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See introductory remarks to "Preliminary Notice" Part I. Ann. Rpt. New-York State Mus. N.o 35 p. 215. (1884.)

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Considered by J Bell. of I G S. to have been written by Hall, K & Whitfield, R P. Oct. 11, 1972 AHL

NEW YORK STATE MUSEUM OF NATURAL HISTORY

quoted by Hall as "Prelim Notice Lamellibranchiata Pt. 2, 1870"

# PRELIMINARY NOTICE

## OF THE LAMELLIBRANCHIATE SHELLS OF THE UPPER HELDERBERG, HAMILTON AND CHEMUNG GROUPS, WITH OTHERS FROM THE WAVERLY SANDSTONES.

[Preparatory for the Palæontology of New-York.]

PART 2.

By J. — Hall K

## GENUS MODIOLA (LAMARCK).

### MODIOLA PRÆCEDENS (n. s.).

SHELL elongate-ovate, very oblique, a little more than twice as long as wide. Valves moderately ventricose: beaks small, appressed; cardinal line short, less than half the length of the shell, slightly alate and compressed at the extremity; postero-basal border broadly rounded; anterior end short, narrow and laterally compressed; byssal side slightly sinuate.

SURFACE marked by fine concentric lines, and by fine radiating wrinkled striæ which diverge along the median line and curve toward the opposite margins of the shell.

*Formation and locality.* In a band of conglomerate and sandstone of the Chemung group, south of Olean, Alleghany county, N.Y.

### MODIOLA METELLA (n. s.).

SHELL elongate-ovate, greatest breadth nearer the anterior end; posterior and antero-basal margins subparallel: beaks small, laterally compressed. Valves evenly ventricose: cardinal line a little more than one-third the length of the shell, slightly arcuate; anterior end projecting but little beyond the beaks, inflated and rounded at the margin; postero-basal extremity sharply rounded.

SURFACE smooth, or indistinctly marked by concentric lines or undulations of growth.

This species differs from the last in the absence of radiating striæ, and very materially in the form of the shell, which attains a larger size, so far as observed. The general features of this shell are similar to those of *Mytilus* (*Mytilarca*) *occidentalis* (WHITE & WHITFIELD) from the sandstones of Burlington (Iowa); but it is more regularly ventricose, and not so frequently marked by concentric undulations, while the hinge line is more oblique to the axis of the shell. These features will serve to



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distinguish the species, when the peculiar characters of the hinge cannot be ascertained.

*Formation and locality.* Sandstone of the Chemung group, collected from loose masses in Cattaraugus county, N.Y.

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# GENUS NUCULA (LAMARCK).

## NUCULA BELLASTRIATA (Conrad).

*Nuculites bellastriata* : CONRAD, Annual Report on the Geological Survey of New-York, page 40. 1841.

*Nucula bellatula* [?] : HALL, Geological Report 4th District, page 197. 1843.

"SHELL subtrigonal; anterior and posterior margins rounded; disk with numerous fine regular striæ; basal margin arched" (CONRAD).

*Locality.* Near Smyrna, Chenango county, N.Y.

## NUCULA VARICOSA (n. s.).

SHELL ovate-triangular, with strong prominent incurved beaks which project above the anterior end. Valves depressed convex below, gibbous above and on the umbones; anterior end short; anterior and posterior extremities abruptly rounded; basal line more broadly rounded.

SURFACE marked by fine obsolete concentric striæ, and by numerous strong varices of growth which are closely arranged.

This species is more erect than *N. bellastriata*, and higher in proportion to the length, giving a more triangular outline; while the concentric striæ are obsolescent, with numerous strong varices, features which are the reverse in the other species.

*Formation and locality.* Shales of the Hamilton group on the shores of Cayuga lake, N.Y.

## NUCULA CORBULIFORMIS (n. s.).

SHELL broadly triangular, a little longer than high, with short subcentral beaks; anterior end very oblique; greatest length below the middle; posterior end longer and more pointed; basal line gently arcuate. Valves varying from depressed convex to gibbous or ventricose in the umbonal region.

SURFACE marked by fine concentric striæ and numerous varices of growth.

This species is readily distinguished from either of the preceding species, by its more equilateral and distinctly triangular form.

*Localities and formation.* Shales of the Hamilton group on the shores of Cayuga, Seneca and Canandaigua lakes, and in the Chemung group near Ithaca, N.Y.

## NUCULA LIRATA (Conrad).

*Nuculites lirata :* CONRAD, Jour. Acad. Nat. Sciences, Philadelphia, Vol. viii, page 250, pl. 15, f. 7. 1842.

*Cucullea opima :* HALL, Geol. Report 4th District, page 197, f. 3; No. 78, p. 196. 1843.

SHELL very gibbous or inflated, with strong distant elevated beaks. Outline triangular, about once and a half as long as high, but ranging in its proportions. Anterior end obliquely truncate, shorter than the posterior, which is obtusely pointed, having an upward curvature : cardinal line concave behind the beaks; basal line gently arcuate.

SURFACE marked by strong somewhat equal concentric furrows, sometimes showing fine radiating striæ.

This species is readily distinguished from any of the associated species by the strong concentric undulations of the surface. The casts are remarkable for their gibbosity and widely distant beaks, as well as the strongly marked muscular scars.

*Formation and localities.* Shales of the Hamilton group on the Skaneateles, Cayuga and Seneca lakes, N.Y.; and also at Paterson's creek in Hardy county, Virginia.

## NUCULA RANDALLI (n. s.).

SHELL transversely ovate, somewhat attenuated behind; height and length about as two to three. Valves very gibbous in the middle and above : beaks prominent, incurved and approximate, about one-third the length from the anterior end, which is short and rounded; basal line gently and regularly curved; hinge-line slightly arcuate; posterior umbonal slope very prominent.

SURFACE marked by strong sharply elevated concentric striæ, and fine closely arranged radiating striæ; the latter often obsolete.

This species presents the general aspect of *N. lirata* in form, but is a little longer, not so gibbous, more attenuate behind; the beaks are less elevated and more incurved, while the surface is never marked by the strong concentric undulations which characterize that species.

*Formation and localities.* In the shales of the Hamilton group in Schoharie and Madison counties, and near Baileytown on the shores of Seneca lake, and also in the Chemung group at Ithaca, N.Y.

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## GENUS NUCULITES (CONRAD).

### NUCULITES OBLONGATA (Conrad).

*Nuculites oblongata* : CONRAD, Annual Geol. Report of New-York, 1841, pa. 50, pl. f. 8.

SHELL oblong, very transverse, widest at the anterior end. Valves depressed convex : beaks small, not projecting above the hinge-line, situated near the anterior end; hinge-line marked by numerous teeth; a clavicular ridge just anterior to the beak, and extending to the middle of the width. Anterior muscular scar subcircular, distinct : posterior scar narrow, wedgeform; palleal line distant from the margin of the valve.

SURFACE marked by fine concentric lines of growth.

*Formation and localities.* Shales of the Hamilton group, in Schoharie and Otsego counties; shores of Skaneateles, Cayuga, Seneca and Canandaigua lakes, and numerous localities in Western New-York; also at Paterson's creek, Virginia.

### NUCULITES CUNEIFORMIS (Conrad).

*Nuculites cuneiformis* : CONRAD; Annual Geological Report, 1841, pa. 50, pl. f. 7.

"Cuneiform : umbo prominent; umbonal slope marginal, acutely
" angulated, rectilinear; posterior extremity narrow, obliquely
" truncated."

"*Locality.* Near Oneonta."

This appears to be an extremely rare species, as there are only three individuals yet known, one of which is Mr. CONRAD's original specimen. It is easily distinguished from the other species by its cuneate form.

*Formation and localities.* In the shales of the Hamilton group at Oneonta in Otsego county, and at Jefferson in Schoharie county, N.Y.

### NUCULITES TRIQUETER (Conrad).

*Nuculites triqueter* : CONRAD, Annual Report of Geological Survey, 1841, p. 50.

"Trigonal : umbo elevated; umbonal slope terminal, and acutely
" angulated in consequence of the profound depression of the
" posterior margin; disc flattened; interior rib curved."

"*Locality.* Cazenovia."

This species is very similar to *Nucula varicosa;* but it attains a much larger size, and the surface is usually smooth or marked by very fine concentric lines, while the impression of the curved muscular ridge or clavicle just anterior to the beaks serves to distinguish the casts, in which condition it is usually found.

*Formation and localities.* Shales of the Hamilton group, on the shores of Skaneateles, Otisco, Cayuga and Seneca lakes, New-York, and at Paterson's creek in Virginia.

### NUCULITES NYSSA (n. s.).

SHELL transverse, broadly ovate, wider anteriorly. Valves highly convex, ventricose below the umbones : beaks situated about one-third from the anterior end, not prominent, a little flattened on the back, the apices incurved; hinge-line very short, slightly arcuate, the anterior end broadly rounded; basal line gently arcuate; posterior margin oblique, subtruncate above and abruptly rounded below; umbonal ridge prominent, the space between it and the cardinal line abrupt; clavicular ridge narrow, curving towards the anterior end, extending about two-thirds across the valve.
SURFACE marked by fine even and concentric striæ.

This species differs from *N. triqueter*, which it closely resembles, in being less ventricose, the umbonal ridge less angular, the shell more transverse, the beaks less prominent and situated nearer the anterior end.

*Formation and localities.* In shales of the Hamilton group : Fabius in Onondaga county, Seneca and Cayuga lakes, and in concretionary layers in the Hamilton shales on the shore of Lake Erie. There are also a few smaller specimens in the Marcellus shales of Leroy and West-Bloomfield, which appear to be of the same species.

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## GENUS LEDA (SCHUMAKER).

### LEDA ? ROSTELLATA (Conrad).

*Nuculites rostellata :* CONRAD, Annual Report, 1841, p. 50.

"Small, ovate acute; posterior end rostrated and slightly recurved;
"disc with regular prominent concentric striæ."
"*Locality.* Smyrna, Chenango county."

This shell appears to vary very much in the proportional extension of the posterior extremity, the older specimens being more extremely pointed or rostrated than younger individuals.

*Formation and localities.* In the arenaceous shales of the Hamilton group in the town of Summit in Schoharie county, and in the soft calcareous shales in the vicinity of Moravia in Cayuga county; also on the shores of Skaneateles lake, N.Y.

### LEDA? BREVIROSTRIS (n. s.).

SHELL small and ovate, acute at the posterior end, and rounded and gibbous anteriorly. Valves convex, with an angular umbonal ridge: basal line nearly straight on the posterior half of the shell, slightly recurved at the extremity; posterior cardinal margin deeply concave beneath the beaks.

SURFACE marked by fine concentric striæ, which are obsolete on the umbonal slope.

This species differs from *L. rostellata* in the short and less strongly curved posterior extremity, and the anterior portion is proportionally broader and more extended. The beaks are distant from the anterior extremity, and, owing to the rapid increase of the shell at this point, they have the appearance of being directed backwards.

*Formation and locality.* In some layers of the arenaceous shales of the Hamilton group at Jefferson in Schoharie county, N.Y.

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## GENUS PALÆANEILO (n. g.).

### NUCULITES (Conrad, *in part*).

Nuculiform shells, transversely ovate or subelliptical, the posterior end extended, often subrostrate, with a more or less defined sulcus along the umbonal slope; exterior surface concentrically striated or ribbed: hinge-line more or less arcuate, crenulate throughout its extent, not interrupted beneath the beak by a ligamental pit, but having an external ligament; anterior and posterior adductor muscular scars distant, faintly marked; pedal muscles forming several small scars within the umbonal cavity; palleal line simple or obliquely truncate posteriorly.

The shells of this genus differ from NUCULITES in having no anterior clavicular ridge. They differ from NUCULA in the elongate and subrostrate posterior extremity and want of a ligamental pit, in the continuous line of crenulations on the hinge, the presence of an external ligament, and externally by the sulcus on the posterior slope. They also differ from LEDA and YOLDIA by the same internal characters, and in the simple palleal line; and from TELLINOMYA, in the character of the teeth and palleal line. Name from the similarity to the recent genus NEILO.

## PALÆANEILO CONSTRICTA (Conrad).

*Nuculites constricta :* CONRAD, Journal Academy of Nat. Sciences, Philadelphia, Vol. viii, pa. 249, pl. xv, f. 8.

"Subovate, compressed, with concentric lines which suddenly become
"obsolete on the margin of an oblique furrow which extends from
"the beak to the base of the posterior side : beaks near the ante-
"rior end, which is acutely rounded ; basal margin arched ante-
"riorly, contracted on the posterior side ; posterior extremity
"rounded, and much above the line of the base."
"*Locality.* Near Moravia in Cayuga county, N.Y."

This species is recognized by its short ovate form, finely striated surface and strong posterior constriction.

*Formations and localities.* This species is found in the shales of the Hamilton group in many localities, and is probably the most abundant nuculoid shell in this formation. It likewise occurs in the Chemung group near Ithaca, N.Y.

## PALÆANEILO PLANA (n. s.).

SHELL transversely elliptical, extremely compressed, elongate and somewhat pointed behind; beaks small at the anterior third; anterior end rounded, the basal line forming a broad regular curve with a very slight constriction.
SURFACE marked by fine concentric lines.

The specimens are generally from half to five-eighths of an inch in length. It differs from *P. constricta* in the more regularly elliptical form, and in being nearly destitute of the constriction near the posterior extremity.

*Formation and localities.* In the arenaceous layers of the Hamilton group in Otsego county, and in the soft shales of Cayuga, Seneca and Canandaigua lakes, N.Y.

## PALÆANEILO EMARGINATA (Conrad).

*Nuculites emarginata :* CONRAD, Annual Report on the Geology of New-York, 1841, p. 50.

"Oblong, with concentric lamellar lines : umbonal slope profoundly
"angulated ; posterior margin obliquely and profoundly emar-
"ginate."
"*Locality.* Smyrna."

This species is readily distinguished from any of the associated forms, by the parallel cardinal and basal margins, the strong constriction or

emargination of the posterior slope, and the sharply elevated concentric ridges of the surface.

*Formation and localities.* In the arenaceous layers of the Hamilton group at Jefferson, Summit and Fultonham, Schoharie county; in the soft shales on the shores of Skaneateles, Cayuga, Seneca and Canandaigua lakes, and at other localities in Western New-York. It likewise occurs in beds of the same age at Cumberland in Maryland, and in Hardy county, Virginia.

## PALÆANEILO MUTA (n. s.).

SHELL rather large, usually compressed or but moderately convex, ovate or subelliptical in outline, a little more than twice as long as wide: beaks small, compressed, a little more than one-third the length from the anterior end; hinge-line gently arcuate, anterior end broadly rounded; basal line curved anteriorly and nearly straight from the middle of the valve to the posterior basal angle, posterior end narrowed and doubly truncate, the lower part extending backwards, and the upper part sloping rapidly to the extremity of the hinge-line.

SURFACE marked by numerous closely arranged and sharply elevated concentric lamellose ridges which are undulated in crossing the posterior slope, and with fine concentric lines of growth between them.

This form is much larger than any of the preceding species, and may be easily distinguished by its size.

*Formation and localities.* In the soft shales of the Hamilton group, on Skaneateles, Seneca and Canandaigua lakes; at North-Bristol in Ontario county, at Bellona in Yates county, and other localities in Western New-York. It likewise occurs in the same formation at Cumberland, Maryland.

## PALÆANEILO FECUNDA (n. s.).

SHELL large, transverse, elliptical or elongate-ovate, widest anteriorly.

Valves depressed convex or moderately convex in front, becoming more compressed and sometimes attenuate behind; hinge-line gently arcuate, more abruptly elevated beneath the beak: beaks small, rounded, situated at or within the anterior third; posterior end prolonged in the upper part.

SURFACE marked by fine even concentric elevated striæ on the anterior half of the shell, which become stronger and less numerous on the posterior half by the coalescence of two or more.

This species differs little in size and form from *P. muta*, but may be readily distinguished from that species by the fine surface striæ upon the anterior part, which become coarser on the posterior, but are still finer than the even continuous striæ of that species.

*Formation and localities.* In the soft shales of the Hamilton group on the shores of Cayuga, Seneca and Canandaigua lakes; at Darien in Genesee county, at York and Moscow in Livingston county (N.Y.). Also at Cumberland (Maryland), and in Hardy county in Virginia.

## PALÆANEILO TENUISTRIATA (n. s.).

SHELL elongate ovate. Valves ventricose, widest at the anterior end in the line of the beaks, and but little contracted posteriorly: beaks small, situated within the anterior third of the length; hinge-line gently curved posteriorly, and more abruptly bent beneath the beaks; anterior end short, sloping obliquely downwards from the beaks and below the middle of the valve; basal line moderately arcuate, posterior end obliquely truncate, longest just below the cardinal line.

SURFACE of the shell marked by very fine concentric lines of growth which are often crowded together, forming irregular undulations of growth. The concentric lines are sometimes more prominent and fasciculose on the upper part of the posterior slope.

This species may be distinguished from *P. fecunda*, with which it is most nearly allied, by the fine irregular lines of growth covering the surface, while in that species they are fine regular ridges.

*Formation and localities.* In the soft shales of the Hamilton group on the shores of Skaneateles, Cayuga and Seneca lakes, and also at York and Moscow in Livingston county, N.Y.

## PALÆANEILO MAXIMA (Conrad).

*Nuculites maxima*: CONRAD, Annual Report, Geol. New-York, p. 50. 1841.

"Ovate acute, compressed; posterior side cuneiform, extremity
" rounded; basal margin profoundly arched, except on the pos-
" terior side, where it is straight."
" *Locality.* Oneonta."

This species may be distinguished by being more nearly equilateral, and in having the margins more rapidly converging on each side of the prominent beaks than any other of the associated species. The surface striæ are so fine as not to be readily perceived by the unassisted eye on most individuals, which gives the appearance of a polished surface.

*Formation and localities.* Shales of the Hamilton group at Summit and Fultonham, Schoharie county, and on the shores of Cayuga lake.

## PALÆANEILO FILOSA (Conrad).

*Nuculites filosa* : CONRAD, Journal Acad. Nat. Sciences, Vol. viii, pa. 250, pl. xv, f. 7.

"Subovate, slightly ventricose, with fine sharp concentric lines, "most distinct on the posterior side, and profound on the submar- "gin of the dorsal line, which is subrectilinear and very oblique; "extremity obtusely angular and much above the line of the "base : anterior extremity subtruncated; basal margin profoundly "arched."

"*Locality*. Ithaca."

This species is closely allied to *P. fecunda* of the Hamilton group, but is readily distinguished by having the posterior extremity prolonged at the cardinal line, giving the greatest length at this point, while in that species the greatest length of shell is considerably below the cardinal line. The shell is also uniformly smaller, never attaining much more than half the length of that species.

*Locality and formation*. In the Chemung group at Ithaca, and near Cortland-village, Cortland county, N.Y.

