

Descriptions of FOSSILS from the Yellow Sandstones lying beneath the  
"Burlington Limestone," at Burlington, Iowa.

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With the view of collecting facts bearing upon the determination of the geological age and equivalents of certain ferruginous sandstones in the lower peninsula of Michigan, which I have provisionally designated the Marshall Group,\* I visited several of the neighboring States during the past summer, for the purpose of examining the principal exposures of strata supposed to occupy nearly the same horizon. At Burlington, Mr. C. A. White accompanied me in all my examinations, and enabled me to procure nearly a complete suite of the species of that place described by Shumard and Hall, but more especially by himself and Mr. R. P. Whitefield.† Besides the recognized species, I obtained from Mr. White, or by his assistance, several undescribed forms. Subsequently Mr. White greatly increased the number of unknown species by his discoveries at exposures hitherto but little explored. The whole collection of new species, together with his own observations thereon, has been kindly placed in my hands for investigation; and the following paper is the result of this study.

The number of new species herein described is fifty-nine, and the number now first identified, ten. The number of species previously known from these rocks was sixty-six,‡—a total which is now raised to one hundred and thirty-five.

The richness of this locality in fossil species is well worthy of note. To the one hundred and thirty-five species from the yellow sandstones must be added three hundred and seven species from the overlying Burlington limestone, making a grand total of four hundred and forty-two species from a single locality. It ought not to be forgotten, that this wonderful result has been developed mainly through the industry and skill of a single individual,—Charles A. White,—who, during eight years of his residence in the locality, has collected the types of two hundred new species and six new genera.

A consideration of the general conclusions deducible from the study of the palæontology of the rocks of the Western States supposed to occupy the horizon of the Marshall Group of Michigan will be hereafter presented. Suffice it to say, on the present occasion, that no one can glance over the list of species described here and elsewhere from these rocks without admitting that the *ensemble* bears a very close analogy with that of the "Mountain Limestone" of the Old World, and raising the inquiry *how* the equivalent of the old red sandstone can lie on the *top* of such an assemblage of strata.

*Descriptions of New Species and Genera.*

LEPTOPORA, n. gen.

Etymology, *λεπτος*, shallow and *πορα*, a cell.

Corallum occurring in thin discoidal masses; cells very shallow, crowded, polygonal, separated by a common cell-wall, which is vertically striated; interior of cells filled with a finely vesicular tissue; cups polygonal, concave, elevated in the centre, and displaying numerous radial lamellæ.

\* See "First Biennial Report" of the Geological Survey of Michigan, 1860. For descriptions of the fossils of this group, see Silliman's Journal, [2,] vol. xxxiii. p. 352, and Proc. Acad. Nat. Sci. Phila., Sept., 1862, p. 405—430.

† For White's descriptions, see Jour. Bos. Soc. Nat. Hist., vol. vii., and Proceedings of same, vol. ix. p. 28, et seq. For White and Whitefield's descriptions, see "Proceedings," vol. viii. p. 289.

‡ In this estimate I omit *Chonetes Logani*, Norwood and Pratten, (not Hall,) *Cardiomorpha ovata*, Hall, and *Cardiomorpha parvirostris*, White, for reasons which will appear in the sequel. *Productus Shumardianus*, Hall, as recognized at Burlington, appears to be *P. concentricus*, Hall, and *Avicula circulus*, Shumard, as recognized at Burlington, is probably *Aviculopecten limexformis*, White and Whitefield.



*LEPTOPORA* *TYPA*, n. sp.—Polypary subcircular in outline, and slightly convex on the general surface; composed (in the specimens examined) of 25–30 rather large cells, of which the internal ones are hexagonal, and the peripheral rounded exteriorly; margins of cups strongly elevated; radial lamellæ about 20.

Diameter of mass .72;\* diameter of the cells about .14, and their depth about .07. In a specimen whose diameter is 1.27, the diameter of the cells is .22.

Ranges from the oölitic bed No. 6 into the base of the Burlington limestone.

This singular coral is not as well known as is desirable. Though discoid, it does not seem to be encrusting. No diaphragms or communicating pores have yet been detected.

#### TREMATOPORA, Hall.

*TREMATOPORA* ? *VESICULOSA*, n. sp.—Corallum delicate, terete, branching, celluliferous on all sides. Cells arranged in spiral and often longitudinal series; cell-mouths oval, slightly elevated on the lower margin, the longitudinal series more or less separated by a straight or flexuous, sharply-raised carina. Surface between the cell-mouths imperforate, but the substance of the corallum beneath is irregularly vesicular. No solid axis exists, the cells appearing to ascend and diverge gradually from an imaginary axis.

Diameter of stem about .05; length and breadth of cell-mouth .02 and .01; distance between the cell-mouths in the spiral series .01. In some specimens the cell-mouths are somewhat more widely separated.

Base of the Burlington limestone and in the fine-grained sandstone of Ohio.

*TREMATOPORA* ? *FRAGILIS*, n. sp.—Corallum delicate, branching, terete or slightly compressed at the bifurcations, celluliferous on all sides. Cell-mouths minute, oval, somewhat remote, not disposed in regular series, more approximate in a transverse than in a longitudinal direction. Intervening surface imperforate; the substance immediately beneath minutely cellular.

Least distance between contiguous cell-mouths about equal to their transverse diameter; greatest distances two or three times as great. The absolute dimensions of the cell-mouths are less than in the last species.

Base of the Burlington limestone.

The two species above described are only provisionally referred to *Trematopora*. They belong to a group often ranged under *Millepora* and *Ceriopora*, but apparently without sufficient reason. The assemblage of branching (or sometimes foliaceous) corals without septa or lamellæ, ranging from the lower Silurian into the Carboniferous limestone, seems to be but imperfectly understood; and the generic and even more fundamental relations are in a state of very unsatisfactory vagueness and confusion.

#### LINGULA, Bruguière.

*LINGULA* *MEMBRANACEA*, n. sp.—Shell flattened, quadrate-elliptical, nearly as broad near the beak as at the same distance from the anterior margin; length nearly equal to twice the width; lateral margins slightly curved; beak scarcely elevated, near the posterior margin, but with a narrow belt behind it. Shell substance membranaceous, marked externally by very delicate, regular concentric lines.

Length .50 (100); breadth in the middle .32 (64); breadth at one-fourth the shell-length from posterior end .28 (56); breadth at same distance from anterior end .31 (62).

Differs from *L. concentrica*, Hall, from the Genesee slate by its subequal

\* The measurements in this paper are given in inches. Where one number is followed by another in parenthesis, the latter is the relative measurement—the dimensions which is generally the greatest being assumed 100



width at the two extremities. A similar undescribed species occurs in the "fine-grained sandstone" of Ohio.

#### DISCINA, Lamarck.

*DISCINA PATELLARIS*, n. sp.—Upper valve circular, elevated, patelliform, with a subcentral beak, from which the surface slopes in right lines to all parts of the margin, except a barely perceptible concavity down the posterior slope. Surface (of cast) with feeble concentric striae.

Diameter .90 (100); height of upper valve .33 (37); The length appears to be a very little greater than the breadth, but the specimen is slightly defective posteriorly.

This species recalls *D. Alleghania*, Hall, of the Chemung Group, but the apex is more central, and the concentric lines less lamellar and regular, and the shell, so far as known, is smaller.

#### PRODUCTA, Sowerby.

*PRODUCTA*? *PARVULA*, n. sp.—Shell very small, semi-elliptic or nearly semi-circular in outline, with a hinge-line equalling the greatest width, or a little less. Ventral valve ventricose, with regular, though slightly diminishing curvature from beak to anterior margin, describing an arc of about 180°; beak elevated above the hinge-line and incurved over it; flanks regularly convex, abruptly flattened and auriculate at the hinge extremities. Dorsal valve unknown. Surface ornamented with small, rigid, continuous, radiating ribs, which on the sides increase by implantation.

Length from beak to anterior margin .38 (100); width .31 (82); depth of ventral valve .23 (61). The prevailing dimensions are less than the above.

Amongst *Productæ* of similar age the miniature size of the present species renders it at once distinguishable. The specimens look like pygmy examples of *P. cora*, *arcuata* or *pileiformis*.

*PRODUCTA MARTINI*, (Sow.) de Kon. (*P. semireticulatus*, Martin.)—In the wide range of characters admitted into this species, as defined by de Koninck, there is little doubt that the Burlington specimens would be embraced. Although most of the American species of *Producta* formerly identified with European types have subsequently been separated, *P. Martini* (or *semireticulatus*) is still admitted to exist in our coal measures; and it seems probable that its first appearance dates considerably further back.

Ranges from the bottom of the Yellow sandstones into the Burlington limestones.

*PRODUCTA SPECIOSA*, Hall, (Tenth Ann. Rep. Reg. N. Y., p. 176).—Several casts of this Chemung species present the appearance of being inside views of very concave dorsal valves; but no internal structures are visible. The beak is flattened, and not elevated above the hinge-line, which is somewhat shorter than the greatest width of the shell. The other characters also agree.

#### STROPHALOSIA, King.

*STROPHALOSIA*? *NUMMULARIS*, n. sp.—Shell of medium size, circular, truncated by the hinge-line. Hinge-line (generally much) shorter than the greatest width of the shell. Ventral valve comparatively very shallow, regularly arching from the anterior side to the vicinity of the beak, which is obtuse, not incurved and not elevated above the dorsal margin; surface depressed each side of the beak; area apparently present, but very narrow. Dorsal valve discoid, with a broad, shallow umbonal depression, which is bounded on the two sides by lines diverging from the beak at right angles with each other, or nearly so; beak depressed, furnished with a small bifid cardinal process or boss, which lies in the plane of the valve and projects beyond the hinge-line; each branch of the boss continued internally in a low vanishing ridge, which is turned outwardly into the position of a socket ridge, but without the socket behind it;

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median septum a low ridge appearing a short distance from the beak, and disappearing toward the middle of the valve; vascular imprints sectoriform reaching half way to the midvalve, separated from the median septum by a faint ridge (occluser apophysis?) on each side. External surface of both valves with numerous concentric lamellar striæ and innumerable little pits which give the impression a finely granular appearance; pits more scattered and deeper toward the anterior margin. Internal surface (of dorsal valve) exhibiting concentric lines and innumerable raised points, apparently corresponding with the pits of the exterior.

