Enumeration
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by
Winchell and Marcy

ENUMERATION OF FOSSILS

COLLECTED IN THE

NIAGARA LIMESTONE AT CHICAGO, ILLINOIS;

WITH DESCRIPTIONS OF SEVERAL NEW SPECIES.

By PROF. ALEXANDER WINCHELL AND PROF. OLIVER MARCY.

WITH TWO LITHOGRAPHIC PLATES.

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Enumeration of Fossils collected in the Niagara Limestone at Chicago, Illinois; with Descriptions of several New Species. By Prof. ALEXANDER WINCHELL and Prof. OLIVER MARCY.

Read January 4th, 1865.

MORE than a year ago, some fossils came into our hands from the quarries in the south part of the city of Chicago, Illinois, in a suburb known as Bridgeport, which seemed to possess an unusual degree of interest. We at once visited the place, and subsequently adopted measures to procure as complete a collection as possible of the fossils of the locality. Believing that an exhibition of the ancient fauna which once lived upon the spot would possess considerable geological interest, we have made note of every species which has fallen under our observation, and, by an understanding with Mr. Worthen, the State geologist of Illinois, offer the results of our studies in the following paper:—

The rock at the principal quarry is a limestone, which, to a considerable extent, is in a broken and amorphous condition. The entire mass, in consequence of the partial or complete destruction of the fossils, has assumed an extremely vesicular structure. The upper portion seems to be somewhat magnesian; it is of a pale buff color, more massive than the lower, and contains nearly all the species enumerated in the present paper. Its thickness at the quarry is about eighteen feet. The lower portion is of a bluish color, generally harder in its solid parts, but somewhat diversified with patches of an argillaceous character. It has not been quarried to any considerable extent, and the excavations do not penetrate it a greater distance than about four feet. It is only in this part that we find those interesting species, *Acidaspis Ida*, *Ischadites tessellatus*, and *Gomphoeras Marcyæ*. The whole mass of the rock, both above and below, is a congeries of organic remains, three fourths of which are reduced to an unrecognizable condition, and many of which have been totally or partially dissolved out, showing, in some instances, the delicate tracery of the exterior, or complicated internal structure, in an extraordinary state of preservation.

We do not intend to be understood by what is stated above, of the upper and lower portions of the exposure, that in our opinion we recognize here the line of demarcation between two stages of the formation, not considering our data sufficient to justify a conclusion on this point.

According to Mr. Worthen, the rocks at this locality are lithologically and paleontologically identifiable with the Leclaire limestone at the upper rapids of the Mississippi, near Leclaire, Iowa, and Port Byron, Illinois.¹ Mr. Worthen states that a Bryozoan form resembling *Dictyonema retiformis*, *Myalina mytiliformis*, *Strophomena depressa*, a small *Pentamerus* resembling *P. galeatus*, and three or four species of chambered shells belonging to the genera *Orthoeras* and *Cyrtroeras*, are common to the Leclaire and Chicago limestones, establishing an identity between the two, as he thinks; while the Niagara age of the latter is shown by the number of Niagara species which it contains.

Professor Hall (Iowa Geol. Rep., p. 73,) had previously supposed the Leclaire limestone might be the western equivalent of the Galt limestone of Canada West, though he subsequently recognized the evidences of its belonging to the age of the Niagara group, occupying a position probably in the upper part of the group.²

¹ Amer. Jour. Sc. and Arts. vol. xxxiii. p. 46, 1862.

² Wiscon. Geol. Rep., pp. 67 *et seq.* and 446 *et seq.*

Our own investigations in the Chicago limestone—which are the first to bring into prominent notice this interesting locality—seem to confirm, beyond all controversy, Mr. Worthen's opinion of the age of the rock, as the following table will show; and by establishing, through numerous identifications, given below, its parallelism with the Racine limestone,—admitted to be equivalent to the Leclaire limestone,—it becomes geologically demonstrated that all these limestones occupy a position in the Niagara group of New York.

But with which member of the group shall they be synchronized? Our own identifications tend to show a relationship with both the Niagara limestone and the Niagara shale; of those species, however, which, at the East, occur in the Niagara shale, it will be observed that some, as *Strophomena rhomboidalis*, *Atrypa reticularis*, *Spirifera crispa*, *S. radiata*, *Meristella nitida*, and *Rhynchonella neglecta*, are species which enjoyed either a great geological or great geographical range, or both together, and are thus proved to have been wanting in that sensibility to geological variations which is requisite in fossils relied upon for stratigraphical determinations. The same may perhaps be said of *Caryocrinus ornatus* and *Loxonema subulata*. Of the others, the *Polyzoa* may be regarded as only provisionally identified. There is left, then, no strong bond of alliance between the Chicago limestone and the Niagara shale, except the prevalence of crinoidal remains in both. But it will be noticed that we have been unable to identify any species except *Caryocrinus ornatus*; so that, admitting the alliance shadowed forth by the presence of the crinoidal type in considerable force, we have a much stronger affinity established with the Niagara limestone by the identification of several species of true corals, as well as by the abundance of individuals of this type. For the present, therefore, it seems to us that the Chicago, Racine, and Leclaire limestones exhibit a satisfactory affinity with the Niagara limestone of New York.

We have detected in the Chicago limestone no less than eighty-two species, of which thirty-nine seem to be hitherto undescribed. If we add to these the few additional species described by McChesney, from the same locality, we find that a single quarry has furnished not less than eighty-seven species,—another evidence of the abundance and variety of life which teemed in the paleozoic seas.

None of the Gasteropoda or Cephalopoda have been identified with New York species. Of the identifications with New York species, the corals are all (except *Petraia calicula*) from the Niagara limestone, and the mollusks (including Bryozoa) are all from the Niagara shale.

It is noticeable that we do not find in our collection any specimens of *Helolites*, *Eucalyptocrinus decorus*, *Orthis elegantula*, *Spirifera niagarensis*, *Pentamerus oblongus*, *Rhynchonella cuneata*, or *Calymene*.

Of the old species recognized by us, all have been described from the Niagara group of North America. *Loxonema subulata* Conrad, was, however, originally described from the Clinton group of New York, but has been identified in the Niagara group of Canada West, as well as at Chicago. The geographical distribution of these species in some of the Northwestern States, Canada West, and Europe, is presented at a glance in the following table:

GEOGRAPHICAL DISTRIBUTION OF NIAGARA SPECIES IDENTIFIED AT CHICAGO.

	N. Y.	Wis.	Ind.	Can.	Eur.
<i>Petraia calicula</i> Hall sp.	*			*	
<i>Zaphrentis turbinatus</i> Hall sp.	*				
<i>Diphyphyllum caespitosum</i> Hall sp.	*	*			
<i>Favosites gothlandica</i> Lam.	*	*	*	*	*
“ <i>venustus</i> Hall sp.	*				
<i>Cladopora fibrosa</i> Hall	*				
“ <i>seriata</i> Hall	*				
“ <i>reticulata</i> Hall	*				
<i>Halysites catenularia</i> Linn. sp.	*	*	*	*	*
<i>Stictopora punctipora</i> Hall	*				
<i>Polypora incepta</i> Hall.	*				
<i>Fenestella elegans</i> Hall.	*				
<i>Lichenalia concentrica</i> Hall	*				
<i>Eucalyptocrinus ornatus</i> Hall.		*			
<i>Glyptocrinus Carleyi</i> Hall			*		
<i>Caryocrinus ornatus</i> Say.	*	*		*	
<i>Caryocystites cylindricus</i> Hall		*			
<i>Strophomena rhomboidalis</i> Wahl.	*	*	*	*	*
<i>Atrypa reticularis</i> Linn. sp.	*	*	*	*	*
“ <i>nodostriata</i> Hall	*				
<i>Meristella nitida</i> Hall sp.	*		*	*	
<i>Spirifera crispa</i> Sowb.	*		*	*	*
“ <i>radiata</i> Sowb.	*	*	*	*	*
<i>Rhynchonella neglecta</i> Hall	*	*	*	*	
* <i>Pterinea neglecta</i> McChesney sp.		*			
<i>Ambonychia mytiloidea</i> Hall		*			
<i>Pleurotomaria Halei</i> Hall.		*			
“ <i>Hoyi</i> Hall		*			
<i>Loxonema subulata</i> Con.				*	
* <i>Orthoceras Laphami</i> McChesney.		*			
<i>Cyrtoceras Fosteri</i> Hall		*			

ENUMERATION OF SPECIES.

Petraia calicula Hall sp., Pal. N. Y., ii. p. 111, pl. xxxii. fig. 1, *a-k*.

Zaphrentis turbinatus Hall sp., Pal. N. Y., ii. p. 112, pl. xxxii. fig. 2.

Cystiphyllum sp? A fragment generically well marked.

Diphyphyllum caespitosum Hall sp., Pal. N. Y., ii. p. 116, pl. xxxiii. fig. 1, *a-b*.

Favosites gothlandica Lam. (*F. niagarensis* Hall.) We adopt the suggestion of Billings (Canad. Journal, March, 1859, p. 99), in referring this form back to the original species. It occurs abundantly in the upper part of the quarry.

Favosites venustus? Hall sp., Pal. N. Y., ii. p. 120, pl. xxxiv. fig. 1, *a-i*.

The agreement is not striking. This is an expanded, incrusting coral, adapting itself to the inequalities of the underlying surface, and, in places, developing tubercular masses. The tubes are ordinarily not more than an eighth of an inch long, but, in the tubercles become sometimes half an inch in length. In the tuberculous parts, the diaphragms are seen to be direct and crowded. No indications of a radial system are seen. The cell-mouths are conformable to this species. The Chicago fossil bears considerable resemblance to *Thecostegites hemisphaericus* Röm. (Sil. Fauna des Westl. Tenn. Taf. ii. fig. 3).

* These species are not enumerated by Hall among the fossils of Wisconsin.

CLADOPORA Hall.

Cladopora lichenoïdes W. and M.

Plate II. figure 1.

Polypary consisting of a mass of crowded cylindrical tubes arranged in ramose and foliaceous forms, both forms being sometimes united in one specimen. The earlier growth, in one of our specimens, is explanate. The cells are elongated, obliquely horizontal, crowded, overlapping, with their mouths opening obliquely through the epitheca. The frond develops into an irregularly undulate form, sometimes dividing, and some of the lobes bending round laterally, after the manner of one or two turns of an *Archimedes*. From the border of the frond arise terete, bifurcating branches, with the mouths opening on all sides. All the cell-mouths are somewhat crescentiform, the outer lip often slightly indented, and sometimes sufficiently so to give the mouth a triangular outline.

In exfoliated, weathered specimens, the cells are seen to be cylindrical and separately walled, but closely in contact. The width of three of these cells occupies the space of one tenth of an inch; their length is about a third of an inch. No evidences of septa or lamellæ can be detected.

The cell-mouths of this abundant and beautiful species resemble *Cœnites*, *Alveolites*, and *Cladopora*. The fossil differs from *Cœnites* and *Cladopora* in not having a solid coenenchyma, and—at least from the usual forms—in its foliaceous ensemble. It differs from *Alveolites* in the want of intra-cellular structure. Some species of *Cladopora* figured by Hall, however, exhibit generic characters to which the present species is sufficiently conformable.

Cladopora verticillata W. and M.

Plate II. figure 2.

Corallum arising in the form of a stem, from which spreads out, horizontally, in all directions, a thin and delicate frond, composed of small radiating cells continually multiplying in number with the distance from the axis. This circular frond is covered superiorly by an epitheca through which the cell-mouths open as in other species. The mouths are triangular-ereseentie; the cells show traces of dissepiments. At the height of an inch and a half above the first frond is another, in all respects similar, and a cylindrical perforation runs through the rock from one to the other. This structure has been seen in two unmistakable specimens. It seems probable that other verticils or circular fronds occur between the two observed, and that the whole space was originally filled up with verticils of cells alternating with plates of epitheca; but of this we have no other evidence than the porous condition of the rock, with occasional traces of minute coral tubes.

