERINA, *var.* AMERICANA, Coues.—*Red-headed Duck; American Pochard.*—A rare migrant.

236. FULIGULA VALLISNERIA, Stephens.—*Canvas-back Duck.*—Migrant. Rare.

237. BUCEPHALA CLANGULA, Coues.—*Golden-eye Duck.*—An uncommon migrant.

238. BUCEPHALA ALBEOLA, Baird.—*Dipper Duck; Butter-ball.*—A common spring and fall migrant.

239. ŒDEMIA FUSCA, Fleming.—*Velvet Duck; White-winged Scoter.*—Franklin Co., Ind. "Numerous in winter."—*Haymond l. c.*

240. ERISMATURA RUBIDA, Bonaparte.—*Ruddy Duck.*—An uncommon spring and fall migrant.

241. MERGUS MERGANSER, Linnæus.—*Shell-drake; Goosander.*—A rare migrant.

242. MERGUS SERRATOR, Linnæus.—*Red-breasted Merganser.*—Rare migrant.

243. MERGUS CUCULLATUS, Linnæus.—*Hooded Merganser.*—A common migrant.

Order STEGANOPODES: PELICANS, CORMORANTS, etc.

Family PELECANIDÆ: *Pelicans.*

244. PELECANUS TRACHYRHYNCHUS, Latham.—*White Pelican.*—Occasional migrant on the Ohio.

Family PHALACROCORACIDÆ: *Cormorants.*

245. GRACULUS DILOPHUS, *var.* FLORIDANUS, Coues.—*Florida Cormorant.*—Rare migrant. Bred abundantly at St. Mary's Reservoir as late as 1867, since when it has rapidly diminished in numbers, and is now comparatively rare (*Dury*). (See page 117, this Vol.)

Order LONGIPENNES: GULLS, TERNS, and PETRELS.

Family LARIDÆ: *Gulls, Terns,* etc.

246. LARUS ARGENTATUS, *var.* SMITHSONIANUS, Coues.—*Herring Gull.*—Irregular visitant in fall, winter and spring.

247. LARUS DELAWARENSIS, Ord.—*Ring-billed Gull.*—One specimen (*Curier Club Coll.*)

248. LARUS PHILADELPHIA, Gray.—*Bonaparte's Gull.*—An irregular

spring and fall migrant. Specimens of this and the four following species taken by Mr. Dury, near the mouth of the Little Miami, in September, 1878.

249. STERNA FORSTERI, Nuttall.—*Forster's Tern.*—Rare migrant.

250. STERNA DOUGALLI, Montague.—*Roseate Tern.*—One specimen only.

251. STERNA SUPERCILIARIS, *var.* ANTILLARUM, Coues.—*Least Tern.*—Several specimens (*Dury*).

252. HYDROCHELIDON LARIFORMIS, Coues.—*Black Tern.*—Spring and fall migrant on the Ohio and its tributaries.

Order PYGOPODES: DIVERS, GREBES, AUKS.

Family COLYMBIDÆ: *Loons.*

253. COLYMBUS TORQUATUS, Brunnich.—*Great Northern Diver*, or *Loon.*—Spring and fall migrant. Not common.

254. COLYMBUS SEPTENTRIONALIS, Linnæus.—*Red-throated Diver.*—A rare migrant. Specimen in Mr. Dury's collection taken on the Ohio. One or two others known.

Family PODICIPIDÆ: *Grebes.*

255. PODICEPS CORNUTUS, Latham.—*Horned Grebe.*—Taken near the mouth of the Little Miami by Charles Weeks, Esq. (*Dury*).

256. PODILYMBUS PODICEPS, Lawrence.—*Pied-billed Dabchick; Water Witch.*—Spring and fall migrant and occasional summer resident.

SPECIES OF PROBABLE OCCURRENCE, NOT YET IDENTIFIED.

The following species, whose known range includes this locality, have not yet been positively identified here. A few of them appeared in the original catalogue (April, 1877), on what I now consider insufficient grounds, and I take this opportunity of removing them from the list of identified species.

The St. Mary's Reservoir alluded to in the following notes, is situated about one hundred and thirty miles north of Cincinnati; and while the species identified there are probably migrants with us, such is not *necessarily* the case, as some of them may, and probably do, pass to and from that locality via the Wabash Valley, through which

a portion of the surplus waters of the Reservoir reaches the Ohio River.

1. CISTOTHORUS STELLARIS, Cabanis.—*Short-billed Marsh Wren.*—"St. Mary's Reservoir; breeds" (*Dury*).

2. PROTONOTARIA CITRÆA, Baird.—*Prothonotary Warbler.*—"Several specimens taken at St. Mary's," where it "breeds in holes in swamp willows" (*Dury*).

3. HELMINTHOPHAGA CELATA, *var.* CELATA, Baird.—*Orange-crowned Warbler.*—Columbus, Ohio; three specimens (*Dr. J. M. Wheaton*).

4. PYRGITA MONTANA, Auctorum.—*European Tree Sparrow.*—Introduced in St. Louis (and probably in other localities) with the House Sparrow, *P. domestica.* (See Dr. J. C. Merrill, in *American Naturalist* for January, 1876.)

5. MELOSPIZA LINCOLNI, Baird.—*Lincoln's Finch.*—"Rather common migrant" at Columbus, Ohio (*Dr. Wheaton*).

6. GUIRACA CÆRULEA, Swainson. *Blue Grosbeak.*—A southern species; possibly a rare summer visitant.

7. CONTOPUS BOREALIS, Baird.—*Olive-sided Fly-catcher.*—Doubtfully identified. Perhaps a rare spring and fall migrant.

8. SYRNIUM CINEREUM, Audubon.—*Great Gray Owl.*—Probably a rare winter visitant from the north. Identified by Mr. Dury in Clark Co., Ohio; and Mr. Quick is confident that he has seen a specimen taken at Brookville, Indiana.