## PALÆANEILO BREVIS (n. s.).

SHELL ovate or ovate triangular with very ventricose valves and prominent rather tumid beaks; hinge-line arcuate. Anterior end of the shell rather more than half as long as the posterior, rounded at the extremity and somewhat contracted near the beak; posterior extremity obtusely pointed; basal line strongly arcuate, more abruptly curving upwards and very slightly sinuate near the extremity.

SURFACE marked by irregular concentric lines of growth.

This species is allied to *P. constricta*, but is more ventricose, somewhat shorter, and the constriction of the posterior end is so slight as to be scarcely detected in most individuals.

*Formation and locality*. Abundant in some shaly calcareous sandstones of the Chemung group at Franklin, Delaware county, N.Y.

## PALÆANEILO BISULCATA (n. s.).

SHELL small, broadly subovate or subrhomboidal in outline. Valves depressed convex, most prominent near the umbo : beaks small, situated a little more than one-third the length from the anterior end; posterior cardinal line sloping downward from the beaks to the extremity, anterior end oblique, longest below the middle of

the valve; basal line straight or but very slightly curved, posterior extremity prolonged obliquely backward from the postero-basal angle to near the extremity of the cardinal line; posterior slope marked by three rather sharp angular carina, one very near the cardinal line, one along the umbonal angle, and another intermediate and equidistant from these, the space between them being rather deeply concave.

SURFACE marked by proportionally coarse elevated concentric ridges, which are regular and equidistant, and are strongly undulated as they cross the ridges and depressions of the posterior slope.

This is a rather rare species, only two individuals having been obtained among a large collection of other fossils. It is most nearly allied to *P. emarginata*, but differs in the characters of the posterior slope; that species having a single very deep sulcus, and the space between it and the cardinal line roundly depressed; while this one has two more shallow sulci, with the upper one extending nearly to the cardinal line.

*Formation and locality.* Chemung group, near Elmira, N.Y.

## PALÆANEILO BARRISI (White & Whitfield).

*Leda barrisi*: WHITE & WHITFIELD, Proceedings Boston Society of Natural History, Vol. viii, p. 298.

SHELL elongate elliptical, widest anteriorly, with ventricose valves most convex at the anterior third of the length: beaks small, incurved, situated a little more than one-third of the entire length from the anterior end. Cardinal line gently arcuate throughout, and covered by numerous small teeth, which gradually increase in size from the beaks to the extremities: basal line broadly and gently curved; anterior end rather sharply rounded; posterior end more narrowly rounded: muscular impressions and palleal line indistinct.

SURFACE of shell marked by rather strong irregular lamellose concentric striæ, very slightly undulated in crossing the posterior slope, and indicating a slight depression of the surface of the shell at this point.

This species is more elongate and narrower than any of the preceding, except *P. plana* of the Hamilton group, with which it is closely allied; but it is uniformly more ventricose, and the concentric undulations are more rugose.

*Formation and localities.* Common in the yellow sandstones at Burlington (Iowa), and not uncommon in the yellow sandstones of the same formation in the vicinity of Granville in Licking county (Ohio), where they attain a rather larger size than at Burlington, but are not otherwise different.

### PALÆANEILO ATTENUATA (n. s.).

SHELL subelliptical, very elongate posteriorly. Valves depressed convex anteriorly, more compressed and attenuate posteriorly: beaks minute, scarcely projecting above the cardinal margin, situated at a little more than one-fourth of the entire length from the anterior end. Shell widest opposite the beaks, and becoming gradually narrowed to the posterior extremity. Cardinal line very gently arcuate throughout, and occupied by a great number of minute crenulations, which terminate anteriorly opposite the anterior margin of the muscular scar, and posteriorly about one-fourth of the length of the shell from the end; extremities rounded: basal line rounded anteriorly and posteriorly, but broadly sinuate or emarginate a little behind the middle of the shell.

SURFACE marked by very fine regular lines of growth.

This species may be easily distinguished by the elongate and compressed valves.

*Formation and locality.* In the yellow sandstones at Granville and Newark, Licking county, Ohio.

### PALÆANEILO ? PERPLANA (n. s.).

SHELL rather large, flattened or very depressed convex, with small compressed beaks situated nearest to the anterior end. Subovate in outline, widest across the beaks, and somewhat narrower posteriorly. A broad shallow sulcus, often undefined, passes from the beaks to the posterior margin just above the umbonal ridge, and a sharper rather abrupt depression above it, reaching to the cardinal line. Hinge arcuate, much shorter than the shell, the anterior portion rather abruptly curved: anterior end of the shell broadly rounded. Basal line very gently arcuate, sometimes flattened in the middle: posterior extremity prolonged obliquely backwards from the postero-basal angle to the point of greatest length, which is about the middle of the valve; and above this point it recedes more rapidly to the extremity of the hinge-line, with usually a slight emargination or constriction of the border at its intersection with the abrupt depression just below the cardinal line. Teeth very fine, extending only about half the length of the posterior hinge-plate, the remainder consisting of an undivided ridge parallel with the border of the shell. On the anterior side there are only a few small teeth near the beak, seldom seen,

in their condition of internal casts, unless by breaking away the beak of the specimen. Muscular impressions very faintly marked or not at all visible : palleal line not observed.

SURFACE of the shell marked by fine irregular concentric striæ of growth, which are strongly undulated as they cross the sulci of the posterior slope; a few of which become strongly elevated lamellose ridges below the cardinal border, on the posterior side of the beaks, and sometimes also on the anterior side.

This species differs from the other forms of the genus here described, in the extreme compression of the valves, in the strong constriction of the posterior slope, in the few teeth of the hinge and the faintly marked muscular scars; indicating a shell of extreme tenuity.

There may be some question as to the propriety of including this species under the Genus PALÆANEILO. The peculiar features of the hinge, and the general form of the shell, bear about the same relations to that genus, as the recent Genus MALLETIA does to that of NEILO. In fact the shell, so far as the external features are concerned, very closely resembles MALLETIA; but as the internal characters have not been sufficiently ascertained, we have preferred at this time to leave it under the present genus.

*Formation and localities.* In the shales of the Hamilton group at Fultonham, and near Summit, Schoharie county; on the shores of Seneca and Cayuga lakes, and in the town of Bristol, Ontario county, N.Y.

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## GENUS MACRODON (LYCETT).

### MACRODON HAMILTONIÆ (n. s.).

SHELL of moderate size, transversely elongate, about twice as long as high and widening posteriorly; hinge-line shorter than the body of the shell. Valves ventricose in front and compressed behind: beaks small, wide and incurved, situated a little behind the anterior end, and slightly projecting above the cardinal line; extremities of the cardinal line rounded; posterior end broader than the anterior; basal line gently arcuate throughout; posterior umbonal slope rounded.

SURFACE marked by regular equidistant concentric undulating ridges of growth, and also by very fine radiating striæ; the latter most distinctly marked on the posterior portions of the valve, and are regularly interrupted at the crossing of the concentric varices, forming in some cases elongate pustulose-like markings. Hinge-

line marked by three or four short oblique teeth at the anterior end, and by two elongate lateral teeth in each valve.

*Formation and localities.* This species occurs in the Hamilton group in most of the localities from Schoharie county to the centre of the State, but it is not very abundant. The greater number have been obtained in Onandaga county, and at Canandaigua and Seneca lakes. It likewise occurs in the soft shales in the town of Bedford, Cuyahoga county, Ohio.

## MACRODON CHEMUNGENSIS (n. s.).

SHELL transversely elongate arcaform; cardinal and basal margins subparallel. Valves ventricose anteriorly and laterally, compressed posteriorly, with strong distant beaks situated within the anterior third of the length; hinge-line straight, as long as the body of the shell; anterior end rounded below and angular above; posterior end a little oblique and truncate, longer below; basal line sinuate at about the middle of its length, corresponding to an undefined depression which crosses the valve obliquely from the beak to base.

SURFACE marked by irregular concentric lamellose lines of growth, and by faint radiating lines which are only seen under favorable circumstances and in well preserved individuals, and appear to have been more distinct on the posterior part of the shell.

This species has many features in common with *M. parvus* (WHITE & WHITFIELD) of the Yellow sandstone of Burlington (Iowa); this one attaining the size of an inch to an inch and a quarter in length, while that one is seldom more than half to three quarters of an inch in length.

*Formation and locality.* In the Chemung group at Philipsburgh and Rockville, Alleghany county; at Chemung creek in Chemung county, at Leon in Cattaraugus county, and near Elmira (New-York), and also at Meadville in Pennsylvania.

## MACRODON PARVUS (White & Whitfield).

*Macrodon parvus* : WHITE & WHITFIELD, Proceedings of Boston Society of Natural History, Vol. viii, p. 299. 1862.

*Macrodon cochlearis* : WINCHELL, Proceedings of the Academy of Natural Sciences of Philadelphia, page 16. 1863.

SHELL small, transversely elongate, a little more than twice as long as high; cardinal and basal lines parallel. Valves ventricose, with prominent beaks which are situated at about one-third of the length from the anterior end, which is longest at the antero-cardi-

nal angle; posterior end obliquely truncate, sometimes slightly emarginate : basal line gently arcuate throughout, or sometimes slightly constricted from the depression which crosses the valves obliquely from beak to base. Anterior hinge-teeth small and oblique; posterior teeth elongate, transverse.

SURFACE marked by concentric lines of growth.

A smaller species than *M. chemungensis*, but otherwise closely corresponding. It does not differ in any essential feature from *M. cochlearis* (WINCHELL,) which is from the same locality.

*Locality and formation.* From the Yellow sandstone of Burlington, Iowa.

### MACRODON OVATUS (n. s.).

SHELL small, transversely elongate-ovate, widest posteriorly : hinge-line very moderately arcuate, shorter than the shell below; beaks small, nearly terminal. Valves ventricose, not angulated, but sometimes slightly constricted by a shallow undefined sulcus crossing the valves obliquely, reaching and constricting the basal margin anterior to the middle; anterior and posterior extremities rounded. Anterior hinge-teeth minute, oblique; posterior teeth elongate, very slightly curved, one long and one short in each valve.

SURFACE marked by concentric lines of growth : no radiating striæ have been observed.

This species rather closely resembles the *M. hamiltoniæ*, but differs in the beaks, the gently curving hinge, the apparent absence of radiating striæ, and in not having the regular concentric varices of that species.

*Formation and locality.* In the Yellow sandstones at Granville, Licking county, Ohio.

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## GENUS LIMOPTERA (n. g.).

SHELLS large, inequilateral, inequivalved, the right valve the smaller : ligamental area large, common to both valves, longitudinally striate and extending to the extremities of the wings. Margins of valves sinuate on the anterior border, forming an elongate byssal opening; hinge edentulous [?]. Anterior muscular impression situated within the umbones, very small and deep; the posterior one large, and placed a little behind the middle of the shell and nearer to the hinge than to the base of the valve. Palleal line simple, formed of a series of small deep pits (or, as seen in the casts, composed of a series of small nodes).

This genus is proposed for a group of shells occurring in the Upper Helderberg and Hamilton groups, of which *Lima macroptera* of CONRAD (Annual Report, Geol. Survey of New-York, 1838, page 117) may be regarded as the typical form. The general form of the shells, when well preserved, is broadly ovate or subquadrate in outline, strongly alate on the posterior side, and often more or less produced on the anterior end. The valves are convex in all the species known; the left valve being strongly convex throughout, while the opposite one is but slightly elevated, and in one species is somewhat concave near the base.

The surface of the shell is coarsely radiate in all except one species; while the muscular system bears a close relation to that of GERVILLIA, especially to *G. hartmanni* of MUNSTER as figured by GOLDFUSS, but with the palleal line more distant from the margin of the shell. The ligamental area is large; those of the opposite valves being subequal, but, as far as can be definitely ascertained, have been destitute of cartilage pits.

## LIMOPTERA PAUPERATA (n. s.).

SHELL moderately large, convex, oblique, strongly winged on the posterior side.

SURFACE of left valve marked by strong rounded radii alternating with smaller ones, and frequently duplicating on the body of the shell, while those on the wing are more nearly equal. The spaces between the radii are narrow and distinctly flattened : the direction of the radii is somewhat curved toward the beak of the valve. The basal portion of the shell is marked by strong irregular concentric wrinkles, which tend to obliterate the radii. Right valve of shell unknown.

*Formation and locality.* In the .Upper Helderberg limestone at Stafford, Genesee county, N.Y.

## LIMOPTERA CANCELLATA (n. s.).

SHELL of medium size, broadly subovate in outline, slightly oblique. Left valve moderately convex, most prominent just below the umbo, becoming broadly and regularly convex toward the base : right valve depressed, convex in the upper part, and becoming somewhat concave toward the base of the shell; body of the shell well defined. Posterior wing of moderate size, not projecting above the line of the beak, obtusely angular at the extremity : anterior wing small, compressed, the byssal opening situated near cardinal extremity; ligamental area rather narrow, largest on the left valve.

SURFACE of the left valve marked by strong distant radii with flattened interspaces, which bear evidence of having been finely striated longitudinally.

The radii become obsolete on the basal portion of the shell, and also on the posterior wing, and are crossed on the body of the shell by fine sharp slightly undulating and equidistant concentric striæ, giving a somewhat cancellated structure to this part of the shell. The surface characters of the right valve have not been ascertained. The palleal line, as seen on the cast, is strongly marked on the anterior portion of the valves; and the anterior muscular impressions are situated within the umbonal cavity, and are small, but very deep, leaving prominent nodes on the cast.

*Formation and locality.* In limestones of the age of the Upper Helderberg group near Louisville, Kentucky.

## LIMOPTERA MACROPTERA (Conrad).

*Lima macroptera* : CONRAD, Annual Report, Geol. Survey of New-York, p. 117. 1838.

SHELL large, erect or slightly oblique, irregularly subovate, or, including the wings, subquadrangular, broadly rounded on the basal margin, with the anterior and posterior borders subparallel. Valves very unequally convex, the left one usually nearly twice as deep as the right : posterior wing compressed, rather distinctly separated from the body of the shell; anterior wing small; cardinal area large, wider on the left valve, marked by coarse longitudinal striæ; byssal opening of moderate size, twice as long as wide.

SURFACE marked by moderately strong equidistant rounded radiating ridges with slightly concave interspaces, the right valve being more closely and less strongly marked than the left. Both valves are marked, below the middle of the shell, by strong irregular concentric undulations, which partially and often entirely obliterate the striæ upon this part of the shell; while on the wing, the striæ are never so strong as upon the body of the valves.

This is the most common form occuring at Cazenovia, the original locality cited by Mr. CONRAD, and is distinguished from the other forms by its erect outline and strong direct radiating striæ, which extend from beak to base with scarcely any curvature. The specimens are frequently crushed and distorted, so as to present very different proportions from those described.

*Formation and locality.* In the arenaceous beds of the Hamilton group in Otsego, Madison and Onondaga counties, N.Y.

## LIMOPTERA OBSOLETA (n. s.).

SHELL large, erect or slightly oblique. Valves depressed convex, the right one much flattened; general outline ovate, with the upper end narrowed and sharply truncate by the hinge-line. Basal margin sharply rounded; posterior wing of moderate size, its cardinal border nearly rectangular to the axis of the shell; anterior wing very small; byssal opening obscure; hinge-area large, coarsely striated. Beak of the left valve considerably projecting above that of the opposite valve.

SURFACE of the valves smooth, or faintly marked by distant obsolescent radii, and more strongly by distant irregular concentric undulations of growth.

*Formation and localities.* In the higher beds of the Hamilton group at Hamilton, Madison county; in Onondaga county, and at Cayuga lake, N.Y.

## LIMOPTERA CURVATA (n. s.).

SHELL large, somewhat ponderous when fully grown, irregularly and broadly subovate in outline, with a decided curvature of the left valve toward the beak; antero-basal margin expanded, and, on the left valve, slightly more depressed than any other part. Valves very unequally convex, the left somewhat inflated : beak large, projecting considerably above the hinge-line and beyond that of the opposite valve. Cardinal line comparatively short, with a wide longitudinally striated ligamental area upon each valve : posterior wing of moderate size, strong, compressed in the outer part and somewhat acutely pointed, distinctly separated from the body of the shell; anterior wing small, scarcely projecting beyond the body of the shell; byssal opening narrow. Right valve not more than half as deep as the left; beak small, compressed, its general surface depressed convex with the posterior wing flattened.

SURFACE of the left valve marked by strong rounded radii, with alternating smaller ones : right valve less distinctly marked, the smaller alternating radii not observed; both valves marked by strong irregular concentric undulations of growth below the middle, which have a tendency to obliterate the radii on that part of the shell. Finer lamellose concentric lines mark the entire surface, when well preserved.

The young shells of this species are much less ventricose proportionally than the older ones, and are more orbicular in outline. The curvature of the body of the shell is less distinctly marked.

The internal casts show a strongly marked palleal line, which incloses a small area and terminates at the anterior end in the small deep muscular pit situated beneath the umbo, and posteriorly in a large suborbicular muscular scar above the middle of the valve and near the junction of the posterior wing with the body of the shell. The area inclosed by the palleal line is, in many instances, closely covered with minute pustules.

This species may be distinguished from the others described, by its broader and shorter form, the inflated left valve, short hinge-line, the curved direction of the radii of the left valve, and by the extension of the antero-basal margin.

*Formation and localities.* In the arenaceous beds of the Hamilton group in Schoharie, Otsego and Madison counties, N.Y.

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## GENUS MYTILARCA (n. g.).

SHELL bivalve, equivalve, inequilateral and mytiliform, with terminal beaks and a straight hinge-line, which is bordered by a flattened longitudinally striated cartilage or ligamental area of greater or less extent. Anterior end of the hinge-plate furnished with from one to three comparatively strong oblique teeth in each valve, with corresponding cavities. The posterior end has from two to four, often obscure, parallel contiguous toothlike ridges, the marginal one parallel with the posterior border of the valve, the others shorter and divergent. Anterior or buccal border of the valves nearly straight, varying from concave to slightly convex, and somewhat sinuate on the margin, apparently for the accommodation of byssal threads : posterior border generally subparallel with the anterior, while the basal margin is usually abruptly rounded like that of MYTILUS. The muscular system, so far as can be determined, is very like that of MYTILUS ; the anterior scar being umbonal, and, in at least one species, situated on the hinge-plate, and the posterior one situated near the postero-basal margin of the valve ; palleal line entire, simple. Surface of the valves not unfrequently marked by very fine obscure radiating striæ.

The group of shells, for which the above name is proposed, have generally been considered as belonging to the Genus MYTILUS, and usually described as such; but the character of the hinge, with its peculiar dentition, at once separates them generically. Their form is very similar, as are also their muscular markings, as far as has been determined; but owing to the thinness of the shell toward the basal portion, they are not well preserved, and it can not readily be decided whether the pos-

terior scar consists of a single or double impression. The palleal line is nearly marginal, and sometimes quite distinctly marked. The shells are usually much thickened at the beaks and around the umbonal region, especially those from the Upper Helderberg limestones; but as they occur as casts of the interior only, the hinge-teeth and other markings are seldom preserved in a very satisfactory manner. Their relations are undoubtedly with the MYTILIDÆ, and they are not far removed from the Genus LIMOPTERA already described; from which they are distinguished by their pointed beaks, a want of the strong radii on the surface of the shell, and by the peculiar character and dentition of the hinge. The *Inoceramus chemungensis* (CONRAD), *Mytilus chemungensis* (PHILLIPS & SALTER), may be considered as the type of the genus. The

*Mytilus priscus*, GOLD. Pet. Germ. pl. 160, f. 13, p. 284;
*Cardium trigonum*, GOLD. Pet. Germ. pl. 142, f. 8, p. 215; and
*C. dimidiatum*, GOLD. Pet. Germ. pl. 160, f. 16, p. 284,

are probably of this type.