In the specimen which is the subject of this description, a second stem, smaller than the first, is seen perforating the rock for the depth of half an inch, and sending out a verticil which becomes confluent with that of the larger specimen. Is this a new colony rooted, banyan-like, from the branches of a parent?

The axis in our specimens is hollow. The filling is a calcareous clay, showing no other structure than a slight porousness, with obscure vertical striations on the exterior. We

might be permitted to infer, from analogy, that the original axis was solid, and resembled the cylindrical stems of other species of the genus, but has been destroyed in our specimens.

Diameter of the hollow axis, .16 below, .19 above; diameter of verticils, more than three inches; number of cells in one tenth of an inch, 6 to 8.

Much remains to be learned of this coral; and we desire to direct attention to it by making known, in the mean time, its very extraordinary *ensemble*. The two species of *Cladopora* described by us not only present unique characters in their general forms, but, in their structure, furnish us with the proofs that *Cladopora* is a generic type founded in nature.

Cladopora fibrosa Hall. Pal. N. Y., II. 139, pl. xxxviii. figs. 4, 5.

Cladopora seriata Hall. Pal. N. Y., II. 137, pl. xxxviii. fig. 1.

Cladopora reticulata Hall. Pal. N. Y., II. 141, pl. xxxix. fig. 3. We have specimens of this exhibiting the reticulations spread over a surface eight or ten inches square.

Halysites catenularia Linn. sp. Seldom found in a recognizable state of preservation. We occasionally find casts of the spaces enclosed by the labyrinthine walls, which, with the vertical striations and transverse wrinkles of the tubes preserved, present an object closely resembling the enigmatical fossil named *Cophinus dubius* in the Silurian System, (pl. xxvi. fig. 12,) and which in the Siluria (p. 136, and pl. xv. fig. 4) is attributed to the slow gyration of the stems of encrinites after the mud had settled around them. The Ludlow fossil may clearly have had the origin attributed to it; but our specimens, though at first obscure, have furnished, at length, conclusive evidence of being the impressions or casts of the walls of a *Halysites*. The transverse dissepiments in some of the cells are well preserved and numerous.

Stromatopora sp? We have a weathered specimen, exposing the stellately diverging ramulets formed in the interlaminar spaces. This curious organism would not ordinarily be identified as a *Stromatopora*; but, by the aid of Dr. Röminger's extensive suite of specimens of this genus, its true character becomes apparent. There is a specimen of the type, which shows stellate cell-mouths, in the Illinois State Cabinet. This is in the usual state of preservation, and may be identical with ours, though we have only had the opportunity to give it a hasty glance.

Stictopora punctipora? Hall. Pal. N. Y., II. 157, pl. xl. B, fig. 2 a-c.

Polypora incepta? Hall. Pal. N. Y., II. 167, pl. xl. D, fig. 5 a-f. A large undulately cyathiform frond, nearly six inches in diameter, with fenestrules somewhat smaller than in the typical species. The cells have not been certainly distinguished either in this or the following species.

Fenestella elegans? Hall. Pal. N. Y., II. 164, pl. xl. D, fig. 1 a-g.

Lichenalia concentrica Hall. Pal. N. Y., II. 171, pl. xl. E, fig. 5, a-g.

ISCHADITES Murchison.

Ischadites tessellatus W. and M.

Plate II. figure 3.

Body somewhat tapering, pyriform, compressed on the side toward which the smaller end is slightly inflected; the larger end imperfect in all our specimens. One example is somewhat in the form of a triangular prism with rounded edges, and the sides indented toward

the base, while the upper end is convex. The whole exterior is divided into small rhomboidal or nearly square areas by ridges which originate at the apex and describe curves obliquely approaching the base, and crossing each other like the curves of the "engine-turned ornament of a watch." In the best preserved specimens, these ridges are surmounted by little crests deepening the pits or cells which they mark out. In other specimens these cells are simply hopper-shaped cavities. The cells of course increase in size from the origin of the ridges to that part of the surface where the diameter of the body is greatest. In the bottom of each cell is a small pore penetrating the internal cavity. Besides this, each cell communicates by pores with the four neighboring cells touching it at the angles. These connecting pores are parallel with the general surface, and pass under the intersection of the two crests or ridges. Each rectangular intersection, therefore, rests over the crossing of a couple of right-angled passage-ways. In some specimens, in which the hopper-shaped cells are shallow, these pores, extending across the cell from corner to corner, present the appearance of open passage-ways excavated through the substance of the test; on the side toward the larger end of the body, however, the passage-way remains covered. In such cases, the feature which first strikes the eye is a pair of furrows intersecting each other at right angles in the middle of each cell, forming three sides of a cross.

Our specimens are all casts, and exhibit no further internal structure, except that the central pores can be seen penetrating the internal cavity, and losing themselves at the depth of a quarter of an inch. Polished sections at right angles with the surface present obscure indications of sac-like cells extending inward from the surface about one fourth of an inch. There is one of these on each side of the central pore, and the inner end of the cell is regularly rounded. The pore seems to have been the means of communication between the inner common cavity of the body and the external element. It was perhaps respiratory in its function. The cells present the appearance of individualization, while the entire body was undoubtedly a compound organism. Polished surfaces at right angles with the larger axes of these cells do not succeed in bringing their walls into view.

No peduncle of attachment appears to have been in connection with the smaller end; but the larger ends are all imperfect, and it seems not unlikely that this end was adherent, or possibly pedicled.

The largest and most perfect specimen is 2.5 inches in length, with a maximum diameter of 1.75 inches. The diameter of the cells over the most swollen portion of the body is .09 inch.

These very interesting and beautiful specimens are evidently congeneric, if not conspecific with *I. Koenigi* Murchison,¹ and *I. canadensis* Billings, (Geol. of Canada, pp. 309, 327,) though the entire form of *I. canadensis* has not been figured, and *I. Koenigi* is less attenuate at the smaller end. We are of the opinion, also, that they possess close relations with *Dictyocrinus* Conrad, and *Tetragonys* Eichwald; and that all these genera belong to the same zoological type as *Receptaculites*, which has been shown by Salter to be one of the *Foraminifera*, as D. D. Owen conjectured in 1844. At least, the affinities of *Ischadites* with *Receptaculites* seem to be pretty clearly shown by our specimens; and it is worthy of remark that Morris, in his Catalogue, has united *I. Koenigi* and *Receptaculites Neptuni*, while Professor Hall says, (Pal. N. Y., III. p. 148): "The figures [of *I. Koenigi*] in the Silurian System bear so close a resemblance to *Receptaculites* that I could scarcely regard them as distinct from that genus."

¹ Silurian System, 697, pl. xxvi. fig. 11; Siluria, pl. xii. fig. 6.

ACTINOCRINUS Miller.¹

Actinocrinus obpyramidalis W. and M.

Plate II. figure 4.

Body pentangularly obpyramidal; radial series standing out in salient angles with depressions between, deepening upward, and giving great prominence to the arm bases, which are quite small, and exist in pairs. Dome arched, with the appearance (in our specimens) of a broken proboscis a little nearer the centre than the anal side.

Basal plates not seen; radials three, the two lower hexagonal, the first a little larger than the other two, and having its upper side shortest; the third radial heptagonal, supporting a pair of hexagonal secondary radials upon its upper sloping faces. The other plates of the cup cannot be satisfactorily defined in our specimen. They give evidence of having been elevated and sculptured. We have seen a specimen 1.75 inches high to the top of the dome.

This species has all the general appearance of an *Actinocrinus*, and resembles such Carboniferous species as *A. quinquelobus* and *A. cornigerus*; and was not improbably furnished, like them, with spines upon the dome. We know of no allied species of the same geological age.

MEGISTOCRINUS Owen and Shumard.

Megistocrinus Marcouanus W. and M.

Plate II. figure 5.

a. Left antero-lateral ray.

b. Left postero-lateral ray.

c. Azygos side, with one half of the azygos interradials.

¹ Learning, after we had engaged in this investigation, that Mr. W. H. Niles, of the Museum of Comparative Zoölogy at Cambridge, was occupied in a reinvestigation of *Crinoidæ* with a view to publication, we should have preferred that

our own specimens of that type should be worked up by him. He has, however, insisted on our proceeding independently; and, having done so, we deem this statement demanded by the courtesy which ought to prevail among co-laborers in science.

Body large and massive, somewhat obconic, spreading more rapidly towards the arm bases; base sub-acute, generally turned to one side. Basal plates three, equal, hexagonal — the inner side very short — a little broader than high. Radials three in each series. Of the first radials three stand opposite the three basals, and are hexagonal, a little higher than wide, the upper side being shortest, the lower next in length. The other two first radials stand opposite the division between two basals; they are heptagonal by the division of the base, the two basal sides, however, lying nearly in the same straight line. The second radials are hexagonal, nearly as large as the first, one fifth longer than wide, the upper and lower sides about half the length of the others. The third radials are larger than the second, octagonal in the anterior and antero-lateral rays, having two upper sides, each of which is about equal to the lower one, the lateral sides being considerably the longest, and thus causing this plate to be longer than broad; in the postero-lateral rays they are heptagonal by the enlargement of the anal plates. The first supraradial plates are irregularly heptagonal, two thirds as large as the third radial. Second supraradials heptagonal or octagonal, of the same size as the first or smaller, supporting on their upper sloping sides a pair of small pentagonal brachials. Number of arms twenty. First regular interradiat hexagonal, nearly as large as the first radials, supporting on its shorter upper sides a pair of smaller interradiats, which are succeeded by about ten other interradiats, making thirteen in all. The azygos, or anal interradiats number about thirty. The first rests upon the basals, and has precisely the same form and size as the antero-lateral first radials; like the radials, also, it is succeeded by two others, producing a series resembling the true rays, differing, however, in the plates, being a little smaller than the true radials, and being succeeded by five other smaller plates nearly in the same line. Between this series of anals and each contiguous ray lies a series of three plates followed by two pairs. First intersupraradial hexagonal, surmounted by two pairs of smaller ones. The formula of this species is, therefore, as follows:—

Basals.....	3
Radials $3 \times 5 =$	15
Supraradials $2 \times 2 \times 5 =$	20
Brachials $2 \times 2 \times 2 \times 5 =$	40
Regular Interradiats $13 \times 4 =$	52
Azygos Interradiats	30
Inter-supraradials $5 \times 5 =$	25
Interbrachials	0
Total plates in the cup	185

One of our specimens is 3.4 inches long, to the bases of the arms. Another one, defective below, has a diameter of three inches at the bases of the arms; most of the specimens are not over half this size.

There is a variety of this species (apparently) which is marked by ridges along the series of radials and secondary radials. These ridges (in casts) are not interrupted by the sutures.

This massive species bears a remarkably close affinity with *Actinocrinus Christyi* Hall, (Notice of Waldron Fossils, p. 2,) but it may be discriminated as follows: The first radial has a height greater than its width, instead of being equal to it; the second radial is higher than wide, instead of the reverse; the third radial is octagonal in the antero-lateral rays, and is

larger than the second, instead of smaller; the regular interradianals are fewer in number, instead of fifteen or over. Lastly, the ridges over the radial plates are entirely wanting in the typical specimens, and in the supposed variety are not interrupted by the sutures. It is quite possible that the structure of the supposed variety may conform completely to that of *A. Christyi*.

It will be observed that this species departs from the usual form of *Megistocrinus* as known in the Carboniferous rocks, at the same time that it falls strictly under the formula of that genus. We feel constrained to say that the same is true of *Actinocrinus Christyi* Hall, — a circumstance which will enable us to perpetuate this preoccupied specific name under the form of *Megistocrinus Christyi*.