9. FALCO COMMUNIS, *var.* ANATUM, Ridgway. Specimens in Mr. Dury's collection from St. Mary's Reservoir.

10. STEGANOPUS WILSONI, Coues.—*Wilson's Phalarope.*

11. LOBIPES HYPERBOREUS, Cuvier.—*Northern Phalarope.*

12. PHALAROPUS FULICARIUS, Bonaparte.—*Red Phalarope.*

13. MICROPALAMA HIMANTOPUS, Baird.—*Stilt Sandpiper.*

14. TRINGA BAIRDII, Coues.—*Baird's Sandpiper.*—Columbus, Ohio: September, 1876; one specimen (*Dr. Wheaton*).

15. TRINGA FUSCICOLLIS, Vieillot.—*Bonaparte's Sandpiper.*—Columbus, Ohio (*Dr. Wheaton*).

16. TRINGA CANUTUS, Linnæus.—*Red-breasted Sandpiper.*

17. TRYNGITES RUFESCENS, Cabanis.—*Buff-breasted Sandpiper.*

18. NUMENIUS HUDSONIUS, Latham.—*Hudsonian Curlew.*

19. PLEGADUS[1] FALCINELLUS, Kaup.—*Glossy Ibis.*—Dr. Wheaton informs me that three specimens of this species have been taken in northern Ohio.

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1 See Salvin and Sclater in *The Ibis* for Jan. 1878; p. 112: quoted by J. A. Allen, *Bulletin Nuttall Orn. Club*, July, 1878; p. 152. (Change in Nomenclature.)

20. PORZANA JAMAICENSIS, Cassin.—*Little Black Rail.*—Partially identified at Madisonville.

21. CHAULELASMUS STREPERUS, Gray.—*Gadwall Duck.*—"Breeds at St. Mary's Reservoir" *(Dury).*

22. LARUS MARINUS, Linnæus.—*Great Black-backed Gull.*

23. LARUS ATRICILLA, Linnæus.—*Laughing Gull.*

24. STERNA ANGLICA, Montague.—*Gull-billed Tern.*

25. STERNA HIRUNDO, Linnæus.—*Common Tern; Sea Swallow.*

26. PODICEPS GRISEIGENA, *var.* HOLBOLLI, Coues.—*Red-necked Grebe.*

NOTE.—*Podiceps cristatus*, Latham, has heretofore been included in various standard works as a bird of general distribution in North America; according to Dr. Brewer, however, there is "no authentic record of the capture of a single specimen in America," and it is therefore dropped from the list of North American Birds.—See his article in *Bulletin Nuttall Orn. Club* for April, 1878, p. 52.

SUMMARY.

The two hundred and fifty-six identified species may be approximately divided as follows:

Constant residents,	27
Summer residents,	62
Winter visitants,	10
Regular migrants,	82
Irregular migrants,	37
Casual visitants,	31
Species that have disappeared within forty years,	7
Total,	256

Adding the twenty-six un-identified species to the aggregate number of irregular and casual visitants, where they would properly belong if identified, we have a total of ninety-four, or exactly one-third of the total number of species in both lists; apparently a remarkable proportion of "casuals," and one probably without a parallel in any other class of vertebrates. It is not by any means peculiar, however, to this locality or State, as may be seen by consulting the List of Massachusetts Birds by Allen,[1] or that of the Birds of Connecticut by Merriam,[2] and other North American Lists, in which about the

1 A List of the Birds of Massachusetts, with Annotations, by J. A. Allen. *Bulletin of the Essex Institute*, Vol. X., pp. 3-37; April, 1878.

2 A Review of the Birds of Connecticut, with Remarks on their Habits, by C. Hart. Merriam. *Trans. Conn. Academy*, Vol. IV., 1877.

same proportion occurs. This state of affairs is easily accounted for, when we consider the superior facilities possessed by birds for moving about from place to place, and their frequent exposure to storms and other adverse influences while migrating.

Eighty-three species (marked *) have been known to breed here, and eighteen others (marked †) are inferred to have done so. Owing to the lack of extended swamps or marshes in this vicinity, many of the water birds which breed in the central and northern portions of the State, occur here as migrants only ; among these may be mentioned, *Ardea herodias*, *Botaurus minor*, *Ardetta exilis*, *Rallus virginianus*, *Porzana carolina*, *Gallinula galeata*, *Fulica americana*, *Anas boschas*, *Graculus dilophus* var. *floridanus*, *Hydrochelidon lariformus*, and *Podilymbus podiceps*. Other species, which have been known to breed in Ohio, but not in this vicinity, are, *Cistothorus stellaris*, *Cistothorus palustris*, *Protonotaria citræa*, *Parula americana*, *Junco hyemalis* (breeds "abundantly" in "Western Reserve"—*vide* Kirtland, 1838), *Dolichonyx oryzivorus*, *Empidonax pusillus* var. *trailli* (Columbus, Wheaton), and *Haliaetus leucocephalus*.

