

Descriptions of New Species of FOSSILS, from the Marshall Group of Michigan, and its supposed equivalent, in other States; with Notes on some Fossils of the same age previously described.

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The following paper is intended to constitute a further contribution to our knowledge of certain western rocks occupying a position near the boundary line between the carboniferous and Devonian systems.* The materials for this paper have been in part collected by the writer in Michigan, Ohio, Indiana, and Iowa. Further material has been found amongst the *investiganda* of the "White Collection" of the University of Michigan. Col. Charles Whitteley's collection of fossils from the "Fine Grained Sandstone" of Ohio, has also been placed in the writer's hands for study. In addition to this, the latter has spent several days with Prof. James Hall in his cabinet, engaged in making direct comparisons between the fossils of the rocks under consideration, and the types of the Chemung group, preserved in his magnificent collection. An opportunity has also been enjoyed of making a hasty survey of the fossils from the same horizon, contained in the extensive collection of the Illinois Geological Survey, for which the writer's acknowledgments are due to the Director, A. H. Worthen, Esq.

The reader will observe that all the identifications heretofore made with typical Chemung fossils from New York and Pennsylvania, have been aban-

* Former papers by the writer, on the same subject, may be referred to as follows: "First Biennial Report" of the Geological Survey of Mich. 1860; Amer. Jour. Sci. and Arts, [2] Vol. xxxiii. p. 362; ib. [2] xxxv. p. 61; Proc. Acad. Nat. Sci. Phil., Sept. 1862, p. 405; ib. Jan. 1863, p. 2.

done. On critical comparison between actual specimens, it has appeared that the differences—some of which have always been admitted—are of too important a character to permit the identification formerly assumed. On the other hand, the following paper discloses an extended network of identifications amongst the fossils from States west of Pennsylvania. But perhaps the most interesting feature of all is the identification of four western species with fossils, contained in the supposed carboniferous conglomerate of western New York. These are *Euomphalus depressus*, Hall, (= *Straparollus Ammon*, White), *Cypricardia contracta*, Hall, (= *Edmondia* ? *bicarinata*, Winchell), *Edmondia æquimarginalis*, Win., and *Allorisma Hannibalensis*, Shumard.* Considering the small number of fossils as yet discovered in this conglomerate, in New York—and these only at one locality (four miles north of Panama, Chautauque County)—so considerable a number of identifications is calculated to excite some surprise, and not a little hope, that we are getting glimpses of the clue to a solution of geological difficulties of long standing.

But further than this, two of the above species—*Edmondia æquimarginalis* and *Allorisma Hannibalensis*—occur in what has been regarded as another conglomerate, whose position is beneath the first and at the top of the Chemung rocks of Western New York.

In the light of these identifications, and in the absence of all identifications between western species and those of the Chemung, as well as between the species of this conglomerate and those of the Chemung, it might not seem unreasonable to doubt its affinities with recognized Chemung rocks, and to suspect its continuity with the supposed "carboniferous conglomerate," until observation shall have demonstrated that its stratigraphical position is really below that formation. And further, since we must probably abandon the attempt to coördinate the Chemung of New York with the fossiliferous portions of the sandstones and shales of the west lying between the "Black Slate" and the coal conglomerate, it seems not unlikely that we may yet be able to prove the conglomerates of Western New York to be the attenuated and littoral eastern prolongation of those western sandstones and shales—at least of the superior and fossiliferous portions of them; so that the latter would stand as a hitherto unrecognized group of strata lying at the very base of the carboniferous system; while the Chemung rocks of New York fall within the Devonian system, toward which the writer is now inclined to think that their paleontological affinities attract them.

It yet remains to determine by observations in the field, whether the so-called "carboniferous conglomerate" of Western New York is really the equivalent of the coal conglomerate of Ohio; and whether any actual junction of superposition can be discovered in Western Pennsylvania or Eastern Ohio, between the Chemung rocks in their westward prolongation and the fine grained sandstones and gritstones of the Western States.

The total number of species at present described from the rocks under consideration is about 379, of which 170 were first described by the writer, and four have been recognized as belonging to undescribed genera. The number of species noticed in the present paper is 94, of which 36 are described as new species, and two are made the types of new genera.

Descriptions and Notes of Species.

CONOPOTERIUM n. gen.

Etymology. *Κώνος*, a cone, and *ποτήριον*, a little cup.

Generic Characters. Corallum compound, generally free, sometimes adherent, but without a distinct base of attachment. Cells somewhat crowded,

* The writer is under special obligations to Prof. Hall for the unreserved liberality with which he has been allowed to examine the specimens in his cabinet, as well as for many kindnesses incident to the generous hospitality of his house.

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FAVOSITES, Lamark.

FAVOSITES? MANCUS n. sp. Coral a small hemispherical mass, with an obtuse apex; principal cell-mouths very small, sub-circular; those occupying the interstices smaller and angular; cell-walls strong, prominently raised above the general surface. Cells rapidly enlarging and multiplying by frequent gemmation. No pores, striæ or diaphragms have been discerned.

Diameter of polypary, .68 inch; largest cell-mouths, .05 inch in diameter.

This differs from *F. divergens*, White and Whitfield—the only other species described from rocks of this age—in its extremely diminutive proportions, and in the apparent absence of diaphragms. There is perhaps as much reason for referring this species to *Conopoterium* as to *Favosites*.

Collected by A. Winchell, in the Goniatite limestone of Rockford, Indiana.

TREMATOPORA? VESICULOSA, Win. Specimens undistinguishable from the Iowa species, in their existing state of preservation, have been collected by A. Winchell, at Alan's quarry, in Hillsdale, Michigan.

LINGULA CUYAHOGA, Hall. Numerous specimens, not distinguishable from this species, were obtained by the writer from fragments of a hard, calcareous, brecciated rock, quarried from a well on the premises of Judge Alan, at Hillsdale, Michigan. The geological position is apparently in the lower part of the Marshall group. The rock here is the nearest approach in physical characters that has yet been seen to the Goniatite limestone at Rockford, Indiana.

Occurs also in the "Fine-grained sandstone beneath the coal at Ward's mine, Wethersfield, Trumbull County, Ohio—conglomerate wanting." Whittlesey's collection.

DISCINA, Davidson.

DISCINA GALLAHERI, n. sp.

Shell of medium size, nearly circular. Ventral valve with the apex slightly excentric; foramen lanceolate, reaching from near the apex four-fifths the distance to the margin, and acute at both extremities. Surface marked by about fifteen rigid, sharp, sub-equidistant striæ, which are somewhat more approximated toward the apex. The striæ are less distinct on the shell than upon the cast.

Dorso-ventral diameter about 1.0; transverse diameter about 1.0; distance from apex to dorsal side, .48; length of foramen, .33.

Found at Hillsdale, Michigan, on the premises of Rev. F. A. Gallaher, in a small loose fragment having the lithological characters of the lower gray portions of the neighboring Marshall sandstone. It occurs also in Col. Whittlesey's collection from Girard and Wethersfield, in Trumbull County, Ohio.

I at first referred the specimens to *D. Newberryi*, Hall, (xvi. Rep. N. Y. Regents, p. 30,) but, direct comparison with the types of that species shows that it differs in having more remote, stronger and more regularly equidistant concentric striæ. In its striation it resembles *D. grandis*, Hall, from the Hamilton group, but the form is more circular and the striæ are relatively less remote.

DISCINA CAPAX, White, (1864.) Identified in Whittlesey's collection, "from rocks next below the coal canal level, one mile below Girard," and also at "Girard, Trumbull County," Ohio.

The types of *D. Newberryi*, Hall, (1864,) do not seem to be distinguishable from this species.

PRODUCTA, Sowerby.

PRODUCTA GRACILIS, n. sp. Shell small, aperture of the ventral valve forming a little more than a semicircle. Ventral valve moderately inflated for a Producta, with flattened, smooth, triangular auriculations; hinge-line equal

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rapidly enlarging, inseparable, with only occasional and rudimentary diaphragms, and no radial lamellæ. Walls marked internally by vertical striæ, and a few pores which communicate between the cells. Exterior, where exposed, covered by an epitheca, marked only by irregular encircling striæ. Cells increasing laterally and interstitially.

This genus, perhaps, approaches nearest to *Sphenopoterium*, Meek and Worthen. It differs in the absence of the cuneate form of the base even in *Sphenopoterium*—the cell mouths in this genus being turned indifferently in all directions. The cells also are smaller and more numerous; and the fewer mural pores communicate from cell to cell, instead of terminating in the intercellular substance. But one species has thus far been observed.

CONOPOTERIUM EFFUSUM n. sp. Corallum small, spheroidal, consisting of 20 to 50 cells, which are crowded, subcircular or irregularly angulated in transverse section, feebly striated internally, and having a thick, feebly wrinkled epitheca. Specimens presenting cells of all sizes. Some tendency is manifest toward a proliferous growth; some of the lateral cells becoming adherent by their sides to a foreign body.

Diameter of largest mass, .58; diameter of mouth of largest cells, about .20.

From the Lithographic Limestone, Clarksville, Mo., "White Collection" of the University of Michigan.

ZAPHRENTIS, Rafinesque et Clifford.

ZAPHRENTIS *IDA* n. sp. Coral simple, of medium dimensions, in the general form of an inverted cone, strongly curved, with numerous encircling wrinkles of growth, and an occasional deep constriction. Epitheca rather thick; though the vertical lamellæ show faintly on the exterior. Cup very oblique, turned toward the shorter side, with a distinct fossette reaching from the centre to the shorter side. Radial lamellæ 31 in a specimen .62 inch in diameter. On the side opposite the fossette is a thick lamella reaching from the periphery to the centre; one-sixth of the circumference on each side of this is another lamella reaching to the centre, and at the same interval from these are two others; in the fossette, near the periphery, is the rudiment of a sixth. The remaining lamellæ do not extend to the centre but become confluent in each sextant, with the principal lamella which lies between them and the fossette—the fossette taking the place of a principal lamella. There are thus, in each sextant, four subordinate lamellæ joining their primaries, except that in one of the sextants adjacent to the fossette there appears a supernumerary lamella, caused apparently by the splitting of the shortest subordinate or the one next the fossette. Taking no account of this anomaly, the whole number of lamellæ is 30, a multiple of six instead of four.