Length .82 (100); width 1.06 (129); length of hinge-line .55 (67); length of cardinal process .04 (5); depression of dorsal valve .04 (5). Depth of ventral valve .15, with a length of .76. Another dorsal valve has a width of 1.46 and a hinge-line 1.22 long.

This anomalous species has more the form of an *Orthis* or *Strophalosia* than a *Producta*. But there is no positive proof of the existence of spines, and the somewhat doubtful existence of an area in either valve furnishes only unsatisfactory grounds for referring it to either genus. At the same time it is difficult to understand how the externally projecting cardinal processes of the dorsal valve could be used without a fissure (and area?) in the ventral valve in which they could move. In view of all the facts, I venture to refer the species with a query to *Strophalosia*. Should the reference prove correct, it will be, so far as I know, the first identification of this genus in American rocks.

#### CHONETES, Fischer.

*CHONETES MULTICOSTA*, n. sp.—Shell of medium size or larger, semicircular, with the greatest width along the hinge-line. Ventral valve depressed-ventricose, more or less flattened toward the hinge extremities, with a barely perceptible mesial sinus reaching two-thirds the distance to the flattened inconspicuous beak; spines two (possibly three) each side of the beak, nearly at right angles with the hinge-line, of medium length, rather stout, the first midway between the beak and cardinal extremity, the second midway between this and the same point; area extremely narrow. Dorsal valve shallow, concave, with a depressed mesial fold extending nearly to the beak; socket plates very divergent; occluser scars forming a very small elliptic pit near the beak. External surface of each valve bearing 180–200 fine, subflexuous, radiating striæ, which increase dichotomously at all distances from the beak, and sometimes also by implantation. Surface of cast rather remotely punctate.

Length of hinge-line .82 (100); length of shell .50 (61); convexity of ventral valve .12 (14). In most specimens the last measure is relatively less.

Ranges from the base of the yellow sandstones into the base of the Burlington limestone. Intermediate in size between *C. Logani* and *C. Fischeri* of Norwood and Pratten. It possesses a greater number of radiating striæ than *C. Illinoiensis* of Worthen.

*CHONETES ILLINOIENSIS*, Worthen, (Trans. St. Louis Acad. Nat. Sci., i. 571;) *C. LOGANI*, Hall, (Iowa Rep. p. 598, pl. xii. fig. 1, a–e and 2,) not *C. Logani*, Norwood and Pratten, (Jour. Acad. Nat. Sci. Philada., [2] iii., p. 30, pl. ii. fig. 12, a, b, c.)

Some confusion seems to exist among the species of *Chonetes* just mentioned. *C. Logani* was described "from the middle portion of the mountain limestone series," at Burlington, Iowa, and characterized as having "about 30 rugose ribs." The figure agrees with the description. Prof. Hall subsequently described a species from the Burlington limestone, of Burlington and Quincy, which he referred to *C. Logani*, Nor. and Prat., though, among the characters, he assigns to it "100–120 or more fine rounded dichotomizing striæ." Still later, Mr. Worthen, conceiving this form to be specifically distinct, gave it the name of *C. Illinoiensis*, remarking that it "is restricted to the crinoidal beds of the 1863.]



mountain limestone," being abundant at Quincy, Ill., and intimating that Norwood and Pratten had erroneously assigned their species to the mountain limestone, in consequence of supposing all the Burlington rocks to belong to that series. The "middle portion of the mountain limestone series," however—even as then understood—would be found far above the yellow sandstones at Burlington. Moreover, in referring *C. Fischeri* to these sandstones at the same locality, they place them "at the base of the mountain limestone." It seems clear, then, that *C. Logani* belongs to the Burlington limestone, but that nevertheless, the species described by Hall cannot be the same, and has been properly separated as *C. Illinoiensis*. The latter species, however, contrary to Mr. Worthen's opinion, occurs frequently in all the beds below the Burlington limestone—having a range co-extensive with that of *C. multicosta*.

#### SPIRIGERA, (d'Orbigny,) Billings.

*SPIRIGERA CORPULENTA*, n. sp.—Shell of medium size, extremely ventricose, varying in outline from oval to orbicular-oval. Ventral valve depressed from the anterior margin to the summit of the greatest gibbosity, which is two-thirds the distance to the beak; anterior margin rather deeply sinuate, or very slightly so, sinus soon disappearing in a mere flattening of the valve, or traceable backwards, in a narrow shallow groove, as far as the middle of the shell; umbonal region extremely inflated; beak abruptly turned toward the opposite valve, not produced, truncate, circularly foraminated. Dorsal valve extremely ventricose near the anterior margin, slightly elevated in a mesial fold traceable to the most gibbous region, which is less than half way to the beak; surface depressed between this region and the beak; beak inconspicuous, covered by its fellow. External surface of casts strongly marked by numerous lamellose wrinkles of growth.

Length .80 (100); breadth .70 (87); depth of both valves .58 (72). Breadth and depth of another specimen .75 and .68.

The aspect of typical specimens is exceedingly unique. The great gibbosity of the rostral region of the ventral valve and the anterior region of the dorsal, causes the line of junction of the two valves to pass *diagonally* from the anterior to the posterior region. The lateral edges of the two valves, moreover, lie in the same plane, so that the sides of the shell present a regular convexity, like the dorsal and ventral surfaces, and the lines of growth of the two valves, diverging from the postero-lateral region complete the illusion of a dorsal or ventral surface radiately ribbed.

#### SYRINGOTHYRIS, n. gen.

Etymology, *σπῆρξ*, a tube and *θύρῆς*, a window.

Shell with an elongated hinge-line. Ventral valve with a mesial sinus, a very broad area, and a narrow triangular fissure closed toward the apex by an external, convex pseudo-deltidium, beneath which, and diverging from it, is another transverse plate connecting the vertical dental lamellæ, arched above, and beneath giving off a couple of median parallel lamellæ, which are incurved so as to nearly join their inferior edges—thus forming a slit-bearing tube, which projects beyond the limits of the plate from which it originates into the interior of the shell. A low median ridge extends from the beak to the anterior part of the valve. Dorsal valve depressed, without area, with a distinct mesial fold. Shell structure fibrous.

The elevated ventral and deficient dorsal area of this genus, not less than its external pseudo-deltidium, of one piece, ally it to *Cyrtia*, Dalman, and *Skenidium*, Hall. It is not known whether the arms were furnished with calcareous spiral supports, though the general aspect of the shell is that of a *Spirifera*. The shell substance is impunctate in all conditions and under high powers.

Some difficulty exists in deciding on the homology of the transverse plate and fissured tube which characterize this genus. In the ventral valve of *Merista*,

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especially of the type of *Camarium*, Hall, an arching lamella arises from the basal portion of each dental plate, and the two unite in the mesial line of the valve, forming a structure which Prof. King, before the separation of this genus, had styled the shoe-lifter process,—arched in front, and attached to the bottom of the valve behind. In *Spirifera granulifera*, Hall, a horizontal transverse plate stretches across the middle of the beak of the ventral valve, connecting the dental lamellæ where nearest approximated by their inward curvatures,—a structure which probably represents the pseudo-deltidium of certain *Spiriferæ*, but not of *Cyrtia*. Beneath this plate, the ventral median septum assumes the form of a tapering cone, resting with its base filling the cavity and having the anterior part of the upper side marked by a longitudinal groove or slit, while the posterior part sends up a small vertical plate to the transverse plate just mentioned. In *Syringothyris*, the transverse plate equally connects the dental lamellæ where most approximated, and is somewhat arched upward, as in *Merista*, but it does not join the bottom of the valve as in that genus, nor is it connected with the median septum as in *Spirifera granulifera*. Nevertheless it would seem that the three structures are modifications of the same elements.

But what is the element thus modified? Prof. King suggested that the shoe-lifter process of *Cleiothyris concentrica* is a modified form of the ventral median plate; but the wide separation of its points of origin from the normal position of this plate seems incompatible with such a conclusion; while in *Syringothyris* and *Spiriferæ granulifera* the median plate exists independently of the apparent homologue of the shoe-lifter. Mr. Billings, whose observations are generally marked by extreme sagacity, regards the shoe-lifter “as an abnormal form of the pseudo-deltidium that occurs in some Spirifers.” This is the relationship pointed out above; and there seem to exist good morphological reasons for regarding the fistuliferous arching plate of *Syringothyris* as a modified pseudo-deltidium. But to what does the latter structure appertain? In *Merista*, *Syringothyris* and certain *Spiriferæ* its relation to the dental plates suggests that it may be an outgrowth of those parts. The dental plates are amongst the most heteromorphous structures of the ventral valve. From a normal erect position, they become approximated along the ventral margins in many *Spiriferæ* and other genera, while in *Pentamerus*, *Orthisina* and *Camarophoria* this approximation results in complete union, and in *Leptæna* in the formation of the saucer-shaped process of the ventral valve. They also vary excessively in longitudinal development. In many *Spiriferæ*, moreover, there is an evident indication of a longitudinal folding of the dental plates, producing on one side or the other a longitudinal laminar process, which, under an extraordinary development, may coalesce with some neighboring part. While, therefore, the shoe-lifter process of *Merista*, and still more the fistuliferous diaphragm of *Syringothyris*, may be but modifications of the false inner deltidium of *Spirifera granulifera*, the three structures—accidental among Palliobranchs—may be but mere outgrowths of the essential and typical parts known as dental plates.

The geological range of the above generic type is, as far as known, only from the base of the yellow sandstones at Burlington, Iowa, to the Keokuk limestone. The species from the latter horizon cannot at present be characterized. There are reasons for believing that *Spirifer extenuatus*, Hall, from the yellow sandstones at Burlington, will yet be found to possess the same peculiarities, if it is not a variety of one of the following species.

*SYRINGOTHYRIS* *TYPA*, n. sp.—Shell large, thin, externally destitute of radiating ribs, or showing them but faintly. Ventral valve with a broad, undefined, rather shallow sinus; beak extremely elevated; slope thence nearly straight to all parts of the margin; area very large, triangular, flat, forming an angle of about 30° with a line along the bottom of the sinus, and perforated by a rather broad triangular fissure. Dental plates diverging at an angle of 30°, continued nearly to the apex of the beak, and extending anteriorly beyond the middle of the valve. Attachments of the myary system unknown.