The "families" represented in our list number forty-six. Of these the most prominent in point of numbers is the *Sylvicolidæ* or Warblers, the great insectivorous group, represented by thirty five species, ten of which are of rare or occasional occurrence only. Eleven members of this family spend the summer with us, the remainder passing on to higher latitudes to breed and returning in the fall on the way to their winter homes in the south. Next in numerical importance is the *Fringillidæ*, comprising the various species of Finches, Sparrows, etc., of which we have twenty-eight species. Seven of these are of fortuitous occurrence, five are constant residents, seven summer residents and seven regular migrants; the other two are regular winter visitants.

The relative proportions of these two families in this locality, conflict with a general rule laid down by Dr. Coues, who says (p. 126 of "Key"): "Any one United States locality of average attractiveness to birds, has a bird fauna of over two hundred species; and if it be away from the sea-coast, and consequently uninhabited by marine birds, about one fourth of its species are *Sylvicolidæ* and *Fringillidæ* together---*the latter somewhat in excess of the former.*" By reference to our figures above given it will be seen that here the contrary is the case, the *Sylvicolidæ* exceeding the *Fringillidæ* in a ratio of five to four (35 to 28). The same is partially true of the State at large, according to Dr. Wheaton's List,[1] which enumerates two hundred and ninety four species.

1 "Food of Birds as related to Agriculture," with a List of the Birds of Ohio, by J. M. Wheaton, M.D.—*Ohio Agricultural Report*, 1874.

thirty-seven of which belong to the *Sylvicolidæ*, and thirty-three to the *Fringillidæ*. In other inland localities, however, Dr. Coues' rule appears to hold good, as the *Fringillidæ* slightly outnumber the *Sylvicolidæ* in Illinois[1] and Minnesota,[2] and exceed them by fourteen species in Kansas.[3]

Of our remaining families of "Land Birds," the Thrushes are noted for their song, the Titmice and Wrens for their activity, the Swallows for their grace and endurance on the wing, and the Tanager and Humming Bird for the tropical vividness of their plumage. The Woodpeckers attract our attention by their peculiar habits; Owls are popularly supposed to possess an unusual share of wisdom; and while some of the *Falconidæ* are famous for their strength and daring, one at least, the emblem of the republic, is infamous as "a piratical parasite" of the industrious Fish-hawk. Our Cowbird, which is classed with the *Icteridæ* or Orioles, is notorious for imposing its eggs on other species in the manner of the Cuckoo of Europe; while the American Cuckoo builds a nest and rears its own young. It is by no means certain however that this is invariably the case with the latter species, as I am informed by Dr. A. J. Howe, that he has in one instance known our Cuckoo (probably the Yellow-billed species) to lay in a Robin's nest; and, watching the nest from day to day he finally observed that the Robin had hatched the Cuckoo's egg along with her own. Nuttall, quoted by Baird, Brewer and Ridgway, also mentions finding an egg of the Yellow-billed Cuckoo in a Catbird's nest, and another in the nest of a Robin. (*North American Birds*, Vol. 2, p. 480.)

Of our "Water Birds," the most noticeable family is the *Anatidæ*, comprising the Swans, Geese and Ducks, of which twenty-seven species have been identified in this vicinity. These are all migrants with us, but some of the ducks are known to breed in the State at suitable localities, as at St. Mary's Reservoir and on the marshes in the neighborhood of Lake Erie. The Wood Duck has also been seen with a brood of very small young, on the Little Miami river, within a few years. Some of the Herons (*Ardeidæ*) and the Cranes (*Gruidæ*) are remarkable for their size and peculiar plumage; and one of our Gallinules (*Porphyrio martinica*) is entitled to especial consideration as a tropical visitor of unusually frequent occurrence recently, five speci-

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1 See "Birds of North-eastern Illinois," by E. W. Nelson.—*Bulletin of the Essex Institute*, Vol. viii., Dec., 1876.

2 See "Catalogue of the Birds of Minnesota," by P. L. Hatch, M.D.—*Bulletin Minnesota Academy of Natural Sciences*, 1874.

3 "A Catalogue of the Birds of Kansas," by Professor F. H Snow, of the Kansas Academy of Science. Third edition, 1875

mens having been taken in Ohio during the spring of 1877—four of them in this vicinity.

Among the interesting ornithological features of this locality should also be mentioned the common occurrence of several rather southerly species, such as the Kentucky Warbler, Yellow-breasted Chat, Summer Redbird and Acadian Fly-catcher, among the summer residents; and the Tufted Titmouse, Carolina Chicadee, Great Carolina Wren and Cardinal Redbird, among the constant residents; this being apparently about the northern limit of the regular occurrence of these species in numbers. Other noteworthy species are the Mocking Bird, Bewick's Wren, Loggerhead Shrike, Barn Owl and the Black Vulture; these, however, are of rare occurrence in this vicinity.

During the past forty years, several important changes have taken place in our local Bird-fauna. As in all thickly populated districts the Wild Turkey and the Prairie Chicken have been exterminated; the Parroquet, which formerly occurred in abundance throughout the Mississippi and Ohio Valleys has at present a much less extensive range, being mainly confined to the Gulf States; the beautiful Swallow-tailed Kite (*Elanoides forficatus*)[1] has apparently ceased to visit us, and our two largest Woodpeckers (*Campephilus principalis* and *Hylotomus pileatus*) have disappeared along with the dense forests that were their favorite resorts. The seventh extirpated species is the Raven, which is said to have been a common resident of this section in former times.