The spaces between the lamellæ are intersected by thin transverse diaphragms arranged at unequal distances, and either flat or concave upwards. There is no correspondence in the positions of the diaphragms in contiguous interlamellar spaces; and the wrinkles of the epitheca sustain no relation to them, since they are not continuous, but are intercepted by vertical interlamellar walls; and besides, they nearly disappear in the peripheral region of the internal cavity.

Collected by A. Winchell, in the Goniatite Limestone at Rockford, Indiana.

The septal system of this coral is described above as senary instead of quaternary. The senary arrangement, as a fact, is sufficiently apparent; and yet it must probably be regarded as illusory—the primary lamellæ being four instead of six, and the illusion being produced by the mode of confluence of the lamellæ of the second and third cycles.

Zaphrentis acutus? White and Whitfield.

Occurs in the Lithographic Limestone of Clarksville, Missouri. "White Collection" of the University of Michigan.

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to greatest width of shell; mesial sinus wanting or barely perceptible; external surface marked by fine, rigid, sharp, once dichotomizing radial lines or ribs, numbering about 40. No indications of spines have been detected.

Length of hinge line, .29 (100); length from beak to anterior margin, .21 (72).

Described from an imperfect ventral valve; but its peculiar characters easily distinguish it.

Museum of University of Michigan, Collected by A. Winchell at Valley Forge, one and a half miles below Cuyahoga Falls, Ohio.

PRODUCTA DUPLICOSTATA, n. sp. Shell rather large with subcircular outline. Ventral valve very ventricose and greatly arched, with steep slopes to the right and left margins, not enlarged at the aperture, and entirely destitute of mesial sinus; marked with numerous interruptedly and irregularly striate sinuous ribs, which dichotomize once or twice in the middle region of the valve, and towards the front resolve themselves each into a fasciule of three or four smaller ribs, themselves raised into a wider rib-like elevation around the anterior margin. The tubular spines are scattered over the whole exterior, but become much more abundant at the commencement of the marginal costate ridges. The whole exterior of the cast is marked also by oblique punctations, which are placed mostly in irregular lines between the ribs, and become consequently most abundant toward the margin. On the sides of the cast the punctations become elongated into short furrows which cross the surface obliquely.

Length, 1.19; breadth, 1.24; convexity of ventral valve, .58; number of marginal ridges, 15 to 20.

Collected by A. Winchell, at Battle Creek, Michigan. Occurs also in Licking County, Ohio.

PRODUCTA MORBILLIANA, n. sp. Shell small, transversely subelliptic, only moderately produced. Hinge line seven-eighths the greatest width of the shell; ears small, nearly right angled. The shell regularly contracts from the aperture to the beak, which is small, subacute, and projects slightly beyond the hinge. The arching of the shell is such that when resting on the aperture the greatest height is equal to one-half the greatest width. No sinus or flattening present. The surface is marked by a series of deep, continuous, equidistant wrinkles, ten or eleven in number, becoming obscure toward the beak; between the wrinkles are numerous fine concentric striæ not easily seen without a magnifier. These features are crossed by a longitudinal system which, near the beak, is a set of fine regular costæ, which near the middle become interrupted by the wrinkles, and, losing their identity, result in several concentric bands of short longitudinal tubes buried in the substance of the shell, and gradually emerging and presenting their apertures anteriorly.

Transverse diameter of aperture, .58 (100); length of hinge line, .51 (88); distance from hinge line across the aperture to opposite side, .44 (76); height of shell when resting on the aperture, .26 (45).

From the base of the Burlington limestone, Burlington, Iowa. "White Collection" of the University of Michigan.

A cast from the yellow sandstone below (probably "No. 5,") is probably identical with this.

This beautiful species is most nearly related to *P. speciosa*, Hall, (xth Rep. N. Y. Reg. p. 176.) The resemblance, however, is not striking, except in the cast referred to. This differs in having the pustules more regularly arranged in concentric bands. *P. morbilliana* may also be compared with *P. Rogerst.*, Nor. and Prat., (Jour. Acad. Nat. Sci. Phil. [2] iii. 9, pl. i. 3, a, b, c, not *P. aspera* McChesney.) It is, however, a much neater species, without trace of sinus, not so full near the beak, while the rib-like tubes arranged

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along the concentric bands are smaller and more regular. Its nearest foreign analogue is *P. punctata*, Sowerby, (Min. Conch. iv. 22, pl. 323.) Its surface features, in point of regularity, are intermediate between the extremes presented by that variable species; but it differs constantly in the absence of a sinus.

PRODUCTA CURTIROSTRA, n. sp. Shell of moderate size, semi-globoid, without mesial sinus. Hinge line nearly equal to greatest width of valve, with but slight flattening in the region of the extremities. Beak scarcely surpassing the hinge line, extremely flattened; general surface regularly convex, marked by numerous interrupted, sub-obsolete costæ, and, in the umbonal region, by numerous concentric wrinkles, most distinct upon the ears. The inside of the dorsal valve presents an appearance very similar to the outside of the ventral valve.

This is the species formerly referred by me (Proc. Acad. Nat. Sci. Phil., Jan. 1863, p. 4,) to *P. speciosa*, Hall. A careful comparison of specimens, however, fail to justify this identification. It most nearly approaches *P. lacrymosa*, Hall. The remarkable features of the beak of the ventral valve, and the great concavity of the dorsal, are, however, characters which distinguish this species from all others. *P. lacrymosa* has less fulness in the region of the cardinal extremities, giving the umbo less breadth and greater isolation from the ears.

From the yellow sandstone, Burlington, Iowa. "White Collection" of the University of Michigan.

PRODUCTA DOLOROSA, n. sp. Shell of medium size, somewhat hemispherical, outline subcircular or somewhat transverse, truncated along the hinge line, which is considerably shorter than the greatest width of the shell. Ventral valve regularly convex, with scarcely an apparent flattening at the hinge extremities; beak depressed, obtuse, slightly surpassing the cardinal line. Dorsal valve but slightly concave, with a low and inconspicuous median septum reaching to the middle of the valve; the muscular scars presenting together a somewhat semicircular contour, in front of which the interior of the shell presents a finely papillose area. External surface presenting a series of elongated pustules, or interrupted, irregular depressed costæ, and a few coarse concentric wrinkles, between which the surface is covered with fine concentric striæ.

Length from hinge, in a straight line to front margin, .54 (66); transverse diameter, .82 (100); length of hinge line, .56 (68); depth of ventral valve, .24 (29).

This species, on casual observation, would be referred to *P. lacrymosa*, Hall, (x. Report New York Regents, p. 177.) The beak, however, is less acute and projecting, the ears less flattened, the dorsal valve less concave, and the ventral less produced. If possessed of cardinal spines it might be taken for *Chonetes truncata*, Hall. Figures D and Dd, Whittlesey, (Proc. Amer. Assoc. Cincinnati, p. 220,) may be intended for this species.

"Weymouth, Medina County, Ohio, 60 feet below the conglomerate." Whittlesey's Collection.

PRODUCTA CONCENTRICA, Hall. In quoting this species from Michigan, (Proc. Acad. Nat. Sci. Phil., Sept. 1862, p. 411,) it was stated that only the interior of dorsal valves had been seen in the southern part of the State. Since then I have obtained good ventral valves from Battle Creek, which agree in every respect with specimens from Burlington, Iowa.

A dorsal valve of this species was found at Rockford, Indiana, in the bluish argillaceous brecciated limestone of the famous "Goniatite bed." This species is now known to occur in Northern and Southern Michigan, at Burlington and Rockford, and probably in Missouri and Illinois.

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The young of *P. concentrica*, *Shumardiana*, *pyxidata*, *Cooperensis* and *arcuata*, present resemblances so strong that it is scarcely possible to distinguish them from each other. In the adult state, however, the last may be distinguished by its much stronger and regular costæ, its less rapid expansion and greater arcuation. *P. Cooperensis* has the form of *P. arcuata*, without its strongly marked ribs. The other three species are not satisfactorily distinguishable, even in the adult state. *P. pyxidata* was described by Hall from the so-called Hamilton shale and limestone of Hamburg, Ill., and Louisiana, Mo.; *P. Shumardiana* was described by Hall from the so-called Hamilton of Clarksville, Mo., and the so-called Chemung of Burlington; *P. concentrica* only from the latter locality. It is probable that the rocks at all of these localities are of nearly the same age. This being the case, the probability becomes strengthened that the three species first named are one and the same. If so, *P. concentrica*, having been first published, will displace the other two names.

PRODUCTA SEMIRETICULATA, Fleming, (*P. Martini*, (De Kow) Win. Proc. Acad. Nat. Sci. Phil. Jan. 1863, p. 4; figs. B. and Bb, Whittlesey, Proc. Amer. Assoc. Cincinnati, p. 219.) This species occurs plentifully at Battle Creek, Michigan. Collected by A. Winchell. Also in Hillsdale County. Collected by Rev. J. D. Parker.

A large specimen from the sandstones at Burlington, Iowa, resembles, in its want of mesial sinus, the forms of *P. semireticulata* occurring in the Burlington limestone, rather than its associates in the same strata. It possesses in addition, a peculiar sharpness of the ribs not seen in other specimens.

Occurs also in Whittlesey's Collection from "Weymouth, Medina county, Ohio, 60 feet below the conglomerate;" and "Sheldo's sawmill, Orange, Cuyahoga county, below the grindstone grit."

P. Newberryi, Hall, (x. Rep. N. Y. Regents, p. 180,) from Ohio, is perhaps too closely related to this species. Dorsal valves cannot be distinguished from dorsal valves of *P. semireticulata*, as they occur at Battle Creek, Mich. The ventral valve of *P. Newberryi* does not become so much arcuate, the concentric wrinkling is a little more wavy, and less regular, the beak is less attenuate, and projects less beyond the hinge, and the mesial depression is smaller.

PRODUCTA COOPERENSIS, Swallow, (Trans. St. Louis Acad. Nat. Sci. i. 640.) The hinge line is shorter than in the typical specimens, but otherwise the agreement is good.

Bed "No. 1," Burlington, Iowa. "White Collection" of the University of Michigan.

CHONETES PULCHELLA, Win., (Proc. Acad. Nat. Sci. Phila., Sept., 1862, p. 410). Collected by A. Winchell at Germain's and Alan's Quarries, Hillsdale, Michigan. One specimen from this locality is larger than usual, presenting a greater elongation of hinge line, which is drawn out at the extremities to an abrupt acumination. The number of ribs is about 60. Two cardinal spines are seen on each side of the beak, making an angle of about 60° with the hinge line.