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The external characters of this shell resemble those of *Spirifera simplex*, Phil. (Pal. Foss. p. 71, pl. xxix. fig. 124, and pl. lx. fig. 124), but the hinge-line is more elongate.

This species, so far as is certainly known, is restricted to the base of the Burlington limestone.

*SYRINGOTHYRIS HALLI*, n. sp.—Shell of medium size, transversely elongate, widest along the hinge-line; greatest depth of the two valves equalling or exceeding the greatest length. Ventral valve with a deep, defined sinus; beak very elevated; surface sloping thence with but little convexity, to all parts of the margin,—being sometimes even concave between the apex and the cardinal extremities; area large, triangular, transversely striate, flat or slightly arched, with a more marked incurvation just beneath the beak; perforated by a narrow, or moderately wide, triangular fissure, which is grooved along its lateral borders as if for the reception of a deltidium; dental plates rather short—in a variety, very short—diverging at an angle of  $66^{\circ}$ ; mesial septum a low ridge extending two-fifths the length of the valve; line of divaricator scars extending with a curve from inner end of dental plates to inner end of mesial septum. Dorsal valve moderately ventricose, with a convex surface, and abrupt well-defined mesial elevation, and a small beak which overhangs the base of the fissure in the area of the opposite valve,—the area being scarcely perceptible in the dorsal valve. Surface ornamented by 12 to 16 rounded ribs on each side of the mesial fold and sinus, becoming obsolete toward the lateral angles. Mesial fold and sinus destitute of ribs. The whole surface is further marked by faint, delicate lines of growth.

Length of hinge-line 1.32 (100); depth from beak of ventral valve to most prominent point of dorsal—which is nearly at right angles to the plane of the valves—.70 (53); distance from hinge-line to middle of anterior margin .54 (41); elevation of (ventral) area .48 (36); width of fissure at base .28 (21).

Ranges through the yellow sandstones. In bed No. 1 is a variety with somewhat convex area, very narrow fissure and very short dental plates. The species occurs also at Clarksville, Mo., where the beak of the ventral valve is bent somewhat to the left (this beak being uppermost) in the style of a *Streptorhynchus*, producing a curvature of the mesial sinus and the fissure; and is further peculiarly marked by several distinct lamellar wrinkles of growth.

Named in honor of Prof. James Hall, the eminent Palæontologist of Albany, N. Y.

#### AVICULA, (Klein,) Bruguière.

*AVICULA WHITEI*, n. sp.—Shell large, transverse, exceedingly oblique, with nearly terminal beaks. Hinge-line more than three times the greatest dorso-ventral dimension. Anterior ear pouched, not distinctly divided from the body of the shell. Left valve ventricose; umbonal ridge somewhat arcuate, or nearly straight, forming an angle of about  $20^{\circ}$ , with the hinge-line; slope thence to the ventral margin very rapid—to the dorsal side rather gradual and symmetrical to the very hinge-line—the posterior wing not being divided from the body of the shell. Ventral margin, in the middle rather straight and nearly parallel with the dorsal; posterior margin sigmoidal by a deep, or rather shallow sinus, isolating the posterior end of the cartilage plate from the body of the shell; posterior wing triangular, exceeding the shell. External surface marked by numerous fine, irregular striæ of growth. Right valve much less ventricose, marked on the body and anterior slope by numerous sharp, regular raised concentric striæ which become very faint posteriorly. Cardinal line in each valve with a long, slender, bifid lateral tooth behind the beak.

Length of dorsal side 2.13 (100); greatest dorso-ventral dimension .70 (33); depth of left valve .22 (10).

*AVICULA ACANTHOPTERA*, Hall, (Geol. Rep. 4th Dist. N. Y., p. 263).—Shell

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rather large, very oblique, becoming distinctly arcuate upwards. Left valve very ventricose, with a tapering, incurved beak, closely approximated to its fellow; body of valve regularly arched along the umbonal slope, from which line it describes a rapid convexity to the anterior margin, sloping more gradually to the ventral margin and becoming gradually flattened toward the posterior ventral angle. The upper boundary of the body is an abrupt descent to the plane of the posterior wing, and sharply divides the two; posterior wing sloping to the dorsal and posterior borders of the valve, produced above into a slender spine, nearly as long as the posterior end of the shell, with a deep sinuation below. Anterior ear short, saccate, less distinctly divided from the body of the valve. Hinge-line straight, with a long, posterior cartilage facet. Surface marked by irregular wrinkles of growth which become fine striæ on the posterior wing, and sharp plications on the anterior slope and auriculation. Right valve smoother and considerably less ventricose, with the posterior wing-surface divided from the body of the valve only by a slight groove.

Length from beak to extremity of posterior wing .81; from beak to extremity of anterior wing .21; from middle of dorsal side to ventral side .70; greatest width of body of shell .48; same width in a larger specimen .93; depth of right valve of same specimen .30.

An occasional specimen of this species, differing from the types of the above description only in the absence of arcuation of the body, presents a good agreement with Prof. Hall's figure and brief diagnosis,—diverging only in the less forward direction of the beak, in the much larger anterior ear, and deeper byssal sinus beneath it. The prevailing forms greatly resemble *Avicula lunulata*, Phil. sp. (Geol. Yorks, ii. pl. vi. fig. 12). It is, however, less oblique, especially in the earlier stages of its growth, and the beak is narrower and more depressed. It is also considerably broader on the antero-ventral side, and has a larger posterior wing.

#### AVICULOPECTEN, McCoy.

AVICULOPECTEN CAROLI, n. sp.—Shell of medium size, subcircular, ventricose. Hinge-line shorter than the shell; anterior ear of right valve shorter than anterior end of shell, rounded, slightly inflated, with a deep, sharply-rounded notch below; posterior ear acute, slightly longer than the anterior, with a broad, shallow notch below; shell otherwise nearly equilateral. Beak central, inconspicuous; greatest convexity of valve a little above the middle. External surface of the body of the valve marked by about 25 nearly equidistant, narrow, sharply-raised, radiating ribs, with two or three fine, raised striæ in each of the interspaces; a set of very fine, sharp, close, concentric raised lines cross the smaller ribs, but are intercepted by the primary ones. The latter, however, show a tendency, toward the pallial margin of the valve, to develop nodes, which, on the anterior and posterior slopes, become distinct spines. The spines sometimes occur in the spaces between the primary ribs. The wings are also marked by two sets of raised lines, but on the posterior wing the radiating set is most prominent, while on the anterior wing the concentric set is strongest. The left valve is exactly like the right, except that the notch below the anterior ear is shallower.

Length from beak to ventral margin .66 (100); length of hinge-line .55 (83); convexity of right valve .20 (30); antero-posterior dimension .66 (100). Number of concentric lines in one-tenth of an inch, 16. The adult size of the species seems to be about one inch in length and breadth.

Ranges from the base of the yellow sandstones into the base of the Burlington limestone.

AVICULOPECTEN OCCIDENTALIS, n. sp.—Shell small, appressed; hinge-line equal to greatest width; anterior and posterior umbonal ridges at right angles, and straight to the middle of the shell extremities, between which the pallial

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margin is regularly curved. Wings distinct, the anterior slightly inflated, rounded at the extremity, and separated from the body of the shell by a rather acute notch, from which a furrow extends to the beak; posterior wing flattened, acute, subtriangular, with a shallow sinus below. Body of shell smooth; wings with radiating ribs, strongest on the anterior wing and crossed by equally strong concentric lines; posterior wing with fine concentric lines.

In the oölitic limestone ("No. 3" of White.)

*AVICULOPECTEN TENUICOSTUS*, n. sp.—Shell small, equilateral; pallial margin circularly rounded between anterior and posterior extremities, which lie midway between the beak and opposite side. Beak slightly prominent; body of shell bounded by a truncation from beak to each lateral margin; anterior truncation slightly concave. Anterior wing of left valve moderately inflated, as long as anterior side of shell, distinctly rounded at extremity, joining hinge-line by a rounded angle, and separated from body of shell by a broadly V-shaped sinus, rounded at the bottom. Posterior wing only very imperfectly seen. Surface (of left valve) ornamented by fine, rigid, nearly equidistant ribs, 50 or 60 in number, separated by concave intervals; similar but finer ribs or striæ marking the anterior ear. Frequently from three to five equidistant costate elevations appear, each of which bears two or three of the ribs. A few inequidistant concentric lines are seen. Right valve unknown.

Length from beak to opposite side .47; antero-posterior dimension the same.

It is a little singular that of seven specimens of this species all are left valves, showing only the anterior ear. The posterior is probably flat and thin.

#### POSIDONOMYA, Brown.

*POSIDONOMYA? AMBIGUA*, n. sp.—Shell of medium size, rather ventricose, somewhat oblique. Hinge-line short, straight, not surpassed by the inconspicuous beak, abruptly rounded at the extremities; sides of shell subparallel, somewhat straight; ventral margin circularly curved, gaping at the antero-ventral angle. Cast nearly smooth, but bearing the impression of a few small, irregular wrinkles around the margin.

Greatest dimension (from beak to ventral margin) .65 (100); antero-posterior dimension .58 (89); angle of umbonal slope with hinge-line 70°.

Three left valves and one right, of an anomalous fossil are here referred with great uncertainty. One of the specimens is larger and relatively longer from beak to venter than the one described, and seems to have been everted around nearly the entire pallial border, producing an extensively gaping shell. The right valve is a smaller specimen, with the beak near the anterior extremity of the hinge-line, and presenting the anomaly of a forward instead of a backward obliquity—in this respect resembling *Streblopteria*, McCoy, but without the anterior wing. The three valves could scarcely belong to the same species of any genus, but it would be folly to attempt a further discrimination at present.

#### DEXIOBIA, n. gen.

Etymology, *δεξιός*, on the right side and *βία*, strength, in allusion to the greater ventricosity of the right valve.

Shell thin, inequivalve, inequilateral; beaks separated by an undefined area. Right valve very ventricose, with a very prominent umbo, and a produced, incurved beak, strongly inclined forward. Left valve much less inflated, with a less prominent beak, scarcely elevated above the dorsal margin. Hinge-line more or less extended, straight, or slightly bent, edentulous (?) furnished with a thickened cartilage plate bearing a linear posterior groove. Pallial line and muscular markings unknown.

In his Report on the Geology of Iowa, (p. 522, pl. vii. fig. 10, a, b, c,) Prof. Hall has described, under the name of *Cardiomorpha ovata* (not *C. ovata*, d'Orb.