To offset these losses, we have the Cowbird and the Black-throated Bunting in abundance, both of which were considered of doubtful occurrence in Ohio forty years ago;[2] the Kentucky Warbler, Loggerhead Shrike and Lark Finch are also inferred to have made their appearance within the same period, as they were omitted entirely from Dr. Kirtland's list; and the Cerulean Warbler, now a common summer resident throughout the State, was observed by him in one instance only, a fact strongly suggestive of its comparative rarity at that time. Within the present decade two European species, the House Sparrow and the Skylark, have also been added to our fauna, the former of which seems likely to exceed in numbers any one of our native species, unless its extraordinary increase should be checked by natural or artificial means—"a consummation devoutly to be wished." With respect to this ever recurring "sparrow question," however, it is sufficient to say here that their introduction is regarded by ornithologists generally as a most decided mistake; for special reasons why they should not

1 See footnote page 14, on the recent occurrence of this species near Columbus, Ohio.
2 *Vide* Kirtland, List of Ohio Birds.—*Ohio Geol. Survey*, 1838.

have been introduced in America, the reader is referred to an able paper on the subject by Dr. Elliott Coues, in the American Naturalist for August, 1878.

The foregoing are doubtless but a portion of the changes in the Avian-fauna of this locality within the period mentioned, as many others, of which we have no definite record, have probably taken place; it is apparent, however, that the various conditions attendant upon civilization have resulted, directly or indirectly, in the extirpation of several of our larger species; while, on the other hand, there has been a decided increase both in species and in individuals, among the smaller birds. And finally, in these various changes that have occurred in our Avian-fauna, we have an excellent illustration of the workings of that universal law of nature, in accordance with which the living things of a country or district become adjusted to their surroundings; protection from enemies and an increased food-supply, resulting in a greater abundance of some forms, while extermination is the fate of others whose habits or constitutions will not admit of the modification necessary to adapt them to new conditions.

MADISONVILLE, HAMILTON CO., OHIO, December, 1878.

REPORT OF COMMITTEE ON GEOLOGICAL NOMENCLATURE.

To the Cincinnati Society of Natural History :

Your Committee, appointed to report upon what seems to be the correct nomenclature of the Lower Silurian Rocks of South-western Ohio, South-eastern Indiana, and Kentucky, represent :

That the fossils found in the strata, for twenty feet or more above low water mark of the Ohio river, in the 1st Ward of the city of Cincinnati, and on Crawfish creek, in the eastern part of the city, and in Taylor's creek, east of Newport, Kentucky, at an elevation of more than fifty feet above low water-mark in the Ohio river, indicate the age of the Utica Slate Group of New York. A fauna is represented in these rocks, that is not found above or below them. Within this range, we find the *Triarthrus becki*, *Leperditia byrnesi*, *Leptobolus lepis*, *Buthotrephis ramulosa*, and several species of Graptolites, Crinoids, Bryozoans, and Brachiopods, that seem to be confined within its limits. Moreover, the brown slates and greenish-blue shales and concretionary nodules give a lithological character to the strata, which distinguish them from the strata both above and below. From the evidences thus furnished by the lithological character of the strata, and the distinct

character of the fossil remains, we refer all the strata containing the *Triarthrus becki* to the age of the Utica Slate Group of New York.

Above the range of the *Triarthrus becki*, the fossils, as well as the position of the rocks, indicate the age of the Hudson River Group of New York, and we have no hesitation in so referring them, and entertain no doubt of the correctness of the reference.

The fossils from Paris, Lexington, the High Bridge over the Kentucky River, and from other places in Kentucky, as well as the lithological character of the strata, furnish abundant evidence of the existence of the Trenton Group over an extensive tract of country, in that State. In the State of Kentucky, we have the Trenton, Utica Slate and Hudson River Groups well represented, and the rocks have a northerly dip from Paris and Lexington, toward the Ohio River, but at what rate per mile we are not advised.

In South-eastern Indiana, neither the Trenton nor Utica Slate appear, and, consequently, we refer all the Lower Silurian rocks of that State to the Hudson River Group.

The Trenton Group is not exposed at Cincinnati, nor at any point in Ohio west of the city, but we think it is probable that it may be represented in the banks of the Ohio river a few miles east of the city. The Utica Slate is represented in Ohio only in the banks of the river, at the city of Cincinnati, and east of the city, and in the excavations near the mouths of the streams which enter the river east of the city. Consequently, all the Lower Silurian rocks in South-western Ohio belong to the Hudson River Group, except those represented by the small exposures in the banks of the river at Cincinnati, and east of the city, in the immediate vicinity of the river.

The conclusion to which we have come is, that all the Lower Silurian rocks, which we have had under consideration, are to be referred to the Trenton, Utica Slate and Hudson River Groups, and that the name "Cincinnati Group" should be dropped, not only because it is a synonym, but because its retention can subserve no useful purpose in the science, and because it will, in the future, as in the past, lead to erroneous views and fruitless discussion. And we would add that so far as any investigations of these rocks have been made, they have not led to any other or further subdivisions than those which we have adopted, and which have been so thoroughly and firmly established by the geologists of the State of New York.

S. A. Miller,
Fred. Braun,
Jno. Mickleborough,
John W. Hall, Jr.,
E. O. Ulrich,
A. G. Wetherby,
Geo. W. Harper,
Paul Mohr,
C. B. Dyer,
R. M. Byrnes.

Contributions to Palæontology,

BY S. A. MILLER AND C. B. DYER.

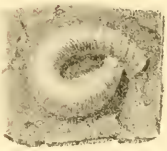
Plate 1

9.

6.

1.

13.