Occurs also in Ohio, at "Howland, Trumbull County, one half mile east from Center, at "Warren, Trumbull County, in coarse bedded sandstone, next below the conglomerate," and at "Tallmadge, Summit County, in a boulder, supposed to be from the shales next below the conglomerate," Whittlesey's Collection.

C. pulchella, in the number of its ribs, is intermediate between *C. Logani*, Nor. and Prat. and *C. Illinoisensis*, Worthen. In this character it most resembles the former, while it differs from it in the smoothness of the ribs. It 1865.]

resembles *C. setigera*, Hall, and *C. nana*, but differs from the former in having oblique instead of erect spines, and from the latter in the smaller area of the ventral valve. *C. setigera* occurs in the Hamilton and Chemung of New York, and I have identified it in the blue argillaceous shales of the Huron group of Michigan. *C. nana* is found in the corniferous limestone; and European geologists regard it as a Devonian species.

CHONETES ILLINOISENSIS, Worthen, (Trans. St. Louis Acad. Nat. Sci. i. 571); *C. Logani*, Hall, (Iowa Rep. p. 598, pl. xii. fig. 1a—e and 2); not *C. Logani*, Norwood and Pratten, (Jour. Acad. Nat. Sci. Phil. [2] iii. 30, pl. ii. fig 12, a, b, c); *C. Illinoiensis*, Winchell, (Proc. Acad. Nat. Sci. Phil., Jan., 1863, p. 5). This wide spread species occurs at the Grindstone quarries at Pt. aux Barques, Mich. The specimens are smaller than the typical ones from Burlington, Iowa, and perhaps for this reason do not number as many striæ around the margin; but specimens from Burlington of the same age cannot be distinguished.

Collected also by A. Winchell at Rockford, Indiana. It also occurs in the base of the Burlington limestone at Burlington, Iowa, ("White Collection") and in the fine grained sandstones of Licking County, Ohio.

This species may be confounded with *C. Shumardiana*, De Koninck; but the latter has 270 to 280 or more radiating striæ, which are less distinctly isolated from each other. The former has from 100 to 125 striæ.

Chonetes geniculata, White, (Proc. Bos. Soc. Nat. Hist. ix. 29). A single ventral valve, collected by A. Winchell at Rockford, Indiana, cannot be distinguished from this species.

CHONETES LOGANI, Norwood and Pratten. In a former paper I pointed out the error of Hall's identification of *C. Logani*, N. & P., though this species had not at that time fallen under my observation, and, I believe, has been seldom seen since first described. I have now, however, in some later additions to the "White Collection" of the University, a number of examples of *C. Logani*, N. & P., fully answering to the original description and figure. These specimens are from the base of the Burlington limestone, and the matrix holds *C. Illinoiensis* in the same association, as previously believed.

C. Logani, N. & P., as far as I have observed, is restricted to the horizon of the Marshall or Burlington sandstone—including the base of the Burlington limestone, which belongs evidently to the same epoch. Prof. Hall, however, has a small *Chonetes* from the Tully limestone, which, he informs me, he has decided to refer to *C. Logani*, (see 11th volume Palæontology of N. Y.), a reference to which, with full acknowledgement of his superior authority, I cannot, at present, give my assent. The Tully limestone species presents a series of concentric rugosities or wrinkles, which extend both across the ribs and the intervals between the ribs; while in *C. Logani* the rugosities are feebler, and are confined to the crests of the ribs.

C. Logani is also recognized in Ohio, with about 40 to 50 ribs. It hence appears that the species, like *C. Illinoiensis*, Worthen, and *C. multicosta*, Winchell, ranges from the Burlington limestone into the sandstone below.

I may perhaps be permitted to add that some typical specimens of *C. Logani* in Prof. Hall's cabinet, sent to him by Dr. Norwood, are imbedded in a matrix of oolitic limestone, such as occurs at the base of the Burlington limestone.

ORTHIS MICHELINI, L'Évêillé, occurs in Whittlesey's collection from "Waverly sandstone, near Newark, Licking County, Ohio." Another *Orthis* from Akron, Ohio, resembles the Burlington species commonly referred to *O. Vanuxemi* (?), but differs in the parallel direction of the dental lamellæ, and in the very indistinct character of the radial striation.

Still another *Orthis*, received from Dr. Shumard and collected at Sulphur Springs, St. Louis County, Missouri, is perhaps the species referred by the

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Missouri geologists to *O. Michelini* (?). It is a small circular species, with extremely fine ribs or striæ, apparently too obscure for either *O. Michelini* or *O. Vanuxemi*.

ORTHIS FLAVA, n. sp. Shell small, transversely oval, slightly truncate on the cardinal side. Ventral valve convex, perceptibly flattened toward the anterior margin, though without a marked sinus; most elevated near the slightly projecting beak; area rather high and broad, triangular, with an equilaterally triangular foramen; dental lamellæ slender, short, diverging at an angle of about 80°; occlusor scars small, together enclosing a longitudinally oval space, which reaches one-third the distance from the beak to the anterior margin; a median internal ridge reaches from the beak to beyond the middle of the valve. The shell was evidently thin; its surface marked by one hundred or more delicate radiating ribs, which increase by implantation.

Transverse diameter of shell .50 (100); longitudinal diameter .39 (78); depth of ventral valve .12 (24).

Burlington, Iowa, apparently from Bed "No. 1." at the base of the yellow sandstones. "White Collection," of the University of Michigan.

This species is less circular than the forms referred to *O. Michelini*, and has a more convex ventral valve and larger area. It differs from *O. impressa*, Hall, (Geol. Rep. 11th Dist. N. Y., p. 267, fig. 2), in its more transverse shape, smaller size, more convex ventral valve, and feebler sinus.

STREPTORHYNCHUS LENS? White, (Proc. Bos. Soc. Nat. Hist. ix. 28), "Weymouth, Medina County, Ohio, 80 feet below the conglomerate." Whittlesey's Collection.

STREPTORHYNCHUS UMBRACULUM? Schloth. sp. From "coarse bedded sandstone, next below conglomerate, Warren, Trumbull County, Ohio." Whittlesey's Collection.

A large, undetermined species from oolitic limestone, "No. 6," Burlington, Iowa, probably belongs here. Collected by A. Winchell.

STREPTORHYNCHUS INEQUALIS, White sp. From Weymouth, Medina County, Ohio, 80 feet below conglomerate." Whittlesey's Collection.

STREPTORHYNCHUS — sp.? A single interior of a ventral valve from "near Ashland, Ashland County, Ohio," resembles *S. Chemungensis*, var. *pectinacea*, Hall. (Pal. N. Y., Vol. iv.) It differs, however, in the possession of a longer hinge line, and distinct aurications, and lacks the alternation in the size of the radial ridges.

PENTAMERUS LENTICULARIS, White and Whitfield. This species, described from the yellow sandstone of Burlington, occurs also in the base of the Burlington limestone. "White Collection" of the University of Michigan.

SPIRIGERA, D'Orbigny.

SPIRIGERA MISSOURIENSIS, n. sp. Shell of moderate size, broadly ovate, moderately ventricose, with lamellose exterior. Ventral valve with an extended beak, turned up at right angles with the plane of the shell, and having a circular perforation at its extremity. Between the beak and the dorsal valve is an external flattening simulating an area, but traversed by the incremental lines. Sinus a shallow but distinct groove, beginning at the beak, widening and deepening anterior to the middle, and near the middle becoming well characterized. Dorsal valve nearly circular, with straight hinge slopes, and obtuse beak closely incurved and concealed, though not in contact with the ventral beak. Mesial fold less distinct than the sinus of the ventral valve, arising near the middle of the valve. Both valves are marked by numerous strongly imbricating lamellæ of growth. Greatest thickness through the middle of the ventral valve.

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Length .69 (100); width .65 (94); thickness of both valves .41 (59).

From the Lithographic limestone of Louisiana, Missouri. White Collection of the University of Michigan. Also from the sandstone at Weymouth, Medina County, Ohio, 60 feet below the conglomerate. Whittlesey's Collection. Close observation is necessary to distinguish this species from *S. subtilita*, Hall. That species, however, is less lamellose, the ventral sinus does not extend above the middle of the shell, and the flattening beneath the beaks of the ventral valve is wanting.

SPRIGERA BILOBA, n. sp. Shell broadly ovate in outline. Ventral valve rather ventricose, with a prominent beak which is gradually recurved, and apparently minutely perforate at apex. A deep, narrow, median furrow begins at the apex and extends to the anterior margin; from the bottom of this the surface rises with a convex curvature to the summits of the two rounded ridges which constitute the most prominent portion of the valve; from these summits the curvatures continue to the right and left margins, which are thus rendered quite obtuse. The external surface is marked only by a few faint incremental lines. Shell structure fibrous. Characters of dorsal valve unknown.

Length .16; breadth .16.

Collected by A. Winchell in the Goniatite limestone at Rockford, Indiana.

This shell has somewhat the aspect of a *Centronella* or *Terebratula*, but its structure is not punctate. The unique character of the mesial furrow distinguishes it from any known species of *Spirigera*.

SPRIGERA OHIENSIS, n. sp., (Figs. A and Aa, Whittlesey, Proceedings Amer. Assoc. Cincinnati, p. 220). Shell large, subcircular in outline, moderately ventricose. Ventral valve regularly arched from beak to anterior margin, having the cardinal slopes somewhat straight, and the lateral margins considerably compressed. Sinus shallow and broad, extending half way to the beak. Surface marked by numerous delicate, subequidistant, rigid, concentric striæ.

Length 1.18; breadth 1.40.

Akron, Ohio, 50 feet below the conglomerate. Whittlesey's Collection.

This species differs from *S. Hannibalensis*, Swallow, in its less ventricosity, especially around the margin, and in the absence of concentric lamellæ; it differs from *S. Missouriensis*, Win., in its transverse form, more compressed lateral margins, and its numerous and regular concentric striæ. In the last character it resembles *S. concentrica*, but the mesial sinus (and probably fold) is much less marked.

SPRIGERA HANNIBALENSIS, Swallow, occurs in the Lithographic limestone at Clarksville, Missouri. White Collection of University of Michigan.

SPIRIFERA, Sowerby.