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= *Mastra ovata*, McCoy,) a common species from the yellow sandstones of Burlington. This species Messrs. Meek and Worthen supposed to be congeneric with their *Cardiopsis radiata*, (Proc. Acad. Nat. Sci. Phil., June, 1861, p. 144). From the same beds, Mr. C. A. White has more recently described a similar species under the name of *Cardiomorpha* (*Cardiopsis*?) *parvirostris*, (Proc. Bos. Soc. Nat. Hist., Jan., 1862, p. 31), which has the small beak and Luciniform aspect of several other species referred by authors to the same genus \*. It was some time since remarked, however, by Mr. White, that amongst all his specimens of these two species, the left valves of *C. ovata* and the right valves of *C. parvirostris*, were entirely wanting. It appears also that Prof. Hall's description was drawn from a right valve. The idea, however, that the two sets of valves might really belong to one species, would not probably have been entertained but for the discovery of a specimen with both valves in closely fitting juxtaposition. On one side the specimen is *C. ovata*, on the other *C. parvirostris*! The beaks of the two valves are wanting, but the ventral margins apply to each other with exactitude,—the number of radiating lines in a given distance being the same on the two sides.

From the same exhaustless deposits of fossil remains, Mr. White's industry has brought to light some other forms which present similar characteristics.

It is evident that these fossils cannot be referred to any known genus. It is doubtful whether they fall within the limits of any recognized family assemblage. Judging from their analogies, they must have been asiphonal, integropallial Pleuroconchs, though little evidence of the possession of a byssus has been detected. From the inequivalve family *Aviculidae* (including *Aucella*, to which they are most related,) they are clearly excluded by the greater ventricosity of the right valve, and the absence of an anterior wing and byssal sinus. From the free inequivalve *Ostreidae* their great gibbosity distinguishes them. From *Dolabra*, McCoy, they differ in the greater ventricosity of the right valve and less transverse shape.

In view of the facts above recited, though some palæontologists may not regard them as sufficiently conclusive, I have ventured to publish a diagnosis of the supposed new genus.

DEXIOBIA WHITEI, Winchell, (= *Cardiomorpha ovata*, Hall. + *C. parvirostris*, White.)—Shell subrotund, with a slight anterior obliquity caused by a moderate protrusion of the antero-ventral border, from which, in the right valve, a slight elevation extends to the beak; anterior margin rather straight above. Hinge-line short, regularly curved; beaks nearly central. Surface marked by fine radiating ribs—becoming obsolete toward the umbo—and numerous irregular concentric wrinkles, which are generally most conspicuous in the left valve.

Height from beak to middle of ventral margin 1.26 (100); greatest antero-posterior dimension, nearly bisecting the first measure, 1.16 (92); convexity of right valve .45 (35). Height of another specimen 1.67. Height and convexity of a left valve 1.19 (100) and .26 (22).

DEXIOBIA HALLI, n. sp.—Shell small, semi-elliptic, subequilateral. Hinge-line straight, extended; in some specimens as long as the greatest width of the shell. Right valve extremely ventricose, flattened and subulate toward the hinge extremities; left valve with a very small obtuse beak, and slender posterior cartilage plate bearing a longitudinal median furrow. Surface smooth.

Height from beak of right valve to middle of ventral side .65 (100); length of hinge-line .76 (117); ventricosity of right valve .35 (54).

#### MYTILUS, Linnæus.

MYTILUS WHITFIELDIANUS, Win., (Proc. Acad. Nat. Sci. Phil., Sept., 1862, p.

\* Compare also *Lucina ? retusa*, Hall, (Geol. Rep. 4th Dist., N. Y., p. 245), and *Ungulina suborbicularis*, (Ib. p. 243).



413.)—The small shells thus identified have heretofore been regarded as the young of *M. occidentalis*, White and Whitfield,—a species with which I formerly identified the Michigan types of *M. Whitfieldianus*,—a close comparison of specimens, however, shows *M. occidentalis* to be quite destitute of the fine diverging striæ which belong to perfect specimens of the other species. *M. occidentalis*, moreover, is more flattened between the umbonal ridge and the hinge-line, and does not attain more than one-fifth the length of the other. It bears considerable resemblance to *Modiola lingualis*, Phil., (Geol. Yorks. p. 209, pl. v. fig. 21.)

#### ORTHONOTA, Conrad.

ORTHONOTA PHASELIA, n. sp.—Shell transversely quadrangular. Beaks inconspicuous, nearly terminal, not raised above the slightly-curved hinge-line. Ventral margin subparallel with dorsal, with a shallow sinuation in the middle. Posterior end truncately curved, a little the most extended toward the dorsal side; anterior end slightly produced below, with a deep lunette above. Shell inflated from the anterior end to near the posterior. Greatest thickness a little in front of the middle. Anterior muscular pit shallow, ovately pyriform. Surface with a few remote concentric lines near the border.

Length .35 (100); height .20 (57); thickness of both valves .13 (37).

#### EDMONDIA, de Koninck.

EDMONDIA NITIDA, n. sp.—Shell small, equivalve, suborbicular, ventricose, slightly oblique, with a subcentral beak. Hinge-line slightly extended posteriorly, obtusely rounded at the extremities; anterior and posterior sides subparallel; ventral border circularly rounded, but a little produced in the line of the umbonal ridge. Beak elevated above the hinge, obtuse, slightly incurved; umbonal ridge making an angle of  $68^{\circ}$  with the hinge-line; behind this ridge the slope is abrupt to the posterior border; middle portion of the shell very slightly flattened from the beak along the region anterior to the umbonal ridge. Surface handsomely marked by rigid, regular concentric raised striæ, with a few remote, irregularly-distributed concentric furrows. The striation is preserved in all its sharpness to the very hinge-border.

Length .59 (100); height .59 (100); thickness of both valves .30 (51).

Closely resembles *E. unioniformis*, de Kon., (Anim. Foss., pl. i. fig. 4,) but the latter is less finely and elegantly striated, and shows no flattening along the region between the beaks and the ventral border. It is much less flattened and less angular than *E. binumbonata*, Win., from Michigan.

EDMONDIA NUPTIALIS, n. sp.—Shell of moderate size, transversely-suboval; in adult specimens considerably inflated in the vicinity of the pallial border. Beaks subcentral, small, incurved, somewhat elevated above the moderately extended, slightly arcuate hinge-line. Ventral margin gently curved or nearly straight in the middle; more rapidly curved toward the rounded, subequal extremities. Hinge structure obscure, but apparently consisting of one or more lateral teeth on each side of the beak. Surface unequally and interruptedly furrowed. Greatest thickness through the middle of the shell.

Length .79 (100); height .62 (78); thickness of both valves .50 (63).

This species is relatively larger than *E. nitida*, and is destitute of the obtuse angulations descending along the anterior and posterior umbonal slopes of the latter. An associated, if not identical, species is less ventricose, with less central beaks, and can scarcely be distinguished from *Lucina? retusa*, Hall.

EDMONDIA STRIGILLATA, n. sp.—Shell rather small, rather gibbous, transversely oval; beaks subcentral, elevated, obtuse, somewhat strongly turned forward. Ventral margin gently arcuate in the middle, more rapidly curved toward the neatly-rounded extremities, of which the posterior is broadest. Hinge-line curved, furnished with a pair of rather thick lateral teeth; cardinal teeth, apparently none. Surface marked by fine radiating lines, and toward the margin by a few irregular concentric wrinkles.



Length .80 (100); height .62 (77); thickness of both valves .40 (50).

Resembles *E. nuptialis* in form, but it is less ventricose around the margin, and is further distinguished by its radiating striæ.

EDMONDIA *ÆQUIMARGINALIS*, Win., (= *Cardinia æquimarginalis*, Win., Proc. Acad. Nat. Sci. Phil., Sept., 1862, p. 413.) The identification with the Michigan species is quite conclusive, but the better state of preservation of this fossil necessitates a correction of the generic reference.

EDMONDIA (?) *BICARINATA*, n. sp.—Shell rather small, transverse, oblong, a little the widest at the posterior extremity of the straight, lengthened hinge-line; dorsal margin erect, not inflected; ventral margin subparallel with the dorsal, having a distinct shallow sinus near the middle, which leaves a diminishing furrow extending to the beaks; angularly rounded to the extremities, of which the posterior is truncate by a slightly curved line at right angles with the hinge-line, and another above this forming an angle of about  $135^{\circ}$  with the hinge-line. Beaks one-fifth the length of the shell from the anterior end, somewhat flattened, and incurved over a deep, distinct lunette. Greatest convexity one-third the distance from the dorsal to the ventral sides. A strong angular ridge extends from the beaks to the posterior ventral angle, and another, less conspicuous, to the angle connecting the two posterior truncated margins. Surface marked by fine incremental lines, parallel to the basal and posterior borders.

Length .59 (100); height .27 (41); thickness of both valves .12 (20).

EDMONDIA (?) *ELLIPTICA*, n. sp.—Shell rather large, appressed, transverse, with an elongate-elliptical outline. Beaks flat, inconspicuous, situated one-fifth the shell-length from the anterior end. Hinge margin elongate, slightly curved, abruptly elevated; a flattened area extending from the beaks backward to the posterior hinge angle. Extremities neatly rounded. Surface marked by numerous distinct unequal lines running parallel with the pallial margin.

Length 1.36 (100); height .65 (48).

#### SANGUINOLITES, McCoy.

SANGUINOLITES *AMYGDALINUS*, n. sp.—Shell of medium size, equivalve; length equal to two and a half times the height; beak about one-fourth the length from the anterior end, scarcely elevated above the hinge, somewhat depressed, incurved; dorsal margins slightly concave, posteriorly inflected inwards, forming a deep escutcheon; ventral margin gradually curved along the middle, more rapidly so toward the extremities; posterior extremity describing nearly a semicircle, and joining the dorsal line by a very easy angle; anterior extremity abruptly rounded to the deep, broad lunette, which reaches from the beak to the middle of the shell. Greatest protuberance one-third the distance from the beak to the venter, rather tumid; an obtuse angulation extending from the beak to the postero-basal angle; a strong internal ridge running near to, and parallel with, the hinge-line. Surface marked by strong concentric wrinkles, which nearly disappear in the dorsoumbonal region. A shallow sinus in front of the mid-ventral margin, which can be traced upward toward the beak.