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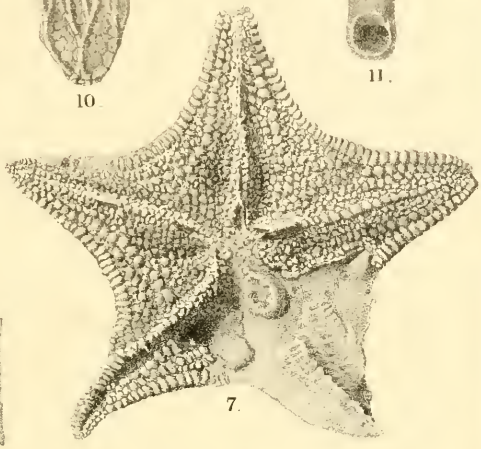

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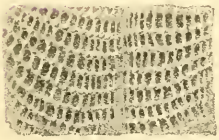

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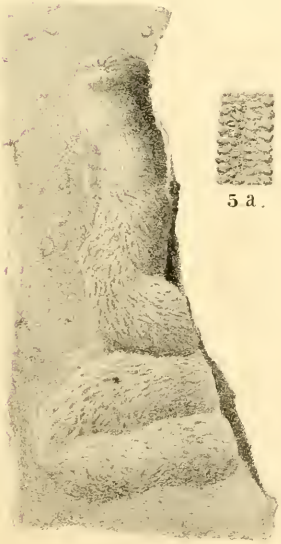

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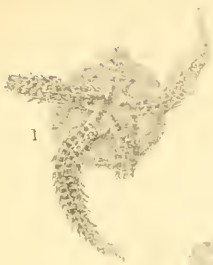
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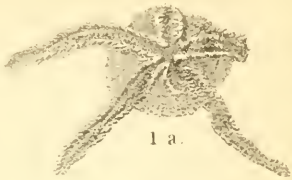
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3 a.


3 b.


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12 b.


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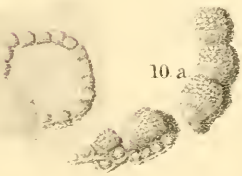
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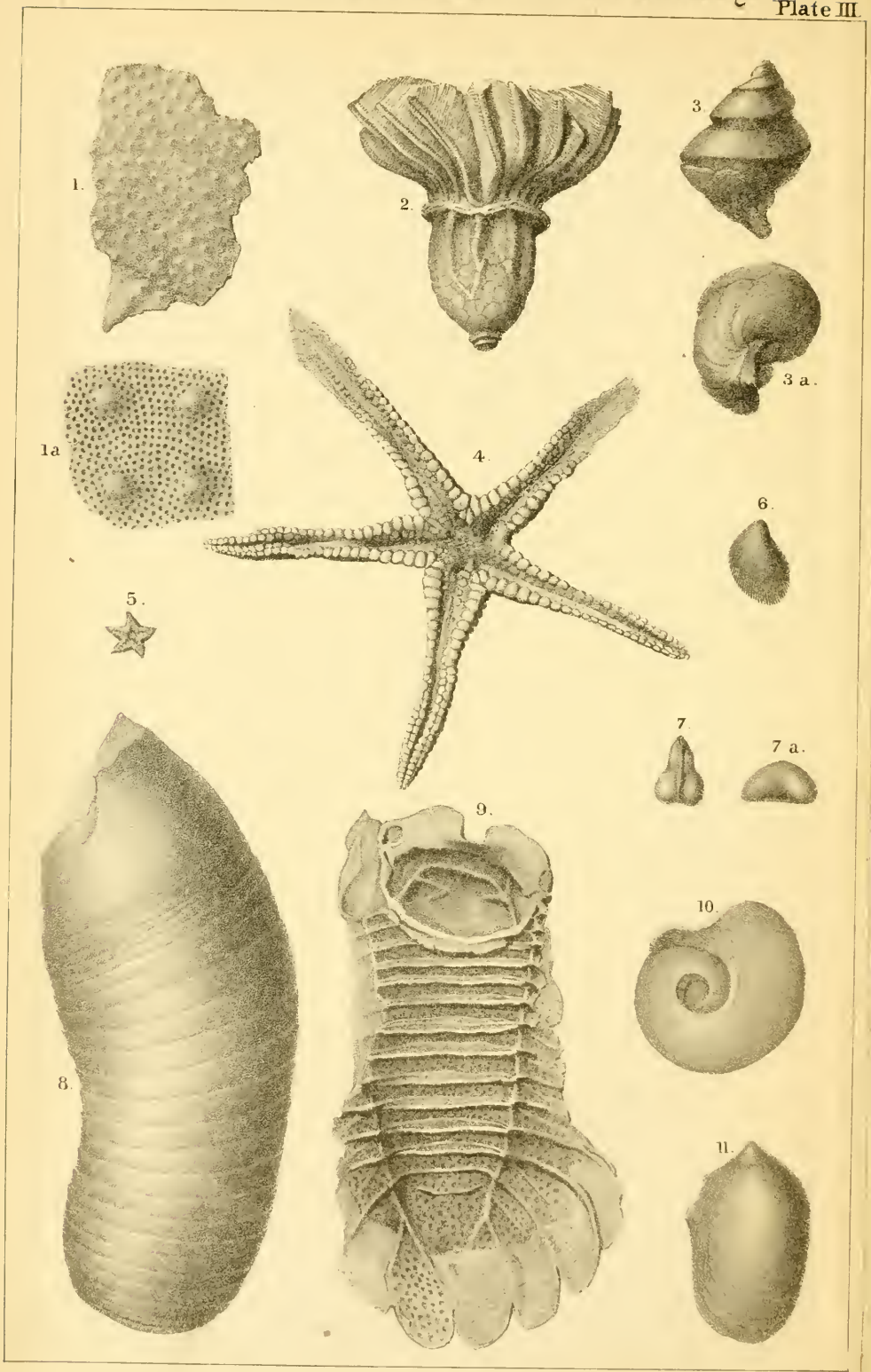
Plate III.