SPIRIFERA CENTRONATA, n. sp. Shell of medium size, with an elongate, cuspidate hinge margin, and, aside from the cardinal extremities, a somewhat semicircular general outline. Ventral valve of medium fulness near the umbo, somewhat depressed between there and the margins; beak elevated above the cardinal line more than one-fifth the whole length of the valve, incurved and overhanging a very narrow area. A distinct and comparatively deep sinus begins at the extremity of the beak, very gradually widening and becoming ill-defined in the middle of the valve and beyond. External surface marked by 36 to 40 ribs, of which from three to five fall in the mesial sinus. The ribs disappear on the alate cardinal expansions. One or two concentric furrows marking the middle region of the valve.

Length along cardinal line, 1.23 (100); length from beak to anterior margin, .52 (42); greatest convexity of ventral valve, .11 (9).

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Museum of the University of Michigan. Collected by A. Winchell, at Cuyahoga Falls, Ohio, in the flagstones below the conglomerate. Occurs also in Col. Whittlesey's collection from Akron, Ohio, 50 feet below the conglomerate.

This species is distinguished from all other spirifers by the association of cuspidate hinge extremities with a ribbed mesial sinus, and semicircular front margin. When the cuspidations are removed, the shell recalls *S. Marionensis*, Shumard, from the so-called Chemung of Missouri and Iowa; and, in all except the semicircular outline it corresponds with *S. cuspidatus*, Hall, (not of Martin,) from the Chemung of New York.

SPIRIFERA SILLANA, n. sp. Shell transverse, broadest at about the middle; anterior margin somewhat straight; ends rounded anteriorly, sub-truncate from the extremity of the greatest diameter to the cardinal side. Dorsal valve of medium convexity, arched regularly from beak to anterior margin; beak but slightly elevated above the hinge, incurved; area narrow. A well defined mesial fold extends from the beak to the front margin, rising abruptly from the general surface, and arching regularly over. The fold is marked only by incremental lines, save a faint indication of two radial ribs in the vicinity of the umbo; the other portions of the external surface are marked by one or two imbricating lamellæ of growth, and regularly formed ribs which radiate without increase in number, from the beak; eighteen or twenty of these can be distinguished on each side of the mesial fold.

Greatest transverse length, 2.1; length from beak to anterior margin, 1.05; greatest convexity of dorsal valve, .20; width of mesial fold at anterior margin, .45.

This species is readily distinguished by having an elongate form, without having its greatest length along the hinge line.

Collected by A. Winchell, at Valley Forge, one and a half miles below Cuyahoga Falls, Ohio, in fine ferruginous sandstone underlying the conglomerate. Museum of the University of Michigan.

Named in honor of Judge E. N. Sill, of Cuyahoga Falls, in acknowledgment of facilities afforded the writer in the examination of the rocks of his vicinity.

SPIRIFERA EXTENUATA, Hall. This Burlington species occurs at Battle Creek, Calhoun county, and Germain's quarry, Hillsdale county, Michigan. Collected by A. Winchell.

SPIRIFERA HIRTA? White and Whitfield. A ventral valve of a spirifer differing from the above only in the absence of all trace of a mesial sinus, and in its somewhat fainter radial lines.

Bed "No. 6," Burlington, Iowa, while the typical specimens seem to come from Bed "No. 1." "White Collection" of the University of Michigan.

SPIRIFERA VERNONENSIS, Swallow, 1860. (Trans. St. Louis Acad. Sci. i. 644.) A specimen labelled as above by Dr. B. F. Shumard, from Sulphur Springs, St. Louis county, Missouri, too strongly resembles *S. Carteri*, Hall, 1858, (xth Rep. N. Y. Regents, p. 170,) judging by a specimen of the latter from Cuyahoga Falls, Ohio, which Prof. Hall admitted to be *S. Carteri*. Coll. A. W.

SYRINGOTHYRIS HALLI, Win. This peculiar form occurs at Battle Creek, Michigan. Collected by A. Winchell.

SPIRIFERINA, d'Orbigny.

SPIRIFERINA CLARKSVILLENSIS, n. sp. Shell small, transverse, semielliptic, with coarse plications. Ventral valve rather ventricose, most elevated toward the beak, regularly arched from beak to anterior margin; beak broad, projecting much beyond the hinge, strongly recurved; hinge line nearly as
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long as the greatest width of the shell, forming a rounded right angle with the short lateral margins; area triangular, three and a half times as long as high, arched in the quadrant of a cylinder, striated in both directions, pierced by a foramen reaching to the very apex of the beak, nearly twice as high as broad, rounded at its upper angle. Mesial sinus deep, broad, regular, beginning at the apex of the beak, the bounding ribs forming with each other an angle of about 22° ; on each side of the sinus five large plications, of which only the first three reach the beak, the others terminating at the area; these are crossed by sharp, neat, imbricating lamellæ of growth, of which, in the middle of the valve, about four occur in one-tenth of an inch. Dental plates short, columnar; a median internal septum reaching from a point a little posterior to the teeth, as far as the middle of the valve, thick at the bottom, thinned to an edge above. Internal surface of valve marked with numerous indented punctations. Dorsal valve unknown.

Length, .48 (71); breadth, .68 (100); length of hinge line, .52 (79); height of area, .15 (22); convexity of ventral valve, .22 (33).

From the Lithographic limestone, Clarksville, Missouri. "White Collection" of the University of Michigan.

This species bears perhaps too close a resemblance to *S. solidirostris*, White. The single valve, however, on which the species is founded, is more convex, with more rounded ribs, less regular lamellæ, a higher area and more incurved beak. This is the specimen referred to by White, (Boston Proc. ix. 25,) and doubtfully identified with *S. subtexta*, White—a Burlington limestone species.

SPIRIFERINA BINACUTA, n. sp. Shell of moderate size, transverse, with numerous rounded ribs and attenuate hinge extremities. Dorsal valve somewhat ventricose in the middle, regularly arched from anterior margin to the beak, becoming depressed toward the lateral extremities. Hinge line elongate, thickened at the margin, abruptly acuminate. Area narrow and long. Mesial fold little elevated above the general surface, divided by a furrow into two ribs, which, in old specimens, are again divided; ten or eleven rounded ribs on each side of the mesial fold, of which the last two or three are subobsolete. External surface finely and regularly lamellose. Substance of shell thin and apparently possessing a rather coarsely punctate structure.

Length of hinge line, .78; length from beak to base, .30.

This species is readily distinguished by its auricular acuminations and plicate mesial fold.

From the base of the Burlington limestone. "White Collection" of the University of Michigan.

SPIRIFERINA SOLIDIROSTRIS, White. From near Hamburg, Illinois. "White Collection." The ribs are more rounded than in the specimens from the Burlington sandstone. The same species occurs associated with *S. binacuta* in the base of the Burlington limestone.

RHYNCHONELLA, Fischer de Waldheim.

RHYNCHONELLA? *TETRAPTYX*, n. sp. Shell minute, subcircular in outline, with few and deep plications. Ventral valve moderately convex, highest in the middle, with a straight projecting beak, which is circularly perforate at apex, with a triangular opening below to the hinge. Along the middle of this valve is a very deep and very narrow sinus reaching nearly to the beak, and bounded by a very prominent rib on each side, beyond which is another smaller rib, making four in all. Dorsal valve almost strictly circular, with the same convexity as the ventral, highest also in the middle, with the inconspicuous beak closely appressed, and the middle raised into a strong plication or rib corresponding to the sinus or furrow of the ventral valve; on each side of this rib

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is another strong one, and still beyond, a very feeble one. None of the shell being preserved, no revelations are made of the minute structure.

Length, .17 (100); breadth, .15 (88); thickness, .09 (53).

Collected by A. Winchell, at Rockford, Indiana.

The straight beak of the ventral valve, and the general aspect of the shell, render the above generic reference unsatisfactory. Externally it seems to have some relations with *Trematospira* and *Leptocalia*, of Hall, while it still more strikingly resembles *Spirifer Buchianus*, de Kow, (Anim. Foss. pl. xv. bis fig. 3, and xix. fig. 6;) but until its internal characters are known, I leave it where it stands.

RHYNCHONELLA HETEROPSIS, n. sp. Shell small, varying from sectoriform to transversely elliptic, with moderately projecting beak; very young specimens in the shape of a barley-corn. Plications sharp, ranging in number from ten to twenty; of which three generally (sometimes two or four,) occupy the sinus of the ventral valve. This valve has a moderately sharp beak, turned back in an angle of 45° with the plane of the shell, and slit (in the cast) from the apex to the hinge; sinus deep toward the front of the mature shell, wanting in the young one; the plications on each side of the sinus variable; four in those with two plications in the sinus, six, seven or eight in those with three, and five in those with four, making the whole number of plications ten to nineteen. These lateral plications are bent backwards in approaching the margin. Greatest prominence of ventral valve near the beak. Dorsal valve more ventricose than the ventral, most prominent at the anterior margin; mesial fold much less marked than the sinus opposite, consisting of two, three, four or five plications, elevated at their extremities somewhat above the lateral plications, the remotest of which exhibit a strong downward curvature. Beak of this valve concealed beneath that of its fellow.

Length, .38 (90); breadth, .42 (100); thickness of both valves, .28 (67).

From one of the calcareous beds, "No. 4," of the yellow sandstone, Burlington. "White Collection" of the University of Michigan. Also near Hamburg, Illinois, and at Weymouth, Medina county, Ohio. Whittlesey's Collection.

I had hoped that these varying forms could be brought under one of the numerous species already described from this group. It is a much smaller shell, with more abrupt sinus than *R. pustulosa*, White, from the same locality. It is about the size of *R. camerifera*, Win., from Pt. aux Barques, but, besides wanting the long dental and median plates of that species, the sinus and fold are much more strongly marked, and the transverse diameter is relatively greater, giving the rostral region less relative prominence; and the mean number of plications is considerably less. In the rostral region it differs from *R. Sageriana*, Win., in the same manner, besides being a smaller shell with shallower sinus.

RHYNCHONELLA PERSINUATA, n. sp. Shell of medium size, transversely oval, with abbreviated rostral extension. Cardinal slopes nearly straight, sides rounded, front straight. Ventral valve depressed, with about twenty straight plications, of which eight occupy the broad and rather shallow sinus. Anterior margin of valve abruptly deflected. Dental lamellæ extending nearly one-third the length of the valve. The beak of this valve projects nearly in the plane of the shell, and the lateral portions of the valve are continued, without convexity, to the borders, thus giving this valve a peculiarly flattened surface—the broad sinus forming a similar plane lying at a lower level.

Transverse diameter, .67 (100); length, .52 (77); thickness of ventral valve, .16 (24).

Burlington, Iowa, in the yellow sandstone. "White Collection" of the University of Michigan.