Length .97 (100); height .44 (45); distance of beak from anterior end .25 (26); from posterior .72 (74); thickness of both valves .36 (37).

Somewhat resembles *Allorisma Hannibalensis*, Shum., but differs in the absence of the "broad concentric ribs" of that species. It less resembles the Burlington fossil, usually referred to the same species.

SANGUINOLITES *CYLINDRICUS*, n. sp.—Shell small, equivalve; length equal to two and a half times its height; beak about one-seventh the length from the anterior end, elevated above the hinge-line, flattened and enrolled; greatest height along the perpendicular from beak to base; dorsal margin extended, 1862.]



slightly concave upwards and inwards, sharply inflected inwards, forming a long, deep posterior escutcheon or cartilage base; ventral margin nearly straight, curving rapidly from a point opposite the beaks to the anterior extremity, which is abruptly rounded into the deep heart-shaped lunette; posterior extremity truncated by a line extending from the basal to the dorsal margin, and making with the latter an angle of  $120^{\circ}$ . Valves very ventricose, the greatest thickness being behind the central point on the sharp, prominent umbonal plication, which extends from the beak to the postero-basal angle—the area between this plication and the anterior region being curved subcylindrically from a dorsal to a ventral direction, and the area between the plication and the hinge-line being a triangular, twisted, somewhat concave surface, faintly marked by lines diverging from the beak to the posterior boundary. Entire surface covered with fine irregular striæ parallel with the basal and anal margins.

Length .63 (100); height .29 (46); thickness of both valves .24 (38); height of posterior end .20 (32); length of anterior end .09 (14); of posterior end .54 (86).

A peculiarity of this fossil is its cylindrical ventricosity and the posterior position of its greatest distension. (Compare Owen, Geol. Rep. Wis., Min., &c., Tab. III. A, fig. 18.)

*SANGUINOLITES IOWENSIS*, n. sp.—Shell of medium size, equivalve, transverse; height equal to nearly one-half the length; beaks elevated above the dorsum; subappressed, incurved and turned forward over a deep cordate lunette; dorsal line straight, reaching to near the posterior extremity of the shell; dorsal margin sharply inflected to form a long cartilage base; ventral border gently curved, posteriorly receding toward the dorsum, and forming at the extremity an angle of  $80^{\circ}$  with the short, truncate, nearly rectilinear hind margin; anterior extremity most projecting in the middle, from this point curving regularly to the ventral border and abruptly into the anterior lunette. Valves ventricose, most inflated in the middle; a sharp carina running sigmoidally from the beak to the postero-basal angle; another, still sharper, bounding the (posterior) escutcheon; the twisted triangular space between these being marked, on the cast, by three faint depressed lines, radiating also from the beak. External surface marked by irregular lines of growth, strongest on the anterior portion and faintest on the dorso-umbonal surface. In some specimens apparently not separable from this species, a shallow groove runs from the ventral margin nearly opposite the beak, over the umbō.

Length 1.03 (100); height .52 (50); thickness of both valves .38 (37); length of anterior end .21 (20); of posterior end .82 (80).

The forms last mentioned above attain a size fully once and a half as large.

The typical specimens of this species are quite distinct, but the larger ones approximate to *S. amygdalinus* in outline and characters of the dorsal region; but they differ in being larger, more ventricose, and in having a sharp umbonal angle and acute posterior extremity.

*SANGUINOLITES SULCIFERUS*, n. sp.—Shell very small, transversely oblong, with nearly terminal beaks. Ventral margin broadly and rather deeply sinuate in the middle; anterior margin abruptly rounded below, terminating above in a deep lunette; posterior margin somewhat produced below, suddenly rounded at the basal angle, and very obliquely truncate from thence to the end of the second third of the dorsal side, from which point the straight hinge-line extends to the beak. Cardinal margins inflected to form a narrow, elongate escutcheon. Umbo full; umbonal ridge arcuate, with the convexity upwards, and terminating at the posterior basal angle; space above this somewhat concave, longitudinally marked by seven or eight strong imbricating concentric ridges.

Length .26 (100); height .14 (54); thickness of both valves .09 (35).

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Resembles in external form *Arca pinguis*, de Kon., (Anim. Foss., 116, ii. 11). Compare also *Cypricardia parvula*, (pl. ii. fig. 3).

The Hamilton group of New York furnishes a fossil similar to the above; and the Waverly sandstone of Ohio another similar, perhaps identical, one.

**SANGUINOLITES (?) JEJUNUS**, n. sp.—Shell of moderate size, equivalve, transverse; beaks small, barely elevated above the hinge, slightly inflected, one-third the shell-length from the anterior end; height fully half the length; hinge-line extended; dorsal slope erect, marked by an internal ridge; margin slightly inflected, if at all, though some indication exists of a very narrow escutcheon; anterior lunette equally inconspicuous; ventral margin symmetrically arcuate between the extremities, with which it connects by similar gradually increasing curvatures; posterior end truncate for a short space near the termination of the hinge-line, with which it forms an angle of about  $130^\circ$ ; anterior end semi-elliptically rounded. Valves somewhat appressed; greatest distension one-fourth the distance from the beak to the venter. Surface of cast marked by faint lines of growth.

Length .86 (100); height .48 (55); length of anterior end .31 (36); of posterior .55 (64); thickness of both valves .20 (23).

Some specimens associated here are relatively shorter posteriorly, but not otherwise distinguishable.

McCoy's generic names and distinctions,—*Sanguinolites* and *Leptodomus*,—seem preferable to King's *Allorisma*, inasmuch as the latter name, besides being subsequent in time, was originally defined under an erroneous idea, and was finally left to embrace shells regarded as sinupallial,—a character which does not seem to belong to the so-called *Allorismas* of the Palæozoic period. *Sanguinolites Iowensis*, and probably some of the others just described, are allied in form to *Cypricardia*; but I agree with Pictet and others in believing that, while we have no evidence of the existence of the teeth of *Cypricardia* in any of the Palæozoic species generally referred to that genus, it is more natural to throw them into another association. Moreover, the sharply-inflected dorsal margin and broad, elongate posterior escutcheon, present in all the species of *Cælonotidae*, would seem to indicate real affinities, and thus withdraw the *Allorisma* type entirely from the association in which it has been placed. *Cypricardia? rigida*, White and Whitfield, from the same rocks, is a *Sanguinolites*.

#### CARDIOMORPHA, de Koninck.

**CARDIOMORPHA TRIGONALIS**, n. sp.—Shell small or of moderate size, triangular, rather ventricose, with elevated, incurved beaks. Ventral margin slightly convex anteriorly, slightly sinuate near the posterior angle; anterior angle regularly rounded to the subtruncate anterior side; posterior angle rather acute, formed by the termination of the sharp postumbonal ridge, from which the surface descends precipitously to the truncate posterior margin. Hinge-line short, rounded, edentulous. Greatest thickness a little above the middle of the shell. Surface marked only by faint incremental striæ; younger specimens smooth.

Length .82 (100); height .72 (88); thickness of both valves .50 (61).

This species has been sometimes regarded as *C. rhomboidea*, Hall, but none of the numerous specimens of it exhibit the least trace of radiating lines. The outline, moreover, is subtriangular instead of subrhomboidal. (Compare with *C? triangulata*, Swallow, St. Louis Trans., i. 655.)

#### ARCA, Linnæus.

**ARCA MODESTA**, n. sp.—Shell small, very ventricose, quadrate-oval, with a posterior alate prolongation of the hinge-line. Beaks subterminal, incurved, separated by a ligamental area; posterior hinge-line straight, nearly as long as the shell. Umbonal ridge and body of the shell inflated to the ventral mar-



gin; alate expansion gradually flattened; anterior end abruptly rounded, excavated by a lunuliform area in front of the beaks; posterior end rounded below, truncate above. Surface covered by fine, rather regular, sharp, concentric striae; the alate expansion bears also faint traces of two or three furrows diverging from behind the beak.

Length .31 (100); height .22 (71); thickness of right valve .10 (32); angle between hinge-line and umbonal ridge  $35^{\circ}$ .

This little species closely resembles *A. arguta*, Phill., sp., var. de Kon., (Anim. Foss., pl. iii. fig. 12.) The beaks, however, are still more terminal than in that variety, and the lunette is not so sharply bounded. *Arca arguta*, var., is from carboniferous limestone—Visé. Though the dental characters of the present species have not been observed, it can scarcely prove to be anything but an *Arca* or *Macrodon*.

#### MACRODON, Lycett.

*MACRODON COCHLEARIS*, n. sp.—Shell of moderate size, rather ventricose, length equal to twice the height; beaks subterminal, flattened, incurved. Ventral border straight, or slightly sinuate in the middle, symmetrically curved toward the extremities; posterior extremity truncate from the hinge-line one-third its width; anterior extremity most projecting above the middle, excavated above by a small deep lunette; dorsal line straight, nearly as long as the shell, not inflected; posterior cardinal extension with feeble indications of one or more lateral teeth. Surface finely striated concentrically.

Length .88 (100); height .44 (50); length of anterior end .16 (19); of posterior end .72 (81); thickness of left valve .18 (22).

Resembles *M. parvus*, White and Whitefield, but, besides its larger size, it is much less ventricose, especially in the posterior half, and has not the conspicuous muscular pits of that species.

#### NUCULA, Lamarck.

*NUCULA MICRODONTA*, n. sp.—Shell small, transversely oblong; height equal to two-thirds the length; beaks small, somewhat incurved, but little elevated above the hinge-line, about one-third the length from the short end. Ventral border rapidly curved, and regularly so to the vicinity of the long end, where it is slightly sinuated, from which point a shallow groove extends up nearly to the beak. Dental plates but little angulated between the beaks; the larger bearing near its outer margin 10 or 12 minute transversely tubercular teeth, and the shorter 4 or 5. Teeth not distinguishable to the beaks, but no cartilage pit seems to be present. Anterior muscular pit oblong, surmounted by a large pedal scar. Shell most ventricose in the middle. No surface markings discernible.

Length .47 (100); height .32 (68); length of short end .18 (38); of long end .29 (62); thickness of both valves .18 (38).

This little species is readily distinguished from *N. Iowensis*, and most others of this age, by its very small teeth and the absence of the usual nukuloid outline.

Ranges from bed No. 5 into the base of the Burlington limestone.