Strobridge & Co. Lith. Cin. O.

PLATE III.

Fig. 1. PTILODICTYA MAGNIFICA—Natural size.

1*a*. Magnified view.

Fig. 2. GLYPTOCRINUS DYERI *var.* SUBLÆVIS—Natural size.

Fig. 3. MURCHISONIA MULTIGRUMA—Natural size.

3*a*. Basal view.

Fig. 4. PALÆASTER LONGIBRACHIATUS—Natural size.

Fig. 5. PALÆASTER CLARKEI—Natural size.

Fig. 6. AMBONYCHIA RETRORSA—Natural size.

Fig. 7. CYTHERE IRREGULARIS—Dorsal view. Natural size.

7*a*. Side view, ventral margin uppermost.

Fig. 8. CYRTOCERAS AMŒNUM—Natural size.

Fig. 9. LICHAS HARRISI—Natural size.

Fig. 10. CYRTOLITES MAGNUS—Natural size.

Fig. 11. ANGELLUM CUNEATUM—Natural size.

PLATE IV.

Fig. 1. PROTOSCOLEX ORNATUS—An entire (?) specimen. Natural size.

1*a*. Another specimen. Natural size.

1*b*. A portion of the same enlarged to show the papillated segments.

Fig. 2. PROTOSCOLEX COVINGTONENSIS—A well preserved and nearly entire specimen. Natural size.

Fig. 3. PROTOSCOLEX TENUIS—A small, entire specimen. Natural size.

Fig. 4. PROTOSCOLEX SIMPLEX—An entire specimen of the natural size.

Fig. 5. EOTROPHONIA SETIGERA—A side view, showing the dorsal and lateral series of setæ.

5*a*. A view of the under side, showing only the lateral series of setæ, the dorsal series being imbeded in the matrix.

Fig. 6. ANOMALOIDES RETICULATUS—A compressed conical fragment, now in the cabinet of Dr. R. M. Byrnes.

6*a*. A fragment of the body, to which the rays, as represented in fig. 6, probably were attached.

6*b*. Enlargement of some of the club-shaped plates.

Fig. 7. CHÆTETES VENUSTUS—Fragment. Natural size. In the cabinet of Prof. J. W. Hall, Jr.

7*a*. Portion of the surface of same. Enlarged to six diameters.

Fig. 8. CALLOPORA CINCINNATIENSIS—Terminal portion of a branch. Natural size.

8*a*. Portion of the surface of same. Enlarged to eight diameters.

Fig. 9. PROTESTERINA FIMBRIATA—View of the ventral surface of a very well preserved specimen.

9*a*. A dorsal view of the same.

9*b*. Portion of one of the rays, magnified to show the arrangement of the plates and position of the sub-conical plates within the pores.

9*c*. Enlargement of the mouth parts, showing the arrangement of the oral plates.

Fig. 10. DISCINA TENUISTRIATA—A ventral valve. Natural size.

Fig. 11. DISCINA SUBLAMELLOSA—View of a dorsal valve of this species. Natural size.

Fig. 12. CRANIA PERCARINATA—Dorsal valve.

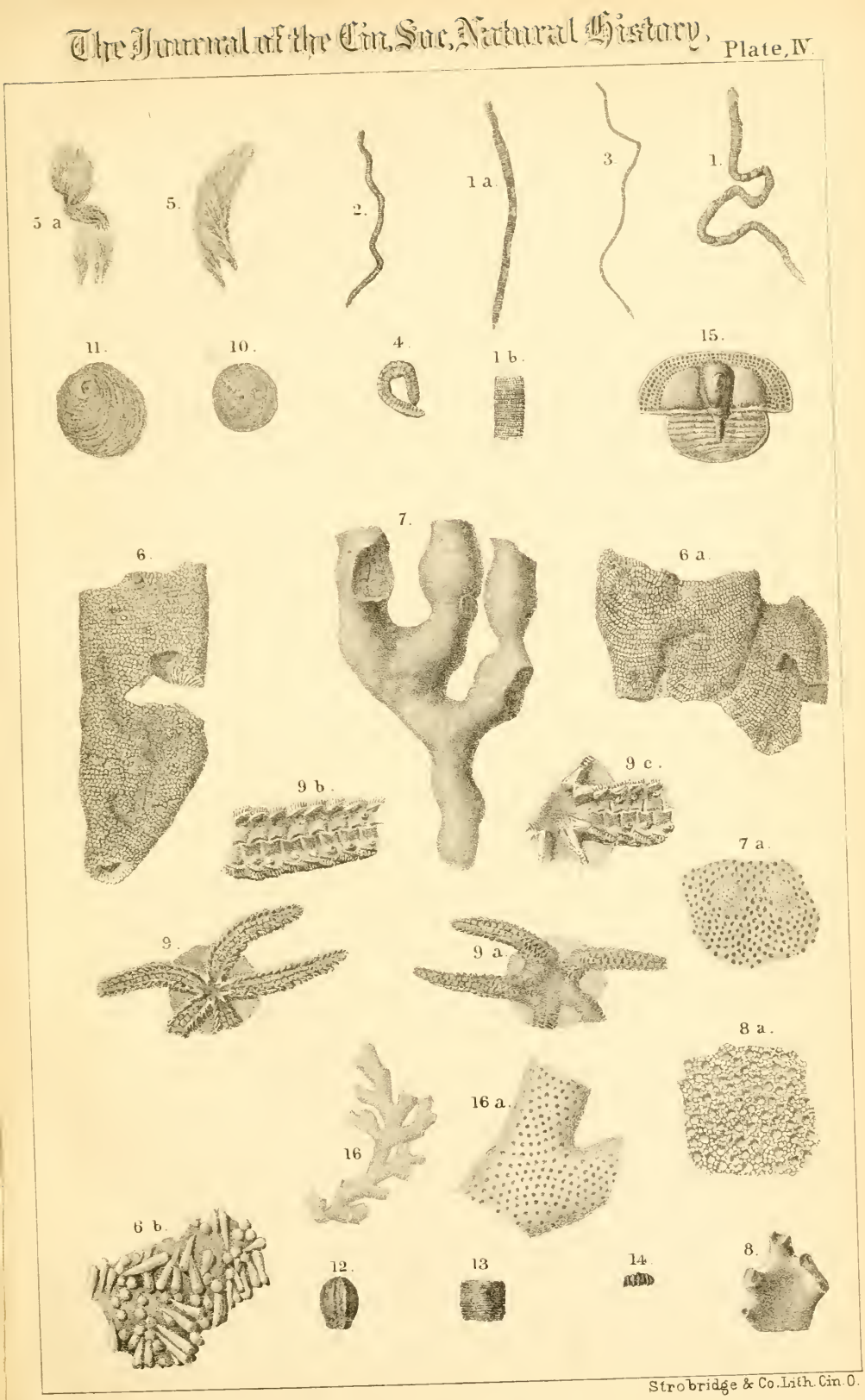
Fig. 13. CRANIA PARALLELA—Dorsal valve. Natural size.