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This shell suggests *Terebratula pleurodon*, variety *polyodonta*, Phillips, (Geol. Yorks, pl. ii. p. 222, pl. xii. fig. 27.) It is a smaller species than that, with a shallower sinus and an abruptly deflected margin.

RHYNCHONELLA UNICA, n. sp. Shell minute, longitudinally ovate in outline, the sides and front equally rounded, the cardinal slopes somewhat straight and the beak acute. The peculiarity consists in the arrangement of the median plications of the two valves. In the middle of the ventral valve are five sharp plications which extend to the beak; the two outer of these are very prominent, projecting above the general surface like vertical laminæ; the middle three are anteriorly depressed considerably below the general surface, and constitute the mesial sinus, which extends to the middle of the valve, and thence rises above the general surface to the level of the two outer plications. On each side of the median plications are four others, which, instead of converging toward the beak in conformity with the median ones, converge toward an imaginary point some distance in front of the beak, in consequence of which the posterior extremities of two or three are overlapped by the median set. In the dorsal valve four median plications rise in an elevated band and attain an equal elevation near the front of the valve, but posteriorly, the two middle ones of the four sink below the level of the others, and are lost from sight before reaching the beak. In consequence of these arrangements, the ventral valve presents a sinus anteriorly and an elevation posteriorly; while the dorsal valve presents an elevation anteriorly and a sinus posteriorly. The two valves are about equally convex. The beak of the ventral valve projects in a tubular form slightly beyond that of the dorsal, and exhibits a circular perforation of the extremity.

Length, .24 (100); breadth, .19 (79); thickness of both valves, .15 (62).

From Bed "No. 4," Burlington, Iowa. "White Collection" of the University of Michigan.

RHYNCHONELLA (RETZIA?) MICROPLEURA, n. sp. Shell of medium size, Retzia-like externally. Ventral valve ovate, somewhat produced rostrally, with rather straight lateral margins, and a semi-circular anterior margin; most tumid near the beak, slightly flattened anteriorly; beak somewhat incurved; mesial sinus wanting or represented only by a slight flattening of the anterior portion; surface with two or three varices of growth, and about 50 rigid, continuous, rounded, radiating ribs, which are separated by narrower spaces.

Length of ventral valve, .59 (100); width, .48 (81); convexity, .15 (25).

Collected by A. Winchell, at Battle Creek, Michigan.

It much resembles *Retzia polypleura*, Win., of the Huron group, but the beak is less prolonged and less straight, and the width of the shell is greater. I know of no *Rhynchonella* which like this is without a sinus, and so finely ribbed at the same time. In the first of these characters it is approached by *R. Hubbardi* and *R. Sageriana*, from the same rocks.

RHYNCHONELLA HUBBARDI, Win. This species originally described from Marshall and Pt. aux Barques, Michigan, has since been found by the writer at Napoleon Cut in Jackson county; and also rather plentifully in some of the thin layers of sandstone at Valley Forge, near Cuyahoga Falls, Ohio. It occurs also at Talmadge, Summit county, Ohio, in beds next below the conglomerate. Whittlesey's collection.

RHYNCHONELLA SAGERIANA, Win. Identified in Whittlesey's collection from Weymouth, Medina county; near Ashland, Ashland county; Drew's saw-mill, Big Brook, Orange, Cuyahoga county, and two miles southwest of Northfield Centre, Summit county, Ohio.

R. Sageriana has remote relations to some of the forms of *R. pleurodon*, Phillips. Compare var. *Devreuxiana*, De Kon. (Davidson's Mono. Brit. Carb.

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Brach. pl. xxiii, fig. 19-21.) The ribs, however, are more numerous, and the frontal commissure more deeply sinuate.

CENTRONELLA, Billings.

CENTRONELLA ALLEI, n. sp. Shell large to medium size, terebratuliform, greatest width a little anterior to the middle, contained one and one fourth times in the greatest length. Ventral valve somewhat ventricose, full to the immediate vicinity of the margin, especially along the cardinal slopes; regularly arching from beak to anterior margin, highest in the middle; anterior margin with a barely perceptible truncation; no sinus or fold present; beak produced beyond that of the dorsal valve, truncated and circularly perforate at the extremity; dental lamellæ more than one-fifth the whole length of the valve; muscular scars, consisting of one faint median linear impression, on each side of which is another, all reaching to the middle of the valve. Dorsal valve with its short imperforate beak closely concealed under that of its fellow, slightly truncate in front, but without mesial fold or sinus; regularly arched from beak to front, highest in the middle, exhibiting a convexity equal to that of the opposite valve. Muscular scars consisting of a faint but distinct linear median impression, with a much deeper linear impression on each side, and a very faint one exterior to each of these—the three principal impressions reaching to the middle of the valve. Shell thin, stony and solid; structure beautifully punctate under a lens; general surface polished, marked by a few feeble concentric lines of growth.

Length of ventral valve, .66 (100); breadth, .41 (62); convexity, .19 (29).

The dorsal valve above referred to comes from bed "No. 6," at Burlington; the other specimens are apparently from "No. 5." "White collection" of the University of Michigan. Also near Hamburg, Illinois, and at Talmadge, Summit county, Ohio. Whittlesey's collection.

Though the peculiar loop of *Centronella* has not been seen in these specimens, the characters given are so closely conformable with that genus that the reference can scarcely be questioned in the present state of our knowledge. It is a larger, more ventricose and more elongated shell than *C. Julia*.

CENTRONELLA JULIA, Win. A single small specimen of this northern species occurs in Whittlesey's Collection, from "one mile east of Orange Center, Cuyahoga county, Ohio."

Specimens of this species from Pt. aux Barques, have been employed by Prof. Hall to illustrate the characters of his genus *Cryptonella*, (Trans. Albany Inst. Feb. 3, 1863, p. 4; reprinted Amer. Jour. Sci. [2] xxxv. 399.) The reference of this species to *Centronella* was made solely in the light of Billings' description and figure of that genus and comparisons with the internal structure of *Centronella glansfagea*, the type of the genus. Prof. Hall asserts that the description and figure do not bear out the reference; and, having previously founded *Cryptonella* on the external characters of certain terebratuliform species, he assumes that *Centronella Julia* affords an exhibition of the internal characters of *Cryptonella*. There is not the least doubt that the original reference of *Centronella Julia* was correct; and since its internal characters are assumed by Prof. Hall as being those of *Cryptonella*, the latter genus is thus admitted by its author to cover the same ground as the older genus *Centronella*, and must consequently pass out of use. Prof. Hall seems to have suspected this result; for in a note interpolated in the New Haven edition of his paper, (p. 405,) he refers to a drawing of a specimen of *C. glansfagea*, showing the loop, (sent him by Dr. Rominger of Ann Arbor,) and admits that the loop "shows essentially the same character as that of *Cryptonella*." He yet insists that this character is not to be inferred from Billings' original description and figure; and, expressing a doubt about the identity of Billings' type species (*C. glansfagea*) and the one figured by Rominger, "hesitates to

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unite" *Cryptonella* and *Centronella* "until a reëxamination of the original specimens of Mr. Billings shall confirm his first observations, or show them to correspond with" *Cryptonella*. It is this hesitation to admit the inevitable consequence, and to retract his honorable and friendly, but unfounded criticism, which induces me to reassert the correctness of my generic reference of *Centronella Julia*, resting as it does upon the original description and figure, and the observed characters of the type of the genus, as well as the subsequent confirmation of the author of the genus, himself.

OSTREA, Linnæus.

OSTREA PATERCULA, n. sp. Shell adherent, thin, small, ovate, deeply boat-shaped, with the deeply excavated beak of the lower valve prominent, incurved and somewhat posterior. The muscular scar is large, transversely broad-renaliform, concave on the cardinal side, situated nearly midway between the centre of the valve and its posterior margin, and is marked by two transverse lamellose lines. The deepest part of the valve is midway between the centre and the beak; the depth is nearly the same for as great a distance on the other side of the centre. The exterior of the shell is irregular with concentric lamellose lines of growth.

Greatest length, .65 (100); greatest width, .40 (61); greatest depth of lower valve, .25 (35); depth of cavity of the beak, .15 (23).

From the buff sandstone at the base of the Burlington limestone, Burlington, Iowa. "White Collection" of the University of Michigan.

The unexpected discovery of this oyster—believed to be the most ancient at present known—together with its somewhat cretaceous aspect, awakened a suspicion that it had not been found in place. To certify myself on this point, I addressed Dr. White on the subject, and received the following reply: "The *Ostrea*, if I remember rightly, was imbedded in a white or light gray, silicious material, of chalky appearance, containing some remains of *crinoids* and shells. My impression is, also, that it was from a quarry about half a mile north of my residence, and in the lower bed of the Burlington limestone, and not far from its base. I think the label which accompanied it, and also my letter at the time, may be entirely relied on. I admit the possibility of error, but I do not believe there is any."

PTERINEA CRENISTRIATA, Win. (*Cardiopsis crenistriata*, Win., Proc. Acad. Nat. Sci. Phil. Sept. 1862, p. 417.) More perfect specimens from the typical locality of *C. crenistriata* reveal the fact that the species is possessed of an anterior wing, which is a mere flattened portion of the anterior angle of the cardinal line, with a barely perceptible sinus beneath. This feature does not belong to *Cardiopsis* as defined, and establishes a probable conformity with *Pterinea*.

The right valves—recently discovered—might be mistaken for another species. They show no radiating lines, except near the hinge, behind the beak. The concentric markings are only small, irregular wrinkles of growth, with none of the sharply raised lines which characterize the other valve. It is of course possible that these right valves belong to another species, but as they have exactly the form of the crenistriated valves, and the latter are all left valves, it seems probable that they belong together.

PTERINEA SPINALATA, n. sp. (*Avicula acanthoptera*, Win., Proc. Acad. Nat. Sci. Jan. 1863, p. 8; not *A. acanthoptera*, Hall, Geol. Rep. 10th Dist. N. Y. p. 263.) Careful comparison with the types of *A. acanthoptera*, Hall, convinces me that the Iowa specimens ought to be separated. The left valve of *A. acanthoptera*, Hall, has the body of the shell broader than in the Iowa specimens, and both wings are less defined. The right valves, also, are much flatter.

Amongst the Iowa specimens appear to be two types—one with the body of the valve arcuate, and the other with it straight. The former type was

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adopted for the specific description, (see the paper referred to.) The latter may constitute the type of still another species.