## MYTILARCA MYTILIMERA (Conrad).

*Inoceramus mytilimeris :* CONRAD, Jour. Acad. Nat. Sciences of Philadelphia, Vol. viii, pa. 246, pl. xiii, f. 10.

*Mytilus mytilimerus* (CONRAD) : PHILLIPS & SALTER, Mem. Geol. Survey of Great Britain, Vol. ii, part 2, pa. 364, pl. 20, f. 7–9.

*Megambonia ovata :* HALL, Pal. New-York, Vol. iii, pa. 279, pl. 50, f. 7.

"Obliquely ovate, slightly ventricose; anterior margin direct, slightly "concave; posterior and basal margins arched; apex acute, "prominent.

"*Locality*. Helderberg mountains; and near Schoharie, New-York. "Middle Silurian shale."

This species is the oldest known form of the genus, occuring in the shaly limestone of the Lower Helderberg group. It was described in Pal. N.Y. as a new species, under the impression that the name given by Mr. CONRAD was applied to the species in the Schoharie grit, which, on further examination, proves to have been undescribed.

## MYTILARCA CORDIFORMIS.

*Megambonia cordiformis*, Pal. New-York, Vol. iii, pa. 378, pl. 50, f. 6.

This species of the Lower Helderberg group will, from its external characters, likewise fall under the proposed genus, as *Mytilarca cordiformis*.

## MYTILARCA ARENACEA (n. s.).

SHELL rather large, ovate, acutely pointed at the beak and broadly rounded at the base, longest on the antero-basal margin; hinge-

line short, projecting but little beyond the posterior slope. Valves compressed, subangular on the anterior part, and gradually declining towards the postero-basal side.

SURFACE marked by numerous strong concentric ridges of growth. No radiating striæ have been detected.

*Formation and locality.* In the Schoharie grit at Schoharie village, and in Albany county, New-York.

## MYTILARCA PONDEROSA (n. s.).

SHELL very large and ponderous, especially about the umbonal portions, the beaks being thick and solid for some distance; outline ovate, broadest below the middle; beaks acute, curved anteriorly; hinge-line short, scarcely projecting beyond the contour of the body of the shell. Ligamental area wide and strongly striated. Anterior border slightly concave, abrupt, flattened or somewhat incurved from the umbo to the byssal margin of the valve: posterior border gently rounded; the basal line more abruptly rounded. General surface of the valves highly convex or gibbous, especially near the beaks and along the anterior border, but more gradually sloping to the basal and posterior portions.

SURFACE of valves smooth, or marked with concentric lamellose lines.

This is the largest species yet known; one specimen measuring five inches from the beaks to the basal margin, by a width from the anterior to the posterior borders of full three and one-fourth inches in its condition as a cast. The largest specimen from New-York measures nearly four and a quarter by two and a half inches.

*Formation and locality.* In the limestones of the Upper Helderberg group, in the Helderberg mountains, and at Clarence-hollow (New-York). Also in rocks of the same age at Columbus, Ohio.

## MYTILARCA OVIFORMIS (Conrad).

*Inoceramus oviformis :* CONRAD, Jour. Acad. Nat. Sci. Philadelphia, Vol. viii, pa. 246, pl. xiii, f. 7.

" Obliquely ovate acute, convex, tapering towards the apex; anterior
" margin descending, straight and nearly direct from the apex to
" the middle of the valve; dorsal margin very oblique, and with
" a slight wing; base regularly rounded.
" *Locality.* Near Smyrna, Chenango county, N.Y."

This species is closely allied to *M. arenacea*, but differs principally in being more ventricose, and in the absence of frequent strong varices which characterize that species. The hinge-line is also less oblique to the axis of the shell.

*Formation and localities.* In the soft shales of the Hamilton group on the shores of Cayuga and Canandaigua lakes, and in numerous localities in Livingston, Genesee and Erie counties, New-York.

## MYTILARCA TRIQUETER (Conrad).

*Pterinea triqueter* : CONRAD, Annual Report on Palæontology, p. 116. 1838.

"SHELL obliquely triangular, cordate; posterior slope flat, profoundly "dilated; umbonal slope marginal, acutely angulated : surface "with simple lines of growth. Length, from beak to posterior ex- "tremity, $1\frac{3}{4}$ inches.

"*Locality.* Oneonta, Otsego county."

This species is broadly subovate or triangular, with very ventricose valves which are flattened on the anterior side and attenuated towards the posterior border; beaks short, rather strongly incurved; hinge-line somewhat oblique to the axis, often equaling the width of the shell below, and furnished with a narrow flattened longitudinally striated ligamental area; posterior and basal margins uniting in a regular curvature from near the antero-basal extremity to the posterior termination of the hinge-line.

SURFACE marked by closely arranged rigid filiform concentric lines, and very fine radiating striæ.

Cardinal teeth three, strong and somewhat diverging; lateral ones somewhat elongate and extending nearly to the extremity of the hinge-line. Anterior muscular scar subcircular, deep, situated near the inner border of the hinge-plate, and truncating the anterior cardinal tooth.

This shell is readily distinguished from the other species of the genus, by its distinctly triangular form, and by the greater length of the hinge-line. There may be some doubt as to its proper association under the same generic head, since the anterior muscular scar is known to be placed upon the hinge-plate, and to truncate one of the teeth; while that of the other forms is only known to be umbonal, but its true situation, whether on the hinge-plate or beneath it, has not been satisfactorily ascertained. In this species, the anterior border, just below the beaks, is considerably protruded, in order to accomodate the muscular pit; while in most other species referred to the genus, this portion of the border is more or less concave. The species is somewhat closely allied to *M.* (*Cardium*) *trigonum* of MUNSTER, as figured in GOLDFUSS, (Petref. Germ. pl. 142, f. 8, p. 215), but differs in having the hinge more nearly rectangular to the axis of the shell, which gives it a more broadly triangular form than the European shell.

*Formation and locality.* In the Hamilton group near Fultonham, Schoharie county, N.Y.

## MYTILARCA CHEMUNGENSIS (Conrad).

*Inoceramus chemungensis* : CONRAD, Jour. Acad. Nat. Sciences of Philadelphia, Vol. viii, pa. 246, pl. xiii, f. 9. 1842.

*Mytilus chemungensis* : PHILLIPS & SALTER, Memoirs Geol. Survey of Great Britain, Vol. ii, part 1, pa. 365, pl. xx, f. 10 & 11.

"Profoundly elevated, compressed; dorsal margin very oblique, "slightly arched; anterior and posterior margins parallel; anterior "margin straight, or very slightly concave from beak to base, the "submargin profoundly depressed; apex acute.

"*Locality.* Chemung-narrows, N.Y."

SHELL small, much elongated from beak to base, with ventricose valves and long slender pointed beaks; hinge-line short, oblique to the axis of the shell, with a narrow flattened and striated hinge-area: anterior margin direct or a little concave; posterior and basal margins rounded, the latter abruptly so. Hinge-line furnished with two cardinal teeth and three short lateral ones in each valve.

SURFACE marked by fine lamellose lines of growth, and often showing, under a magnifier, evidences of very fine radiating striæ.

This shell is quite variable in some of its features, some specimens being much more ventricose than others; while the obliquity of the hinge-line to the axis of the shell is liable to considerable variation, thereby giving a greater or less width to the beaks. The valves, when not compressed, are rather more ventricose near the anterior border than elsewhere, but are sometimes quite the reverse from compression.

*Formation and localities.* This species is common in the micaceo-arenaceous shales of the Chemung group at Philipsburgh and Rockville, Alleghany county; at Chemung-narrows, and numerous other localities in the southwestern counties of the State.

## MYTILARCA ATTENUATA (n. s.).

SHELL extremely elongated from beak to base, with long slender erect pointed beaks. Valves angular, and obtusely carinate along the anterior slope; hinge-line long, very oblique to the axis of the shell: anterior margin direct, almost as long as the entire length of the shell, the anterior slope abrupt; posterior margin from near the extremity of the hinge to its junction with the basal margin, nearly parallel with the anterior border; basal margin short, abruptly rounded. Surface of the valves elevated along the anterior slope, and gradually declining to the posterior border.

SURFACE marked by strong distant and irregular varices, and by fine concentric lines of growth. No radiating striæ have been

observed; although the enclosing material is not such as would have well preserved them, had they ever existed.

This species is easily distinguished from *M. chemungensis*, with which it is most nearly allied, by its extreme elongation, the strong varices of growth, and the angular anterior umbonal slope.

*Formation and locality.* In the arenaceous beds of the Chemung group near Elmira, New-York.

## MYTILARCA OCCIDENTALIS (White & Whitfield).

*Mytilus occidentalis :* WHITE & WHITFIELD, Proceedings Boston Soc. Nat. History, Vol. viii, p. 297. 1862.

This species is very closely allied to *M. chemungensis* of CONRAD, from the Chemung rocks of New-York, but may be distinguished by having the beak straighter, caused by a fullness on the anterior or byssal side : in fact, the beaks often have the appearance of being directed backwards, instead of forwards as in that species. The same prominence of the byssal side often gives a somewhat greater obliquity to the hinge-line in the western forms.

*Formation and locality.* In the Yellow sandstones of Burlington, Iowa.

## MYTILARCA FIBRISTRIATA (White & Whitfield)

*Mytilus fibristriatus :* WHITE & WHITFIELD, Proceedings Boston Soc. Nat. History, Vol. viii, p. 296. February 1862.

*Mytilus whitfieldianus :* WINCHELL, Proceedings of the Academy of Nat. Sciences, Philadelphia, p. 413. September 1862.

ID. IB. p. 11. 1863.

SHELL elongate mytiliform, with attenuated beaks and strongly convex valves, becoming subcarinate on the byssal side above the middle of the shell; byssal area convex and protruding, giving to the beaks an apparent posterior direction : postero-basal portion of the valves somewhat compressed; cardinal line very oblique. Hinge structure unknown.

SURFACE covered by fine threadlike radiating striæ, which are often undulated or contorted, especially where crossing the concentric lines of growth.

This species is readily distinguished from any other at present known, by the peculiar striated surface.

The *M. whitfieldianus* of WINCHELL (loc. cit.), from the same locality, differs from this species only in its smaller size, and is apparently a young individual of the same.

*Formation and locality.* In the Yellow sandstones of Burlington, Iowa.

## REMARKS ON THE GENERA

## *CYPRICARDITES, CYRTODON, MODIOLOPSIS, MEGALOMUS, MEGAMBONIA, &c.*

The Genus CYPRICARDITES, as described and applied by Mr. CONRAD (5th An. Rept. Geol. Sur. N.Y. 1841, p. 51, pl. f. 4), included a very heterogeneous group of shells, widely differing in character from each other, and also from his generic description and figure. The figure, however, distinctly indicates the shells to which it properly belongs, and which are the same as those described in Vol. 3, Pal. N.Y. f. 271, as PALÆARCA. These shells are characterized by a flattened ligamental area of greater or less width, similar to that of the recent Genus ARCA; and by having several (4 – 5) short oblique cardinal teeth near the anterior end of the hinge-line, and two or more elongated, slightly oblique, lateral teeth near the posterior extremity. The shells are usually ventricose and more or less orbicular in outline, with rather prominent beaks.

The Genus MODIOLOPSIS was instituted for a group of thin flat transversely elongated modiola-like shells, the *Cypricardites modiolaris* of CONRAD being selected as the type. At the time the genus was described, the hinge-structure and other internal characters were not well understood, which led to the error of considering the shell as unimuscular; but from more recent examinations of better specimens, they have proved to be much more closely allied to CYPRICARDITES than was at that time supposed, and it has long been known that they were bimuscular. The structure of the hinge is very similar to that of CYPRICARDITES, so far as the dentition is concerned. It does not, however, possess the flattened external ligamental area; but has a deep ligamental groove, and an external ligament, rounded on the back. The anterior muscular scar is usually well marked, of medium or large size, and somewhat circular or reniform; the anterior portion of the shell embracing it being extended beyond the beaks, and the posterior portion expanded, presenting a strong resemblance to MODIOLA. The posterior muscular scar is large, but faintly marked, situated near the posterior cardinal border, and narrowing anteriorly: palleal line simple. The hinge-teeth of the typical species are not yet very distinctly known, the best specimens examined not showing these parts satisfactorily; but they give evidence of one or more oblique cardinal teeth, and a rather strong elongate lateral tooth in the left valve. A closely allied species from Tennessee, from the same geological horizon as the *M. modiolaris*, shows three strong oblique cardinal teeth, and a single elongate lateral tooth.

In the Canadian Journal of July 1861, Mr. BILLINGS has cited the Genus MEGALOMUS as a synonym of CYPRICARDITES and CYRTODONTA; and on page 92, he asserts that it is a true CYRTODONTA. The species described, however, does not possess any posterior teeth, this portion of the shell being quite thin; but there is a deep ligamental groove commencing beneath the beak, and running along the cardinal portion of the valve about one half its length, indicating the existence of a strong external ligament quite distinct from that of CYPRICARDITES, and presenting strong similarity to that of the recent Genus VENUS.

There is but one point of difference generically between MEGALOMUS and the typical species of MEGALODON, *M. cucullatus* (SOWERBY); namely, the strong internal septum in that species, which extends from the umbonal cavity along the posterior or cardinal portion of the valve in the region of the posterior muscular impression, and which doubtless served the purpose of muscular attachment, like the similar ridge in CUCULLEA; while in MEGALOMUS, the posterior muscular scar is faintly marked, but very large and entirely destitute of any thing like a ridge. The hinge-plate is large and strong, becoming much thickened in old shells.

In a specimen of more than medium size, but where the thickening has not been great, there are four strong tuberculose teeth, having a direction almost parallel with the longitudinal direction of the valve. In old and thickened individuals, the teeth have apparently been absorbed and the intermediate space filled, until the surface of the hinge-plate presents only a roughened appearance. The anterior muscular scar is double, the principal one being large and very deep, situated at the extreme anterior part of the valve, and the small pedal scar placed close to its posterior border.

The Genus MEGAMBONIA is apparently nearly allied to CYPRICARDITES, and may possibly prove closely related to those Lower Silurian forms which correspond with CONRAD'S generic figure. The characters of the hinge are yet involved in some obscurity, though there is evidence of one or two short lateral teeth, and what may be considered faint cardinal teeth; but we have yet no specimens in the collection, showing this part of the hinge in a satisfactory manner.

The cardinal area is very narrow or obsolete, at least in specimens preserving the substance of the shell; and where the valves are in contact and without distortion from compression, the space between the cardinal margins is so little as to have led to the belief that no area existed, and, on casts made from natural molds of thickened shells, the area is scarcely discernible.

We have therefore the following characters for these genera:

CYPRICARDITES. Shells ventricose, suborbicular or broad ovate in outline, with an external flattened ligamental area : cardinal teeth four to five, short, oblique; lateral teeth two or more, oblique; muscular impressions two (anterior one single?); palleal line simple. Silurian.

SYNONYMS : *Cyrtodonta* and *Vanuxemia* (BILLINGS), *Palæarca* (HALL).

MODIOLOPSIS. Shells more or less compressed, transversely elongate : cardinal teeth two to four, short and oblique; lateral teeth one to two, elongate, curving; ligament external, no flattened area; muscular impressions single, anterior one small and deep, posterior one large, obscure; palleal line simple.

MEGALOMUS. Shells ventricose, ponderous : beaks strong, incurved, anterior; hinge-plate with several oblique tuberculose teeth at the anterior end, subject to absorption; lateral teeth none; ligament external; anterior muscular scar double, one large and deep, the other minute; posterior scar very large, obscure; palleal line simple.

MEGAMBONIA. Shells ventricose, broad ovate or suborbicular; anterior end with a ventricose wing or extension, separated from the body of the shell by a deep curved sinus; anterior hinge-teeth unknown; lateral teeth two to three, short, small and oblique; ligamental area narrow or obsolete : anterior muscular scar deep, circular, and having a small pedal scar upon its upper margin; posterior scar larger, faintly impressed; palleal line simple.

In the Hamilton group of New-York we have several species of shells, which, in their internal characters, approach very nearly to MODIOLOPSIS, but are still too much unlike the typical forms of that genus to be included under the same designation. I therefore propose to arrange them as a subgenus, under the name MODIOCONCHA. These may be characterised as transversely elongate subelliptical shells convex or moderately ventricose valves; beaks small, usually appressed, situated near the anterior end, with a more or less defined umbonal ridge which extends to the postero-basal angle, leaving a sinus just anterior to it : surface smooth, or with concentric lines of growth. The anterior end of the hinge-plate is furnished with several irregular conical teeth in the young stages, which become more or less thickened and coalescent with age : the posterior or lateral teeth are elongate; the casts of the right valve show evidence

of having had two, and the left has probably had but one tooth. Anterior muscular scar strong and deep; posterior scar larger, faintly marked; palleal line entire; ligament external, inconspicuous. Typical form, *Nyassa arguta*.

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# GENUS MODIOLOPSIS (HALL).

## SUBGENUS NYASSA (HALL.)

### NYASSA ARGUTA (n. s.).

SHELL of medium size, transversely elongate, the length from the anterior to the posterior extremity twice or more than twice as great as the greatest height. Valves somewhat ventricose, with a prominent subangular umbonal ridge which is slightly arcuate and extends from near the small appressed beak to the posterior basal angle, causing a slightly impressed sinus anterior to it, which reaches to and constricts the basal margin a little posterior to the middle. Cardinal margin strongly arcuate from the beak to the nasute or subtruncate posterior extremity; anterior end short, broader than the posterior end, and abruptly rounding into the basal margin. Beaks situated less than one-fourth of the entire length from the anterior extremity.

SURFACE of the valves marked by moderately fine, somewhat lamellose concentric lines of growth, without other ornamentation. The hinge is characterised by several (four to six) small teeth situated beneath the beak; some of them having no definite arrangement or direction, while the posterior ones of this number are directed obliquely backwards, and are more elongated than the others. There are two long curved lateral teeth in each valve, the outermost being considerably shorter than the other: ligament narrow, external, not very prominent, extending from near the beak to the crest of the cardinal border. Anterior muscular impression deep, somewhat semicircular, situated close to the anterior border of the shell; posterior scar subcircular or subquadrate, not strongly marked, and situated near the postero-cardinal border; palleal line entire, often strongly marked in the anterior portion and but obscurely in other parts.

*Geological formation and localities.* In the arenaceous shales of the Hamilton group in Schoharie, Otsego, Madison and Onondaga counties, and abundant in some calcareous layers of the group at Pratt's falls in Onondaga county, N.Y.