Fig. 14. CRANIA SOCIALIS—View of dorsal valve.

Fig. 15. TRINUCLEUS BELLULUS—A large and very perfect specimen. Enlarged to four diameters.

Fig. 16. PTILODICTYA PERELEGANS—A fragment of a frond. Natural size.

16*a*. A portion of same enlarged to six diameters.



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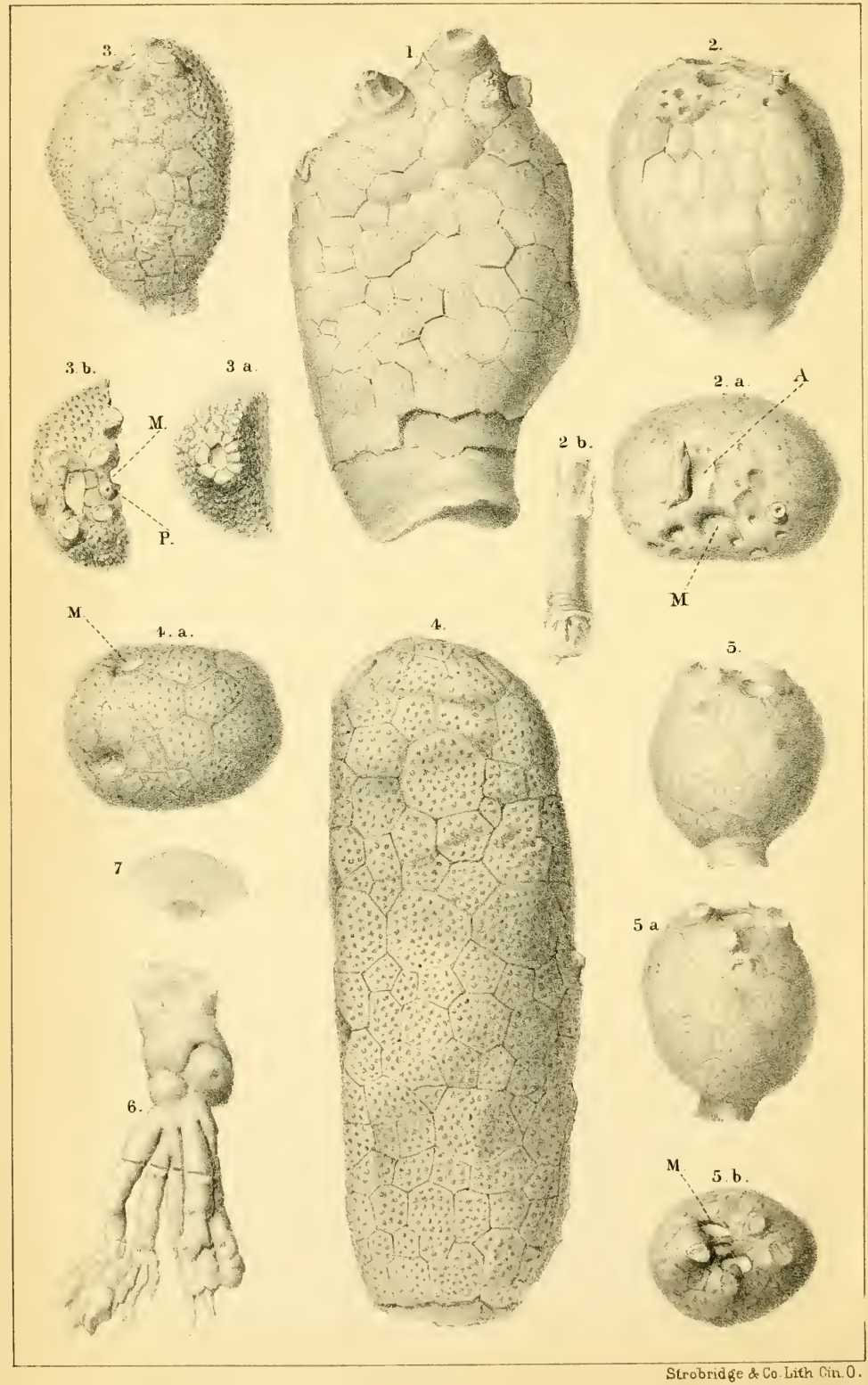

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PLATE V.