The species described as *Avicula Whitei*, Win., and *Gervillia strigosa*, White and Whitfield, should probably be referred to *Pterinea* in accordance with views recently put forth by Mr. Meek.

AVICULOPECTEN CAROLI, Win. This species first described from the yellow sandstone at Burlington, Iowa, is found also in the base of the Burlington limestone at the same locality. "White Collection."

AVICULOPECTEN TENUICOSTUS, Win. A very small specimen, collected by A. Winchell, at Rockford, Indiana, seems to agree with the above Burlington species.

Other specimens collected at Germain's quarry, Hillsdale, Michigan, have the same proportions and general surface characters, but they are once and a half as large as the Burlington types, and the anterior auriculation is marked by coarser, instead of finer striæ. The body of the shell presents about 57 striæ and the anterior ear 8.

The foreign analogue of this species seems to be *Pecten arenosus*, Phillips.

PERNOPECTEN, new genus.

Etymology.—*Perna* and *Pecten*, from a combination of some of the characters of the two genera.

Generic Characters.—Shell bivalve, sub-equivalve, monomyary. Valves more or less inequilateral and auriculate. Hinge line straight; hinge furnished with a central, triangular cartilage pit, and a transverse plate bearing on each side of the middle a series of smaller pits diminishing in size and depth from the centre outwards. The shell seems to be thin, and probably has a structure more like *Pecten* than *Perna*.

This genus, or subgenus is founded on *Aviculopecten limaformis*, White and Whitfield, (Proc. Bos. Soc. Nat. Hist. vol. viii. p. 295.) My attention was first directed to the peculiarity of the hinge structure in two or three specimens sent me by Dr. White himself; and an examination of a number of specimens previously referred to this species shows that they all possess it. The genus *Aviculopecten*, happily constituted by McCoy to receive a number of paleozoic species having affinities with *Pecten* in their external form, and with *Avicula* in their cardinal structure, is made by its author to differ from *Pecten* by the absence of a central ligamentary pit, and from *Avicula* by its nearly equilateral outline. The present genus differs from *Avicula* and *Aviculopecten*, and approaches *Pecten* and *Monotis*, in the presence of a mesial ligamentary pit; and it differs equally from *Pecten*, *Aviculopecten* and *Avicula*, and approaches *Perna*, by the presence of a series of isolated ligamentary pits in the cardinal area. It differs from *Perna* in its sub-central beaks, with ligamentary pits on both sides. It agrees with *Amusium* in its sub-symmetrical ears, central cartilage pit, and the absence of radiating ridges, but differs in its straight hinge line and lateral cartilage pits. The position of the genus is apparently between *Perna* and *Pecten*, with a preponderance of affinities for the latter, sufficient, perhaps, to throw it into the family of *Pectinidæ*, White. *Aviculopecten* is grouped with the *Aviculidæ*.

It is probable that in addition to the two following species, others referred to *Avicula*, *Pterinea*, and more especially *Aviculopecten*, *Amusium* and *Pecten*, will be found to possess the assemblage of characters shown in *Pernopecten Lima? obsoleta*, Hall, (Rep. 10th Dist. N. Y., p. 265,) = *Pecten subobsoletus*, d'Orb., is stated to have a "crenulated hinge line," while its external characters are quite conformable to *Pernopecten*. Not improbably *Lima glaber*, Hall, belongs in the same association. The same may be said of *Pecten densistria*, Sandb., from the *Posidonomyenschiefer* of Nassau; *Avicula tumida* and 1865.]

Avicula lævigata, de Koninck, from the carboniferous limestone of Belgium, &c. &c.

This genus is known to have existed in the Chemung of Phillipsburg, New York,* whence it probably continued to the epoch of the Burlington limestone. An undescribed species occurs in the fine grained sandstone of Ohio.

PERNOPECTEN LIMÆFORMIS, Winchell. (*Aviculopecten limæformis*, White and Whitfield.) In this typical species, the number of ligamentary pits is about seven on each side of the mesial one. The hinge line is short, and the auriculations are small and Lima-like.

PERNOPECTEN LIMATUS, n. sp. Shell rather small, moderately ventricose, subcircular. Body of shell bounded by two straight lines diverging from the beak at an angle of 126° , and proceeding to the superior lateral margins, from which points the outline of the shell is very nearly circular. Hinge line straight, a little more than one-third the greatest width of the shell; ears very small, flattened, subequal; the anterior (of the left valve) making an angle of about 106° with the hinge line, and 120° with the body of the valve; the posterior ear forming an angle of 129° with the hinge line and 146° with the body of the shell. Beak small, inconspicuous, not projecting beyond the hinge line. Convexity of the valve nearly a segment of a sphere, a little more elevated in the umbonal region. Surface extremely smooth.

Dimensions parallel with the hinge 1.20; at right angles with the hinge 1.05; length of hinge line .40; length of anterior slope of body of valve .59; of posterior slope .47; convexity of left valve .17.

From the base of the Burlington limestone, Burlington, Iowa, a horizon identified by its fauna with the yellow sandstones below, (compare my paper, Proc. Acad. Nat. Sci. Phila., Jan., 1863, p. 25). "White Collection" of the University of Michigan.

The internal hinge structure of this species has not been observed, but the auriculations are scarcely such as belong to *Aviculopecten*, as defined by McCoy, while they present a close conformity with the foregoing species.

Aviculopecten occidentalis, Win., differs from this in its longer cardinal slopes, making a smaller angle with each other, and in its longer hinge line, with larger and distinctly ribbed auriculations.

PERNOPECTEN SHUMARDANUS, Winchell, (*Avicula circulus*, Hall, non Shumard). It is scarcely possible that the species identified by Hall (Iowa Rep. 522, pl. vii. fig. 9) as *A. circulus*, Shum., (Missouri Rep. 206, pl. c. fig. 14), can be the same species. Prof. Hall's figure and description do not show it; nor do specimens from the same bed, commonly regarded as *A. circulus*, Hall, present satisfactory correspondence. The shell has a much shorter hinge line, with smaller ears, joining the cardinal slopes by obtuse angles. Moreover the concentric lines are very regular, and the radial ones are faint, irregular dashes, entirely unlike the continuous and distinct though diminutive ribs of *A. circulus*, Shumard.

Yielding to the suggestion of Dr. White, I formerly identified *A. circulus*, Hall—before I had seen actual specimens—with *Aviculopecten limæformis*, White and Whitfield. I am convinced, however, on careful comparison of specimens, that we must regard *A. circulus*, Hall, as a distinct species.

In general characters this species resembles *P. limatus*, and only differs in its shorter and less sharply defined cardinal slopes, and the presence of the two systems of superficial markings.

PINNA, Linnæus.

PINNA? MARSHALLENSIS, n. sp. Shell small, equivalve, compressed, lanceolate, squarely truncate and gaping at the extremity opposite the hinge, and

* I find that Prof. Hall has also marked this form as a distinct genus.

acuminately tapering toward the opposite extremity. Anterior side nearly straight, or distinctly hollowed. Posterior side parallel with the anterior for half its length; toward the hinge gradually approaching the opposite side. The truncation is at right angles with the anterior side, leaving a broadly gaping ventral margin. External surface smooth.

Length dorso-ventrally .97 (100); greatest dimension at right angles with this .26 (27); thickness of both valves .12 (12).

Collected by A. Winchell at Napoleon cut, Jackson County, Michigan.

MYALINA, De Koninck.

MYALINA LOWENSIS, n. sp. Shell rather small, ventricose, obliquely elongate-quadrate. Umbonal ridge elevated, arched, highest about midway between the beak and the opposite end, forming an angle of 50° with the straight, somewhat elongate hinge line; anterior and posterior sides parallel, the former distended in a very shallow pouch just beneath the beak, the latter very slightly hollowed throughout its upper half; basal region regularly rounded, with an obtuse angulation next the posterior side. From the umbonal ridge the slope is precipitous to the anterior margin, much less so toward the posterior, and it gradually subsides into a flattening toward the dorso-lateral angle. Surface of shell nearly smooth, marked with fine incremental lines.

Greatest dimension—from beak to opposite extremity—.83 (100); length of hinge line .46 (55); diameter, at right angles with umbonal ridge, .41 (50).

From the base of the Burlington limestone. "White Collection," of the University of Michigan.

This species resembles *M. angulata*, Meek and Worthen, from the Chester limestone of Illinois, and *M. Michiganensis*, Winchell, from the Marshall group of Michigan. From the former it differs greatly in its smaller size, its shallower posterior concavity, and its less abruptly rounded base. From the latter it differs in having straighter anterior and posterior sides, giving it a more quadrate outline, a more elevated umbonal ridge, and a shorter antero-posterior dimension.

MYALINA MICHIGANENSIS, Win. Collected by A. Winchell at Napoleon Cut, Jackson County, and at Germain's Quarry, Hillsdale, Hillsdale County, Mich.

EDMONDIA ? BICARINATA, Win. A species apparently identical with this occurs in a conglomerate four miles north of Panama, Chataque County, New York, supposed by Prof. Hall, in his Report on the Fourth District of New York, to constitute a portion of the Millstone Grit of Pennsylvania. It was figured and briefly characterized under the name of *Cypricardia contracta*, Hall. The later specific name must therefore be abandoned.

EDMONDIA ÆQUIMARGINALIS, Win. Specimens clearly identical with this occur in the same conglomerate with the above, as also in a conglomerate at another locality, supposed by Prof. Hall to underlie the Millstone Grit, and to constitute the terminal member of the Chemung Group.

The specimens of these two species occurring in New York, as well as the two others to be mentioned, are preserved in Prof. Hall's cabinet; and I desire to acknowledge my great obligations for the opportunity afforded of making the direct comparisons.

EDMONDIA BURLINGTONENSIS? White and Whitfield. A lamellibranch, too imperfect for certain determination, but closely resembling the above, occurs in Whittlesey's Collection, from a place "one mile east of Orange Center, Cuyahoga County, Ohio, 25 or 30 feet below the Grindstone Grit."

SANGUINOLITES, McCoy.

SANGUINOLITES STRIGATUS, n. sp. A small species, resembling *Arca modesta* Win., from Burlington, Iowa. Unfortunately the specimen was lost while awaiting a description. It had, however, been investigated and its generic [1865.]

position fixed. Coming from a locality difficult of access, and poor in fossils, it seems proper to admit this reference to its existence.

Collected by A. Winchell at Point aux Barques, Huron County, Michigan, at the base of the Marshall group.