## NYASSA RECTA (n. s.).

SHELL small, subrhomboidal in outline, transversely elongated, with the cardinal and basal margins subparallel; a little more than twice as long as high: beaks prominent, incurved, situated near the anterior end, which is longest above the middle and abruptly rounded, and curving more broadly to the base, which is nearly straight along its posterior half; posterior extremity obliquely truncate, longest below and suddenly rounding into the basal line. Cardinal line straight, gradually declining toward the posterior end: umbonal ridge prominent, somewhat angular, reaching the postero-basal border at the point of greatest length.

SURFACE marked by irregular lines of growth: anterior muscular impression small, semicircular, situated near the anterior extremity; posterior impression not distinctly defined.

This shell differs from the preceding (*M. arguta*) in its smaller size, straight umbonal ridge, want of sinus, more prominent beaks, and straight cardinal line.

*Geological formation and locality.* In the arenaceous shales of the Hamilton group near Summit in Schoharie county, N.Y.

## NYASSA SUBALATA (n. s.).

SHELL broadly subovate, and, including the posterior alation of the cardinal line, subrhomboidal in outline; once and a half as long as wide. Valves depressed convex, most ventricose along the posterior umbonal slope, which is slightly arcuate; beaks small, laterally compressed, projecting but little above the hinge-line and situated near the anterior end. Cardinal line alate posteriorly, about half as long as the shell; anterior end short, projecting but little beyond the beaks and abruptly rounding into the basal line, which is gently arcuate; posterior end very oblique, extended and rounded at the postero-basal angle: umbonal ridge rounded; hinge-plate broad at the posterior end and narrowing toward the beaks, marked by one or two long toothlike ridges, which extend to near the extremity: cardinal teeth not determined. Anterior muscular scar of moderate size, round and deep, situated close to the anterior margin and near the beaks: posterior scar faint: palleal line distinctly marked in the anterior portion of the valve, but becoming obscure behind.

SURFACE marked by fine concentric lines of growth, and by faint traces of radiating striæ along the umbonal ridge.

This species differs from *N. arguta* in the greater width, more evenly convex surface, less arcuate umbonal ridge, alate hinge-line, and in being less produced or curved downward at the posterior angle.

*Formation and locality.* In the soft shales of the Hamilton group at Fultonham and Summit, Schoharie county, N.Y.

### NYASSA ELLIPTICA (n. s.).

SHELL transversely subelliptical in outline, the cardinal margin a little more arcuate than the basal line. Valves depressed convex, most ventricose a little below the hinge and anterior to the middle, gradually declining toward the base and posterior margin : beaks small, compressed, situated near the anterior end; anterior and posterior ends rounded, the former most abruptly. Basal margin very slightly constricted, or sometimes only straightened about the middle of its length. Anterior muscular scar deep, and situated close to the anterior end of the shell : posterior muscular impression large, superficial, situated near the postero-cardinal border. Hinge and surface characters not fully ascertained.

The specimens from which the species is described are internal casts, and do not possess all the characters necessary to a full description; but they furnish satisfactory evidence of their generic affinities with the typical forms. This is a much larger species than the *M. arguta*. The umbonal ridge is not well defined; while the posterior extremity is rounded upward, instead of being directed downward, as in that one.

*Formation and locality.* In the Upper Helderberg limestones at Stafford in Genesee county (N.Y.), and more abundant at Columbus, Ohio.

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## GENUS MICRODON (CONRAD).

Journal of the Academy of Natural Sciences of Philadelphia, Vol. viii, p. 247. 1842.

"SHELL bivalve, equivalve; hinge with a slender oblique tooth in the left valve."

The typical species, *M. bellastriata*, is the only one described by Mr. CONRAD. There are at least three others which may be included under the same designation, and the group may be described as thin flattened shells, varying from transversely subelliptical to quadrate in outline : hinge-line straight or slightly arcuate; anterior end narrowed and rounded; posterior extremity broad and truncate : beaks inconspicuous, pointed nearer the anterior end. Surface of valves marked by a more or less defined, always

depressed umbonal ridge, extending from the beak to the postero-basal angle, over which the regular concentric striation of the surface is sharply bent upward towards the cardinal line, the bending of the striæ being often the only indication of the ridge : hinge characterized by a single triangular tooth in each valve, that of the left valve short and situated beneath the centre of the beak, with a more elongate pit or groove behind it for the reception of the tooth of the right valve. The right valve has also a triangular pit beneath the beak for the reception of the short tooth in the left valve, and a longer triangular tooth behind. No lateral teeth, unless the long oblique tooth of the right valve be regarded as lateral. Anterior muscular impression moderately large, subcircular or short reniform; posterior scar obscure : palleal line simple, very faintly marked, and generally obliterated by the impressions of the surface markings. Ligament external, extending almost or quite the entire length of the hinge-line.

The above name, proposed by Mr. CONRAD, is applicable to a group of thin flat shells occuring in the Hamilton and Chemung groups of New-York, which could not be satisfactorily referred to any existing genus; and although they have been referred to several different genera by different authors, they vary so much from the true characters of those genera, that it will be necessary to arrange them as a distinct genus under the above name.*

## MICRODON BELLASTRIATA (Conrad).

SYN. *Microdon bellastriata*, CONRAD, Jour. Acad. Nat. Science of Philadelphia, Vol. viii, pa. 247, pl. 13, f. 12.

"Much compressed, with very regular equal concentric striæ : hinge
" margin slightly declining and nearly straight; posterior margin
" wide, direct; a slight fold anterior to and parallel with the
" umbonal slope.
" *Locality*. Near Smyrna, Chenango county, N.Y."

The shell, when not distorted by compression, is nearly quadrangular, with the anterior end narrowed, prolonged below and rounded : hinge-line straight or slightly arcuate. Posterior margin nearly vertical, and almost as wide as the greatest width of the shell : basal margin gently rounded : beaks small, pointed, greatly compressed, situated at the anterior third; umbonal angle usually distinct, owing to the strong deflection of the concentric striæ, which are sharp, regular and well

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* The name MICRODON is objectionable from having been previously used by Prof. AGASSIZ for a genus of Fishes. After consulting Mr. CONRAD, he prefers to leave the generic name as it stands, rather than propose a new one.

defined, and strongest on the ridge; hinge plate narrow : ligament, when preserved, large.

*Formation and locality.* Not uncommon in the Hamilton group throughout the State, but most abundant in the softer shales of the western counties.

## MICRODON TENUISTRIATA (n. s.).

SHELL very thin and compressed, with fine even concentric striæ; umbonal ridge inconspicuous : beaks small and pointed; hinge-line generally slightly arcuate. General form irregularly suboval or subquadrate; anterior end longest below the middle of the shell, sharply rounded at the extremity, and concave just below the beak. Basal margin gently and regularly rounded throughout its entire length; posterior end obliquely truncate : ligament extending more than two-thirds the length of the hinge-line. Anterior muscular scar large, short reniform; posterior scar and palleal line obscure.

This species differs from *M. bellastriata* in its greater size, finer striæ, less conspicuous umbonal ridge, proportionally wider hinge-plate, and in having the posterior end less vertical to the axis of the shell.

*Formation and localities.* In the finer arenaceous shales of the Hamilton group at Fultonham in Schoharie county, and also at Canandaigua lake and elsewhere in New-York.

## MICRODON GREGARIA (n. s.).

SHELL small, subquadrangular, larger than high. Valves very much compressed, and slightly angular along the umbonal ridge; hinge-line shorter than the shell below : beak compressed, inconspicuous, rounded; anterior end oblique above and rounded below; posterior end obliquely rounded. Basal line gently curving, and sometimes appearing nearly straight.

SURFACE smooth, or marked by very fine concentric striæ and a few stronger undulations of growth.

This shell possesses many of the features of the preceding species; but it is constant in size, and, so far as yet seen, never attains more than a fourth the dimensions of that one. It is also constant in its character and habits and limited in its geographical range, but appears in great numbers in certain layers of rock. It is usually a little longer proportionally than *M. tenuistriata*, the hinge-line proportionally shorter, and the beak situated a little nearer the anterior end.

*Formation and locality.* In some thinbedded strata of the Hamilton group at Jefferson in Schoharie county, and in the shaly sandstones near Ithaca, N.Y.

### MICRODON RESERVATUS (n. s.).

SHELL broad, somewhat rhomboid-ovate; length and height about as four to three. Valves depressed convex: beaks small, and slightly projecting beyond the cardinal line; umbonal ridge often obscure, sometimes conspicuous, and always readily distinguished by the bending of the striæ along that line. Cardinal line short, about half the length of the shell, slightly declining and curving into the posterior border; anterior end making about one-third the length of the shell, abruptly contracted beneath the beaks and rounded below; posterior end obliquely truncate, narrow; basal margin strongly curved.

SURFACE marked by moderately strong concentric striæ; the anterior muscular impression sometimes faintly shown in the casts.

This species differs from any other described, in the more abrupt curvature of the basal margin, bringing the termination of the umbonal ridge higher, and giving a proportionally narrower cardinal slope and posterior end: in other respects, it is very similar to the *M. tenuistriata* of the Hamilton group.

*Locality and formation.* In the Waverly sandstones of Licking county, Ohio.

### MICRODON? COMPLANATUS (n. s.).

SHELL depressed, broadly subovate or subrhomboidal, with small beaks about one-fifth from the anterior end; a flattened umbo, from which proceeds an obtusely subangular posterior umbonal ridge. Length and breadth about as five to three; greatest length below the middle. Hinge-line equal to about half the entire length of the shell, slightly arcuate; anterior end short, contracted below the beak and rounded at the extremity. Basal margin regularly and gently arcuate; posterior end obliquely truncate, a little convex.

SURFACE marked by extremely fine concentric lines of growth. Anterior muscular impression large and faintly marked.

This species is more elongate than *M. tenuistriata*, and is also more convex, with a more prominent umbonal ridge and elevated beaks. Its absolute identity with the internal characters of the Genus MICRODON has not been determined, but its general form and external characters ally it more nearly with that than with any other known genus.

*Formation and locality.* In the thinly bedded arenaceous shales of the Hamilton group at Jefferson, Schoharie county, N.Y.

# GENUS SANGUINOLITES (M$^{c}$COY).

Notwithstanding the confusion existing in regard to the species of this genus, and the difficulty of satisfactory reference to internal characters, I am inclined to adopt the generic name for the designation of a group of species which are similar in their general form and external characters to *S. angustata* (*Sanguinolaria? angustata* of PHILLIPS).

This species is first cited by M$^{c}$COY, following his original generic description, in the Carboniferous fossils of Ireland, page 47. At a later period, it would appear that a heterogeneous assemblage of species has been included under the genus; and the *S. anguliferus* first cited after the emended generic description in the "British Palæozoic Fossils," page 276, has all the external characters of CONRAD's Genus ORTHONOTA.

The following are given in M$^{c}$COY's original description as the generic characters of SANGUINOLITES:

" *Generic characters.* Transversely oblong, convex, equivalved, very
" inequilateral; dorsal and ventral margins parallel or nearly so;
" anterior side short, rounded; posterior side lengthened, obliquely
" truncate, gaping: an oblique ridge usually extends from the beak
" to the anal angle, but no flexure; ligament external."

The species included under this genus, in the following pages, possess the external characters given in the above generic description, as well as the internal characters of the emended generic description, and may be characterized as follows:

SHELLS transversely elongated, subelliptical or trapezoidal, marked with a strong angular umbonal ridge extending from the beak to the postero-basal angle, while the valves are marked by an antero-mesial sinus: beaks situated near the anterior end; cardinal border inflected, forming an elongate escutcheon.

SURFACE of shell marked by fine concentric striæ and strong rugose lines of growth, and usually by fine radiating striæ. The hinge is characterized by having a single strong somewhat wedgeform tooth in the left valve, situated beneath the beak and directed obliquely backwards toward the cavity of the valves; the right valve having a corresponding cavity, but no tooth. No lateral teeth exist: hinge-plate wide and thick. Ligament external, situated in a deep groove formed by the overlapping lamella of the shell, similar to that of many of the living Tellinides. Anterior muscular

scar distinct, with a small pedal scar on its postero-cardinal margin : posterior muscular scar elongate, faintly marked, widening behind ; palleal line simple.

In the characters of the hinge and also in the anterior muscle scars, this genus is very similar to MYOCONCHA. The general features of the hinge and arrangement of the muscles are the same as those given to SANGUINOLITES by Prof. M^c^COY, but very different from those forms usually referred to that genus.

### SANGUINOLITES PERANGULATUS (n. s.).

SHELL transverse, trapezoidal, very inequilateral. Valves highly convex and sharply carinate along the umbonal ridge, which has a double flexure in its passage from the beak to the postero-lateral angle. Length of shell about twice as great as the greatest height. Beaks nearly terminal, elevated above the cardinal line, angular and incurved : hinge-line short, but little more than half as long as the shell, and straight; basal line nearly parallel with the hinge or slightly diverging posteriorly, somewhat constricted near the middle, and curving upward near the posterior extremity ; anterior end very short, rounded at the lower angle ; posterior extremity very obliquely truncate, the margin being straight and the lower extremity pointed. The body of the valves marked by a slight sinus crossing obliquely from the beak, and reaching the basal border anterior to the middle of the valve.

SURFACE marked by fine concentric lines, which are sharply bent upward as they cross the umbonal ridge, and then run parallel with the posterior margin to the cardinal border.

This species, so far as yet known, is confined to the Schoharie grit, and may be distinguished from the angular forms of the genus in the higher rocks by its greater angularity and flexuose umbonal ridge. On many specimens, the carina is so salient as to leave the cardinal slope almost vertical.

*Formation and locality.* In the Schoharie grit at Schoharie village and vicinity, Schoharie county, N.Y.

### SANGUINOLITES ? PONDEROSUS (n. s.).

SHELL large and ponderous, longer than high, widening posteriorly. Valves very ventricose, with a rounded prominent umbonal ridge : beaks strong, obtuse, moderately prominent and incurved : hinge-line slightly arcuate, much shorter than the length of the shell,

the border inflected; anterior end short and narrow, obtusely pointed below; posterior end oblique above and broadly rounded in the lower part to the basal line, which is but little curved except in the posterior third of its length. The body of the shell is marked by a broad undefined sinus or depression, crossing obliquely from the beak to the basal line, and causing a slight constriction of its border just within the anterior third of its length.

SURFACE characters unknown, the specimens being casts in limestone. The anterior muscular scar is large and rather well defined: the posterior scar and palleal line is obscure.

This shell is referred, with some doubt, to the Genus SANGUINOLITES; but it seems to possess many of the features of the genus, and to approach it more nearly than any other. It is a large species, and, from its peculiar characters and size, not easily confounded with any other of that formation found in the State. The larger specimens used in the description measures nearly four and a half inches in length, by two and three-fourth inches in its greatest height, and has been about two and a half inches through the greatest depth of the two valves.

*Formation and locality.* In the Upper Helderberg limestones at Clarence-hollow, N.Y.

## SANGUINOLITES HAMILTONENSIS (n. s.).

SHELL transversely elongate, about twice and a half as long as high, very inequilateral, trapezoidal in outline, posterior end widest. A strong sharply elevated carina passes obliquely across the valve from the beak to the postero-basal angle. Anterior end, from the beaks, one-fifth to one-sixth the entire length of the shell, narrow and sharply rounded; basal line somewhat emarginate just anterior to the middle, corresponding to a broad shallow sinus which crosses the shell from the beak to that point: posterior end very obliquely truncate, margin rectilinear. Cardinal line straight, from one-half to two-thirds as long as the entire shell; the margins strongly inflected, forming a long deep escutcheon: ligament about half the length of the hinge-line, strong and prominent, its form frequently preserved on specimens retaining the valves in conjunction.

SURFACE of valves marked by fine but distinct rugose lines, parallel to the margin of the valve, which are strongly deflected in crossing the oblique carina.

*Formation and locality.* Found in the rocks of the Hamilton group throughout the State, but most abundant near Fultonham, Schoharie county, N.Y.

## SANGUINOLITES ACUTUS (n. s.).

SHELL rhomboidal, very much elongated posteriorly, with highly elevated valves, which are crossed obliquely by a salient umbonal ridge : beaks small, strongly incurved, situated close to the anterior end, flattened. Cardinal and basal margins subparallel, the latter somewhat strongly sinuate near the middle, and gently curved upward anteriorly; anterior end narrow and rounded; posterior end very oblique; the postero-basal angle acute, and the postero-cardinal border curving into the cardinal line; cardinal slope very abrupt and slightly concave. Body of the valve crossed obliquely by a well marked sinus from the beaks to the basal border, a little anterior to the middle.

SURFACE marked by very fine closely arranged threadlike concentric striæ, and by almost equally strong radiating striæ just anterior to the umbonal carina.

This species is remarkable for the very salient umbonal carina, which is sharply angular on the posterior part and is attenuated into a thin alation on the umbonal region of the older individuals. The shell is also proportionally narrower than the *S. hamiltonensis*, and the surface striæ are finer and more threadlike than those of any of the other species described, while the radiating striæ just anterior to the umbonal ridge or carina are stronger than in other species : the beaks are likewise more anterior than in the species of generally similar form.

*Formation and locality.* In the soft shales of the Hamilton group on Canandaigua lake, New-York.

## SANGUINOLITES RUGOSUS (Conrad).

SYN. *Cypricardites rugosa,* CONRAD, An. Rept. Geol. Sur. N.Y. p. 53. 1841.

SHELL subrhomboidal, widest posteriorly, anterior end short : basal margin gently rounded, with a more or less distinct sinus anterior to the middle and passing to the beak; posterior end obliquely truncate : hinge-line straight; beaks small, giving origin to an angular carina which extends to the postero-basal angle, and having a slight upward curvature in the upper part of the valve.

SURFACE marked by strong rugose or undulating concentric striæ parallel to the margin of the shell.

This species differs from *S. carinata* in being proportionally shorter; their respective lengths, in comparison with their height, being as two to three : this shell is also more rotund, and the basal margin is rounded; while the surface striæ are not fasciculate as in that one.

*Formation and localities.* In the softer shales of the Hamilton group on the shores of Canandaigua and Cayuga lakes, and also in the arenaceous beds near Schoharie, N.Y.

### SANGUINOLITES GLAUCUS (n. s.).

SHELL large, rhomboidal; cardinal and basal margins subparallel; length varying from nearly twice to a little more than twice the height. Beaks small, compressed, situated near the anterior end, which is rounded and longest below the middle of the shell: basal line gently and somewhat regularly rounded from its junction with the anterior end to near the postero-basal angle; posterior end long, obliquely truncate. Cardinal line short, very slightly arcuate; surface marked by a strong and well defined umbonal carina, but destitute of any mesial sinus either crossing the valve or constricting the basal margin.

SURFACE striæ distinct, moderately crowded and directed gently forward where they cross the umbonal ridge, giving a somewhat pointed character to the extremity of the valve. Anterior muscular impression large; palleal line faintly marked.