PAGE.

Fig. 1. HOLOCYSTITES BRAUNI—Natural size. Side view, ... 130

Fig. 2. HOLOCYSTITES WETHERBYI—Anterior view, ... 131

2*a*. Summit view, with anterior side down. M, mouth. A, ambulacral orifice.

2*b*. Magnified view of what is supposed to be an arm, that is to be seen on 2*a*, by the side of the ambulacral orifice.

Fig. 3. HOLOCYSTITES ORNATUS—Posterior view, ... 132

3*a*. View of the base, showing the form of the plates, and the flattened anterior side, part of which is due to compression.

3*b*. Summit view. M, mouth. P, anal aperture.

Fig. 4. HOLOCYSTITES PERLONGUS—Posterior view, ... 132

4*a*. Summit, bringing the anterior part more into view than the posterior. M, mouth.

Fig. 5. HOLOCYSTITES GLOBOSUS—Anterior view, ... 133

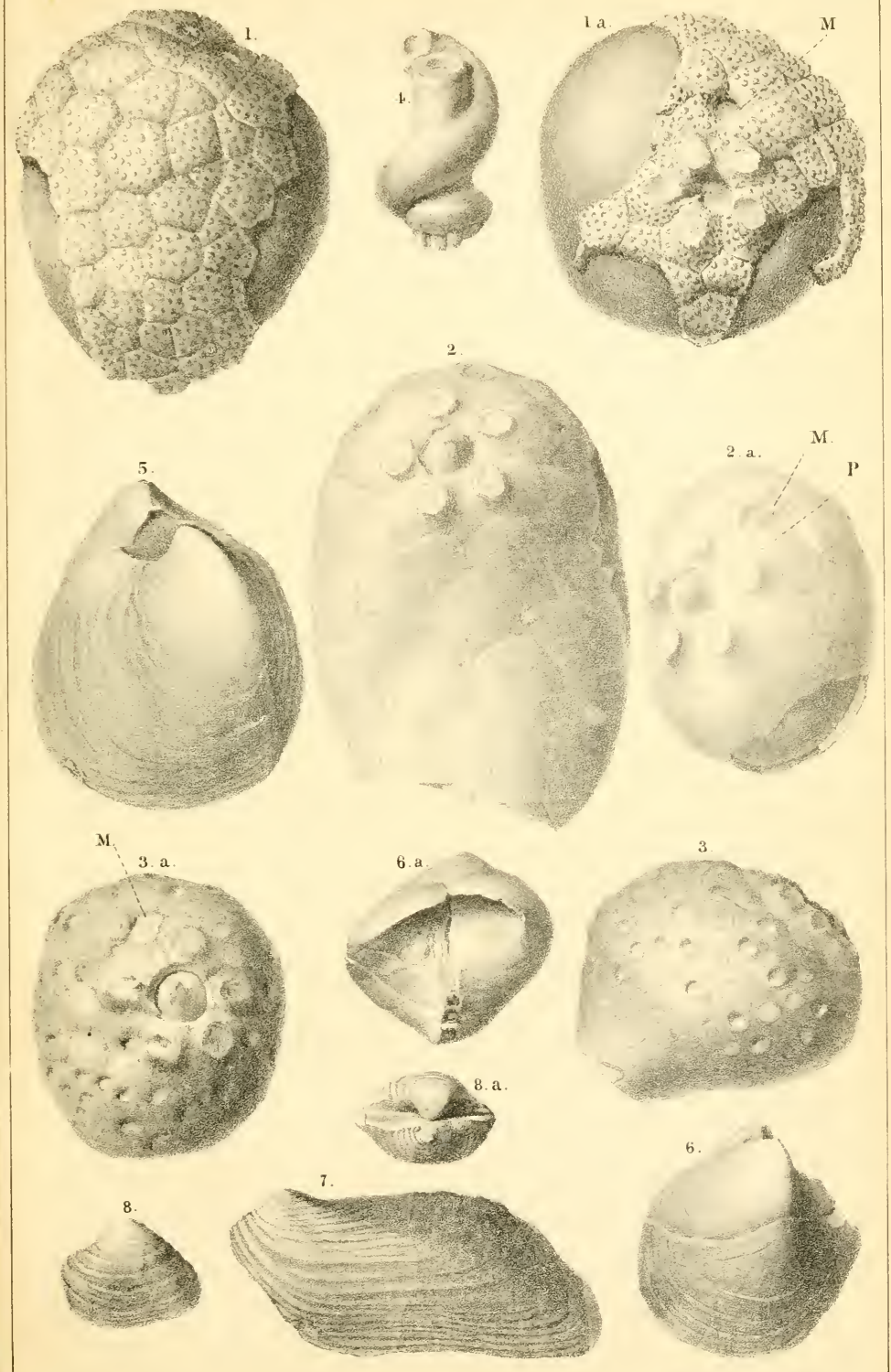
5*a*. Posterior view.

5*b*. Summit view. M, mouth.

Fig. 6. The root of a HOLOCYSTITES showing its crude branches.

Fig. 7. Part of the plate of a column, showing the fine lines which radiate from the center to the circumference.

PLATE VI.



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