SANGUINOLITES CONCENTRICA, Win., (*Cardinia concentrica*, Win., Proc. Acad. Nat. Sci. Phila., Sept., 1862, p. 413). Collected by A. Winchell at Alan's and Germain's quarries, Hillsdale, Hillsdale County, Michigan.

This species is the analogue of *Cardinia tellinaria*, Goldf. sp., (Petr. Germ. ii. 180, pl. 131, fig. 17), but is more enrolled and more distinctly furrowed. It resembles also, in external characters, *Allorisma Hannibalensis*, Shum.

In the original description of this species, "ventral," in the second line, should be changed to "vertical."

SANGUINOLITES HANNIBALENSIS, Win., (*Allorisma Hannibalensis*, Shum.) The single specimen collected by the writer at Alan's quarry, Hillsdale, Michigan, less resembles the original figure than it does the Burlington specimens referred to this species. The Hannibal type is more elongate, with broader furrows.

This species also occurs, satisfactorily identifiable, in both the conglomerates spoken of under *Edmondia*.

CARDIOMORPHA JULIA, Win. Occurs at Napoleon Cut, Jackson County, Michigan. Collected by A. Winchell.

LEDA BELLISTRATA, Stevens. This has been collected by A. W. at Alan's and Germain's quarries, Hillsdale, Michigan.

CTENODONTA, Salter.

CTENODONTA HUBBARDI, Win., *Nucula Hubbardi*, Win., Proc. Acad. Nat. Sci. Phila., Sept., 1862, p. 417; ? = *Nuculites sulcatina*, Conrad, Jour. Acad. Nat. Phila., viii. p. 250, pl. xv. fig. 10). Collected by A. W. at Napoleon Cut, Jackson County.

Amongst my collections from the Marshall group are numerous specimens generically closely allied to, if not identical with, *Nucula*, from which I have described *N. Hubbardi*, *sectoralis*, *stella* and *Iowensis*—the latter having been originally described by White and Whitfield from the yellow sandstones at Burlington, Iowa. To the Iowa species I have added another—*N. microdonta*. These five species all present a line of teeth continuous from one side of the beaks to the other, without the ligamental pit which belongs to the modern species of *Nucula*. This variation attracted my attention at the very first; and I observed that the hinge characters seemed to identify the species with *Tellinomya*, Hall, and *Ctenodonta*, Salter. A species from the Hamilton group, and identified again in the Chemung group, had been described by the subsequent founder of *Tellinomya*, as *Nucula bellatula*, (Rep. 10th Dist. N. Y., p. 196); and *Nucula hians* had also been recently described by him (xiii. Rep. N. Y. Regents, p. 110) from rocks of nearly the same age in Indiana, to say nothing of the description by Stevens of *N. Houghtoni*, from the Marshall group. Without being acquainted with the details of the hinge structure of these species last mentioned, I yielded to the influence of example in referring my species to *Nucula*. I did this the more readily, as Prof. Hall had expressed the conviction (x. Report N. Y. Regents, p. 184) that *Tellinomya* would prove to be a Silurian genus. It may be added to this, that *Nucula ventricosa*, Hall, (Iowa Rep. p. 716, pl. 29, fig. 4, 5) does not possess the ligamental pit of a modern *Nucula*, although it offers rather important departures from *Tellinomya*.*

* A fossil from the Coal Measures of LaSalle, Illinois, usually identified with *N. ventricosa*, Hall, exhibits no teeth whatever on the anterior side of the beaks, and thus presents generic characters heretofore unobserved. This feature is shown in several separated valves mineralized by Pyrites. This character would seem to possess equal importance with the absence of the ligamentary pit, on which *Ctenodonta* has been founded.

The uninterrupted series of teeth possessed by the Nuculoid shells already referred to, from the Marshall group and its supposed equivalents, seems to constitute good grounds for a generic separation. For this hinge structure three names have been suggested. *Nuculites* was assigned by Conrad to shells having a continuous series of teeth and an internal clavicular ridge like *Cliodophorus*. This genus has a real existence in the Hamilton group. *Tellinomya* has been applied by Hall, and *Ctenodonta* by Salter, to shells having the generic characters of the species under consideration. As, however, objections have been urged against the import of the name *Tellinomya*, and, on the other hand, Prof. Hall insists upon the rights of priority over *Ctenodonta*, (x. Report N. Y. Regents, p. 181), it becomes a delicate matter to decide between the two. But since the genus *Tellinomya* was not founded upon characters possessing generic value, while the real generic characters, owing to the state of preservation of the specimens, entirely escaped observation; and, since the name proposed actually conveys a false idea of the relations of the genus, I feel constrained, in spite of my desire to perpetuate an American name, to pursue the same course as I do in regard to *Athyris* and other terms founded upon a misapprehension, and, in their meaning, at variance with facts.

In regard to *Ctenodonta Hubbardi*, I desire further to admit the possibility that this is the species described by Conrad under the name of *Nuculites sulcatina*. All that is stated in the description applies to this species; and the figure also agrees. Nothing, however, is said or shown respecting the hinge structure; and both the description and figure will apply nearly as well to *Sanguinolites concentrica*, Win., which occurs abundantly at the locality whence Conrad's specimens were obtained; while *Ctenodonta Hubbardi*, so far as I have observed, is unknown at that locality. The latter, nevertheless, approaches nearest to *Nuculites*; and it may be fair to presume that Conrad had a view of the hinge structure of the specimens he described. But it must be stated, finally, that not one of the hundreds of specimens that I have had in my hands, furnishes evidence of the existence of the internal septum which is essential to *Nuculites* and *Cucullela*. For the present, therefore, I feel compelled to regard *Nuculites sulcatina*, Con., as a species that has not yet fallen under my observation.

Conrad, in the paper referred to, has described *Nuculites mactroides*. If this is really a Nuculoid shell it approaches *Ctenodonta sectoralis*, Win., without being identical. If not a Nuculoid shell, as I suspect, it approximates *Edmondia equimarginalis*, Win., but at the same time, I could scarcely identify it. For the present, therefore, I leave it as I have left the species just referred to.

CTENODONTA STELLA, Win. (= *Nucula stella*, Win.,) also occurs at Napoleon Cut, Jackson county, Michigan.

SANGUINOLARIA, Lamarck.

SANGUINOLARIA ROSTRATA, n. sp. Shell rather large, transverse, cuneate-ovate in outline, of medium convexity. Beaks two-fifths the shell length, from the anterior end, quite prominent, and rather strongly incurved. Greatest convexity above the middle, continuing along the postero-dorsal slope. Hinge line somewhat more than one-third the length of the shell, slightly angulated between the beaks; buccal slope slightly curved, the anal nearly straight; extremities obtusely rounded; ventral margin nearly straight in the middle region, curved rapidly beyond. Longest dimension equidistant between the beaks and venter. Pallial impression deep, without sinus (?); anterior muscular pit deep on the rostral side, roundish-oval, striate radiately and concentrically; equidistant between the beaks and extremity; posterior muscular pit more elongate; a feeble ridge extends from the beak along the inner border of each muscular pit—more perceptibly the posterior. In the right valve a strong triangular cardinal tooth stands just anterior to the point
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of the beak, and is bounded posteriorly by a deep triangular pit, and anteriorly by a shallower and narrower one. Nothing further is clearly known in reference to the hinge. The shell seems to be thick and externally smooth.

Length, 1.72 (100); height, 1.13 (66); convexity of one valve, .34 (20); distance from beak to anterior extremity, .55 (32); to posterior extremity, 1.21 (70).

Collected at Battle Creek, Michigan, by A. W.

Resembles *S. similis*, Win., but differs in more prominent beak, greater convexity and straight ventral margin.

SANGUINOLARIA SIMILIS, Win., occurs at Napoleon Cut, Jackson county, Michigan.

CONULARIA, Miller.

CONULARIA NEWBERRYI, n. sp. Shell very small, in the form of a quadrangular pyramid, (the apex of which has been broken off in the specimen described.) The pyramid is inclined over one of the angles. Angles of the pyramid slightly rounded, and marked by a shallow groove running longitudinally. Each side is marked by sharp, raised, transverse lines, which, instead of running directly across, are angulated in the middle, so that at this point they are nearer the base of the shell by a distance equal to once and a half the distance between two lines. The distance between the lines increases from above downwards, and is everywhere equal to about one-ninth the width of the side. These transverse lines have the appearance of the projecting edges of septa, and are continuous from the middle of one of the shorter sides of the pyramid around to the same point, though the ends do not join but alternate in position. The sides of the pyramid are inclined at an angle of 30°, and, if they met at a point in the perfect specimen, it must have been about half an inch in length, with a width at base of about .17 inch.

Collected by A. Winchell, at Cuyahoga Falls, Ohio, in the water limestone below the conglomerate.

Named in honor of Prof. J. S. Newberry, M. D., equally distinguished in the service of science and of his country.

BELLEROPHON, Montfort.

BELLEROPHON WHITTLESEYI, n. sp. ("Goniatite," figs. 1 and 2, Whittlesey, Proc. Amer. Assoc. Cincin., p. 219.) Shell rather large, globoid, rapidly enlarging, umbilicus moderately large, exposing one anterior whorl. Transverse section triangularly and broadly lunate, the dorsum being slightly elevated, and the dorso-lateral slopes slightly flattened; greatest diameter of section near the umbilicus. Keel rather distinct but with an indistinct band. Surface marked by raised, rather distant striae, which emerge from the umbilicus with a slight backward inclination, and, curving forwards, pursue a course directly across the lateral surfaces for two-thirds the distance from the lateral to the dorsal angle, where they undergo a sudden deflection backwards, making with themselves very nearly a right angle, and forming on the dorsum, by the meeting of opposite branches, a retral angle of 45°. Sinus not seen; but probably triangular and broad.

Greatest diameter of whorl, .87; dorso-ventral diameter of aperture, .57; number of striae in one-tenth of an inch, near the aperture at the point where they turn backwards, 3 to 3½.

This species resembles *B. rugosiusculus*, Win., in general features, but lacks the longitudinal decussating striae. It may be distinguished from all related species by the peculiar geniculation of the striae in the dorso-lateral region.

One mile east of Orange Center, Cuyahoga county, Ohio, 20 or 30 feet below the grindstone grit. Whittlesey's collection.

[July,

BELLEROPHON NAUTILOIDES, Win., (Proc. Acad. Nat. Sci. Phil. Sept. 1862, p. 427.) Collected by A. W., at Alan's quarry, Hillsdale, Michigan.