This species differs from either of the preceding, in the form of the basal margin, and in being destitute of a mesial sinus as well as in its broader and less ventricose valves.

*Formation and localities.* In the arenaceous bands of the Hamilton group at Kelloggsville in Schoharie county, and at Lebanon in Madison county, N.Y.

### SANGUINOLITES SOLENOIDES (n. s.).

SHELL transversely elongated, nearly three times as long as high, but somewhat variable. Cardinal and basal margins subparallel: beaks small, appressed, situated about two-fifths of the length from the anterior end. Anterior end narrow, prolonged, sharply rounded at the extremity, the longest point a little below the middle of the shell; basal margin concave in the middle and recurved toward the postero-basal angle, giving to this part of the shell a somewhat pointed appearance: posterior end obliquely truncate, the margin gently rounded. Valves marked by a distinct but not prominent carina, passing from the head to the postero-basal angle: there is also a very faint mesial sinus crossing the valve, and constricting the basal margin a little anterior to the middle.

SURFACE ornamented by numerous irregular concentric undulations of growth, which are strongest on the anterior half, and are bent abruptly upward in crossing the umbonal ridge, and directed obliquely backward to the cardinal line. The posterior half of the shell, especially above the umbonal ridge, is further marked by

very fine transverse threadlike lines, which are entirely destitute of any regularity, extending from the cardinal line to just below the ridge. This feature, although very artificial in appearance, is nevertheless constant in every specimen of the species yet seen.

This species differs from the preceding forms in the greater length of the anterior end, and the parallelism of the cardinal and basal margins; also in the characters of the surface striæ, which are not regularly elevated ridges as in those species.

*Formation and localities.* In the Hamilton group in the town of Summit in Schoharie county; in Onondaga county; at Canandaigua lake, at Ludlowville, at Cayuga lake, and at Darien, N.Y.

## SANGUINOLITES CUNEATUS (Conrad).

*Pterinea cuneata:* CONRAD, Annual Report, Pal. N.Y. p. 116. 1838.

"SHELL oblong ovate; posterior side profoundly elongated, sub-
"cuneiform: surface with obsolete concentric carinæ; disk
"obliquely contracted from beak to base. Length 2 inches.
"*Locality.* Near Oneonta, Otsego county."

The shell identified with this species is transverse, the length a little more than twice as great as the height. Cardinal line straight and nearly parallel to the basal margin, its border strongly inflected: anterior end short, obliquely sloping from the beak to near the basal line; posterior end widest, doubly truncate, the upper part very oblique and the lower nearly vertical. Basal line slightly constricted near the middle, and greatly curved upwards toward the postero-basal angle. Beaks small, incurved and compressed, giving origin to a distinct and well-defined umbonal ridge passing to the lower posterior extremity, and a smaller less distinctly marked ridge intermediate to the first and the cardinal line. A broad undefined sinus crosses the valve obliquely a little anterior to the middle.

SURFACE marked by irregular concentric lines of growth, and ornamented, in well-preserved specimens, by very fine radiating lines, which are sometimes quite regular and direct, and on other individuals are crowded and tortuous.

This species is somewhat variable in its proportions, in the prominence of the carinæ, the gibbosity of the valves and the strength of the mesial sinus. The surface-radii are frequently obliterated, or so faint as to be detected only on small parts of the shell: they can generally be seen, if at all, near the beak, or in the sulci between the ridges of the posterior slope. It is readily distinguished from the foregoing species by the

double carina, and when the radiating striæ are preserved, they are a ready guide for identification.

The species was originally described by Mr. CONRAD, in 1838, as *Pterinea cuneata*, and an outline figure made which was never published. The description and figure were evidently made from a specimen which had been somewhat crushed vertically, contracting the width of the posterior end of the shell, a condition very common with the species. It is often laterally compressed or flattened; in which case, the posterior extremity is much wider than the opposite end.

*Formation and localities.* In the shales of the Hamilton group in Schoharie county, on the shores of Cayuga and Canandaigua lakes, and at York in Livingston county, N.Y.

## SANGUINOLITES ARCÆFORMIS (n. s.).

SHELL transversely oblong, subcuneiform, widest at the anterior end, about twice as long as the greatest height. Valves ventricose anteriorly, and becoming attenuate posteriorly: beaks large, incurved, flattened on the umbo, situated within the anterior third. Cardinal line straight, gradually declining from the beaks to the extremity; margins inflected; anterior end rounded, greatest extension opposite the middle of the valve. Basal line gently and regularly curved from the anterior end to the postero-basal angle, though sometimes having a slight sinuosity a little anterior to the middle; posterior extremity very obliquely truncate: umbonal slope marked by a well defined angular ridge which is slightly curved in its direction, and a second fainter ridge intermediate to the umbonal ridge and the cardinal line. On some of the specimens there is a shallow undefined sinus crossing the valves obliquely from the beak to base, just behind the middle.

SURFACE marked by very faint concentric striæ and stronger undulations, and also by radiating striæ which are rarely well preserved. There are also very fine striæ crossing the cardinal slope vertically, which are not lines of growth merely, but present a distinct feature.

This shell resembles *S. cuneata*, much more than any other, but is readily distinguished from it by its proportional greater width across the umbonal region, and becoming narrower posteriorly, while that one is parallel or widens posteriorly. The striæ are also much fainter, and have not been detected on the cardinal slope: the peculiar striæ are also a distinguishing feature where preserved.

*Formation and localities.* In the arenaceous shales of the Hamilton group at Delphi village and falls, and other places in Onondaga county, N.Y.

## SANGUINOLITES UNDATUS (n. s.).

SHELL oblong, with parallel cardinal and basal margins, and short rounded anterior end, which is slightly contracted beneath the beaks; posterior end truncate, a little shorter at the cardinal border than below, angles rounded; beaks small, sub-anterior, and flattened on the back; valve, with the general surface flattened anterior to the umbonal ridge, which is straight, angular and well defined; cardinal slope with a sub-angular depression half way between the umbonal ridge.

SURFACE marked by strong concentric undulations parallel with the margins, which are bent abruptly upwards in crossing the umbonal ridge. Faint traces of radiating striæ can be detected by the aid of a magnifier.

This species is peculiar in its almost squarely truncate posterior margin, and the strong regular undulations of the surface, which are bent rectangularly in crossing the straight umbonal ridge. The surface of the shell has a slight convexity, but from the point of greatest elevation to the basal margin, and posteriorly to the umbonal ridge, it is straight, or flattened with a scarcely perceptible oblique depression from the beaks to the base of the shell. From its rigid form and peculiar features, this shell will not readily be confounded with any other known species.

In its general aspect this species resembles *Orthonota*, and the surface markings are of similar character, but the declining margin anterior to the beaks is a distinctive feature, incompatible with the typical forms of the genus. In the absence of a knowledge of the hinge structure it is referred to the Genus SANGUINOLITES.

*Formation and locality.* In the soft micaceous layers of the Chemung group at Buck's quarry, near Elmira, N.Y.

This species is known only from this locality where it is associated with other well known fossils of the period. The single specimen of rock collected at the place contains an entire right valve with parts or impressions of three others. From the fact that it does not occur in the extensive collections from various points to the east and west of this locality, we infer that its geographical distribution may be extremely limited.

## SANGUINOLITES SUBTORTUOSUS (n. s.).

SHELL robust, subquadrate, twice as long as high, widest posteriorly and irregularly ventricose. Beaks of moderate size, elevated but little above the hinge-line and flattened on the umbo, situated near

the anterior end. Cardinal line straight or a very little arched, the margin strongly inflected; posterior end doubly truncate. Basal line sinuate anterior to the middle; anterior end obliquely rounded below to the basal line. Valves marked by a strong sinus passing obliquely from the beak, and reaching the base anterior to the middle of the length; also by an angular umbonal ridge from the beak to the postero-basal angle, and by a second ridge, intermediate to this and the cardinal line, slightly longer than the principal one; giving a greater extension to the margin of the valve, and causing the double truncation of the posterior end.

SURFACE ornamented by irregular concentric lines of growth, and fine almost obsolete radiating striæ on the body of the valves.

This species is intermediate to the two last: it differs from *S. cuneatus* in being more robust in its habit, a little more ventricose, and in having a greater extension of the intermediate or secondary umbonal ridge. It differs from *S. elongatus* in being shorter, decidedly more angular, and more ventricose, with a shorter secondary ridge.

*Formation and locality.* In the shales of the Hamilton group at York, Livingston county, N.Y.

## SANGUINOLITES TRUNCATUS (Conrad).

*Cypricardites truncatus*: CONRAD, Jour. Acad. Nat. Sci. Philadelphia, Vol. 8, pl. 12, f. 17, p. 244.

SHELL small, seldom exceeding half an inch in length by about two lines in width from the cardinal to the basal margins. Valves moderately ventricose, subcylindrical anterior to the strongly angular umbonal ridge; the portion between the ridge and the cardinal line, concave: beaks small, compressed, incurved, projecting but little above the hinge, situated about one-third of the length from the anterior end. Cardinal line straight, with strongly inflected margins; anterior end contracted above and regularly rounded below. Basal line straight; posterior end obliquely truncated, the margin a little rounded. Besides the strong umbonal carina passing from the beak to the postero-basal angle, there is a faint secondary ridge intermediate to the first one and the cardinal line: the primary ridge is sometimes so distinctly elevated as to present the appearance of a rounded rib.

SURFACE marked by lamellose lines of growth, occasionally forming undulations: there are also faint indications of radiating striæ on the body of the shell.

The only species in the same formation, with which this one can possibly be confounded, is *Orthonota parva* (CONRAD), and from which it

differs in its greater proportional width, longer anterior end, more distinctly marked umbonal ridge, the possession of a secondary ridge, and in the inflected cardinal line; the last character being almost the only constant external feature which distinguishes SANGUINOLITES from ORTHONOTA.

*Formation and localities.* In the sandy calcareous shales of the Hamilton group at various places in Schoharie county; and as far as is now known, it does not occur in the softer beds of this formation at any of the localities in Western New-York.

## SANGUINOLITES IDA (n. s.).

SHELL of medium size, transversely subelliptical in outline and moderately convex; with small appressed beaks barely projecting above the hinge-line, and situated about one-third of the length of the shell from the anterior end. Cardinal line straight, less than one-half as long as the shell, its margins slightly incurved; posterior extremity elongated, very oblique and pointed below. Basal line gently and regularly curved from the posterior to the anterior extremities; anterior end contracted, the extremity abruptly rounded. Body of the valve regularly convex anterior to the umbonal ridge : space posterior to the ridge abruptly depressed and concave.

SURFACE marked by regular even concentric lines, which are stronger and more regular on the posterior cardinal slope, with evidence of fine radiating striæ on the middle of the valve.

This species differs from all the preceding in its elliptical form, the pointed postero-basal extremity, regular curved basal line, long and narrowly rounded anterior end, and the shorter hinge-line, which gives to the beak the appearance of being more nearly central than in any other species.

*Formation and localities.* In the shales of the Hamilton group at Geneseo in Livingston county, and near the shores of Cayuga lake, N.Y.

## SANGUINOLITES CARINATUS (Conrad).

*Cypricardites carinata :* CONRAD, An. Rept. Geol. Sur. N.Y. 1841, pl. —, f. 21, p. 53.
Compare *Cypricardites chemungensis,* VANUXEM: Geol. Report, p. 181, f. 2; p. 179, 1842.

SHELL trapezoidal, very transverse and elongated posteriorly. Valves convex, sharply carinate along the umbonal ridge, which is slightly flexuose : beaks small, projecting but little above the hinge-line, incurved and flattened on the back, situated about one-third or more than one-third the length from the anterior end. Cardinal

line straight, rigid; anterior end acutely rounded at the extremity, and longest above the centre of the valve, from which point it is regularly curved into the basal line: posterior border very oblique, running direct from the end of the hinge-line to the pointed postero basal angle. Basal line nearly parallel with the cardinal border, or gently diverging posteriorly; strongly curved upward at the anterior, and but little or not at all at the posterior end, and having a moderate constriction near the middle of the shell. Body of the shell crossed obliquely from the beak to near the middle of the basal line, by a broad shallow and undefined sinus.

SURFACE marked with somewhat irregular concentric striæ, which unite and form strong fascicles on the anterior portion, and, on the umbonal ridge, are bent sharply upward and backward, being directed to the cardinal border parallel with the posterior margin. There are faint indications of very fine radiating striæ on the body of the shell in some individuals, but these are not observed on the postero-cardinal area.

This species bears considerable resemblance to *S. hamilton ensis* and *S. rugosa* of the Hamilton group, but may be distinguished by its narrower or more elongate form, and by the anterior end being longer in proportion, having the greatest extension above the centre of the valve. The concentric striæ are also finer and less conspicuous on the body of the shell, but more distinct on the anterior end; while there are numerous undulations or folds of the surface, which are not characteristic of either of the other species.

*Formation and locality*. This species is cited by Mr. CONRAD from Oneonta (N.Y.), and the original may have been derived from that locality. Its similarity to *Cypricardites chemungensis* of VANUXEM has induced me to regard the two as identical; and if this be proven, we have the species from both the Hamilton and Chemung groups.

## SANGUINOLITES RIGIDI (White & Whitfield).

*Cypricardia? rigida* : WHITE & WHITFIELD, Proc. Bost Soc. Nat. Hist. Vol. viii. p. 300. 1862.

*Edmondia? bicarinata* : WINCHELL, Proc. Acad. Nat. Sci. Philadelphia, Vol. — p. 13. 1863.

SHELL transversely elongate, twice or more than twice as long as high, the cardinal and basal margins nearly parallel or slightly converging posteriorly. Valves moderately convex, with an angular umbonal ridge crossing obliquely from beak to the postero-basal angle, and a broad shallow sinus anterior to the ridge and constricting the basal line near its middle: there is also a secondary ridge traversing the cardinal slope, about midway between the

primary ridge and the cardinal border. Beaks small, appressed, slightly projecting above the cardinal border, and but little incurved : hinge-line straight ; anterior end short, more extended near the basal line ; posterior end oblique and doubly truncate. The upper truncation, reaching from the end of the cardinal line to the junction of the secondary ridge, is very oblique, while the other or lower part is vertical or but slightly oblique.

SURFACE of valves marked by fine irregular concentric lines parallel with the margins of the shell. The specimens are usually casts of the interior, and preserve no fine surface markings, if there ever have been any other than the concentric lines. The anterior muscular scar is often represented by a slight elevation below the the beaks, leaving a sharp depression on its posterior side, which may be readily mistaken for the impression of a muscular clavicle like that occuring in the Genus NUCULITES.

This species has many features in common with *S. cuneata* (CONRAD) of the Hamilton rocks. The mesial constriction is, however, not so distinctly marked, nor the cardinal border so strongly inflected : the beak is less prominent; the shell more generally narrowed posteriorly, and the radiating striæ of the surface have not been seen on any of the specimens examined, although seen on that species in its condition of internal casts. After critical comparison between the New-York forms and those from the yellow sandstones of Burlington (Iowa), no distinction has been found that can be considered of the least importance.

*Formation and localities.* In rocks of the Chemung group, at Phillipsburg and Rockville in Alleghany county, in Chautauque and Cattaraugus counties (N.Y.), and in the Yellow sandstones at Burlington, Iowa.

### SANGUINOLITES ? CLAVULUS (n. s.).

SHELL of medium size, transversely elongate, attenuated posteriorly. Valves depressed convex, most gibbous at the anterior end and compressed behind, with a distinct but not prominent rounded umbonal ridge : beaks small, inconspicuous, varying from nearly terminal to the anterior sixth. Cardinal line straight, the margin slightly inflected, forming a very narrow escutcheon ; anterior end broad, rounded, longest in the middle. Basal margin nearly straight, very slightly sinuate near the middle ; posterior end rounded, and somewhat oblique above the umbonal ridge. Body of the valves crossed obliquely by a scarcely perceptible sinus.

SURFACE marked by irregular concentric lines, which are generally strongest posteriorly. No radiating striæ have been detected.

This species may be distinguished by its posteriorly attenuated form, short broad and rounded anterior end, almost terminal beaks, nearly

obsolete mesial sinus, and rounded umbonal ridge, in which characters it differs from most of the other species described.

*Formation and localities.* In sandstones of the upper part of the Chemung group at Olean station in Cattaraugus county, and at Porterville in Allegheny county, N.Y.

## SANGUNOLITES VALVULUS (n. s.).

SHELL subcylindrical, very elongate posteriorly. Cardinal and basal margins subparallel; anterior end very short and rounded; posterior end rounded and obliquely truncate above. Beaks at the anterior sixth appressed, very slightly elevated above the cardinal line: umbo not prominent; umbonal ridge rounded, not well defined, with a secondary less prominent ridge between the first and the cardinal line. The general form regularly convex from the basal to the cardinal line, with a short oblique shallow sinus crossing the valve from the beak, which reaches the basal line at about the anterior third of the length.

SURFACE marked by obscure concentric lines (no radiating striæ observed).

This species is intermediate in form between *S. elongata* of the Hamilton group and *S. clavulus* of the Chemung group, being more nearly of the general form of the first named species, having the beak a little more anterior and the posterior extremity less recurved; the oblique sinus is narrower and more anterior. It is wider posteriorly, and not as convex in the umbonal region as that species.

*Formation and locality.* In the Waverly sandstones of Licking county, Ohio.

## SANGUINOLITES ÆOLUS (n. s.).

SHELL elongate ovate: beaks anterior, small, compressed and closely incurved; posterior umbonal ridge strongly marked, angular. Cardinal slope abrupt; cardinal line long, nearly straight, the borders strongly inflected; anterior end very short, abruptly rounded, the greatest extension above the middle of the shell. Basal line strongly curved, more abruptly at the anterior end; posterior extremity narrow, obliquely truncate above the umbonal ridge. There is a slight indication of a sinus on the umbones, which becomes less conspicuous below, or is indicated only by a flattening of the valves anterior to the middle.

SURFACE marked by strong concentric lines of growth, with finer concentric and radiating striæ, the latter very obscure in the casts.

This species bears much resemblance to *S. rigida* of the Chemung group and Yellow sandstones of Burlington (Iowa), but differs mainly in the greater curvature of the basal line and the absence of a secondary umbonal ridge.

*Formation and locality.* In the Waverly sandstones at Newark, Ohio.

### SANGUINOLITES ? FLAVIUS (n. s.).

SHELL elongate, subcylindrical : cardinal and basal margins subparallel. Valves somewhat strongly convex, with small subanterior beaks and a prominent rounded umbonal ridge ; the oblique antero-mesial sinus broad and shallow. Cardinal line straight, about half as long as the entire length of the shell ; anterior end short and obtuse : basal margin nearly straight, or slightly sinuate in the middle and curved upward at the extremities ; posterior extremity rounded, rapidly receding to the extremity of the hinge-line.

SURFACE marked by strong concentric ridges of growth, with intermediate finer striæ and obsolete radiating striæ upon the body of the shell.