ICHTHYOCRINUS Conrad.

Ichthyocrinus corbis W. and M.

Body pyriform, section nearly circular, one specimen flattened and even indented on the anal side; greatest diameter at one third the height of the body below the arm bases; oblique height gradually or rather rapidly curved below, and more rapidly curved in the vicinity of the greatest diameter, giving the body, in most specimens, a sub-ventricose appearance. Stem very slender at the upper end, turned to one side in all our specimens. Basal plates five, equilaterally triangular, slightly truncated by the stem at their lower apex, flattened, so that the five sutures by their prominence convert the pelvic cup into an inverted pentagonal pyramid. Radials two in each ray, alternating with the basals, which project their angles in pairs into the lower sides of the first radials, rendering them pentagonal by a reëntrant angle below; second radials also pentagonal, with two upper sloping faces to receive the secondary radials. Secondary radials four in each series, each with a transverse diameter equal to twice its height or more; the fourth with two upper sloping sides for the support of the tertiary radials, which are about nine or ten in number in each radiating series, gradually diminishing in height from below upwards, while they increase in transverse diameter, so that the uppermost plates are not more than one twentieth of an inch in vertical height, while their transverse dimension is one fourth of an inch.

In one of our specimens the height of the body to the bases of the free arms is 1.8 inch; greatest diameter (.55 inch below the free arm bases) 1.62 inch. In another specimen, less ventricose, the height is 2 inches, and the greatest diameter (.66 inch below the free arm bases) is 1.6 inch.

The distinctive characters of the species are the small size of the stem, the large size of the basal plates, corresponding to the sides instead of the angles of the pentagonal base, the presence of two instead of three radials, and the perfectly straight transverse sutures separating the plates of the several radial series, except the suture separating two successive series.

In the specimens which we have for examination, the exterior of the plates is removed, and the filling of the sutures projects conspicuously, giving the body a peculiar basket-like

Ichthyocrinus corbis.
Showing the plates of one ray.

or net-like appearance. The characters about the base are somewhat obscure, and it is possible we have overlooked the real first radial. This supposition would reduce the fossil to a greater conformity with *I. lævis*, but it would still be distinct.

GLYPTOCRINUS Hall.

Glyptocrinus Carleyi? Hall. Notice of Waldron Fossils, p. 19. We have several specimens, in a poor state of preservation, which evidently belong to *Glyptocrinus*, or one of the allied genera. We are inclined to think the basal plates are entirely covered by the stem. The radials are three in each series. A conspicuous ridge runs along the middle, bifurcating at each end, in the centre of the first and third radials. The lower branches of the ridges proceed to the centre of the subradials. The azygos interradius is broader than the others, and contains a plate with radiating ridges. The whole number of interradians cannot be determined. The form of the cup is pentangularly turbinate, about three fourths of an inch high, with the same diameter at the bases of the arms. In form, size, and disposition of the visible markings, our specimens agree with specimens from Waldron.

Glyptocrinus sp.? A species quite distinct from the last, being more slender, with a more attenuate base, and more spreading rays. Our specimens also are of smaller size.

LECANOCRINUS Hall.

Lecanocrinus pusillus W. and M.

Body small, depressed, broader than high, constricted above the first radials. Basals small, two hexagonal and one pentagonal. Subradials pentagonal and hexagonal, each equal in size to the whole base. Radials three in each ray,—the first five-sided, having the upper side longest, the basal sides next in length, and the remaining two parallel with each other; second radial quadrangular, short, being five times as broad as high; third radial with two upper sloping faces supporting a pair of secondary radials. Secondary radials transversely oblong, quadrangular; no more than three have been seen. Height to base of arms, .24 inch; diameter at base of arms, .40 inch.

EUCALYPTOCRINUS Goldf.

Eucalyptocrinus chicagoënsis W. and M.

Eucalyptocrinus chicagoënsis.

Body massive, obconic from the base to the arms; base truncate, deeply impressed, obscurely pentagonal, the rim of the impression presenting five protuberances corresponding to the intervals between the first radials. Basal plates small, concealed within the basal cavity. First radial plates quadrangularly heptagonal, the upper side presenting an obtusely reëntrant angle. Second radials as large as the first, nearly square, but having the lower side angulated to suit the reëntrant angle of the first radial. Third radials hexagonal, or very nearly pentagonal, the lower lateral sides being relatively short, and the upper side almost zero. First supraradial smaller than the third radial,

irregularly pentangular. Second supraradials less than half the size of the first, pentangular, with the lower lateral sides shortest, each upper side supporting a small triangular piece, upon which rests the first arm plate. The interradial plates are one large and two smaller to each interradius. The general outline of the lower is somewhat kite-shaped; it is bounded by ten contiguous plates, but the two lower lateral sides are so crowded by the bounding second radials, that the two lower sides touching the first radials are extremely short; and the two short upper sides, in contact with the second interradials, lie nearly in the same line. The pair of smaller interradials are nearly as long and broad, taken together, as the first interradial; the greatest width is below the middle, and their summits reach higher than the bases of the arms. The intersupraradial is similar in shape to the pair of upper interradials, but smaller, and the lower side is almost zero, touching the apex of the third radial. Height of cup to bases of arms, 1.1 inch; greatest diameter (at arm bases), 1.7 inch.

This species greatly resembles *E. crassus* Hall, but a comparison of numerous specimens of each shows constant differences. The first radial is of nearly the same width as the second, instead of being much wider; the first interradial is more elongated, and the two lower sides together are not one fourth the length of the two corresponding sides in *E. crassus*. The second interradials are also more elongate, and narrower. The base shows a tuberculately pentagonal form not possessed by the Waldron specimens.

Eucalyptocrinus ornatus Hall. Wis. Geol. Rep. 1861, p. 20. Differs in no way from Hall's description, except that the first interradial plate is a little higher than wide; and our casts do not exhibit the characters of the exterior.

One of our specimens possesses a sub-central proboscis, of which three eighths of an inch are preserved, exhibiting such a taper that the entire length would seem to have been five or six eighths of an inch. Only the cast of the proboscis exists. The dome is depressed, and the base of the proboscis is elevated about three eighths of an inch above the arm bases. This is a common species, and may be at once distinguished from *E. chicagoënsis* by its much more depressed and generally sub-hemispherical body. This is probably the species mistaken by Worthen for *E. decorus*, which it resembles in form while it is amply distinct in the details of the plates.

Caryocrinus ornatus Say. This species is common, and many of the specimens exhibit, by the removal of the exterior, the grooves running from the pores to the margins of the plates, as shown by Hall, Pal. N. Y., II. pl. xlix. fig. 1, *u*. The external impression of the body is sometimes extremely well preserved.

Caryocystites cylindricus Hall. Geol. Rep. Wis. 1861, p. 23; figured in Rep. for 1862, p. 69. The ovarian aperture, not seen in the typical specimens, is very distinct in a fine specimen belonging to the Chicago Academy of Sciences.

STROPHOMENA Raf.

Strophomena macra W. and M.

Plate II. figure 8.

Shell thin, with both valves nearly plane in young specimens; general outline semicircular, but with a straight hinge-line projecting somewhat at the lateral angles. Ventral valve very slightly elevated in the umbonal region, deeply concave nearer the border in old individuals, having a long, moderately wide area with a triangular fissure; divaricator

scars a pair of small, feeble, diverging pyriform impressions, separated by a faintly raised rostral septum, which reaches two fifths the length of the scars. Inside of valve showing numerous faint, irregularly distributed radiating ridges which become visible about midway between the beak and the margin. Sometimes one or two feeble concentric wrinkles a little beyond the middle of the valve. The exterior is very differently marked. It presents a series of shallow, flattish-concave, radiating furrows, separated by abruptly raised, narrow, sharply carinated costæ. The latter double in number near the middle of the valve by implantation in the middle of the intervening furrows.

Length of hinge-line of large specimen, 1.8 inch; length of shell from beak to front margin, 1.21 inch; transverse diameter of fissure, .39 inch; greatest width of area, .15 inch; depth of ventral valve, .04 inch; length of divaricator scars, .5 inch.

In outline and surface characters of the casts of young individuals, this species resembles *Leptaena sericea* Sow., but the divaricator scars are very much smaller, differently shaped, and more feebly impressed. It is also a leaner shell, and on the inside shows but faintly the costal impressions which can be so plainly traced around the margin of that species. It differs similarly from *Streptorhynchus subplanus*, its nearest analogue in rocks of the same age. The characters of the exterior, and of the adult shell present, on the contrary, few resemblances to the species with which we have compared the young.

Strophomena niagarensis W. and M.

Plate II. figure 9.

Shell of large or medium size, somewhat hemispherical, hinge-line equal to the greatest width, producing a semicircular outline. Ventral valve extremely ventricose, regularly arched from beak to anterior margin, most elevated in the middle, flattened toward the hinge extremities; beak depressed, incurved, not surpassing the hinge-line. Area moderately elevated in the middle, with a broad triangular foramen, situated nearly in the plane of the commissure of the two valves, delicately striated transversely. Divaricator scars elongate-ovate, but slightly divergent, reaching one third the length of the valve; ocluser scars narrowly linear, closely approximate; rostral septum low, one third the length of the divaricator scars. Internal surface of shell finely papillose in the region between the muscular scars and the hinge-line; the entire inner surface marked with very fine, irregular, wavy striae. Ventral valve sometimes with a shallow undefined sinus each side of a low median ridge.

Length of hinge-line, 1.58 inch; length of shell, 1.34 inch; convexity of the ventral valve, .50 inch; length of divaricator scars, .65 inch.

We have endeavored to unite this species with some of those already recognized. It belongs to the group embracing *S. inaequistriata*, *hemisphaerica*, etc. which are the nearest related American forms. In outline it resembles the first, but the beak is less projecting, and the striae are much finer. Unlike *S. hemisphaerica* it has no concentric wrinkles or other markings; and the hinge-line is proportionally longer, the muscular scars more elongate and narrower, and the whole structure about the hinge is bolder and stronger. Neither does *S. hemisphaerica* exhibit the internal granulations so conspicuous in our species. We think, too, that our species is always even more ventricose than the other. Amongst known fossils of the same age, there are none closely related. The resemblance of *S. subplanus* and *S. semifasciata* is quite superficial, and no more can be said of *S. patenta* of the Clinton group. Amongst foreign species it approaches nearest to *S. imbrex* Pander and Davidson.

Strophomena rhomboidalis Wahl. Numerous excellent examples of the middle-silurian type, showing both external and internal characters. We shall probably discover grounds hereafter for a division of this nominal species.

STREPTORHYNCHUS King.

Streptorhynchus hemiaster W. and M.

Plate II. figure 10.

Shell small, semicircular, hinge-line the longest diameter; in some specimens slightly auriculate. Ventral valve depressed-convex, with an abruptly elevated beak, truncated by the area on the cardinal side, and gently twisted toward the right; area triangular, nearly at right angles with the plane of the shell, its fissure closed by a convex pseudo-deltidium of one piece. Surface marked by straight, sharp, radial costæ which double in number by implantation at about one third the distance from the beak to the margin, and double again nearer the margin. Dorsal valve flat, appearing, in the condition in which we find the specimens, to be constituted by a series of radiating, rounded, threadlike ribs which show most conspicuously on the inside, the principal ones extending from the beak to the margin, and increasing in number by implantation.

Length of hinge-line .38 inch; length of shell .23 inch; height of area of ventral valve .10 inch.

Atrypa reticularis Dalm. sp. Abundant, often exhibiting the internal structure in a beautiful state of preservation.

Atrypa nodostriata Hall. Pal. N. Y., II. 272, pl. lvi. 2. Common, in an imperfect condition, but in some instances exhibiting the spiral armature.