#### LEDA, Schumacher.

*LEDA SACCATA*, n. sp.—Shell very small, transversely elongate, rostrate at the longer extremity; obtuse, ventricose and saccate at the other. Beak abruptly, though moderately drawn out, and but slightly incurved. Ventral side strongly curved, becoming nearly straight toward the rostral extremity. Dorsal region deeply excavated for an escutcheon on the longer side of the beak; hinge plates bearing each six or seven teeth. Greatest thickness of shell between the beaks and the middle. Pit of adductor of short end very deep

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on its superior border; the other pit smaller, deepest on its superior border. Surface with fine, indistinct striæ of growth.

Length .32 (100); height .16 (50); length of short end .13 (41); of long end .19 (59); thickness of both valves .13 (41).

#### ISOCARDIA Lamarck.

ISOCARDIA? JENNÆ, n. sp.—Shell of rather large size, triangular, very ventricose. Beak elevated above the hinge, flattened, incurved and directed forward, with a deep lunule in front. Hinge-line extended posteriorly; alate expansion more or less flattened, posterior border truncated at right angles with the dorsal line, elongate; antero-ventral margin nearly straight throughout the lower two-thirds of its length, forming an angle of  $50^{\circ}$  with the posterior border, above gradually curved to the lunette. An elevated sharp umbonal ridge runs sigmoidally from the beak, arching first backwards, then forwards, and again backwards to the posterior ventral angle; the posterior slope from this ridge becomes more and more steep in approaching the beak, at and near which it faces dorsally, and is overhung by the umbonal ridge. A shallow sinus appears in the middle of the antero-ventral margin, from which a furrow ascends toward the beak. Surface marked with faint incremental lines which, on the antero-ventral slope near the base, become distinct, and nearer the beak rise in well marked wrinkles converging in the lunette. Greatest length from beak along the umbonal angle 1.27; length of hinge-line .81; length of shell posterior to the beak .65; length of posterior side .90.

This species, in its essential features well marked, seems, nevertheless, to be quite variable. In some specimens the posterior alate portion is much more developed. In others it is less developed, and the umbonal ridge is more acute, giving the shell the appearance of being truncated through its thickest part.

There is no direct evidence of the affinities of this species with *Isocardia*, except the swollen umbones and enrolled beaks; and it is so referred, mainly, in deference to high authorities who have made similar disposition of such forms. (See Sandberger, Verstein., pl. xxvii. fig. 11). It has the posterior wing of the *Aviculidæ*, and also the ventricose left valve and enrolled beak of *Aucella* in that family. Yet it differs from *Aucella* in having the right valve equally ventricose, and in being entirely destitute of an anterior wing and byssal sinus. The sharp, sigmoid umbonal angle is a feature seen in some species usually referred to *Cypricardia* (See *C. bipartita* de Kon. Anim. Foss., p. 94. pl. fig. 15).

Finally, it is worthy of mention that the peculiar angular form of this species is but an exaggeration of the characters of *Sanguinolites cylindricus*. It is relatively shorter, more ventricose and more flattened on the posterior cardinal angle. If external form is to be the basis of family distinctions and alliances, (See Agassiz, Cont. to Nat. Hist. of N. A.) then *Isocardia Jennæ* will go with *Sanguinolites cylindricus*, Win., *S. decipiens*, McCoy, *Cypricardia rigida*, W. and W., *C. bipartita*, de Kon., *Isocardia cælata*, Sandb., &c., &c., into a family whose circumscription has not yet been marked out.

#### CARDIOPSIS, Meek and Worthen.

CARDIOPSIS MEGAMBONATA, Win. (Proc. Acad. Nat. Sci., Sept., 1862, p. 417.) —The specimen here referred is many times larger than the types of the species, being of the size of *C. crenistriata*, Win., from which it differs principally in the coarser and more rigid ribs and more prominent beak.

The ribs in the Burlington specimens do not increase in number with age, and scarcely increase in size; the intercostal spaces are flat, gradually widening.

Height from beak to ventral margin .91 (100); length .85 (97); thickness of left valve .55 (60).



## SANGUINOLARIA, Lamarck.

SANGUINOLARIA? LEPTOGASTER, n. sp.—Shell small, thin, subquadrangular. Beaks subcentral, flat, not elevated above the dorsal line. Posterior end obliquely truncated; anterior gently rounded below, abruptly above, with a long deep lunette; ventral side arcuate in the middle, joining the extremities by a gradually increased curvature. Umbo flattened,—a low ridge extending obliquely to the posterior basal angle. Dorsal line straight behind the beaks, joining the posterior side at an angle of  $125^{\circ}$ . Surface marked by fine regular striæ parallel with the ventral and posterior margins.

Length .53 (100); height .38 (71); thickness of valves .09 (17).

## BELLEROPHON, Montfort.

BELLEROPHON CYRTOLITES, Hall, (Thirteenth Rep. Reg. N. Y., p. 107).—A small Bellerophon, laterally appressed, and with an acute periphery, approaches too closely to *B. cyrtolites* to justify discrimination. It is known, however, only by its cast, which is quite smooth. Should the identification prove correct, this species occurs at Rockford, Ind., Marshall, Michigan, and Burlington, Iowa.

## PORCELLIA, Lévêille.

PORCELLIA RECTINODA, n. sp.—Shell small, gradually enlarging, marked by a series of transverse nodes, which are strongest on the dorso-lateral region, and gradually diminish to the middle of the side; transverse section between two nodes subcircular. Dorsum unknown.

Diameter of last whorl about .59; dorso-ventral diameter of tube near the aperture .19.

This species differs from *P. crassinoda*, White and Whitefield, in its circular section and transversely elongate nodes—from *P. obliquinoda*, White, in the transverse position of the nodes—and from *P. nodosa*, Hall, (Geol. Surv. Ia., Supplem. to vol. i. part 2, p. 92), in its much smaller size and different geological horizon,—the latter being found in the upper bed of the Burlington limestone, which has thus far furnished no species identifiable with fossils from the sandstones below.

## DENTALIUM, Linnæus.

DENTALIUM GRANDÆVUM, n. sp.—Shell rather large, perfectly straight and terete, or a little compressed; tapering .09 in one inch near the larger end, less rapidly near the small end; surface marked by faint, irregular incremental striæ, which run obliquely around the shell, and in flattened specimens are most advanced along one edge.

Length of largest specimen 2.18; diameter at larger end .21; at smaller end about .05.

This species resembles *D. venustum*, Meek and Worthen, (Proc. Acad. Nat. Sci., Phila., June, 1861, p. 145), from the St. Louis and Spergen Hill limestones. The latter, however, tapers but .075 in one inch, and is described as “nearly” straight and quite smooth, while the present species is rigidly straight and transversely striated.

## PLATYCERAS, Conrad.

PLATYCERAS CORNUFORME, n. sp.—Shell small, describing about half a whorl, very rapidly enlarging, similarly curved throughout, broadly and obtusely carinated, when young, along the peripheral line; transverse section becoming subsequently nearly circular; aperture a little oblique to the whorl, with a somewhat sinuous peristome,—the principal sinus being just beneath the middle of the outer lip. Surface marked only by striæ of growth, which curve forwards on the sides, and backwards along a belt just beneath the periphery. The shell is nearly symmetrical and its curvature planorboid. The apex is blunt and not perceptibly turned to the right or left.



Height when resting on the aperture  $\cdot 32$ ; summit in this position two-thirds the distance from the aperture to the apex; width of aperture  $\cdot 33$ .

*PLATYCERAS VOMERIUM*, n. sp.—Shell of medium size, describing about half a direct whorl, very rapidly enlarging; peripheral (or dorsal) region elevated and surmounted by a strong, broad, rounded carina, which becomes more obtuse toward the aperture,—a shallow groove running along each side of the carina; transverse section showing an angle of about  $70^\circ$  toward the beak, which enlarges to about  $110^\circ$  near the aperture; surface of cast destitute of markings.

Distance from front of aperture in a straight line, to most projecting portion of beak  $\cdot 85$  (100); height of shell when resting on the aperture  $\cdot 47$  (55); summit when in this position three-fifths the distance from aperture to apex; length of aperture  $\cdot 67$  (79); width of aperture  $\cdot 58$  (68).

This sharp-backed species approaches *P. carinatum*, Hall, (Fourteenth Rep. N. Y. Reg., p. 5,) but differs in being equilaterally developed. It belongs to the *Orthonychia* group, which Prof. Hall has welded to the Neritoid forms under one generic designation.

Believed to range from the base of the yellow sandstones into the base of the Burlington limestone.

#### PLEUROTOMARIA, DeFrance.

*PLEUROTOMARIA? ROTA*, n. sp.—Shell small; spire depressed, convex, consisting of four or five flattened whorls; suture sharply channelled as if by the rabbet of a joiner. Base of shell unknown, but a solid axis in the cast of the spire would indicate a deeply perforate umbilicus. No surface markings.

While the imperfect specimens plainly indicate an undescribed species, it is as yet impossible to determine the generic position of the shell.

Ranges from bed No. 5 into the base of the Burlington limestone.

*PLEUROTOMARIA TECTORIA*, n. sp.—Shell small; spire trochoid, consisting of about four whorls, flattened between the periphery and the suture; periphery marked by a raised, somewhat bicarinate band; a raised carina running along the upper margin of each whorl close to the suture; base rounded regularly from the periphery to a small, sunken, perforate umbilicus; aperture subcircular, somewhat modified by the body whorl, angulated posteriorly, rounded in front,—the peristome descending into the umbilicus.

#### MURCHISONIA, d'Archiac.

*MURCHISONIA QUADRICINCTA*, n. sp.—Shell of medium size, turritid; whorls convex, regularly enlarging to the last, with an obsoletely bicarinate band running along the middle, below which are four small, rigid, thread-like, approximated carinae, leaving the base of the body whorl smooth or faintly lined, and regularly curved into the umbilical cavity; the surface above the band marked only by very delicate lines of growth, which arch backwards to the peripheral band, below which they arch far forwards, entering the umbilical cavity half their length in advance of their place of origin at the suture. Suture deeply impressed.

The only specimen showing the external markings has a defective spire, but it could not be completed with less than 8 or 9 whorls, giving a length of  $1\cdot 8$  (100); an apical angle of  $19^\circ$ , a sutural angle of  $66^\circ$ , while the body whorl is  $\cdot 25$  (14) high.