This species can be distinguished from its associated forms by the want of angularity on the umbonal ridge, and the general convexity of the valves and strong undulations of the surface. It approaches the *S. valvulus* in some of its characters, but is proportionally shorter and has but a single umbonal ridge.

*Formation and locality.* In the Waverly sandstones of Licking county, Ohio.

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## GENUS GRAMMYSIA (DE VERNEUIL).

*Descr.* SHELLS equivalve, inequilateral, not gaping, furnished with two muscular impressions of very unequal size ; palleal line rounded posteriorly, and united with the large muscular impression in such a manner as to leave about two-thirds of it outside of the line : ligament external, much prolonged in the depression of the escutcheon. Surface traversed by an oblique fold or rib extending from the beak to the middle of the inferior border, and by numerous rounded concentric folds.

The above is essentially the generic description given by M. DE VERNEUIL, in the *Bulletin de la Soc. Géol. de France*, 2d series, vol. iv, p. 696. 1847.

He further adds, that "in the unequal muscular impressions and the form of the palleal line, it resembles and may be placed near to

CYPRICARDIA and CYPRINA." In his further remarks, he appears to consider the oblique fold or rib traversing the valves as of generic importance; but since we find that in the typical species this fold is sometimes so indistinct as to be barely recognizable, and perhaps sometimes actually obsolete, it ought scarcely to be considered of generic importance. M. D'ORBIGNY has referred the typical species to the GENUS CARDINIA (AGASSIZ). But these forms differ materially from that genus, both in external characters and in their dentition; for they certainly have never possessed the strong prominent anterior and posterior teeth which characterize that genus; and if we can judge from the figures of CARDINIA given in the "*Mollusques fossiles*," they have possessed no external ligament, and appear to be allied to CRASSATELLA; while this genus has a large and strong external ligament, the form of which is often preserved where the valves are united.

The characters of the hinge-teeth have not been fully ascertained; and an examination of several hundred individuals has failed to develope anything like true teeth, or other hinge characters, beyond an irregular fold of the shell which may have served that purpose. The ligament is strong and well developed, commencing beneath the beaks, and extending nearly half the length of the narrow but deep escutcheon. On the anterior end, there is a small deep and often strongly marked lunule. The mesial rib or fold is characteristic of a small number only of those species which we have found it desirable, from their similarity of structure, muscular impressions and general form, to include in the genus; and from its great variability in the typical species, it has not been considered of true generic importance.

It has seemed desirable, therefore, to modify the generic description so as to include the species which naturally belong to the same group.

*Generic characters.* SHELL equivalve, inequilateral, varying from subquadrate to transversely elliptical. Valves ventricose, sometimes inflated: beaks strong, prominent and incurved; hinge-line shorter than the shell, posterior to the beaks. Dentition obscure, or represented only by irregular folds on the cardinal line: ligament external, prominent, extending from beneath the beaks to nearly one-half the length of the hinge-line. Cardinal margin bordered by a deep well-marked escutcheon; anterior end marked by a small deep and strongly defined lunule. Anterior and posterior muscular impressions faintly marked, the latter much the larger: palleal line not sinuate, but broken into points or ridges, strongly rounded posteriorly, and uniting with the large muscular scar near its anterior border.

SURFACE of shell often marked by an oblique mesial rib or fold extending from the beak to the basal border, and by numerous strong concentric folds or ridges, which are frequently obsolete on the posterior part of the shell. The shells appear to have been thin and fragile, and are usually much crushed and distorted from compression; but most of the species occurring in the New-York rocks are well marked and not readily mistaken, since their specific characters are easily distinguished.

## GRAMMYSIA BISULCATA (Conrad).

*Pholadomya anomala* : GOLDFUSS, Pet. Germ. p. 272, pl. 157, f. 9. 1834–1840.
*Pterinea bisulcata* : CONRAD, An. Rept. Geol. Sur. N.Y. p. 116. 1838.
*Cypricardites bisulcata* : CONRAD, An. Rept. Geol. Sur. N.Y. p. 52. 1841.
*Grammysia hamiltonensis* : DE VERNEUIL, loc. cit. 1847.
*Cardinia hamiltonensis* : D'ORBIGNY, Prod. Paléon. Vol. I, p. 76. 1850.

SHELL large, transversely ovate, ventricose, about once and a half as long as high; hinge-line rather more than half as long as the shell: beaks strong, incurved, situated near the anterior end. Cardinal line with a narrow well-marked escutcheon; anterior end having a proportionally large sharply defined lunule beneath the beaks, which is rounded below into the basal border: posterior margin oblique, extended below; ligament large, reaching less than one-half the length of the cardinal line.

SURFACE marked by a strong mesial fold or rib crossing the valves obliquely from the beaks to the middle of the basal margin, bordered on each side by a furrow or abrupt depression. There are also numerous strong concentric folds crossing the valves parallel with the margin, which are strongest on the anterior end, which sometimes become obsolete on the posterior and cardinal portions of the shell, and are deeply undulated where they cross the oblique ridge.

The transverse rib and concentric undulations of the shell appear to be subject to considerable variation; some individuals having the latter characters well marked over the entire surface, and others only on the umbonal region. Shells from three-fourths of an inch to three inches in length.

*Formation and localities.* In the arenaceous shales of the Hamilton group in Schoharie, Otsego and Madison counties (N. Y.), and more rarely in the softer beds of the group in Ontario and other counties in the western part of the State.

## GRAMMYSIA NODOCOSTATA (n. s.).

SHELL large, very oblique, transversely or obliquely subovate. Valves ventricose and somewhat angular, with strong prominent and incurved beaks projecting as far as, or beyond, the anterior end Cardinal line short, less than one-half as long as the shell, bordered by a deep moderately wide and well-defined escutcheon with angular margins : the anterior end has a small deep lunule beneath the beaks, and the margin below abruptly curving into the basal border, which is gently arched and marked by a constriction near the middle, caused by the oblique furrow and fold of the surface; posterior extremity prolonged and very oblique, somewhat pointed at the postero-basal extremity.

SURFACE of the valves crossed obliquely by a distinct rib which extends from the beak to a point on the basal line just anterior to the middle, and bordered by a deep groove on its anterior, and sometimes a fainter one on its posterior side; concentrically marked by folds or ridges which are sharp, irregular, and lamellose; the principal ones being composed of several smaller ones, which unite and form fascicles on the anterior portion of the shell. The oblique rib is generally flattened on the umbonal portion of the shell, and divided into three, four, or more ridges, which form nodes where crossed by the concentric folds. There are also sometimes a few fine radiating lines on the beaks outside of the principal oblique fold.

This species resembles, and has generally been confounded with *G bisulcata ;* but it is much more oblique, with a shorter hinge-line; the valves are more angular along the umbonal slope, the lunule in front of the beaks is much smaller, the concentric folds much more numerous and finer, besides being lamellose, angular and fasciculate, with a greater number of intermediate ones. The oblique rib is very different from the same feature in that species ; being flattened in the umbonal region, with angular edges, and divided longitudinally into several smaller ridges, which form three, four, or more rows of small nodes by the intersection of the concentric folds. Shells from two inches or less, to four inches in length.

*Formation and localities.* In the arenaceous shales of the Hamilton group near Sherburne in Chenango county, and at Hamilton in Madison county, N.Y.

## GRAMMYSIA MAGNA (n. s.).

SHELL large, broadly ovate or subquadrangular in outline, with ventricose valves, strong incurved beaks and prominent umbones :

beaks situated near the anterior extremity, and projecting but little above the cardinal line; hinge-line nearly two-thirds the length of the shell, very slightly curved : anterior end short, rounded below the lunule; posterior end oblique, prolonged below, rounded at the extremity. Basal line curved, somewhat constricted just anterior to the middle by the oblique rib which crosses the valve : escutcheon deep and narrow, extending to the end of the cardinal line; posterior cardinal area strongly lobed; lunule moderately large and deep.

SURFACE of the valve marked by a strong narrow oblique rib on the right side, extending from the beak to the base of the shell, which it reaches just anterior to the middle, and by a corresponding shallow furrow on the left valve; and also by numerous irregular concentric fasciculate folds or undulations, which are not strong and distinct as on many species of the genus, but are low and often obscured by being broken up into smaller striæ, especially along the posterior umbonal ridge and towards the front or base of the shell. These folds are strong and most distinct near the anterior end and around the beak, sometimes forming indistinct transverse nodes on the umbo where they cross the oblique rib. On some individuals, the surface, especially on the posterior slope, is marked by numerous irregular wrinkles crossing the concentric lines obliquely, and giving a chopped or shortly corrugated aspect to the surface.

This is one of the large forms of the genus, and is closely allied to *G. nodocostata*, from which it differs principally in the form and structure of the oblique mesial rib, which is a simple fold on the right valve and a furrow on the left, and never divided into nodose ridges, or accompanied by lines of nodes on the sides as in that one. The concentric undulations are also more indistinct, and do not bifurcate on the margins of the fold and furrow. The oblique furrow is often exaggerated by the crushing of the shell, the folding taking place along that line. This species often attains a length of four inches.

*Formation and locality.* In the arenaceous shales of the Hamilton group in Cazenovia and Hamilton, Madison county, N.Y.

## GRAMMYSIA CIRCULARIS (n. s.).

SHELL subcircular in outline and only moderately convex, with strong closely incurved beaks and a subangular umbonal slope which is slightly curved; hinge-line short, gently arcuate, bordered posteriorly by a deep narrow escutcheon : anterior end marked by a

large lunule having angular margins; anterior and basal borders of the valve somewhat regularly rounded; posterior end nearly vertical or slightly rounded. Anterior muscular scar small, situated near the margin of the lunule: posterior scar large; palleal line indicated by numerous short ridgelike pustules.

SURFACE of valves marked by concentric lamellose lines of growth and stronger concentric folds or ridges, which are most distinct on the anterior end near the beaks, and become obsolescent on the central, posterior and basal portions. There is also an indistinct mesial rib, with bordering furrows extending from the beaks to the basal margin, a little posterior to the middle, and causing a slight protrusion of the margin of the valve. The rib is moderately distinct on the umbonal region, but generally becomes obsolete below the middle of the valve, and is represented only by the slight undulation of the concentric striæ.

This species is readily distinguished from any of its associated forms, by its subcircular outline, in which character it seldom varies materially (sometimes appearing slightly elliptical); but the accompanying fold and furrow are generally present on the beaks, and serve to characterize it.

*Formations and localities.* In the Hamilton group in Schoharie and Madison counties; in the Chemung group at Nichols in Tioga county, near Waverly in Chautauque county, and at Bell's quarry near Cortland in Cortland county, N.Y.

## GRAMMYSIA ERECTA (n. s.).

SHELL of moderate size, erect, subtriangular in outline, with ventricose valves and large heavy prominent beaks which are strongly incurved; hinge-line very short; posterior end obliquely truncate; anterior end contracted below the beak, and broadly rounded. Basal line gently curved, a little constricted near the middle: umbonal slope somewhat angular and arcuate. Centre of valves marked by a distinct rib passing from beak to base.

SURFACE concentrically marked by numerous small angular ridges, which divide into fascicles on the body of the valve, and are bent forward and undulated in crossing the mesial fold, often forming round nodes on its crest. The concentric undulations are likewise sometimes abruptly bent upward so prominently just anterior to the rib, as to form a curved nodelike elevation. Lunule of moderate size; escutcheon distinct.

This species differs from any of those having mesial folds, in its erect form and triangular outline; and from *G. alveata*, in the possession of the fold and finer concentric ribs. The specimens are distorted and fragmentary, and therefore unsatisfactory.

*Formation and locality.* In the shales of the Hamilton group at Fultonham, Schoharie county, N.Y.

Among the outline figures of Mr. CONRAD, there is one without designation, marked as coming from Oneonta, which corresponds with the better specimens of this species in our collections.

## GRAMMYSIA ELLIPTICA (n. s.).

SHELL of medium size, transversely elliptical in outline, with compressed valves and strong incurved beaks which are flattened on the back: hinge-line short, strongly arcuate, bordered by a narrow deep escutcheon; anterior end narrow and short, having a moderate but deep and well-marked lunule beneath the beaks, below which the margin of the shell is sharply rounded into the basal line: posterior end prolonged, very oblique and narrowed, the extremity rounded into the base which is regularly and gently curved, except a very slight constriction and extension a little posterior to the middle of its length. The shell is marked by a distinct but not strong mesial fold on the left valve, and a corresponding shallow furrow on the right valve, which, crossing obliquely in a curved line from the beak, reaches the basal margin a little behind the middle of the valve, causing the slight protrusion and accompanying indentation of the border: umbonal ridge strong, subangular and curved upward in the middle, situated near the upper part of the valve, leaving but a narrow cardinal slope which is marked by a slight depressed line extending from the margin of the escutcheon just behind the beak, to the posterior border of the shell above the middle of the posterior slope, and giving a somewhat distinct lobation to the part immediately bordering the escutcheon.

There are numerous rather fine and closely arranged concentric furrows traversing the shell parallel to the margin of the valves, which are stronger on the anterior end, become divided into simple almost even striæ on the middle and posterior portions, and have a strong forward or downward direction where they cross the mesial furrow, and a slight backward curvature on the fold corresponding to the protrusion and indentation of the border. On the umbonal portions of the valves, the concentric striæ are stronger

than below, and have a somewhat nodose appearance where they cross the mesial rib, somewhat after the character of this portion of the shell of *G. bisulcata*. No fine radiating striæ have been detected on any of the individuals, but some of them show indications of having had a few broad faint radii on the posterior slope above the ridge.

This species is somewhat closely related to *G. circularis* of the Hamilton and Chemung groups, in its surface characters; but it is generally much more elliptical, the umbonal ridge is stronger and more angular, the valves more compressed, and the mesial fold is distinct on the left side; whereas the *G. circularis* has only a furrow on each valve.

*Formation and localities.* In the Chemung group at Phillipsburg in Alleghany county, and at M$^{c}$Cormick's quarry near Ithaca, N.Y.

The following species are all destitute of the oblique mesial fold or rib crossing the valves from beak to base, but have all the other characters of the genus as given by M. DE VERNEUIL.

## GRAMMYSIA PRÆCURSOR (n. s.).

SHELL small, transversely ovate, ventricose, once and a half as long as high: beaks small, moderately prominent and enrolled, situated near the anterior end; hinge-line straight; escutcheon and lunule distinct, the latter small: anterior end short, contracted and rounded; posterior end oblique, somewhat pointed below. Basal line moderately rounded, very slightly constricted anterior to the middle.

SURFACE of the valves marked by numerous concentric ridges which are sharp on the anterior end, becoming more distant and rounded toward the umbonal slope and partially obsolete near the posterior extremity, with occasionally interstitial ridges rising anterior to the middle of the valves. A shallow indistinct depression crosses the valve about one-third of its length from the anterior end.

*Formation and locality.* In the Schoharie grit at Schoharie, N.Y.

## GRAMMYSIA SECUNDA (n. s.).

SHELL transversely elliptical, nearly twice as long as high. Valves ventricose, with broad but not prominent beaks, which are situated near the anterior end; hinge-line straight, shorter than the shell below, the margin bordered by a narrow deep escutcheon: anterior end short, oblique above and rounded below. Basal margin slightly

rounded, constricted anterior to the middle, and curved upward near the posterior extremity to the postero-basal angle : posterior end obliquely truncate ; umbonal ridge well marked, angular in the upper part. Cardinal slope narrow, concave between the umbonal ridge and border, and marked by an intermediate ridge above the middle of its width.

SURFACE marked by strong distinct concentric ridges, which are angular anteriorly, but become broader and rounded as they approach the umbonal ridge, beyond which they are obsolete.

This species differs from the preceding (*G. præcursor*) in being less ventricose, in having stronger and less numerous concentric furrows, and in being more strongly sulcate; and from *G. alveata*, in the distinct umbonal ridge, and in having the concentric furrows obsolete on the posterior slope.

*Formation and locality.* In the Upper Helderberg limestones at Clarence-hollow, Erie county, N.Y.

## GRAMMYSIA ALVEATA (Conrad).

*Posidonia alveata :* CONRAD, An. Rept. Geol. Sur. N.Y. p. 53.

SHELL large, trapezoidal, subtriangular when compressed. Valves very ventricose, with a subangular slightly arcuate umbonal ridge : hinge-line short, not exceeding half the length of the shell below, bordered by a narrow but well-defined escutcheon posterior to the beaks ; lunule, in well-preserved specimens, large and distinct, often obscure ; beaks situated near the anterior end, prominent, inflated and closely incurved. Anterior end gradually sloping forward from beneath the beaks to the point of greatest length, and thence curving into the basal border, which is gently and almost evenly rounded to the posterior basal angle : posterior extremity obliquely truncate, the border straight from the extremity of the cardinal line to near the postero-basal angle ; ligament not prominent, but extending rather more than half the length of the posterior cardinal line.

SURFACE marked by several strong angular and distinct concentric folds, which are most plainly marked on the anterior portion of the shell, and become obsolete on the umbonal ridge. Cardinal slope smooth, or marked only by fine concentric lines of growth.

This species is readily distinguished from all others except *G. erecta*, by its elevated or erect form ; and from that species, by the absence of the oblique rib crossing the valves. The specimens are usually distorted from compression ; and when compressed vertically to the plane of the valve, they have somewhat the aspect of specimens of *G. arcuata*, but

can generally be distinguished in this condition by the absence of the concentric folds on the posterior slope, while in that species the folds extend more or less distinctly over that part of the shell.

*Formation and localities.* Abundant in the arenaceous shales of the Hamilton group in Schoharie and Otsego counties, and found in nearly all localities throughout Eastern and Central New-York, but seldom in the softer shales of the western part of the State.

## GRAMMYSIA ARCUATA (Conrad).

*Posidonia? arcuata* : CONRAD, An. Rept. Geol. Sur. N Y. p. 53. 1841.

SHELL transverse, broadly elliptical, once and a half to a little less than twice as long as high, strongly ventricose or inflated when not artificially compressed, with strong prominent and incurved beaks situated near the anterior end; hinge-line slightly arcuate, and margined by a narrow well-defined escutcheon extending the entire length of the cardinal line: lunule large, not well defined, but having the margins rounding into the anterior portion of the shell. Extremities rounded, the anterior one contracted below the beaks.

SURFACE of the valves ornamented by several strong rounded concentric folds, most of which commence at the anterior cardinal border within the limits of the lunule, and continues parallel with the margins of the valve, reaching the posterior cardinal border or the margin of the escutcheon : others originate between the primary ones, about one-third of the length of the shell from the anterior end, and continue to the posterior with the first. The body of the valves is sometimes marked by a broad shallow sinus or constriction, running obliquely from beak to base at about the anterior third; but this feature is frequently indistinct. There are also two or three obscure radii between the umbonal ridge and the cardinal border, but which are not always visible.

Mr. CONRAD says, in his description of this shell, that it "differs from the preceding (*G. alveata*) in having a rounded posterior margin, and the umbonal slope not angulated."

It further differs in its transversely elliptical form, but most conspicuously in having the concentric folds extending with nearly undiminished strength across the umbonal ridge, and nearly to the posterior cardinal depression; while in that species, they become obsolete on the umbonal slope.