Trematospira Matthewsoni McChesney. New Paleozoic Fossils, p. 71.

Athyris nitida Hall sp. Pal. N. Y., II. 268, pl. lv. 1, 2. Occurs in the typical form, and the variety *oblata* Hall.

Nucleospira sp? A small pyriformly ventricose species, exhibiting the internal structure, but too imperfect for description. We suspect this is the species referred to by Hall (Iowa Rep. p. 73, note), as a *Spirigera*, occurring at Leclaire, Iowa, in great numbers.

SPIRIFERA Sow. Martinia McCoy.

Spirifera (Martinia) *similior* W. and M.

Outline subcircular, transverse diameter greatest, gently rounded from the sides to the cardinal margin; hinge-line about two thirds the greatest width of the shell. Ventral valve ventricose, gently convex to the very margin on all sides, deepest at about one third the distance from the beak to the anterior margin; beak incurved and slightly surpassing the hinge-line, overhanging a large triangular fissure, without noticeable area. A trace of a mesial septum extends from the beak one third the length of the valve. In some specimens no sinus whatever can be discerned; in others, a shallow and obsolete one; in others still, one or two inconspicuous undulations each side of a mesial sinus. Surface of cast otherwise smooth, or with numerous fine concentric wrinkles. In one specimen faint radiating lines may be doubtfully detected.

Length of shell, .57 inch; transverse diameter, .80; height of umbo of ventral valve, .31 inch.

In its smooth exterior, and gently undulate margin, this species calls to mind *Spirifer bicostatus* Hall; and we were at first inclined to regard it as a variety of that species; but the beak is always less prominent and less incurved, and the sinuations of the exterior are much less apparent, and in some specimens entirely wanting.

It is an abundant species at Chicago; and in some instances one of the spires has been found in a complete state of preservation, showing that it consists of seven turns conically arranged.

Spirifera radiata Sowerby. Silur. Sys. 637, pl. xii. fig. 6, and 638, pl. xxi. fig. 5. Very good ventral valves of this species occur, and in one instance, a fine specimen with the valves united. Another specimen exhibits the internal structure, showing that the spire is a delicate hollow tube of about 14 turns, of which 11 are preserved. In these specimens it is interesting to observe that the margin is distinctly plicated, as in the Dudley specimens from England. According to Hall, (Pal. N. Y., II. 265,) this character is not observed in the New York specimens of the species. Neither does it occur in specimens in our possession from Waldron, Indiana.

Spirifera crista Sowerby. Silur. Sys. 624, pl. xii. fig. 8. Each spire has about ten turns, the first of which corresponds to the sinus bounding the mesial elevation. The crus expands into a little plate and becomes coincident with the dental lamella of the opposite valve. A little curved, barb-like branch departs from each of the crura, on the ventral side, and the two perhaps meet together in the manner of *Zygospira* Hall, though in a different position.

PENTAMERUS Sowerby.

Pentamerus chicagöensis W. and M.

Plate II. figure 11.

Shell of moderate size, the commissure, (including the hinge-line) presenting a somewhat semicircular outline; but in consequence of the prominence of the beak of the ventral valve, the outline presented by a view from this side is obtusely sectoral. The ventral valve is very ventricose, with the beak recurved over that of the dorsal valve. The highest point of the convexity is two fifths the distance from the beak to the front margin. A narrow, rather deep and distinct sinus extends from the umbo to the anterior margin, which is bounded on each side by a stout obtuse rib considerably elevated above the general contour. In other words, this valve may be said to present a median ridge which is deeply divided in the middle. Following each of the median ribs are three others, smaller than the two middle ones, and of which the first is less developed than the other two. The last two ribs only reach half way to the beak. Still nearer the right and left extremities the surface seems to be plane, but near the beak are five or six radial striæ on each side. No other surface markings are visible either on the shell or the cast.

Length from beak to anterior margin, .65 inch; greatest transverse diameter—lying midway between the anterior and cardinal margins—.65 inch.

The form of this species is similar to that of *P. galeatus* Dalman, but the extremities are less rounded, and the costæ are fewer and less regular. It is related to *P. trisinuatus* Mc-

Chesney, but our species has two additional ribs on each side of the ventral sinus. We have not access to Hall's description of *P.?* *ventricosus* from the Niagara limestone of Wisconsin.

Rhynchonella neglecta Hall. Pal. N. Y., II. 274, pl. lvii. fig. 1, *a-p*.

PTERINEA (Goldf.) Meck.

Pterinea volans W. and M.

Shell large, very oblique, with an extended hinge-line, and alate posterior extremity. General outline nearly semicircular. Left valve moderately inflated anteriorly, flattened in the posterior half; beak small, nearly terminal, incurved, not surpassing the hinge-line; whole pallial outline regularly circular, except a rather deep sinus beneath the posterior hinge extremity. Cartilage facet not certainly determined; in one small specimen it appears to be very wide, with four or five furrows. External surface marked by strong ribs which bifurcate and become wavy beyond the middle in old shells; the ribs becoming abruptly much smaller on the posterior wing. Besides the ribs, the superficial layer of the shell is cancellated by strong concentric and feeble radiating ridges. The costæ show distinctly on the cast, except on the posterior wing.

Length of hinge-line, 2.1 inches; greatest height of shell (at middle of hinge-line,) 1.5 inch; convexity of left valve, .26 inch.

This species differs from *P. striæcosta*, in its less rugose reticulations, stronger ribs, and straight, instead of curved, umbonal slope. Young specimens resemble *P. (Avicula) emacerata* Hall, but the posterior wing is more expanded, so as to constitute half the surface of the valve.

Pterinea revoluta W. and M.

Plate II. figure 12.

A distinct and well-marked species known only by the impression of the left valve, which is beautifully restored by means of a *gutta percha* cast. This is rotund-quadrate in outline, ventricose, with depressed beak, hinge-line but slightly produced posteriorly. Anterior margin regularly rounded to the ventral side; posterior slightly sinuate below the hinge extremity; greatest dimension from the hinge to the circularly curved ventral side. The surface is marked by seven or eight concentric, lamellose folds or layers of substance, each of which is ornamented by a distinct set of numerous rounded striæ. These are not continuous from fold to fold; neither are they straight, nor strictly radiating from the beak; but they generally exhibit, especially toward their upper ends, a convexity toward the posterior side; in other words, the upper ends of the striæ on each concentric fold are bent forward. The margin of the valve is strongly revolute.

Length from beak to ventral side, .56 inch; length along hinge-line, about .47 inch.

This curious and pretty species recalls *P. planulata* Conrad, and *P. hians* McCoy, from the Amesbury limestone, but the description given above distinguishes it decisively from these and all others known to us.

Pterinea cyrtodontoides W. and M.

Shell of moderate size, oblique; hinge-line equal to greatest width; its extremities rounded, scarcely alate; beaks anterior to the middle. Left valve ventricose, with an in-

curved beak, an umbonal slope forming an angle of about 65° with the hinge-line, most elevated about midway between the dorsal and ventral margins; anterior margin parallel with umbonal slope, slightly sinuated below the hinge extremity; ventral and posterior margins circularly rounded. Cartilage facet narrow, with apparently a single posterior linear groove, deepest near the hinge extremity, and another short, similar groove anterior to the beak. Surface of cast with feeble concentric striae.

Length of hinge-line, .66 inch; greatest length of shell, .70 inch; height, .78 inch; depth of left valve, .22 inch; length of anterior end, .25 inch; of posterior end .41 inch; projection of beak, .08 inch.

Differs from *Avicula undata* Hall, by its shorter hinge-line, more projecting beak, and greater ventricosity.

Pterinea striacosta McChesney, sp. *Ambonychia striacosta* McChesney. "New Paleozoic Fossils," p. 88. This fine species, to the general form of *Pterinea*, adds a cartilage facet with at least four longitudinal furrows. In one of our specimens the facet is .18 inch wide.

Pterinea neglecta McChesney, sp. "New Paleozoic Fossils," p. 88. Very abundant in casts, often with the two valves united. Exterior seldom seen. This species possessed a very wide cartilage facet which is rarely seen.

CLIDOPHORUS Conrad.

Clidophorus m'chesneyanus W. and M.

Plate III. figure 3.

Shell equivalve, with the general aspect of an *Orthonota*; but very slightly widening posteriorly; posterior end symmetrically truncate-rounded above and below, so that the most projecting extremity is on the line midway between the dorsal and ventral sides. The dorsal side is erect, compressed, and the hinge-line is three fourths as long as the shell. The anterior margin is rounded. The beak is very near the anterior end and projects slightly above the hinge. Shell rather ventricose—the umbonal ridge lying above the middle and vanishing in the direction of the posterior extremity. The casts prove the existence of deep pyriform pits for the anterior adductors, which are bounded posteriorly by an elevated margin scarcely possessing the characters of the "elavieular ridge" of *Clidophorus*. The posterior sears cannot be detected in any of the specimens. In the left valve was a deep cardinal pit, with a stout cardinal tooth in front of it. The surface of casts is marked by two or three deep furrows of growth, with several smaller incremental lines. Restored exteriors present the same character with increased sharpness.

Length, 1.11 inch; greatest width—three fifths the distance from anterior to posterior extremity—.59 inch; length of anterior end, .15 inch; thickness of both valves, .4 inch.

This species differs from *Orthonota* and *Modiolopsis* as defined by McCoy, in the possession of cardinal teeth, and from the first, in its deep anterior muscular impression. It differs from *Orthonota* as restricted by Pictet, in the absence of numerous areoliform teeth. At the same time it has not the form of *Modiolopsis*, nor its byssiferous sinus and oblique depression; and we are unacquainted with any established genus with which it strictly agrees.

We have dedicated the species to Prof. J. H. McChesney, U. S. Consul at Newcastle-on-Tyne, for his investigations made at the typical locality.

EDMONDIA de Koninck.

Edmondia Nilesi W. and M.

Plate II. figure 13.

Shell rather small, equivalve, transverse, once and a half as long as wide, subventricose with a prominent umbonal ridge extending to the postero-ventral angle, becoming somewhat acute near the beak, and leaning over toward the hinge, so as to cause the subterminal beaks to project considerably beyond the slightly arched hinge-line and to have their apices twisted forward. The general outline is oval, a little widening posteriorly, and flattened along the dorsal side as far as the middle. Beneath the beaks is an anterior lunette, forming a small notch in the outline. Ventral side gently curved. Shell thin; its exterior nearly smooth, and marked by faint incremental lines. The casts do not enable us to determine the character of the muscular impressions. Greatest width, a little posterior to the middle; greatest thickness, a little anterior to it. In the casts the beak is less terminal than in the shell.

Length, .95 inch; greatest width, .60 inch; greatest thickness of both valves, .40 inch.

We have some hesitancy in making a generic reference of this species, thinking it may be an *Orthonota*; but the apparently edentulous hinge, and the slightly convex dorsal and ventral sides seem to point to *Edmondia*.

Dedicated to W. H. Niles of Cambridge, Mass., the discoverer of the species.

Ambonychia mytiloidea Hall. Wis. Geol. Rep. 1860, p. 2. Casts show concentric folds near the margin. The shell was apparently thick. Resembles *Myalina mytiliformis* Hall, (Pal. N. Y., 100, Pl. xxx. fig. 1,) from the Gray sandstone of the Clinton group.

CONOCARDIUM Bronn.

Conocardium niagarensis W. and M.

Plate II. figure 14.

Shell small, ventricose, about twice as long as wide, with central beaks and finely costate exterior. The truncation, or boundary of the ribbed portion is posterior to the middle of the shell, and forms, on the posterior side, an angle of 58° with the straight, elongate dorsal side. The form of this end resembles the outside of a salver. The rostrum is produced into a linear extension reaching as far behind the beak as the opposite extremity is in front of it. The beak is incurved, but not perceptibly turned one way or the other. The body of the shell is ornamented by eighteen sharp and delicate ribs, the anterior one forming an angle of 28° with the hinge-line, and the included space being apparently smooth.