Some internal casts—perhaps of the same species—have double the above dimensions, and exhibit a shallow longitudinal groove on the penultimate whorl near the suture, which, in the ultimate whorl, becomes a broadly concave flattening of the upper region, and a somewhat sharp angulation at the suture. In these, the outer lip is rounded, the inner somewhat excavated, and the aperture is angulated and slightly effuse in front. Still other casts exhibit a more elevated spire, with the smooth, rounded whorls barely in con-

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tact, the body whorl disproportionately enlarged, the aperture effuse and the general aspect that of *Loxonema*; but the condition of the specimens renders it unsafe to undertake to decide on specific or even generic characters.

The general appearance of this species is like that of *M. bilineata*, Goldf. (Petr. Germ. iii. 24, Taf. cxxxii. 1,) but the four carinæ below the band render it easily distinguishable. The casts recall *Turritella obsoleta*, Sow. from the old red sandstone of Felindre.

**MURCHISONIA NEGLECTA**, n. sp.—Shell of moderate size, turreted, with an apical angle of  $12^\circ$ . Suture impressed, whorls convex, slightly flattened above the middle, bearing a bilinear band below the middle close to the suture. Surface marked by faint, transverse, sinuous striæ, which, on the outer portion of the body whorl, appear to assume the character of transverse wrinkles.

Described from a defective specimen, but the bicristate band on the lower side of the whorls is sufficient evidence of its distinctness. It seems to have consisted of 8 to 10 whorls.

**MURCHISONIA SHUMARDIANA**, n. sp.—Shell small, conical, consisting of six or seven gradually enlarging whorls, somewhat flattened on the base and outer surface, so as to leave but a shallow suture; body whorl obtusely angulated at the junction of the basal and lateral surfaces; aperture broadly cuneate-ovate, angulated behind, scarcely effuse in front; plane of aperture parallel with vertical axis of shell. Surface of cast quite smooth.

Height of shell .57 (100); height of last whorl .24 (42); diameter of base of shell .28 (49); length of aperture .23 (40); greatest width .17 (30); apical angle  $34^\circ$ .

Much resembles the young of *M. proluxa*, W. and W. It differs in more rapidly enlarging whorls, larger apical angle and the obtuse angulation limiting the basal surface.

#### STRAPAROLLUS, Montfort.

**STRAPAROLLUS BARRISI**, n. sp.—Shell of medium size, depressed-turbinate; whorls four or five in number, moderately impressed, rather gradually enlarging to the last, which enlarges somewhat rapidly; surface generally convex, with three rounded, barely perceptible angulations.—the first near the somewhat channelled suture, the second along the periphery, and the third at the brink of the medium-sized umbilical cavity. Base of the body whorl sometimes slightly flattened, giving an increased transverse diameter to the section, —a feature which is associated with a somewhat greater depression of the spire.

Diameter of one of the largest specimens .96 (100); height .67 (69); height of body whorl .46 (48); transverse diameter of body whorl near aperture .38 (40); approximate diameter of umbilicus .29 (30); spiral angle  $100^\circ$ .

This somewhat resembles a species in the Burlington limestone, but the spire is somewhat more elevated, the suture deeper and the whorls are less rapidly enlarged.

**STRAPAROLLUS MACROMPHALUS**, n. sp.—Shell of moderate size; spire little elevated; whorls barely in contact, gradually enlarging, with a nearly circular section, and circumscribing a broad dish-like umbilical cavity, open to the apex of the spire. Surface of the whorls marked by distinct regular striæ of growth, which arch slightly backward in descending the umbilical cavity, and terminate with a slight forward curvature.

Diameter of shell .84 (100); transverse diameter of body whorl near aperture .25 (30).

A close analogue of some forms of *Euomphalus lævis*, d'Arch. and Vern., and can only be distinguished by its wider umbilicus and slightly sigmoid striæ on the base of the body whorl. *Straparollus costellatus*, McCoy, (Pal. Foss., 538, pl. 3 H. fig. 3,) is a closely-related form, but differs in some of its surface markings and its larger number of whorls.



## PHANEROTINUS, J. Sowerby.

PHANEROTINUS PARADOXUS, n. sp.—Shell of medium size, discoid; whorls four, widely disjoined, rather rapidly enlarging, nearly terete; spire depressed below the level of the outer whorl, causing a slightly deeper concavity above than below the shell; upper side of last whorl with a scarcely perceptible undulation in the middle, and another on the slope of the umbilical depression; under side regularly curved; faint incremental lines running directly around the whorl.

Diameter of shell 1.0 (100); diameter of aperture at right angles with peripheral line .33 (33); same dimension one revolution back from the aperture .14 (14).

The faint appearance of angulations on the upper side may be deceptive; in which case, the greater depression of the spire on that side would indicate it as the base of the shell, and the whorls would be sinistral.

The only specimen of this unique species—so far as I know, the first of the genus noticed in America—is in the form of a gutta-percha cast, taken from natural moulds in friable sandstone, of the spiral and basal sides of the same individual. The moulds themselves it was impossible to preserve. The nearest American analogue of this species is *Euomphalus laxus*, Hall, (Fifteenth Rep. Reg. N. Y., p. 54, pl. vi., fig. 2).

## HOLOPEA, Hall.

HOLOPEA CONICA, n. sp.—Shell very small; spire elevated, consisting of about three or four rounded whorls, of which the last forms about four-fifths of the entire length; suture distinct; aperture lying nearly in the plane of the axis of the spire, ovate, acutely angulated behind, neatly rounded in front; outer lip thin, regularly convex; inner lip almost equally convex, slightly thickened by the nearly continuous peristome. Surface not satisfactorily known, but apparently smooth.

Length .27 (100); length of body whorl .20 (74); width of body whorl .18 (67); length of aperture .12 (44); width of aperture .08 (29); spiral angle  $44^{\circ}$ .

This little species generally resembles *Holopella mira*, but the apical angle is greater, the body whorl more developed and the aperture more angulated behind, with a less continuous peristome.

HOLOPEA SUBCONICA, n. sp.—Shell small, breadth equal to its height; spire turbinate, consisting of two or three rounded, rapidly enlarging volutions, bounded by a distinct suture; aperture subcircular, with a slightly interrupted peristome; outer lip thin; base gracefully rounded into the minutely-perforated umbilicus, which is closely bordered by the free columellar lip. Surface apparently smooth.

Height about .15 (100); width of last whorl .16 (94); height of last whorl .09 (56); apical angle about  $80^{\circ}$ .

Associated with *Holopea conica* and *Holopella mira* in the calcareous bed "No. 3."

## MACROCHILUS, Phillips.

MACROCHILUS PINGUIS, n. sp.—Shell globoid; spire short, rapidly tapering; volutions not more than five, largely overlapping; suture moderately impressed; body whorl ventricose, broadest in the middle, somewhat flattened above; aperture ovate, its longer axis forming an angle of  $27^{\circ}$  with the axis of the shell, acute posteriorly, abruptly rounded anteriorly; inner lip flattened, with indications of a columellar fold. Surface marked by faint directly transverse striae of growth.

Height of shell 1.93 (100); height of body whorl 1.41 (73); height of spire .52 (27); length of aperture 1.44 (74); width of aperture .93 (48); spiral angle  $85^{\circ}$ .

This species is related to some of the globose forms from the Coal Measures. 1863.]



Its closest analogue is *M. primigenius*, Hall, (Io. Rep. p. 720, pl. xxix. 11.) = *M. ponderosus*, Swallow, (Trans. Acad. Sci., St. Louis, i. p. 202). The aperture, however, is broader, the spire less elevated and the columellar fold apparently much less pronounced.

From the lower bed of the yellow sandstones—being, until the recent description of some specimens from the Hamilton Group of New York, (See Fifteenth Rep. N. Y. Reg., p. 48), the lowest known position of this section of the genus.

#### LOXONEMA, Phillips.

LOXONEMA OLIGOSPIRA, n. sp.—Shell small; whorls about six, rather rapidly enlarging, convex exteriorly, with traces (on the cast) of vertical ridges, which become most observable in the vicinity of the aperture; suture deep; body whorl three-fifths the length of the shell, more rapidly enlarging than the spire, gently convex on the outer side, more rapidly curved toward the base—which is somewhat umbilicately indented—rapidly increasing in diameter toward the aperture, which is thus rendered somewhat effuse in front.

Height of shell .41 (100); height of body whorl .25 (61); diameter of body whorl .29 (71); diameter of penultimate whorl .16 (39).

#### HOLOPELLA, McCoy.

HOLOPELLA MIRA, n. sp.—Shell small, turritid; whorls gradually and regularly enlarging, seven or eight in number, of which four or five are generally preserved,—the apical ones, in numerous specimens, uniformly wanting; whorls sometimes slightly flattened on the exterior; suture distinctly but not deeply impressed; body whorl regularly rounded beneath into a minute umbilicus; aperture nearly circular, obtusely angulated behind, regularly rounded in front; peristome complete or slightly interrupted; columellar lip without a fold, very slightly excavated by the aperture.

Height of shell about .24 (100); height of body whorl .11 (46); diameter of body whorl .14 (58); apical angle 35°.

This little shell occurs gregariously in calcareous layers of bed No. 3, and also occasionally in sandstone No. 5. The exterior seems to be destitute of natural ornaments, but the specimens in bed No. 3 are universally marked by lines like cleavage cracks, running very obliquely across the several whorls,—their lower extremities being nearest the aperture.

This fossil bears a close resemblance to *Turritella* (*Holopella*) *gregaria* and *conica*, Sow., (Murch. Sil. Syst., pl. iii. fig. 1, f. and 8) from the old Red Sandstone, but it differs from both (See McCoy, Pal. Foss., p. 303,) in apparently having no natural surface markings.

#### NATICOPSIS, McCoy.

NATICOPSIS DEPRESSUS, n. sp.—Shell small; spire of about four volutions, scarcely elevated above the body whorl; last whorl rapidly enlarging, especially in an obliquely transverse direction; suture very shallow, giving the upper side of the shell a general convexity; width of last whorl at the aperture three-fifths the transverse diameter of the shell; aperture oval, rounded anteriorly and posteriorly; within, somewhat contracted on the inner side by the broad, flattened columella; surface marked by delicate lines of growth, which, toward the suture, become, on the last whorl, fine, regular, elongated nodes. Highest point of shell, when resting on its base, is on the last whorl, near the junction of the outer lip with the penultimate whorl.