*Formation and localities.* In the arenaceous shales of the Hamilton group in Schoharie county, and common in the softer shales in Western New-York. It has also been obtained from the soft shales of this group at Paterson's creek, Virginia.

## GRAMMYSIA GLOBOSA (n. s.).

SHELL below the medium generic size, subcircular or slightly ovate transversely, extremely ventricose or subglobose, with proportionally strong elevated incurved beaks situated nearest the anterior end: hinge-line short, straight or slightly arcuate, bordered by a narrow escutcheon; lunule obscure. Anterior end of the shell somewhat narrower than the posterior; both rounded, as also the base. Umbonal angle scarcely distinguishable from the general convexity of the valve.

SURFACE of the shell marked by strong rounded concentric ridges, some of which become duplicate a little anterior to the middle of the valve, the whole becoming indistinct posteriorly before reaching the cardinal border. No mesial furrow or constriction has been seen on any of the specimens examined.

This species differs from any other described, in its globose form. No specimens of large size have been observed, the largest individual measuring only one inch and three-tenths in its longest diameter.

*Formation and locality.* In the arenaceous shales of the Hamilton group in Schoharie county, N.Y.

## GRAMMYSIA LIRATA (n. s.).

SHELL below the medium size, broadly subovate or trapezoidal, with broad prominent appressed beaks which are rather closely incurved, the height of the shell being three-fourths or more than three-fourths as great as the extreme length. Cardinal line short, slightly arcuate, the edges strongly inflected, forming a narrow moderately deep escutcheon which extends to the extremity of the hinge-line; posterior umbonal slope or area constricted near the middle of its width, leaving a prominent lobe bordering the escutcheon: anterior end short when not produced by distortion, and having a large scarcely defined lunule beneath the beaks. Basal line gently curved, becoming a little more abrupt towards the anterior end; posterior end obliquely truncate from the extremity of the hinge-line to the narrowly rounded postero-basal angle: posterior umbonal ridge well marked but not distinctly angular, straight or but slightly curved, which, together with the obliquely truncated posterior margin, gives a somewhat cuneate aspect to the shell. Body of the shell, when in its normal condition, somewhat flattened from the posterior umbonal ridge to near the anterior end.

SURFACE of the valves marked by numerous deep somewhat irregular concentric furrows, which vary much in strength on different individuals and on different parts of the same shell; being always stronger on the anterior and middle portions, and becoming obsolete on the umbonal ridge, posterior part of the shell, and within the limits of the lunule. The posterior slope, on some well-preserved specimens, shows evidence of having been marked by several indistinct radiating lines.

This species is perhaps subject to a greater variety of form, from compression, than any other of the group. When occurring in what appears to be its normal form, the shell is much the longer on the posterior end; but many of the individuals in the collection have been so distorted as to leave this part of the shell not more than half as long as the anterior end. The same degree of distortion is liable to occur in the height or depth of the valves, so as to produce an almost endless variety of form. In its general form and features, it closely resembles *G. alveata*, and has usually been regarded as a small form of that species; but the transverse furrows are more numerous, always more or less broken and irregular, and frequently pass over the umbonal ridge on to the posterior slope, while in that species they never cross the ridge.

*Formation and locality.* In the arenaceous beds of the Hamilton group south of Fultonham, Schoharie county, N.Y.

## GRAMMYSIA (LEPTODOMUS?) CONSTRICTA (n. s.).

SHELL small, very transverse, broadest anteriorly, subcuneate and compressed behind, with a strong mesial constriction crossing the valves obliquely from beak to base, which it reaches at about the anterior third of the length. Beaks strong, incurved, elevated above the hinge, situated very far anteriorly: hinge-line straight, the margins strongly inflected, forming a narrow, deep, escutcheon; lunule large, deeply depressed, its margins somewhat angular. Anterior extremity oblique from the beak to below the middle of the valve, and rounding below into the basal line: posterior extremity narrowly rounded, longest above the middle of its breadth. Basal line strongly constricted by the oblique groove which crosses the valves.

SURFACE of the valves marked by comparatively strong concentric furrows, most distinctly marked on the anterior portion and sometimes well pronounced behind, but usually obscured, and not unfrequently becoming obsolete before reaching the posterior slope: when continuous, they are strongly recurved after crossing the

position of the posterior ridge. Some individuals show smaller and somewhat regular concentric striæ between the stronger folds. There are also fine radiating striæ crossing nearly all parts of the valve, except on the lunule and posterior slope above the umbonal ridge. These striæ, on some specimens, are continuous, and on others are composed of lines of small nodes : they also vary much in their relative distance, some being closely arranged, and others quite distant, the lines of nodes appearing as distinct isolated pustules. On specimens from the arenaceous shales, the radiating striæ are frequently obscure, especially on the anterior portions of the valve ; and occasionally an individual occurs, on which the striæ are entirely obsolete.

This species is easily distinguished from any other of the New-York forms from the Hamilton group, by the strong mesial constriction ; but from the Chemung form referred to *G. hannibalensis* of the Choteau limestones and the Yellow sandstones of Burlington (Iowa), it is not so readily distinguished. This one is, however, usually narrower, more compressed, and more cuneate posteriorly than that form ; and the presence of the radiating striæ, when they can be detected, will serve as a distinguishing feature.

*Formation and localities.* In the arenaceous beds of the Hamilton group near Fultonham and other parts of Schoharie county, and in the soft shales of the formation on the shores of Cayuga and Canandaigua lakes, N.Y.

## GRAMMYSIA PARALLELA ( n. s.).

SHELL small, transverse, twice as long as high. Cardinal and basal margins parallel, the latter with a very slight constriction anterior to the middle : beaks strong, extending above the hinge, incurved, situated near the anterior end. Cardinal line shorter than the shell below, and straight, its margin inflected, forming a narrow escutcheon : anterior end short, the greatest extension near the base ; posterior end oblique or obliquely rounded. Umbonal ridge not prominent, but often appearing angular from compression.

SURFACE marked by numerous concentric wrinkles, strongest on the anterior end, and becoming faint or obsolete on the umbonal ridge and above; leaving the umbonal slope destitute of markings, except faint lamellose lines of growth.

This species is the smallest one yet noticed, the largest specimen measuring only about three-fourths of an inch. It may be readily distinguished from any of the other forms, by the parallel margins and its small size.

*Formation and locality.* In the soft shales of the Hamilton group on Skaneateles lake, N.Y.

## GRAMMYSIA OBSOLETA (n. s.).

SHELL moderately large transversely, oval or rounded and ventricose, with strong tumid and closely enrolled beaks. Hinge-line proportionately long, straight or but slightly curved, bordered by a narrow but well-defined escutcheon; with sometimes a distinct rounded ridge a little below on the posterior cardinal slope, extending from near the beaks to the posterior margin of the shell, forming a somewhat distinct posterior cardinal lobe : posterior extremity rounded, the point of greatest length usually above the middle of the valve. Basal border rounded or nearly straight, and occasionally slightly sinuate near to or anterior to the middle of its length. Anterior end short, with a large but not distinctly limited lunule; below which there is a concave depression extending along the ridge of the beak, and gradually widening to the margin of the valve.

SURFACE of valves evenly convex, and marked by regular concentric lines of growth which sometimes form fascicles or irregular undulations. Upon the posterior slope of some specimens from the soft shales of the Hamilton group, there are fine distant threadlike radiating lines visible to the naked eye, and which, under a magnifier, prove to be composed of rows of minute pustules. This feature is seldom seen on specimens from the arenaceous beds of the group. No evidence of oblique mesial fold or constriction has been detected on any specimens referred to this species.

The general form and proportions of some individuals of this species are so nearly like those of many individuals of *G. bisulcata*, that they have been referred to that species without hesitation, under the belief that they were individuals on which the fold and characters of the concentric undulations were obsolete from accident or variation; but on comparing a large number of specimens of both forms, and noting these varieties, it is evident that they are distinct and somewhat widely separated species. In addition to the absence of the oblique fold and strong characters of the concentric undulations in the characteristic specimens of that species, these are shorter and rounder, more evenly ventricose, and never have the lunule well defined. The *G. bisulcata* never possesses the gradually widening anterior depression beneath the lunule, and the point of greatest extension of the posterior extremity is usually much below the centre, while it is always above the centre of the valve on this one.

There are many features about this shell which ally it strongly with DE KONINCK's Genus EDMONDIA; but the presence of an escutcheon and exterior ligament, together with the features of the hinge, which are precisely like those of other species of GRAMMYSIA, would separate it from that genus.

*Formation and localities.* In the arenaceous layers of the Hamilton group in Schoharie, Madison and Onondaga counties, and in the soft shales of the group on the shores of Seneca and Cayuga lakes, and also near Bellona and Moscow, N.Y.

## GRAMMYSIA SUBARCUATA (n. s.).

SHELL of medium size, transversely elongate and ovate, widest at the posterior end : beaks strong, not prominent, even with the anterior extremity. Valves most ventricose anterior to the middle, and compressed behind : hinge-line short, straight, margined by a narrow depression; ligament short, less than half the length of the cardinal line; posterior end obliquely rounded above the middle, and receding to the basal border below; anterior extremity short, nearly vertical, with a distinct well-defined lunule. Basal line curved, slightly constricted at the anterior third of its length by a mesial furrow, which crosses the valve obliquely from the beak to this point : umbonal ridge rounded, not very distinctly marked.

SURFACE of valves marked by strong concentric ferrows, which are strongest and sometimes angular on the anterior end, becoming broader, rounded and fainter on the umbonal ridge and obsolete about midway between the ridge and the cardinal line, at which point there is a rather broad and distinct ridge passing from near the beak to the posterior margin of the shell, and above which the surface is smooth, or marked only by fine even concentric lines of growth. The posterior slope of some of the smaller well-preserved individuals is marked with fine radiating striæ, but they have not been detected on the body of any of the larger specimens.

This species somewhat closely resembles *G. arcuata* of the Hamilton group, but differs materially in being widest at the posterior end, while in that species it is the reverse : it also differs in being more or less pointed behind, and in not having the concentric furrows pass upward to the cardinal line as in that one.

*Formation and localities.* In the arenaceous layers of the Chemung group at Ithaca, near Elmira, and near Chemung in Chemung county, N.Y.

## GRAMMYSIA HANNIBALENSIS.

*Allorisma hannibalensis* : SHUMARD, Rept. Missouri Geol. Sur. Vol. I, part ii, p. 206, pl. c, f. 19.

SHELL small, transversely oval or ovate, with ventricose valves and strong prominent tumid beaks situated near the anterior end, and marked by a more or less strongly impressed mesial furrow passing obliquely from beak to base, anterior to the middle of its length : hinge-line comparatively long and straight, bordered by a narrow escutcheon ; posterior end rounded, narrower than the anterior. Basal border curved upward at the extremities, and constricted anterior to the middle : anterior extremity obliquely rounded, longest below the middle of the valve. Umbonal ridge rounded or subangular, not always well defined : posterior end somewhat compressed laterally ; middle and anterior portions more strongly inflated.

SURFACE of valves marked by a few strong, generally rounded, concentric furrows, which are strongest on the anterior portions, becoming fainter and often obsolete near the posterior end and above the umbonal slope. There are occasionally specimens on which the posterior slope is marked by one or more curved obscurely developed radii, passing from behind the beak to the posterior border; but this feature is by no means a constant one.

In general form, this species is extremely variable; so much so, that there is scarcely a single feature that does not undergo modifications among those from the same locality. The gibbosity of the valves and the height of the beaks, the depth of the furrow or the strength of the concentric folds, are all subject to change. In some individuals the hinge-line is straight; in others, the posterior end is curved upward, giving an undue width to this part; while in yet others it slopes downward to such a degree as to contract the posterior extremity, giving it quite a cuneate form.

This species has usually been considered as belonging to the Genus ALLORISMA ; but, so far as I can determine from specimens in the collection, as well as from analogy with other associated forms, the parallel line is not sinuate as in that genus. Though not having been able to entirely satisfy myself on this point, I prefer to place it in this association for the present.

*Formations and localities.* In the Chemung group at New-Albion and Olean in Cattaraugus county, and at Fortville and Little-Genesee in Allegany county (New York) ; at Meadville in Pennsylvania, and at Cuyahoga falls in Ohio. In the Yellow sandstone of Burlington in Iowa, and in the Lithographic limestone at Hannibal in Missouri.

## GENUS PHOLADELLA (HALL, n. g).

Equivalve, inequilateral, transversely elongated shells, with more or less inflated valves, and strong, somewhat tumid incurved beaks situated near the anterior end. Valves crossed by a more or less distinct antero-mesial sinus constricting the basal margins, and also by a somewhat prominent umbonal ridge. Cardinal margin inflected, forming a more or less distinctly defined escutcheon and anterior lunette. Hinge characters and muscular impressions unknown; ligament external? Surface ornamented by oblique radiating ribs or striæ, which are mostly confined between the anterior prominence and the posterior umbonal ridge; while the anterior end, and sometimes the posterior cardinal slope are without radii.

The shells for which the above generic name is proposed have somewhat the external form and appearance of those of the recent Genus PHOLAS, as well as their peculiar surface characters. The specimens are in such a condition that their entire characters cannot be ascertained: they are, however, sufficiently distinct externally from any described genus, to warrant separation on external characters alone. They appear to have possessed an external ligament, but it has been broken, as the shells are usually found as separated valves, although sometimes occurring in juxtaposition. The valves may have been slightly gaping posteriorly, though we have not satisfactory evidence of the fact.

*P. radiata* (CONRAD), from the Hamilton group of New York, and *P. newberryi* from the Waverly sandstones of Licking county, Ohio, may be considered as types of the genus.

### PHOLADELLA RADIATA (Conrad).

*Nuculites radiata:* CONRAD, Jour. A. N. S. Ph. Vol. viii, p. 248, pl. 12, f. 16. 1842.

SHELL transversely elongate, sub-rhomboidal or elongate ovate. Valves ventricose, with strong tumid beaks, which are situated at about the anterior fifth of the entire length: hinge-line from the beaks posteriorly, about half as long as the shell, the margins inflected; escutcheon narrow; lunule large and broad. Basal line arcuate, strongly curving upwards near the posterior extremity, and constricted just anterior to the middle by the broad, shallow, sometimes undefined sinus; anterior end obtusely rounded, longest below the middle of the shell; posterior end very obliquely truncate. Umbonal ridge strongly marked; cardinal slope slightly concave.

SURFACE marked by strong concentric undulations, and, on the body of the shell and cardinal slope, by distinct, somewhat prominent, moderately distant radii, while the anterior end, for a short distance, is marked only by the concentric lines.

This shell is somewhat variable in the strength of the radii, and the definition of the oblique submesial sinus.

*Formation and localities.* In the shales of the Hamilton group, in Schoharie county, and near Fabius and other places in Onondaga county, N.Y.

## PHOLADELLA TRUNCATA (n. s.).

SHELL of moderate size; trapezoid or subtriangular in outline, the posterior end obliquely truncated, giving a rectilinear cardinal slope like that of CONOCARDIUM; beaks subanterior, closely incurved; anterior end short and rounded; basal margin gently arched with a slight antero-mesial constriction caused by a shallow oblique sinus which crosses the valve; umbonal angle salient; hinge-line very short, bordered by a small escutcheon and lunule.

SURFACE marked by fine strong concentric striæ, which appear to have been elevated or lamellose, especially on the anterior and posterior ends; there are likewise fine distinct threadlike radiating striæ on the body of the shell, commencing near the antero-mesial depression and increasing in strength and distance to the umbonal ridge, giving a finely cancellate surface to those parts of the shell where both sets of striæ exist.

This species differs from all the other species of the genus here described by the truncation of the posterior end of the valves. It is possible that it may prove not strictly belonging to the genus, though it apparently possesses all the essential generic characters; the sharply carinate umbonal ridge being the only feature which gives it a different aspect.

*Formation and localities.* In the Hamilton group at Delphi Falls, Onondaga county, and on the shores of Cayuga lake, New-York.

## PHOLADELLA ORNATA (n. s.)

SHELL below medium size, valves moderately convex, beaks prominent, with a somewhat angular umbonal ridge and concave cardinal slope. Cardinal line concave, with inflected margins; anterior end short, rounded, or obtusely pointed. Basal margin abruptly curving upwards near the extremities, and slightly constricted near the

middle; posterior end oblique, or at right angles to the extremity of the cardinal line. Valves very slightly constricted from beak to base.

SURFACE ornamented by strong concentric undulations, and by radiating lines, from the anterior side of the submesial sinus to the umbonal ridge. The radii are clear and well defined, the spaces between them flattened and much wider than the rays : cardinal slope and anterior prominence without radii.

This species differs from *P. radiata* of the Hamilton group, which it closely resembles in size and general appearance, in being more elongate posteriorly, in the concave cardinal slope, which is destitute of radii, and in having a much larger proportion of the anterior end also without the radii : the shell is likewise much more recurved. In the surface characters it closely resembles *P. newberryi*, but is not so ventricose, and the umbonal ridge is angular with a concave cardinal slope.

*Formation and locality.* In the Chemung group at the Inclined Plane, Ithaca, New-York.

## PHOLADELLA NEWBERRYI (n. s.).

SHELL large, transversely subovate, with ventricose valves and broad tumid umbones which project considerably above the cardinal line, and are situated just within the anterior third of the length; posterior half of the shell gently curving upwards. Cardinal line slightly concave behind the beaks, the margins scarcely or but very slightly inflected; posterior end obliquely truncate, the margin a little rounded; anterior end obtusely pointed, gradually declining from the beaks to the point of greatest extension, and rounded below into the basal line, which is curved upwards at the extremities and sinuate a little anterior to the middle; umbonal slope prominent, rounded or subangular in its posterior extension. Valves crossed obliquely by a broad shallow undefined sinus just anterior to the middle.

SURFACE marked by rather strong concentric undulations of growth, and also by strong, equal, distinct radii crossing obliquely from the beaks to the basal margin, and extending from the anterior portion of the sinus to the posterior umbonal slope, while the anterior end and the cardinal slope are marked only by the concentric lines.

This species differs from *P. radiata*, in being a much larger shell, in being more recurved posteriorly, in having no radii on the cardinal slope and also a greater anterior space without them, and in the greater ventricosity of the valves.

*Formation and locality.* In the Waverly sandstones of Licking county, Ohio.

### PHOLADELLA CUNEATA (n. s.).

SHELL of moderate size, sharply cuneiform. Cardinal and basal margins nearly straight, and rapidly converging posteriorly; anterior extremity obliquely truncate, rapidly declining from the beaks for nearly two-thirds the width of the shell, and abruptly rounding below into the basal line. Beaks small, projecting but little above the cardinal margin; escutcheon and lunule indistinct; posterior umbonal ridge rounded: cardinal slope very narrow, convex; anterior slope abrupt, giving an angular anterior umbonal ridge.

SURFACE marked by numerous distinctly defined, equidistant, concentric ridges, which are strongest and sharply recurved in crossing the posterior umbonal ridge, and become obsolete before reaching the cardinal angle; also by equally strong radiating lines, which cancellate and form small nodes in crossing the concentric ridges.