Length of shell, about .46 inch; height, .26 inch.

This shell is sometimes found with the two valves united. It is the only species of *Conocardium* known to us in the Niagara group.

It will be perceived that we denominate the rostral extremity the posterior one, contrary to the usage of Pictet, McCoy, and others, but, as we believe, more in accordance with analogies.

PLEUROTOMARIA Defrance.

Pleurotomaria gonopleura W. and M.

Plate III. figure 4.

Shell conical, somewhat flattened on the upper portion of the whorls and on the base. Number of whorls six or seven, enlarging with regularity; suture moderately impressed; keel near the lower side of the whorl, quite prominent; whorl rounded below this, to the suture; above the keel, nearly half way to the suture is another low ridge separated from the first by a concave belt; above this ridge the whorls are flattened convex. Surface marked only by incremental lines which incline backwards in passing from the suture to the keel, and continue in the same direction into the umbilicus, suffering a slight retral inflection in passing the peripheral band.

Height, 1.19 inch; diameter of base, .98 inch; height of last whorl, .50 inch.

This species, though resembling *P. Hoyi* Hall, from the Racine limestone, has two or three more volutions; and has the band on the lower, instead of the upper, angle of the whorls.

Pleurotomaria Halei Hall? Wis. Rep. 1861, p. 34. Abundant specimens of a *Pleurotomaria* occur, which agree generally with the above species. They differ as follows:—Height equal to transverse diameter, instead of two thirds that diameter; number of volutions five or six instead of three or four; number of revolving ridges on the upper side of the volution five or six, instead of ten or twelve. The periphery, moreover, can hardly be said to be sub-angulated.

To Hall's description it may be added, that the under side of the body whorl is marked by about thirteen wavy, revolving ridges, alternately larger and smaller, intersected by transverse striæ emerging from the umbilicus. It resembles *P. decussata* Sandberger, from the *stringocephalenkalk* of Nassau.

We are in possession of the casts of the umbilical cavity of a very large *Pleurotomaria* which may belong to this species. The revolving ridges rise obliquely from the umbilical cavity, and are intercepted nearly at right angles by a set of less numerous ridges, also rising from the umbilicus, and curving in the opposite direction. Some of these casts show that the umbilical cavity exposed five whorls. The diameter of the base of the largest individual must have been two and a half inches. This individual was reversed, or sinistral. It is not unlikely that the great size of the umbilicus in these casts, and the interrupted character of the ridges emerging from it, and perhaps also the great size of the specimens, give indications of an undescribed species.

Pleurotomaria Hoyi Hall. Wis. Geol. Rep. 1861, p. 35. No flattening appears on the lower side of any of the volutions of our specimens.

Pleurotomaria sigaretoïdes W. and M.

Plate III. figure 5.

Shell small, depressed-conical, oblique, sinistral (in our single specimen), consisting of three or four rapidly enlarging whorls. The whorls are flattened on the exterior, leaving a linear suture. The last whorl is two and a half times as broad on the flattened exterior as the penultimate whorl, sharply angulated at the periphery, which forms the outer boundary of the flat, or shallow funnel-shaped base. It is supposed that this angle is the place of the

band, since the surface of the body whorl shows numerous transverse lines, curving re-
trally from the suture to this peripheral angle. The rapid increase of the whorls throws the
apex much nearer to one side than the other.

Height, 30 inch; height of body whorl, .18 inch; diameter of base, .44 inch; apical
angle, 76°.

PLATYCERAS (Conrad) Hall.

Platyceras campanulatum W. and M.

Plate II. figure 16.

Whorls three or four, in contact; spire scarcely elevated above the last volution; last
volution greatly enlarged, with a nearly circular section, an angulated periphery and
trumpet-shaped, circular aperture. Columella none; umbilicus minute; lip not modified
by the penultimate whorl. Peripheral ridge in the middle of the whorl or a little above.
Surface marked by extremely faint longitudinal striæ, and by remote, obscure, transverse
ridges, not retroflected in passing the periphery.

This species seems to be the representative of *Platystoma niagarens* Hall. It is inferior
in size to full-grown specimens of that species, and differs from it in the possession of an
umbilicus, and in the completeness of its peristome. It is to be observed, however, that
the entire peristome is possessed by many specimens from Waldron, Indiana, that have
been referred to *Platystoma niagarens*; and that the two genera run inseparably together.
Should we retain but one of these generic names, *Platyceras* has the prior claim.

HOLOPEA Hall.

Holopea niagarensis W. and M.

Plate II. figure 18.

Shell small, consisting of four or five very convex whorls in a moderately elevated spire
having an apical angle of 58°; the last whorl more rapidly enlarged than the preceding,
rounded below, and apparently excavated into an umbilicus. Suture deeply impressed,
each whorl being almost completely above the level of the preceding one. No surface-
markings visible on casts.

Height, .25. inch; diameter of last whorl, .20 inch.

Holopea chicagoënsis W. and M.

Plate II. figure 18.

Shell small, consisting of five or six moderately convex whorls in a sub-elevated spire,
having an apical angle of about 42°; body whorl proportionally higher, but not more en-
larged than the preceding. The outer side of the whorls is somewhat flattened, becoming
rapidly incurved in the upper part, toward the suture; whorls apparently overlapping.
Base of last whorl rounded into a minute umbilicus; transverse section of whorl nearly
circular. Surface of casts smooth.

Height, .35 inch; diameter of last whorl, .25 inch.

These two species of *Holopea* — existing only in the form of casts — it is impossible to
distinguish certainly from *Cyclonema*, though that genus is said to be always exumbilicate.

They are, however, quite distinct specifically from anything at present known to us in the upper silurian.

Loxonema subulata Conrad (*Murchisonia subulata* Hall). No decisive characters separate our forms from the above species of the Clinton group. The number of volutions is nine or ten. Indications of sigmoid incremental lines, without the faintest trace of a peripheral band or apertural slit, induce us to refer our specimens to *Loxonema*, as was originally done by Conrad with the New York specimens. It differs from its foreign analogue, *Loxonema sinuosa* Sowerby, by feebler transverse striæ and a deeper suture, distinguishing it from *Holopella*. This species is quoted from the Niagara group of Canada West. Geol. of Canada, p. 326.

SUBULITES Conrad.

Subulites brevis W. and M.

Plate II. figure 19.

A species apparently referable to this genus is evidently distinct from any known form belonging to this age. Aperture unknown; number of whorls at least five or six, rather rapidly tapering, flattened on the exterior, widely overlapping, attenuated to a sharp edge on the upper side, producing a shallow linear suture which is also very oblique. Transverse section of whorl narrowly crescentic. No surface characters imprinted upon the casts. This species, in robustness and number of whorls, is intermediate between *S. elongatus* and *S. ventricosus*. The apical portion in all of our numerous specimens is distinctly bent to one side.

BELLEROPHON Montfort. BUCANIA Hall.

Bellerophon (Bucania) perforatus W. and M.

Plate III. figure 7.

Shell large, sub-discoid, with about four whorls moderately impressed, and an umbilical cavity exposing all the volutions. Aperture suddenly and broadly expanded, with the lip almost reflexed. Transverse section of whorl circular, with an indentation on the ventral side. Dorsum of last whorl with a low carina on which are elevated a series of elongated nodes becoming somewhat continuous near the aperture — the length of the nodes generally about equal to the distance between them. These are visible on the cast, which also imperfectly preserves some longitudinal markings. The latter, near the aperture, are raised bands with intervening spaces of equal width, and some indications of a general longitudinally striated surface. No nodes exist on the young shell. Exterior of shell marked by numerous sharp, abruptly raised longitudinal ridges, which increase rapidly by implantation in the vicinity of the trumpet-shaped aperture. The nodes of the shell appear, near the aperture, to have been completely perforated, — a circumstance which seems to be only an exaggerated condition of the nodes, as the latter are but apertural modifications of the continuous carina.

Transverse diameter of aperture at least 2.56 inches; transverse diameter of whorl, one third of an inch back from the margin of the aperture, 1.58 inch. — one inch back, 1.42 inch.

This may be the *Bucania pervoluta*, McChesney, though that is described as below medium

size; and no mention is made of the very conspicuous dorsal nodes. McChesney has also described *B. chicagoënsis* from the same quarries, but he expressly states that the cast is destitute of a carina. Our species may also be compared with *B. (Bucania) angustata* Hall, as figured in the Geology of Canada, p. 344. There is no comparison, however, between the apertures or dorsal characters of the two.

Orthoceras Scammoni McChesney. New Palaeozoic Fossils, p. 92. Specimens unusually well preserved. We may add to the characters given by McChesney, the following: The siphon is .52 inch in diameter, at a place where the shell has a diameter of 1.77 inch. In the same specimen, at the distance of four inches, the siphon is .5 inch in diameter, and the shell has become 1.38 inch. The siphon tapers less rapidly than the shell, and is about one third the diameter of the shell. In the same specimen the diameter of the larger end is 2.2 inches, being the largest specimen seen. Nine and a half inches from here the diameter has diminished to one inch. The distances of four successive septa, where the mean diameter of the shell is 1.4 inch, are .34, .45, .41, .40 — the mean being .40. Striæ of growth two and a half to three in the space of one tenth of an inch.

This species closely represents *O. cancellatum* Hall, but we have not been able to detect any longitudinal striæ between the ridges.

Orthoceras nodocostum McChesney. New Pal. Fossils, p. 94. Our specimens enable us to complete McChesney's description.

Shell very gradually tapering; annulated by a raised rounded ring corresponding to each chamber, and situated a little in front of the middle of the chamber. Intervals between the rings regularly concave. Septa rather deeply concave, crossing the shell with a deviation of three or four degrees from a right angle; their distance asunder being one third the diameter of the shell. No annular striæ can be seen in our specimens. The longitudinal ridges are barely discernible on the shell, and leave no trace upon the cast. The siphon is cylindrical, and about one fourth the diameter of the shell.

The distances apart of four successive septa, in a region where the mean diameter is .65 inch, are .20, .22, .22, .21, giving a mean distance of .21 inch.

The absence of concentric striæ, and the presence of faint longitudinal ridges, distinguish this species from *O. undulatum* Hisinger.

Orthoceras Laphami McChesney, New Pal. Foss. p. 91.

GOMPHOCERAS Sowerby.

Gomphoceras Marcyæ W. and M.

Plate III. figure 8.

Shell of moderate size, perfectly straight. The outer chamber, in connection with the penultimate chamber, gives an outline which is neatly and symmetrically elliptic, with a little flattening at each end. That portion of the shell between the penultimate chamber and the apex is gradually tapering. Transverse section elliptic, with transverse axis to dorso-ventral as 27 to 29 or 30. Apertural extremity constricted in a regularly increasing ratio to the ventral lobe of the aperture, beyond which the constriction proceeds on the sides, in the same manner as far as the lateral lobes of the aperture. The aperture is trisinate; the two lateral sinuses are situated a little back of the central axis, and are separated from each other by a transverse oral axis, equal to one half the greatest transverse diam-

eter of the shell. The ventral sinus projects nearly as far as the most prominent portion of the shell on the ventral side; and is bounded laterally by the two projecting lips of the aperture. The siphon is of medium size, strongly moniliform, situated on the greater axis, one eighth that axis or less, from the ventral side. The septa are deep, regularly concave; the penultimate chamber is one sixth the depth of the chamber of habitation. Surface of casts marked by numerous incremental ridges, which are deeply sinuate on the ventral side.