Conrad has described *B. stamineus*, from Moscow, Hillsdale county, Michigan, at which place I have observed both *B. nautiloides* and *B. galericulatus*, Win., and it is probable that he had one of these species in view in his description. The *ten words* employed in the description, however, will apply equally well to half a dozen species of *Bellerophon*; and it is hence utterly impossible to avail myself of the results of his studies.*

BELLEROPHON CYRTOLITES, Hall. This widely distributed species has been found at Alan's quarry, Hillsdale, Michigan.

PUGIUNCULUS? ACULEATUS, Hall. This Rockford species has been collected by A. W., at Alan's and Germain's quarries, Hillsdale, Michigan.

DENTALIUM? BARQUENSE, Win., (Proc. Acad. Nat. Sci. Phil., Sept. 1862, p. 425.) Additional specimens from the same locality, show that the short tubes supposed to belong to the shell structure, are not always normal to the surface; and that when the internal cylinder is removed, so as to afford a view of the inner surface of the prismatic coating, the oblong sections of the prisms as they were applied to the cylinder, look somewhat like the polyp cells shown in longitudinal sections of some branching corals; and there is seen also something like the same divergent disposition of the tubes. Moreover, the structure is extremely like that referred to in the last paragraph of my paper in the Proceedings for Sept. 1862, p. 430. This latter structure is foliaceous, but occurs at the same locality. Can these rigid stems, then, be corals with very large hollow axes?

METOPTOMA, Phillips.

METOPTOMA UNDATA, n. sp. Shell of medium size, nearly erect, apex nearly central, aperture transversely slightly elliptic; body of shell most inflated in the middle, somewhat acuminate toward the apex, and contracted at the aperture. Cast nearly smooth over the body of the shell, longitudinally undulate near and at the aperture, with a few wavy concentric lines of increment.

Height of shell, 1.15 (100); longest diameter of aperture, 1.06 (92).

From Bed "No. 5," Burlington, Iowa. "White Collection" of the University of Michigan.

The inferior side of the only specimen seen is defective; yet there are indications that it was flattened, as in the typical species of Prof. Phillips.

PLATYCERAS PARALIUM, White and Whitfield. Identified in the Lithographic limestone of Clarksville, Missouri. "White Collection."

A variety more robust than the typical form, and wanting in the longitudinal folds which characterize the latter, occurs in the base of the Burlington limestone at Burlington.

PLATYCERAS VOMERIUM, Winchell. From Sheldon's saw-mill, Big Brook, Orange, Cuyahoga county, Ohio, below grindstone grit. Whittlesey's collection.

The Ohio specimens have a dorsum not quite so acute as the Iowa types, and an aperture a little less expanded.

PLEUROTOMARIA, DeFrance.

PLEUROTOMARIA QUINQUESULCATA, n. sp. Shell of medium size, depressed—conical, consisting of three or four rapidly enlarging whorls. Outer whorl

* In the 4th line of my description of *B. galericulatus*, (loc. cit. p. 426,) for "ventrally," read "retrally."

nearly as wide as all the others, having a nearly circular section, and presenting on its exterior about five broad longitudinal furrows, covering the space from the suture above to the base below; shell otherwise apparently smooth.

Diameter of last whorl, 1·07 (100); height of spire, about ·72 (67).

From the oölitic bed "No. 6," Burlington, Iowa. "White Collection" of the University of Michigan.

This species is imperfectly known, though clearly distinct from all other species of this age, and hence deserving of notice. It is probable that the base is regularly rounded into a broad and deep umbilicus, and that the aperture is nearly circular. It calls to mind *Euomphalus carinatus*, Sow., from the "Aymesbury limestone," but the sulcations are only half as numerous.

A similar species exists in Whittlesey's collection, from "Sheldon's saw-mill, Big Brook, Orange, Cuyahoga county, Ohio, below grindstone grit."

PLEUROTOMARIA VADOSA, Hall, (xiii. Rep. N. Y. Regents, p. 108.) To Prof. Hall's description of this species, founded upon casts, may be added the following observations on the shell: The periphery of the body whorl is flattened into a sharp carina, just above which is another, heavier one, but not quite so projecting; a concave belt separates these from another pair of ridges which lie near the suture, and are interrupted by numerous regular transverse rugulations rising into minute nodes, on the ridges.

Collected at Rockford, Indiana, by A. Winchell.

STRAPAROLLUS MACROMPHALUS, Win. Specimens having twice the diameter of the types of the species, showing the tube septate a little more than one whorl back from the aperture. One specimen preserving the shell, shows that it was marked only by incremental lines.

From bed "No. 1," and the oölitic layer, "No. 6." "White Collection" of the University of Michigan.

STRAPAROLLUS AMMON, White. This Burlington species occurs in the so-called millstone grit of Western New York, and was figured as *Euomphalus depressus*, Hall, (Geol. Rep. ivth Dist. New York, p. 291.)

ORTHOCERAS INDIANENSE, Hall. Collected by A. W., at Alan's and Germain's quarries, Hillsdale, and Napoleon Cut, Jackson county, Michigan.

NAUTILUS (TREMATODISCUS) DISCOIDALIS? Win. A small fragment from Rockford, Indiana, affords strong presumption that this species existed at that locality.

CYRTOCERAS, Goldfuss.

CYRTOCERAS ROCKFORDENSE, n. sp. Shell rather large, rapidly expanding, especially toward the aperture, apparently forming, in adult age, nearly a complete whorl. In some specimens the transverse section is subcircular or laterally compressed, in others decidedly elliptic, being flattened dorso-ventrally. The curvature is rapid for a shell of so large size, which renders it necessary that the chambers should be about four times as deep on the outer as on the inner side of the whorl. Septa deeply and regularly concave; siphon small, situated close to the dorsal side. No surface markings are preserved on casts.

Transverse diameter of the last chamber, in a specimen wholly septate, 1·86 (100); dorso-ventral diameter, 1·35 (72); depth of chamber on the dorsal side, ·59 (32); on the ventral side, ·13 (7); diameter of siphon, ·10 (5). In another specimen the transverse diameter of a section is 1·60; the dorso-ventral diameter, ·170.

Collected by A. Winchell, at Rockford, Indiana.

It is impossible to affirm that this species did not describe one or more detached volutions. In case such was its character, it must have borne a close resemblance to *Nautilus cyclostomus* (Phillips) de Kon., (Anim. Foss. 553, pl. xxv. 1, a, b; xlix. 1, a, b.)

[July,

GONIATITES ALLEI, Win. The most perfect specimens seen were collected by A. W., at Germain's quarry, Hillsdale, Michigan. Apertural constrictions occur at regular intervals.

GONIATITES MARSHALLENSIS, Win. Collected by A. W., at Napoleon Cut, Jackson county, Michigan.

Occurs also at Weymouth, Medina county, Ohio, 80 feet below the conglomerate. Whittlesey's collection.

PHILLIPSIA, Portlock.

PHILLIPSIA DORIS, Win. (= *Proetus Doris*, Hall, xiiith Rep. N. Y. Regents, p. 112.) This species was established by Hall on some pygidia occurring in the Goniatite limestone at Rockford, Indiana. I am in possession of several pygidia from this locality which agree with his description, though in the absence of measurements, it may be that his specimens are much larger. Associated with these are numerous fragments of bucklers, which prove that the trilobite is a *Phillipsia*. The head is furnished with a border sloping downwards, and separated from the cheeks by a deep but narrow groove; the middle of the border is marked by a groove which reaches from a point opposite one eye, to the corresponding point on the other side of the head; in some specimens the latter groove reaches backward to the posterior borders of the buckler. The cheeks are raised abruptly above the border, and terminated by spinous points which are ornamented with raised longitudinal striæ and extend backwards a distance equal to one-third the whole length of the cephalic shield. The principal lobe of the glabella is in the form of a prolate semi-ellipsoid, is almost destitute of furrows, and is supported on each side by a large complementary lobe. The surface is obscurely granulose. The pygidium is in the form of a semi-ellipse, with the longer diameter transverse; it is convex, with a gibbous axis, obtuse posteriorly, and articulated to the extremity. The lateral lobes are a little narrower than the axis, and their terminal points join the extremity of the axis. The pygidium is bordered by a plain belt curved downwards around its margin, and barely marked by a continuation of the articulations—except the two which bound it anteriorly. Number of segments in the axis, 11; in the side lobe, 7; surface the same as in the buckler.

Width of pygidium, .35; length, .21; width of axis at anterior end, .12; width of border, .04. Length of buckler of another specimen, .31.

Proetus Missouriensis, Shumard, (Missouri Report, p. 196, pl. B, fig. 13. a, b,) would seem also to be a *Phillipsia*, as well as its Ohio representative, *Proetus auriculatus*, Hall, (xv. Rep. N. Y. Regents, p. 107.) Pictet says of *Proetus*, "La glabelle est lobée par des sillons," and of *Phillipsia*, "La glabelle est composée d'un grande lobe median simple, et de deux petits lobes latero-postérieurs." Furthermore, *Proetus Swallowi*, Shumard, (loc. cit.) does not present the posterior termination of the great suture required by the genus to which it stands referred.

PHILLIPSIA ROCKFORDENSIS, n. sp. Cephalic shield surrounded by a narrow, convex border, which is bounded internally by a narrow but deep groove, and terminates posteriorly in conically tapering genal points. The principal lobe of the glabella is relatively very large, convex, highest in the middle, widened anteriorly, circularly rounded in front, and gently curved on the sides; no glabellar furrows are present. The complementary lobes are large, oval, and project laterally farther than the main lobe. The surface of the test of the glabella is finely, but sharply granulated; that of the border is finely striated. Size about the same as that of *P. Doris*.

Collected by A. W., at Rockford, Indiana.

CYTHERE CRASSIMARGINATA, Win. Collected by A. W., at Alan's and Germain's quarries, Hillsdale, Michigan.

UNIVERSITY OF MICHIGAN, *Ann Arbor*, 13th May, 1865.

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ERRATA

The proof sheets of the following article not having been submitted to the author, some typographical errors have occurred, of which the following are the most important:

In title, for "equivalent" read "equivalents."
Page 110, 3d line from top, for "identification" read "identifications."
Page 111, 7th line from top, for "even" read "seen."
Page 125, 10th line from bottom, for "White" read "while."
Page 127, 10th line from top, for "Lowensis" read "Iowensis."