Height of shell from antero-lateral margin of aperture obliquely to summit of spire .50 (100); greatest transverse diameter .59 (118); width of body whorl measured in the same direction .36 (72); altitude of shell when resting on its base, in a direction nearly at right angles with the last measure .30 (60); length of aperture .37 (74); width .32 (64).

#### ORTHOCERAS, Breynius.

ORTHOCERAS WHITEI, n. sp.—Shell annulated, very gradually tapering, with

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very deep concave septa, and a somewhat elliptic section. Major angle of divergence  $5^{\circ}$  in a specimen about four inches long, giving a taper of  $\cdot 09$  in the space of one inch; ratio of axes of transverse section  $\cdot 98 : 1\cdot 32 = 1\cdot 34$ ; ratio of concavity of septa to greater diameter  $\cdot 38 : 1\cdot 2 = 3\cdot 16$ ; annulations, ten in the space of three inches, where the mean transverse axis is  $1\cdot 27$ , making their distance a little less than one-fourth this axis, the plane of the annulations forming an angle of  $74^{\circ}$  with the longitudinal axis of the shell, the opening generally toward the extremity of the shorter diameter; the annulations having a broad, shallow, retral sinuosity, which in some specimens is distinctly marked, and in others obscure; position of the sinuosity somewhat variable; space between the annulations regularly concave; a peculiar obsolescence of the annuli sometimes occurs along the side marked by the sinuosity, and not unfrequently a partial or nearly complete obsolescence of entire annuli takes place along a portion of the shell. Siphon large, situated on the longer diameter two-sevenths of the distance from the centre to the periphery. Surface (of cast) marked by feeble, rounded, encircling striae, which generally run parallel with the annulations, but sometimes cross them at a small angle.

The deep concavity of the septa is a strong distinctive mark of this, amongst annulated species. In many specimens this is much deeper than in the large specimen from which the measurements have been taken. The occasional obsolescence of the annulations may also be noted.

*ORTHOCERAS HETEROGINCTUM*, n. sp.—Shell unequally annulated, rather rapidly tapering, with a nearly circular section and a subcentral siphon. Angle of divergence  $11^{\circ}$ ; annulations inequidistant, strong, rounded, separated by concave intervals, somewhat oblique and slightly sinuated retrally on one of the sides, very often becoming more or less obsolete, and sometimes entirely disappearing; septa slightly oblique; siphon on the longer diameter less than its own diameter distant from the longitudinal axis of the shell. Surface marked by unequal striae running parallel with the rings.

Resembles *O. Whitei* in the occasional obsolescence of the rings; and casual observation would not distinguish the two. The present species, however, tapers more rapidly, is less compressed, has a less excentric siphon and exhibits a much more frequent disappearance of the annuli.

Ranges from the base of the yellow sandstones into the base of the Burlington limestone.

*ORTHOCERAS INDIANENSE*, Hall, (Twelfth Rep. N. Y. Reg., p. 10.)—Numerous specimens of an *Orthoceras* having a circular or slightly eccentric section, a central or subcentral siphon and an angle of divergence of about  $8^{\circ}$  fail to furnish any characters for distinction from the above species. If such identification is correct, this species enjoyed considerable geographical range.

Ranges from the bottom of the yellow sandstones into the base of the Burlington limestone, in company with crinoids regarded as characteristic of the latter formation.

#### PHRAGMOCERAS, Broderip.

*PHRAGMOCERAS EXPANSUM*, n. sp.—Shell slightly arcuate in the earlier stages of growth, becoming nearly straight at a later period; somewhat gradually enlarging at first, but afterwards expanding with great rapidity, finally undergoing a gradually reduced rate of expansion, which, at the aperture of the adult, amounts to a slight constriction; transverse section very slightly compressed laterally; position of siphon unknown; septa transverse, moderately concave. Surface of cast smooth.

In a specimen which is  $\cdot 70$  in diameter at the small (imperfect) end, the same diameter increases to  $2\cdot 1$  in the space of  $1\cdot 37$  inches, showing an angle, of divergence of about  $68^{\circ}$ .

#### CYRTOCERAS, Goldfuss.

*CYRTOCERAS UNICORNE*, n. sp.—Shell arcuate; angle of divergence when young  $1863^{\circ}$ .]



about  $11^{\circ}$ , rapidly increasing with the growth of the shell to  $35^{\circ}$  or  $40^{\circ}$ ; transverse section laterally compressed, with the dorsum a little more acute than the venter; last chamber fully half the length of the shell. Septa transverse, regularly concave. Siphon rather large, terete, somewhat close to the dorsal margin. Surface apparently without ornaments; incremental lines forming a variable angle with the septa.

A specimen which is 2.23 long is .38 in dorso-ventral diameter at the small (imperfect) end, and 1.60 at the larger end, being septate the whole length. Another specimen must have been about 2.3 in dorso-ventral diameter at the larger end.

#### PHILLIPSIA, Portlock.

PHILLIPSIA INSIGNIS, n. sp.—Head paraboloid; border wide, broadly and deeply furrowed, with the margin reflected upward, and the lateral angles continued posteriorly in acuminate prolongations, reaching twice the length of the glabella from the anterior end; the margin and reflected portion of the test marked by fine longitudinal striæ. Glabella elongate-paraboloid, tuberculated. In the middle of the posterior border of the glabella is a pair of tubercles, and in front of these a second and third pair, the last resting on the middle of the glabella—the whole so arranged as to form two longitudinal rows; opposite the first pair are the two small complementary lobes, with four pustules on the summit of each; opposite the second pair, on each side, a transversely elongate tubercle with a trifid crest; opposite the first pair, a similar tubercle with a bifid crest; the ornaments on the posterior half of the glabella being consequently arranged in three transverse series, in the posterior of which are ten elevations, in the middle eight, and in the anterior six; the anterior half of the glabella is covered by pustules somewhat promiscuously arranged, and varying in different specimens. Eyes large, globoid, slightly excavated by the palpebral lobe of the fixed cheek, situated opposite the posterior third of the glabella. Occipital ring broad, with its posterior margin elevated nearly as high as the posterior extremity of the glabella, and ornamented with a row of small, raised points turned backwards. Pygidium very convex, semielliptic, the axis very prominent and forming about one-third the width at the anterior margin; consisting of twelve to fourteen rings, each bearing six small tubercles, the whole of which are arranged in six longitudinal rows; the tubercles often worn down on the exterior of the test, but always well defined in the cast; lateral lobes bent rather abruptly downwards, having ten ribs, which become indistinct and disappear toward the margin, and are entirely wanting over the narrow space behind the axis; the anterior ribs showing a faint median groove toward their vanishing extremities, and a few of the posterior ones bearing feeble tuberculations toward their axial extremities.

The pygidium of this species nearly resembles that of *P. truncatulus*, Phillips, sp. (Geol. Yorks, ii. p. 240, pl. xxii. fig. 13,) but the head is widely different.

From the base of the Burlington limestone.

PHILLIPSIA MARAMECENSIS? Shumard.—Border of head of medium width, regularly convex, separated from the glabella by a narrow, distinct furrow. Glabella oblong, slightly quadrangular, a little broader behind than before, convex, highest in the middle; complementary lobes obliquely oval, protruding a little beyond the lateral boundaries of the glabella, from which they are separated by shallow depressions; a diminishing series of three feeble lobes in front of each complementary lobe; surface of glabella smooth to the naked eye, but under a lens finely granulated. Eyes opposite the last quarter of the glabella.

The fragment above described is associated with the pygidium described by Dr. Shumard, (Mo. Rep. Part ii. p. 199, Pl. B. fig. 9,) simply in consequence

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of the granulated surface of the two, and the impossibility of proving them distinct. The original specimen, however, was obtained from the "Archimedes limestone" of St. Louis County, which, according to Prof. Hall, is the equivalent of the "Keokuk limestone."

Of the foregoing species, four are not positively known to occur below the base of the Burlington limestone; but they are confidently embraced in the fauna of the yellow sandstones, for the reason that they ascend no higher, and that of the 131 remaining species constituting that fauna, not less than 40 are known to range upwards to the same horizon.

*University of Michigan, Dec. 6th, 1862.*

Pursuant to the By-Laws, an election of members of the Standing Committees for 1863 was held, as follows:

*ETHNOLOGY.*

J. A. MEIGS,  
S. S. HALDEMAN,  
I. I. HAYES.

*BOTANY.*

E. DURAND,  
JOSEPH CARSON,  
AUBREY H. SMITH.

*COMP. ANAT. AND GEN. ZOOLOGY.*

JOSEPH LEIDY,  
J. M. CORSE,  
J. H. SLACK.

*GEOLOGY.*

ISAAC LEA,  
CHARLES E. SMITH,  
J. P. LESLEY.

*MAMMALOLOGY.*

J. H. SLACK,  
JOHN CASSIN,  
J. L. LE CONTE.

*MINERALOGY.*

WM. S. VAUX,  
J. C. TRAUTWINE,  
T. D. RAND.

*ORNITHOLOGY.*

JOHN CASSIN,  
S. W. WOODHOUSE,  
J. H. SLACK.

*PALÆONTOLOGY.*

JOSEPH LEIDY,  
T. A. CONRAD,  
J. L. LE CONTE.

*HERPETOLOGY & ICHTHYOLOGY.*

E. D. COPE,  
R. BRIDGES,  
J. C. MORRIS.

*PHYSICS.*

B. HOWARD RAND,  
WM. M. UHLER,  
R. E. ROGERS.

*CONCHOLOGY.*

T. A. CONRAD,  
W. G. BINNEY,  
G. W. TRYON, JR.

*LIBRARY.*

WM. S. VAUX,  
JOSEPH LEIDY,  
JOSEPH JEANES.

*ENTOMOLOGY AND CRUSTACEA.*

R. BRIDGES,  
SAMUEL LEWIS,  
E. T. CRESSON.

*PROCEEDINGS.*

ROBERT BRIDGES,  
JOSEPH LEIDY,  
WM. S. VAUX,  
JOHN CASSIN,  
THOMAS STEWARDSON.





Winchell, Alexander. 1863. "Descriptions of Fossils from the Yellow Sandstones Lying beneath the "Burlington Limestone," at Burlington, Iowa." *Proceedings of the Academy of Natural Sciences of Philadelphia* 15, 2–25.

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