Length of last two chambers, 1.6 inch; greatest transverse diameter, 1.09; greatest dorso-ventral diameter, 1.16; depth of penultimate chamber, .20; dorso-ventral axis of the aperture, .84; transverse axis, .60; diameter of siphon, .09; distance from ventral side, .16.; concavity of penultimate chamber, .18.

This unique and elegant, and rather abundant species is amply distinct from anything known to us. There is indeed no other with which it can be compared, though it approaches nearest to *Gomphoceras pyriforme* Sowerby.

LITUITES Breynius.

Lituities Hercules W. and M.

Plate III. figure 9.

Shell very large, apparently forming less than a complete whorl in any of the specimens seen. Dorsum and sides flattened-convex — the latter less flattened than the dorsum. Septa moderately concave, plane, much flatter in the middle than around the margins; siphon rather small, central. Greatest transverse diameter three fourths the distance from the dorsal to the ventral side, causing the lateral surfaces to approximate dorsally.

Surface ornamented only by encircling striæ which at intervals aggregate into irregular undulations. The striæ curve backwards on the sides and make a further deep retral sinus across the dorsum.

Dorso-ventral diameter, 4.25 inches; transverse diameter, 4.12; diameter of siphon, .22; depth of dorsal sinus of the striæ, about one inch. The diameter of the shell from the mouth to the opposite side was from seven to nine inches.

One of our specimens is an impression of the shell in the rock. This shows that the apex of the whorl presented an obtuse termination more than an inch in diameter.

Cyrtoceras Fosteri Hall, (Wis. Rep. 1861, p. 41). The specimens in our collection enable us to add to Prof. Hall's description the following characters: Shell rather more rapidly expanding toward the aperture, which is sinuate on the dorsal side. The exterior is marked by incremental lines, which, on the dorsum, are correspondingly sinuate. The two diameters of the aperture in one of our specimens are 1.22 and 1.5 inch; depth of the last chamber, measured on the side, 1.12; depth of the apertural sinus, .18. Siphon cylindrical, .07 inch in diameter, where the septa are at the same distance apart.

GYROCERAS H. de Meyer.

Gyroceras Bannisteri W. and M.

Shell consisting of about one and a half whorls, barely in contact, gradually increasing in diameter; transverse section nearly circular; surface ornamented by encircling convex ridges which extend quite around the shell, crossing the ventral side at right angles, thence arching backwards to the dorsal side, where the corresponding branches meet in a broadly

rounded angle of about 100° . The distance from the summit of one ridge to that of the next, measured on the dorsum, varies from one third the transverse diameter of the whorl, to considerably less. The space between the ridges is nearly flat, and in the cast—but not on the shell—discloses indications of two low, barely perceptible ridges. The last chamber seems to be entirely destitute of surface ornaments, except incremental lines, which are sinuate dorsally, to correspond with the ridges. There are indications that the aperture was correspondingly sinuate. The position of the siphon has not been observed, but a feeble depressed line or shallow furrow runs along the back of the cast, visible between the ridges, and creating a suspicion that the siphon is in close proximity.

Dorso-ventral diameter, .78 inch at a place where the transverse diameter is .73 inch; distance between the ridges on the dorsum, at the same place, .25 inch. In other specimens the ridges are more approximated.

This species differs from *Gyroceras (Lituiles) americanum* Billings, in not being flattened on the back, and in the course of the annulations. It differs from *Lituiles giganteus* Sowerby, in having the annulations extend quite across the back without any diminution in size.

Named in recognition of aid received from Henry Bannister, a zealous and promising young geologist of Evanston, Illinois.

LICHAS Dalman.

Lichas pugnax W. and M.

Plate III. figure 10.

Body large, outlines unknown. Glabella somewhat parabolic in contour, prominent, with a middle-lobe and two lateral ones on each side. Middle lobe consisting of two regions, the anterior of which has a triangularly rounded base, and in the centre is extremely prominent, the front margin descending precipitously to the border; the posterior region is depressed and cuneately produced backward between the lateral lobes, diminishing in the narrowest part to one fifth the greatest transverse diameter of the anterior region, and then widening behind the approximated ends of the lateral lobes. The lateral lobes are oblong-elliptic, slightly flattened on the outer side by the eyes, less prominent than the middle lobe and separated from it by deep valleys; these lobes are twice as long as broad, and their longitudinal axes lie at an angle of 36° with the axis of the middle lobe. The ocular lobes are smaller and more depressed than the last, and lie against their outer sides a little posterior to their middle, being deeply separated from them. The border is thick and narrow, regularly curving around the middle lobe of the glabella, and is not produced in front into a proboscis. Occipital ring very prominent and broad; furrow deep. All parts of the glabella are covered by a granular crust.

The thorax is imperfectly known. It appears from some specimens that the axis is prominent, and from numerous others that the lateral lobes are broadly expanded and imperfectly articulated, though the crust covering the pleuræ is deeply furrowed between the joints as well as along the middle of each pleura. Some of the articulations, undoubtedly posterior ones, become very broad and flat. Every portion of the thorax seems to have been covered with a separable, coarsely and unequally granulated crust, the granules or eminences of which are directed backwards, as in other species of the genus. The basis of the crust is marked by irregularly wavy, somewhat continuous, imbricated furrows, which seem to run nearly parallel with the general outline of the body.

The pygidium is also imperfectly known. It consists of at least three joints. The axis is moderately elevated anteriorly; the first two segments are narrow, the third much wider, and its depressed and narrowed posterior portion extends apparently to the caudal extremity. The flattened and expanded pleuræ are surmounted each by a pair of broad, elongated, obtusely terminated, pad-like elevations, which terminate much short of the tips of the pleuræ. In two large specimens these elevations are separated from each other, and from contiguous pairs, by an intervening flat area. The basis of the granular crust is marked, as in the thorax, by concentric imbricating wrinkles. Characters of the margin unknown.

Length of cephalic shield to the collar, 1.8 inch; greatest width of anterior region of middle lobe, 1.0 inch; length of lateral lobe, 1.0; width of lateral lobe of thorax, more than two inches; length of pygidium, more than three inches. These parts may belong to different individuals.

We at first imagined the conspicuous and unique fragments of this large species to belong to *L. Nereus* Hall, which, in a general way, it strongly resembles. It may be distinguished by the absence of a "proboscis," and the want of articulations in the peripheral area of the caudal shield. A pygidium, with a similar flat inarticulated flap, is seen in *Lichas canadensis* Logan, (Can. Rep. 1844, p. 54).

Lichas decipiens W. and M.

Plate III. figure 11.

Pygidium semi-elliptic, of three articulations, with a prominent axis and a flat border. Two anterior joints of axis, narrow; posterior consisting of an anterior narrower portion and a posterior depressed portion, rapidly subsiding to a level with the lateral lobes, and tapering to a point before attaining the caudal extremity. The ribs are broad, flattened, expanding, divided by a median groove, and terminating in short free points. The anterior rib is nearly transverse at its origin, and distinctly curves backward. The second makes an angle of 45° with the axis and is less curved. The third is straight, and its posterior lobe or moiety is parallel with the axis, meeting the corresponding moiety of the posterior rib of the opposite side. The surface is densely granulated.

Length of pygidium, .5 inch; width, .6 inch.

BRONTEUS Goldfuss.

Bronteus occasus W. and M.

Plate III. figure 12.

Pygidium with the axis consisting of two articulations. The limb slopes laterally and posteriorly, and is marked by seven equal ridges radiating on each side from the axis, and one additional on the median line, all becoming confluent around the border. These ridges, or rays, exhibit but very little curvature. The median (or posterior) ridge is nearly twice as broad as the others; the extreme ridges on the right and left are at right angles with the axis. The general outline is parabolic. Neither striæ nor granulations are apparent.

Length, .48 inch; breadth, .62; length of axis, .13; breadth of axis, .23 inch.

Several small pygidia in our collection, very well preserved, appear to be distinct from any described species known to us. They differ from *B. flabellifer* Goldf. which has been

doubtfully identified in Canada, by their straight ribs, not reaching the margin, and by the absence of striæ and granulations. The species is quite distinct, of course, from *B. niagarensis* Hall (Pal. N. Y., II. 314, pl. lxx. 3).

ILLÆNUS Dalman. BUMASTUS Murchison.

Illænus (Bumastus) worthenanus W. and M.

Plate III. figure 13.

Head elevated, greatly inflated, the glabella closely imitating the superior portions of the human cranium from the middle of the forehead over to the lamboidal suture. The lateral lobes are separated from the glabella by shallow furrows which arise from pits on the antero-lateral aspects, a little above the border, and arch upwards, backwards, and downwards nearly in a circular arc of 160° . The eyes are small, superficially elongate-elliptic, bent over the most prominent portion of the lateral lobes in such position as to look exactly at right angles to the vertical plane passing longitudinally through the middle of the animal. Their position is greatly posterior to, and a little below, the middle of the head. The facial suture starts in the border, below the antero-lateral pit, rises with slight curvature, at an angle of 45° to the anterior extremity of the eye, and thence descends rapidly to the posterior border. The fixed cheek has thus a lunate form. The movable cheek is limited in extent, its width being about equal to the length of the eye; it extends backward as far as the main lobe of the glabella. The occipital ring is extremely arched, giving the head a truncate appearance posteriorly.

In young specimens the glabella is relatively more depressed,—the eye being half way up; the eye itself is more prominent, with a sub-ocular furrow.

The hypostome, in a young specimen, is nearly as convex as the glabella. It has the form of a pentagon with the two sides opposite the base rounded and coalesced into a semicircle,—the curved side of the figure being anterior, the base posterior and transverse to the animal's body. The two sides adjacent to the base are deeply isolated from the central area by furrows which begin at the lateral angles of the pentagon and extend to the base, in close proximity to the basal angles. The thorax is unknown.

The pygidium is the figure included in the arcs of two circles, the anterior of which is of greater radius, and embraces about 60° —the posterior embracing about 160° . A belt around the margin is somewhat depressed, but no trace of trilobation is apparent.

No portion of the test is preserved in any of our numerous specimens; and the casts do not exhibit any traces of superficial ornamentation. The head of the largest individual is 1.9 inches long, 2.2 broad, and 1.4 high. The narrowest part of the glabella, which is between the eyes, is 1.15 inches across, and the widest part—the front—1.45 inches across, the width next the collar being very nearly the same.

This striking species might, on casual comparison, be referred to *Bumastus barriensis* Murchison, but on extended consideration we have been induced to regard it as decidedly distinct from the types of that species. On the side view of the head the anterior portion is more depressed; the eye is below the middle instead of above it; it is horizontal instead of oblique; and the facial suture, instead of ascending almost vertically, rises at an angle of 45° . On the view from above, the head is relatively longer and narrower, and the furrows isolating the glabella much more distinct. Moreover, the pygidium of *B. barriensis* (aut *rectius barrensis*) is more than a semicircle,—in our species considerably less; it is also much more depressed, and its border is flattened.

We hesitate to insist upon these distinctions after the foreign species has been recognized in this group, in New York, by Prof. Hall. But without expressing any opinion of that identification we may say that the head of our species is much narrower relatively than that figured by Hall, and the glabella has a greater development posterior to the line of the eyes. Some of the pygidia of Hall's species greatly resemble ours,—*e. g.* Plate 66, fig. 2, Pal. N. Y., Vol. II. This species should also be compared with *Illæxus imperator* Hall, (Wis. Geol. Rep. 1861, p. 49,) from the Racine limestone.

ACIDASPIS Murchison.

Acidaspis Ida W. and M.

Plate III. figure 13.

Head more than twice as broad as long, transversely subelliptic in outline, very tumid. Glabella consisting of a median body and three lateral lobes on each side. The median body is twice as long as broad, and narrows somewhat in front of the anterior lateral lobes. It rises in a steep arch anteriorly and posteriorly, being somewhat flattened in the middle. A slight protuberance is generally visible in the middle between the anterior lateral lobes. The median body is separated from the lateral lobes by shallow "false furrows," uniting the extremities of the lateral furrows which sink into deep pits between the lateral lobes. The dorsal furrow is extremely shallow and indistinct, so that the lateral lobes are nearly confluent with the fixed cheeks. The middle pair of these lobes are about twice the size of the others; and the anterior are smaller than the posterior. Occipital furrow deep, its lateral bifurcations sinking into deep pits and isolating the posterior lateral lobes. Occipital ring with a pair of slender, slightly diverging spines, gently curved downward toward the extremity, and having a length of about one inch. Between the bases of the spines is a small tubercle which, in good specimens, is seen to become a short erect spine.

The fixed cheek is convex, somewhat pyriform in outline.

The ocular fillet is well defined along the antero-lateral border of the fixed cheek as far as the eye, which is situated upon a slender, diverging peduncle, about three tenths of an inch high, arising opposite the middle of the cheek.

The movable cheek is broadly erecentiform, of medium size, about as broad as the main lobe of the glabella, projecting forward a little further than the frontal border. Its plane in the broadest part makes, with a vertical plane through the axis of the animal, an inferior angle of about 35°, but anteriorly to this the border is turned upwards, giving a concave upper surface to that part of the cheek. The anterior border is thickened and ornamented with numerous small tubercles arranged at regular distances; the posterior angle is drawn out, and terminates in a slender spine about one inch in length and standing at an angle of 55° with the axis of the animal. The inner side of the base of the spine is continued so far as to deeply indent the posterior border.

The entire surface, except the occipital ring, is covered with granules of unequal size.

Nothing is known of the other parts of the animal, except that a fragment, probably the border of the pygidium, is armed with short, stout spines.

Transverse diameter of cephalic shield (in a straight line), 1.65 inches; longitudinal diameter, .87; width of median body of the glabella, .46; width of fixed cheek, .25; width of movable cheek, .31; middle of glabella elevated above outer border of movable cheeks, .36 inch.

We are in possession of over a dozen cephalic shields of this species, and they all agree to a remarkable extent.

This fine species is in no danger of being confounded with any other American form. It has close analogues, however, in *A. vesiculosa* Beyrich (Barrande, *Silur. Syst.* p. 715, Pl. 38, figs. 13-21), and *A. Verneuilli*, (Id. Pl. 38, figs. 1-9). The occipital and genal spines, nevertheless, are longer, the ocular peduncle is more elevated and more cylindrical, (in this resembling *A. mira*.) the lateral lobes are more confluent with the checks; the movable cheeks are more depressed, and the whole head is transversely more elongate.

Besides the foregoing species in our collection from this interesting locality, the following described species have not been met with by us.

<i>Bucania chicagöensis</i>	McChesney, New Paleozoic Fossils,	p. 69.
" <i>crassolaris</i>	" " " "	p. 91.
" <i>pervoluta</i>	" " " "	p. 91.
<i>Orthoceras cameolare</i>	" " " "	p. 93.
" <i>striatilineatum</i>	" " " "	p. 94.

Besides the organic remains already enumerated, we are in possession of a few others in a condition too imperfect for determination; among which may be mentioned specimens resembling *Strophomena* and *Naticopsis*; a cluster of eight or ten small, hollow conical, slightly bent tubes, having the appearance of a small Dentalium; also a considerable mass of small stellate and acicular crystal-like bodies, resembling freshly fallen snow-flakes, which may have had an organic origin.

DECEMBER 22, 1864.

SUPPLEMENTARY NOTE.

About a month after the foregoing paper had been accepted for publication, a pamphlet appeared, from the pen of Professor James Hall, entitled, "*Account of some new or little known Species of Fossils from the Niagara Group.*" This pamphlet, while mainly devoted to fossils from Wisconsin, embraces a notice of twenty-two species of fossils from Illinois, most of which are referred to Bridgeport, and the remainder of which, as I have since learned from examinations kindly permitted by Prof. Hall, come also from that locality. *Of these, only eleven species are quoted from Bridgeport.*¹

We had been aware, early in December, 1864, that Prof. Hall was at work upon fossils from the Niagara group of Wisconsin; and one of us also informed him that we had just completed a monograph of the fossils of Bridgeport,—a work which had been in progress for about two years. It did not occur to either of us that Prof. Hall's plan, as we understood it, would embrace fossils recognized only at the locality upon which we had been especially engaged. From this misunderstanding has resulted a little synonymy and a little clashing of identifications. A brief review of Prof. Hall's paper seems, consequently, to be called for.

1. The following twelve species are quoted by Prof. Hall from Bridgeport, and other localities.

Ilcæus insignis, *I. armatus*, *Sphærexochus mirus* Beyrich; *Ambonychia Aphæa*, *Avicula undata*, *Avicula emacerata*, Conrad; *Cypriocardinia arata*, *Modiolopsis Dictæus*, *Modiolopsis rectus*, *Modiolopsis subulatus*, *Amphicelia Leidyi*, *Subulites ventricosus*.

¹ The locality of *Pterinea Brisa* Hall, is not given, but it is now known to be from Bridgeport.

2. The following eleven species are quoted only from Bridgeport.

Ichthyocrinus subangularis, *Illænus armatus*, *Acidaspis Danai*, *Lichas breviceps* (?), *Ambonychia acutirostris*, *Pterinea Brisa*, *Cypriocardites* (?) *quadrilatera*, *Pleurotomaria Axion*, *Tremanotus Alpheus*, *Cyrtoceras Fosteri*, *Gomphoceras scriinium*.

3. The following three species, quoted from Bridgeport, have not yet been seen there by us. *Sphærexochus mirus* Beyr., *Modiolopsis Dietæus*, *Cypriocardites* (?) *quadrilatera*.

4. The following five species, described by us as new, have been identified by Hall with old species.

(a) *Ichthyocrinus corbis* W. and M., with *I. subangularis* Hall. Besides the uniform want of angularity of this species, it differs in the perfectly straight bounding lines of the upper and lower sides of the secondary and tertiary radials, which, in *I. subangularis*, are bounded by a double curvature, as in *I. lævis*. We are not in possession of specimens of *I. subangularis* showing the form of the primary radials, but Hall states that "the centres of the upper margins are depressed or emarginate, and their lower margins produced." Scores of specimens of *I. corbis* show a uniform difference in this respect, not to speak of the supposed difference of basal structure.

(b) *Lichas pugnax* W. and M., with *L. breviceps*? Hall. The glabella is extremely similar to that of *L. breviceps*, but the pygidium has its axis much narrower anteriorly, and it continually tapers backwards instead of widening. The pluræ also differ.

(c) *Pterinea volans* W. and M., with *Avicula emacerata* Conrad. Had Prof. Hall seen the full-grown and perfect specimens in our possession, it is doubtful whether this identification would have been made.

(d) *Subulites brevis* W. and M., with *S. ventricosus* Hall. We are not confident in our opinion in this case, but, besides the contrast in proportions, already pointed out, it may be stated that all the specimens in our possession (as well as Prof. Hall's) have the upper part of the spire turned to one side.

5. The following six new genera and species, described by Prof. Hall, have been identified by us with established forms.

(a) *Ambonychia Aphæa*, with *A. mytiloidea* Hall. Prof. Hall has cited also *A. acutirostra* Hall, from Bridgeport, and refers to his *Ann. Rep. of Progress of Geol. Surv. of Wisconsin for 1860*. Our copy of that Report (embracing a manuscript copy of a "galley" of matter not bound up with the Report), contains no mention of *A. acutirostra*, or any other Niagara species of that genus, except *A. mytiloidea*. The same is true of the final Report for 1862. Both *A. Aphæa*, and *A. acutirostra* must be extremely near to *A. mytiloidea*, — judging from the descriptions; and it is probable that our identifications, however correct, have embraced both the forms separated by Prof. Hall.

(b) *Pterinea brisa* Hall, is undoubtedly *Ambonychia striæcosta* McChesney, or *Pterinea striæcosta* W. and M.

(c) *Anphicelia Leidyi* Hall, is *Ambonychia neglecta* McChesney, or *Pterinea neglecta* W. and M. This new sub-genus (of *Leptodomus*, as supposed) will hardly stand, as our abundant materials have shown that the species on which it is founded possesses a long, broad striated cartilage plate, — an important character not seen by Prof. Hall, and one which, with the cardinal teeth, make it a proper *Pterinea*. At least, it cannot stand as a subgenus of *Leptodomus*. At the same time the general form departs considerably from the type of *Pterinea* (*P. lævis* Goldf.) in being less modified by the anterior and posterior relations. The deep triangular pit beneath the break in each valve, and the duplex, crescentic posterior muscu-

lar scar may also be cited as furnishing some grounds for a subgeneric distinction under *Pterinea*. This form may be compared with *Avicula Triton* Salter (Mem. Geol. Surv. Great Brit. Vol. II. Pt. I. Pl. xxiii. fig. 5.)

(d) *Pleurotomaria Axion* Hall, has been referred by us to *P. Halei* Hall. We have, however, in our notice, cited the disagreements, while, in the absence of authentic specimens of *P. Halei*, we hesitated to found a new species on the Bridgeport specimens. Having now seen Prof. Hall's types of that species,—an opportunity for which we would again express our obligations,—we are convinced that the separation of the Bridgeport specimens is perfectly proper.

(e) *Tremanotus* Hall, is a new subgenus of *Porcellia*, founded upon our *Bellerophon* (*Bucania*) *perforatus*. We may have sufficient evidence of the existence of dorsal perforations in this species. Nevertheless, the perfectly symmetrical enrollment of even the young shell, as well as the enormously expanded aperture (not seen by Hall), would seem to indicate stronger affinities with *Bellerophon* than with *Porcellia*.

6. The following five new species described by us, have been also described by Hall.

Illæus worthenanus W. and M. (*I. insignis* Hall). *Acidaspis Ida* W. and M. (*A. Danai* Hall). *Chidophorus macchesneyanus* W. and M. (*Modiolopsis rectus* Hall). *Bellerophon* (*Bucania*) *perforatus* W. and M. (*Tremanotus Alpheus* Hall). *Gomphoceras Marcyæ* W. and M. (*Gomphoceras scrinium* Hall).

Of these, the following are quoted only from Bridgeport: *Acidaspis Danai*, *Tremanotus Alpheus*, *Gomphoceras scrinium*.

Illæus armatus Hall, has been detected among our specimens since the appearance of Prof. Hall's paper.

Cypricardinia arata Hall, has also more recently been observed.

Avicula undata Hall. Specimens have been brought to light which resemble this species, and it is probable that they are the forms referred to it by Hall. They differ, however, in having the beak subterminal, and the posterior wing not isolated from the body of the shell and not extending as far back as the most projecting part. The right valve has two posterior, linear, diverging teeth, which terminate abruptly three fifths the distance from the beak to the cardinal extremity. We should feel inclined to separate these forms from *A. undata* Hall. For the present we designate them as *Pterinea undata* Hall, sp.

Modiolopsis subalata? Hall. We adopt nearly the same observations in reference to certain other forms, which probably are the ones referred by Hall to *Modiolopsis subalata*. Our specimens, however, have, in the right valve, two linear, posterior teeth, and two short lamelliform anterior teeth. The size of the shell is also more than twice that of the types of the species. It seems to possess the characters of a true *Pterinea*. The left valve is much more ventricose, and shows distinctly a strong arcuation of the body, which is less visible in the thinner right valve. Casts of both valves show a few obscure, remote radiating ridges on the anterior slope.

The following new species have also been brought to light by recent work in the quarry:—

Megistocrinus necis W. and M.

Plate II. figure 6.

Body of medium size, pentangularly ovoid, tapering below and contracted toward the bases of the arms, giving the greatest diameter a little above the middle; flattened along the interradi al spaces, causing the rays to occupy five conspicuous angles. The interbrachial spaces are also flattened. Basals rather small, hexagonal. First radials the largest plates of the body, hexagonal or heptagonal, one third higher than wide, the lower lateral sides much the longest. Second radials smaller, hexagonal, similar in form to the first radials; third radials heptagonal, in some specimens nearly twice as long as wide, supporting on its two short upper sides a pair of hexagonal supraradials, above each of which is a second. Regular interradi als about ten; the first a little smaller than the first radial, hexagonal, approximately equilateral, surmounted by a pair of smaller plates, and these by a pair still smaller, the others diminishing similarly in size upwards. First azygos interradi al heptagonal, a little smaller than the antero-lateral first radials, supporting three variable plates in the second series, of which the middle one is much the smallest. The remaining ones gradually smaller, amounting apparently to twenty or more in number.

The forms and arrangement of the plates in this species are quite similar to those of *M. Christyi* Hall sp. The bifurcation of the rays, however, is considerably lower. The form of the cup, moreover, is very different, being somewhat obpyramidal below, instead of urn-shaped, while it is also much contracted above. The angulations along the rays modify the form of the cup, and are not to be compared with the small threadlike ridges occupying the same position in the Waldron species. The specimens show constant characters.

Megistocrinus infelix W. and M.

Plate II. figure 7.

Body of moderate size, urn-shaped, having a rounded base, but slightly diverging sides, and no constriction below the arm bases, which are somewhat prominent. Raised ridges extend from the basals over the radials, supraradials, and brachials. Basals rather small, as large as the second radials. Radials rapidly decreasing in size; first radials large, nearly as broad as long, with the upper side the shortest; second radials with the upper and lower sides short; third radials oval, heptagonal. First supraradials regularly hexagonal, two thirds as large as the third radials; second supraradials similar in form, but smaller. Brachials two beneath each arm-base. Arms in ten pairs. Regular interradi als about ten or twelve in each interradius; the first, hexagonal, as large as the second radials or larger; above this are two others of the size of the third radials, followed by about three or four pairs decreasing in size. Azygos interradi als apparently thirty or more, generally hexagonal in form, with nearly equal sides.

Dome depressed, nearly flat, composed of a large number of plates, with apparently a central proboscis. The dome is marked by ten radiating furrows, increasing in depth and width from the centre to the spaces between the pairs of arms, and extending a short distance down the side of the cup, where they vanish. The azygos furrow is much deeper, and deeply indents the upper part of the azygos side of the cup.

This species has the calycinal form of *M. Christyi* Hall sp., but in that species the bifurcation of the rays takes place at more than two thirds the distance from the stem to the arm bases, while in ours the bifurcation is very little above the mean height of the cup. The marked sulcations between the pairs of arms, especially on the azygos side, — existing both on the exterior and in the cast, — constitute the most marked peculiarities of our species so far as at present known.

Holocystites sphaericus W. and M.

Body spheroidal, slightly produced on the basal side, composed of about twelve ranges of polygonal plates rather irregularly disposed, and varying both in form and size, each plate apparently being indented in the middle.

The only specimen of this cystidean in our possession, is a mould of a portion of the exterior, which, when first discovered, was nearly a hollow hemisphere. Its generic relations are not satisfactorily shown, but the great number of ranges of plates seems to ally it to *Holocystites*, — a genus so abundantly represented in the neighboring State of Wisconsin, while the globoid form distinguishes it from any of the species recently described by Prof. Hall.

Conocardium ornatum W. and M.

Plate II. figure 15.

Shell small, very ventricose; beak a little nearest the anterior end, projecting beyond the hinge line and greatly incurved; surface arching from the beak to the ventral side in nearly the form of a semicircle. The truncation, or separation of the rostrate slope from the anterior aspect of the shell forms a posterior angle of about 75° with the cardinal side, and an anterior angle of about 55° with the plane separating the two valves. This truncated plane rises into a crest or elevated rib on the surface of the valve, a little anterior to which and forming an angle of about 20° with it, is another, double-crested, but feebler rib. The remainder of the surface is marked by regular radiating raised striae. Decussating these and the ribs is a set of numerous sharp raised concentric striae stronger than the radial ones, the two sets producing a beautifully cancellated surface. The concentric striae extend over the rostrate slope of the valve, but become there feebler, more crowded, and less rigid.

Length of the shell, .41; dorso-ventral diameter, .30; thickness through both valves, .32; distance from beak to anterior end, .16; to rostrate extremity, .25 inch.

Porcellia senex W. and M.

Plate III. figure 6.

Shell small, consisting of one and a half or two very rapidly enlarging, detached whorls, which are somewhat oblique in the young, but afterwards continue very nearly in one plane. Toward the aperture the shell is flattened and sub-nodulous on the dorsum, — the nodes consisting of a larger and a smaller, alternating with each other in a line along the middle of the flattened surface. The angle by which the dorsal surface unites with the upper side of the whorl is rounded; the other angle is considerably sharper. The aperture is not expanded, but presents a deep sinus extending across the dorsal side. Apex of spire depressed much below the level of the upper side of the outer whorl.

Greatest diameter of shell, .83; transverse diameter of whorl at aperture, .36; the same one inch back, .22; dorso-ventral diameter at aperture, .30; depth of sinus, .22 inch.

The total number of species thus far known from the locality is eighty-two. Of these thirty-nine have been described by us, thirty-nine by others, and four are not specifically determined. There are, besides, three others referred by Hall to the locality, but not seen by us.

NOTE. We are authorized by Prof. Hall to state that he relinquishes all claims upon our two species, following, which were published by him after our paper had been read, viz: *Gomphoceras Marcyæ*, and *Acidaspis Ida*. A similar announcement is to be made in a postscript to his paper, on the appearance of the completed Report of the Regents of the University of the State of New York, vol. xviii.

EXPLANATION OF PLATE II.

	PAGE
Fig. 1.—CLADOPORA LICHENOIDES W. and M.	84
View of a portion of a frond.	
1a, a, a. Ramose prolongations of the explanate portion.	
1b, b. Stumps of other branches broken off.	
Fig. 2.—CLADOPORA VERTICILLATA W. and M.	84
View of one of the verticils.	
1a. Place of supposed accessory stem.	
Fig. 3.—ISCHADITES TESSELLATUS W. and M.	85
Fig. 4.—ACTINOCRINUS OBPYRAMIDALIS W. and M.	87
4a. Base of left postero-lateral ray.	
4b. Base of right antero-lateral ray.	
Fig. 5.—MEGISTOCRINUS MARCOUANUS W. and M.	87
View of left side of medium sized specimen.	
Fig. 6.—MEGISTOCRINUS NECIS W. and M.	109
6a. Dorsal side of a small specimen.	
6b. Outline of a larger specimen.	
Fig. 7.—MEGISTOCRINUS INFELIX W. and M.	110
7a. View of right side.	
7b. View of dome, showing deep sulcation on azygos side.	
Fig. 8.—STROPHOMENA MACRA W. and M.	91
8a. Exterior of ventral valve.	
8b. Interior of same valve of a younger specimen.	
Fig. 9.—STROPHOMENA NIAGARENSIS W. and M.	92
9a. Cast of ventral valve.	
9b. Cardinal side of same.	
Fig. 10.—STREPTORHYNCHUS HEMIASTER W. and M.	92
10a. Exterior of cast of ventral valve.	
10b. Arca, pseudo-deltidium and hinge-line.	
Fig. 11.—PENTAMERUS CHICAGOENSIS W. and M.	94
11a. Front view of ventral valve.	
11b. Side view of the same.	
Fig. 12.—PTERINEA REVOLUTA W. and M.	95
Exterior of portion of right valve.	
Fig. 13.—EDMONDIA NILESI W. and M.	97
13a. Exterior of right valve.	
13b. Cast of left valve, showing muscular impression.	
13c. Hinge-line of cast of a right valve.	
Fig. 14.—CONOCARDIUM NIAGARENSE W. and M.	97

A. Winchell del.

L. Trouvelot on stone.

J.H. Bufford & Co. print.

Winchell & Marcy on the Fossils of the Niagara Limestone at Chicago, Ill.

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Fig. 15.—CONOCARDIUM ORNATUM W. and M.	111
Fig. 16.—PLATYCERAS COMPLANATUM W. and M.	98
16a. View of upper side.	
16b. View of aperture.	
Fig. 17.—HOLOPEA NIAGARENSIS W. and M.	99
Fig. 18.—HOLOPEA CHICAGOENSIS W. and M.	99
Fig. 19.—SUBULITES BREVIS W. and M.	99

EXPLANATION OF PLATE III.

Fig. 1.—PTERINEA SUBALATA (Hall) W. and M.	109
Cast showing linear posterior and anterior teeth.	
Fig. 2.—PTERINEA UNDATA (Hall) W. and M.	109
Cast showing linear posterior teeth.	
Fig. 3.—CLIDOPHORUS MC CHESNEYANUS W. and M.	96
Cast of left valve showing clavicular impression, muscular scar and pallial outline.	
Fig. 4.—PLEUROTOMARIA GONOPLEURA W. and M.	97
Exterior of specimen with a defective base.	
Fig. 5.—PLEUROTOMARIA SIGARETOIDES W. and M.	98
Cast, defective at the aperture.	
Fig. 6.—PORCELLIA SENEX W. and M.	111
6a. View of aperture and spire of a cast.	
6b. Dorsum of same, showing notch and nodular elevations.	
Fig. 7.—BELLEROPHON (TREMANOTUS) PERFORATUS W. and M.	100
7a. Cast, with apex and a portion of aperture broken away.	
7b. Portion of exterior of a specimen from near the aperture.	
Fig. 8.—GOMPHOCERAS MARCYÆ W. and M.	101
8a. Left side of a cast, showing the faint encircling furrows, and an outline continuation of the specimen to near the apex, as demonstrated in specimens actually examined.	
8b. View of the aperture of another specimen.	
8c. Fragment, showing the obliquely moniliform sub-ventral siphon, and the convexity of the septa.	
Fig. 9.—LITUITES HERCULES W. and M.	101
Cast of a medium-sized specimen, drawn one half the natural size, showing chamber of habitation with faint encircling furrows.	
This is not a representation of one of the typical specimens, and there is even some doubt of its specific identity with them.	
Fig. 10.—LICHAS PUGNAX W. and M.	102
10a. Cast of a cephalic shield.	
10b. Side view of the same.	
10c. Exterior of a defective pygidium.	
Fig. 11.—LICHAS DECIPIENS W. and M.	103
Cast of a pygidium.	
Fig. 12.—BRONTEUS OCCASUS W. and M.	104
Cast of pygidium.	
Fig. 13.—ACIDASTIS IDA W. and M.	105
Cast of cephalic shield, with spines restored, as seen in numerous specimens.	

ERRATA.

Page 93, line 17 from bottom, for "*Athyris*" read "*Meristella*."

Page 99, line 18 from bottom, for "figure 18" read "figure 17."

Plate II. figure 2. *Cladopora verticillata*. The engraver has omitted the "a" which should stand at the upper left hand side at the semicircular notch.

Plate II. figure 15. *Conocardium ornatum*. The engraver has omitted the delicate radiating lines on the anterior side, and the delicate concentric lines of the rostrate side.

Plate III. figure 3. *Clidophorus McChesneyanus*. The muscular impression has been omitted in the engraving.

Plate III. figure 11. *Lichas decipiens*. The outline is palpably incorrect. Moreover, the lines separating the articulations of the lateral lobes do not exhibit the curvatures noticed in the description.

Plate III. figure 13. *Acidaspis Ida*. The engraver has omitted the furrow behind the ocular *filet* or thread on the right side.