This species differs from the preceding forms in its strongly cuneate posterior extension, small beaks, want of antero-mesial constriction, and in the cancellation of the surface. There may be some doubt of its true generic affinity with the preceding species; but in general appearance and surface characters, it approaches them so closely, that in the absence of other information it is referred with doubt to the above genus.

*Formation and locality.* In the Yellow sandstones at Burlington Iowa.

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## GENUS CIMITARIA.

SHELLS bivalve, equivalve, inequilateral, transversely elongated, and more or less recurved with depressed convex valves, which have an antero-mesial constriction, slightly angular umbonal, and somewhat prominent incurved subanterior beaks; cardinal line recurved, bordered by a narrow escutcheon and lunette; posterior end truncate and usually nearly rectangular to the posterior part of the cardinal line.

SURFACE marked by moderately strong irregular concentric undulations on the anterior end, which extend to the umbonal ridge and sometimes continue vertically across the cardinal slope. Some species are likewise marked by fine radiating lines of pustules on

the body of the shell. Cardinal slope often marked by one or more radiating ridges; valves united by an external ligament. Hinge-teeth and muscular impressions undetermined.

This genus is allied to SANGUINOLITES, PHOLADELLA and somewhat to ORTHONOTA in its general appearance. From SANGUINOLITES it differs in its recurved form and concave hinge-line; from PHOLADELLA in the want of the peculiar radiating lines on the body of the shell and character of the cardinal slope, abrupt truncation of the posterior end and recurving of the shell. From ORTHONOTA it differs in having the hinge-line bent beneath the beaks and declining toward the anterior end, and in the presence of antero-mesial constriction, escutcheon and lunule.

Although desirous of placing these shells under some previously established genus, or under one of those already proposed, they are found to possess certain characters which preclude them from any genus with which we are acquainted. The three species having similar characters are therefore united under a distinct generic designation, as *Cimitaria corrugata*, *C. recurva* and *C. elongata*, all belonging to the Hamilton group, and described by Mr. CONRAD under the Genus CYPRICARDITES.

## CIMITARIA CORRUGATA (Conrad).

*Cypricardites corrugata*: CONRAD, Journal Acad. Nat. Sciences, Philadelphia, 1st. series Vol. viii, p. 244, pl. 13, f. 6.

SHELL extremely elongated posteriorly and moderately recurved, with subparallel cardinal and basal margins; valves compressed posteriorly, more convex anteriorly, and somewhat inflated in front of the antero-mesial depression; beaks subanterior, rather large, prominent and incurved; cardinal line concave or rising towards the posterior extremity; escutcheon short and narrow; lunule proportionally long, narrow and sharply defined, extending to the anterior extremity, below which the outline is abruptly declining or rounded to the basal margin; basal line strongly impressed by the antero-mesial sinus and curved upwards behind for more than one-third the length of the valve; posterior end squarely truncate.

SURFACE of the shell marked by moderately strong irregular concentric undulations, which are broken up and sometimes contorted so as to present a rugose appearance. These undulations are usually much stronger on the anterior portion of the shell, but sometimes equally strong on all parts anterior to the umbonal ridge, where they are usually interrupted or become obscure; when continuous however, they are abruptly bent upwards and cross the cardinal slope rectangularly to the hinge-line, but are much fainter on that part of the shell. The umbonal ridge is

marked by a distinct rounded rib which increases in width with the growth of the shell; there are three undefined ridges traversing the cardinal slope which are often very faint or sometimes obsolete. The anterior end of the shell is sometimes covered with fine pustulose markings, but this feature is not always visible even by aid of a lens.

In some of its phases this species bears much resemblance in general aspect to the straighter forms of *C. recurva*, but it is never so much recurved, while the concentric undulations are more defined, and the umbonal ridge is much more direct and prominent. The shell sometimes attains a length of four inches or more.

*Formation and localities.* In the Hamilton group near Summit and Fultonham, Schoharie county, and on the shores of Canandaigua lake and other places in New-York. Mr. CONRAD cites the species from near Smyrna, Chenango county.

## CIMITARIA RECURVA (Conrad).

*Cypricardites recurva :* CONRAD, Jour. Acad. Nat. Sci., Philadelphia, Vol. viii, p. 245, pl. 13, f. 18. 1842.

*Pterinea punctulata :* CONRAD, Ann. Rept. Geol. Sur. N.York. p. 116. 1838.

*Cypricardites recurva :* VANUXEM, Geol. Rept. 3d Dist. New York, p. 152–3: 1842.

SHELL very transverse, elongated posteriorly, and recurved: cardinal and basal margins subparallel. Valves compressed, with strong broad and somewhat flattened beaks which project considerably above the cardinal line, and are situated very near the anterior end: umbonal slope usually strong, subangular and reflected, although sometimes low and indistinct; anterior portion of the valves crossed a little obliquely by a distinct and well-marked sinus. Cardinal line concave, extending nearly to the extremity of the shell; the borders but slightly deflected in the posterior part, but more distinctly so near and between the beaks, forming a broad escutcheon; lunule distinct, with angular margins. Posterior extremity truncated nearly at right angles to the cardinal line, its border a little rounded at the cardinal and basal angles; anterior end short, obtusely rounded. Basal line arcuate, with a constriction at the junction of the oblique sinus which crosses the valves.

SURFACE of valves marked by distinct and sometimes strong concentric undulations of growth which are strongest on the anterior portions, and also by distant radii on the cardinal slope. The entire surface is covered by elevated pustulose or granulose markings, arranged in radiating lines, from the beaks to the basal margin; the lines most defined on the anterior prominence.

This is a large and often much recurved form, one specimen measuring four and a half inches in length. Some individuals are but little, and others very much, recurved : they are also sometimes almost destitute of the radii on the posterior slope, and the fine pustules of the surface. The more strongly recurved forms have generally a more angular umbonal slope than the straighter ones.

The *Pterinea punctulata* of CONRAD (loc. cit.) is probably a specimen of this species, preserving the pustulose surface; while the specimen figured by VANUXEM is unusually recurved.

*Formation and localities.* This species occurs in the Hamilton group at many localities, but is more numerous and attains a larger size in Madison county than elsewhere observed.

## CIMITARIA ELONGATA (Conrad.)

*Cypricardites elongatus* : CONRAD, Ann. Rept. Geol. Sur. N.Y. 1841, p. 51.

"Subensiform, contracted from beak to base; concentric lines strong
" and irregular; anterior margin rounded, posterior margin
" obliquely truncated, slightly emarginate.
" *Locality*. Smyrna."

The shells of this species are much elongated posteriorly, with subparallel cardinal and basal margins. Valves depressed, soleniform, somewhat strongly constricted anterior to the middle, and marked by a rounded not well-defined umbonal ridge : beaks elevated above the cardinal line and incurved, situated near the anterior end. Cardinal line straight, or sometimes appearing very slightly concave, the margin inflected; anterior end oblique above and rounded below the extremity. Basal line rounded, strongly sinuate anterior to the middle, and directed upward to the angle formed by the umbonal ridge; posterior margin obliquely truncated : umbonal ridge angular in its upper part, and becoming less distinct and somewhat recurved in its extension toward the posterior extremity.

In most specimens, there is a second obscure ridge reaching the basal line about one-third the length of the shell from the posterior extremity.

SURFACE marked by irregular concentric lines of growth, and also by very fine and faintly marked radiating striæ upon the body of the shell, which are stronger in the sinus, and not observable on the anterior end or above the posterior ridge.

This shell differs from the *S. arcæformis*, in its more elongate form, stronger sinus, larger beak, and the form of the umbonal ridges and posterior extremity, which, if the lower or fainter ridge is considered as

being analogous to the lower one described in that species, would give a much greater extension to the intermediate space, thus prolonging the middle of the posterior margin of the shell. All the foregoing species are also much more angular than this one.

*Formation and locality.* In the arenaceous shales of the Hamilton group at Pratt's falls in Onondaga county, and also near Summit in Schoharie county, N.Y.

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## GENUS PHTHONIA (n. g.).

SHELLS thin, compressed, equivalve, transversely elongate-ovate, widening posteriorly and having small obscure subanterior beaks, and an obscure angular umbonal ridge. The surface is covered by more or less distinct radiating striæ or costæ, which are crossed and cancellated by finer concentric lines, often forming rugæ or node like markings on the rays. The shells appear to have been destitute of any teethlike processes on the hinge, but were united by a small elongated external ligament, which in one of the species reaches more than half the length of the cardinal line; the muscular scars have been small and superficial, and the pallial line apparently without sinus.

Externally these shells resemble the Genus PLEUROPHORUS King, but differ in having the entire shell ribbed, and otherwise in the absence of hinge teeth.

Only two species are yet known, both being from the Hamilton group of New-York. They differ from PHOLADELLA in not having the cardinal border inflected to form an escutcheon and lunule, and also in the form and strength of the umbonal ridge, as well as in having the entire surface marked with radii.

### PHTHONIA SECTIFRONS.

*Cypricardites sectifrons.* CONRAD, Jour. Acad. Nat. Sci. Philadelphia, Vol. viii. p. 245, pl. 13, f. 8.

"Subovate, compressed, with fine obsolete radiating lines; hinge
" margin elevated, straight; anterior side with an oblique narrow
" groove or fold; posterior margin obliquely truncated above, the
" extremity rounded; basal margin straight in the middle;
" umbonal slope with a rather wide obsolete furrow extending the
" whole length."

"*Locality.* Cazenovia, Madison county, New-York. Upper Silurian shale."

SHELL transversely elongate, ovate or subquadrangular, more than twice as long as high and widening posteriorly, with moderately convex valves, and small compressed beaks situated near the anterior end; umbonal ridge scarcely defined, not angular; hinge-line straight, or very slightly arcuate; more than half the length of the shell; anterior end very short, abruptly rounded, and longest above the middle of the valve, basal line slightly convex, except anteriorly where it is more strongly curved upward to the anterior extremity; posterior end rounded below and obliquely receding above to the extremity of the hinge-line; cardinal slope a little concave, and sometimes having an indistinct ridge near the middle of its width.

SURFACE marked by fine concentric striæ and also by fine radiating threadlike lines, a few of which on the anterior end are rather distant and curved, but becoming gradually more closely arranged to near the middle of the valve, and thence increasing in distance to the umbonal ridge.

On one individual of this species the form of the ligament is preserved for much of its length, showing that it has extended for more than half the length of the cardinal line, and has been elevated considerably above the line of the shell, and rounded on the back.

*Formation and localities.* In the arenaceous shales of the Hamilton group in Madison county, and one individual has been found in the soft shales of the formation on the shores of Canandaigua lake, N.Y.

## PHTHONIA NODICOSTATA (n. s.).

SHEEL transversely elongate, ovate, with cardinal and basal margins subparallel, or gradually diverging posteriorly; valves very moderately convex, most prominent along the umbonal ridge which is scarcely, or but slightly angular, except near the upper part; beaks subanterior, very small and flattened on the back; cardinal line nearly straight; elevated posteriorly and a little more than half as long as the length of the shell; anterior end short, obliquely declining from the beaks to below the middle of the valve, and rounded into the basal line, which is nearly straight or but slightly curved, except at the extremities, where it is abruptly rounded upwards; posterior end rounded below, and rapidly receding above to the extremity of the cardinal line; cardinal slope gently convex.

SURFACE marked by strong radiating costa, which are more distant on the anterior end and cardinal slope, and more crowded about

the middle of the valve, and also by finer, more closely arranged, equidistant, concentric striæ, which cross and form small transverse ridges or nodes on the radiating costæ.

This species differs from *P. sectifrons* principally in the strong costæ which are distinctly nodose, and which number on a full grown shell usually from twenty-three to thirty, while on the other species there are from eighty-five to more than one hundred.

There is, in the collection from the higher beds of the Hamilton group at Oneonta, Otsego county, a single individual which is of a more regularly ovate form, rather more convex, and having about forty costæ. It is referred with some doubt to this species, but may on the examination of other specimens prove to be distinct.

*Formation and locality.* In the soft shales of the Hamilton group on Cayuga and Canandaigua lakes, New-York.

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## GENUS MODIOMORPHA (n. g.).

SHELLS equivalve, very inequilateral, compressed, subovate in outline, largest posteriorly : beaks small, compressed, usually situated within the anterior third of the length. Surface of shell marked by rugose or undulating concentric striæ, which usually coalesce or become fasciculate toward the anterior end. The valves are crossed obliquely by a more or less distinctly defined sinus passing from the beak to base, and constricting the basal margin : the anterior end is rounded, forming a projecting lobe of greater or less extent beyond the beak. Hinge characterized by a single strong wedgeform tooth in the left valve, and a corresponding cavity in the right : no lateral teeth exist. Anterior muscular impression subcircular, situated within the anterior extension of the shell : posterior impression large and superficial, situated near the cardinal border; pallial line entire. Ligament external, attached to the thickened margin of the shell.

The shells for which the above generic name is proposed have been referred to the Genera MODIOLA, MODIOLOPSIS and CYPRICARDITES, to the two former of which they bear considerable external resemblance; but they differ from the first in the toothed hinge, and in the muscular system. From MODIOLOPSIS, they differ materially in having no lateral teeth; and with true CYPRICARDITES, they have no essential features in common. In the characters of the hinge and arrangement of the muscular system, they appear to be precisely similar to MYOCONCHA, according to SOWERBY's description; but the figure on plate 467 M. C. Vol. v, has the tooth in the opposite valve. These forms

differ, however, in not having a terminal beak as in that genus, which feature gives a very different outline to the anterior portions of the shell.

The *Pterinea concentrica* (CONRAD) = *Cypricardites concentrica* (CONRAD) = *Modiola concentrica* (HALL), may be considered as a typical form of the genus.

## MODIOMORPHA COMPLANATA (n. s.).

SHELL large, broadly subovate, about once and a half as long as wide, very depressed convex : beaks of very moderate size, sub-anterior. Cardinal line slightly arcuate, gradually rising from the beaks posteriorly for about one-half the length of the shell, and rounding into the postero-cardinal border; anterior end short, scarcely projecting beyond the beaks, and rounded below. Basal line strongly arcuate posteriorly, and a little sinuate near the anterior end; posterior extremity very obtusely rounded. Anterior muscular scar large, ovate, strongly marked and situated close to the anterior end : posterior scar large, irregularly ovate, distinctly marked and roughened, situated about half its breadth from the cardinal line and a little more than one-third the length of the shell from the posterior end. Pallial line rather strongly marked, distant from the shell margin, extending posteriorly a little beyond the postero-muscular scar, and recurved to unite with its posterior border.

SURFACE of the valve not known, but, judging from the appearance of the cast, it has been marked by strong concentric undulations of growth.

Only a single individual of this species has been obtained; but its large size and peculiar characters are sufficient to distinguish it from *M. macilenta* of the Hamilton group, with which it is most nearly related. The specimen measures about four and a half inches in length, by three inches in its greatest width.

*Formation and locality.* In limestone of the age of the Upper Helderberg group of New-York, six miles northwest of Delaware, Ohio. From the Rev. Mr. HERZER.

## MODIOMORPHA CONCENTRICA (Conrad).

*Pterinea concentrica :* CONRAD, An. Rept. Geol. Sur. N.Y. p. 116. 1838.
*Cypricardites concentrica :* CONRAD, An. Rept. Geol. Sur. N.Y. p. 52. 1841.
*Modiola concentrica :* HALL, Geol. Rept. 4th Dist. p. 196, tab. 78, f. 9. 1843.
*Cypricardites oblonga :* CONRAD, An. Rept. Geol. Sur. N.Y. p. 52. 1841.

SHELL of medium size, very transverse, irregularly subovate in outline, with thin, rather compressed valves, most gibbous just behind

the beaks; narrowed in front and expanded behind; with a broad, shallow, rather undefined sinus passing obliquely across the valves from the beaks to the basal margin, anterior to the middle, and somewhat constricting the border of the valves. Beaks small, compressed near the anterior end, but never terminal: anterior end projecting beyond the beaks, in the form of a rounded lobe of varying extent. Hinge-line arcuate, becoming almost alate behind the middle of the valves; hinge-tooth strong, obtuse, with a corresponding cavity. Muscular impressions of moderate size, the anterior one somewhat strongly marked, situated in the anterior projecting lobe; the posterior one superficial; pallial line faintly marked.

SURFACE marked by distinct concentric lines, which are strongest and most prominent on the umbonal slope. Ligament small.

*Formation and localities.* This is a common species in the soft shales of the Hamilton group throughout the State, often presenting an indistinct and macerated appearance; but in the harder and more compact portions of the rock on the shores of Seneca and Cayuga lakes, it preserves the form and surface characters very beautifully. In the eastern part of the State the species is frequently found in the form of internal casts, showing the impression of the interior of the shell. The *Cypricardites oblonga* (CONRAD), as recognized from an outline figure made by the author many years ago, seems to have been only a very broad specimen of this species.

## MODIOMORPHA PLANULATA (n. s.)

SHELL large, with flattened or depressed convex valves which increase in width from the beaks to the posterior extremity of the hinge-line, and are rapidly narrowed and rounded at the anterior extremity, the greatest extension being below the middle of the valve; posterior end obliquely rounded, longest below the middle. Basal line slightly contracted anterior to the middle of the shell, by a broad shallow sinus which crosses the valves from this point to the beaks: hinge-line nearly straight behind the beaks, and about one-half as long as the entire length of the shell; beaks small, compressed, situated about one-fourth of the length of the shell from the anterior end.

SURFACE marked by numerous distinct but irregular concentric lines, which are usually strongest and somewhat fasciculate on the anterior part of the shell, but occasionally show strong undulations on the umbonal slope during the earlier stages of growth, which become obsolete in a more advanced age. The anterior muscular

impression is large and rather superficial; the pallial line, where visible, is somewhat broken into points, but not strongly marked: other internal characters not observed.

This species differs from *M. concentrica* in being more elongate, somewhat more extended anteriorly, and in being less elevated posteriorly: the hinge-line is proportionally longer; the concentric striæ are of quite a different character, and always become more or less obsolete in crossing the umbonal slope, while in that species they are strongest in those parts. It is also a larger, and usually a more flattened, shell.

*Formation and localities.* In the Hamilton group at several places in Schoharie county; at Hamilton in Madison county, and on the shores of Cayuga, Seneca and Canandaigua lakes, N.Y.

## MODIOMORPHA CYMBULA (n. s.).

SHELL transversely elliptical in outline, a little more than twice as long as wide, the cardinal border slightly more arcuate than the basal, the anterior and posterior ends somewhat pointed, with the greatest extension opposite the middle of the valve. Valves moderately convex, most ventricose just below the middle of the cardinal border: beaks small, situated at about the anterior fifth of the length of the shell, a slight constriction or sinus extending thence obliquely to the basal margin. Anterior adductor scar somewhat large, subcircular, situated very near the anterior end, with a small pedal scar on its dorsal margin: posterior adductor large and circular, situated just within the cardinal line, and more than one-third of the length of the shell from the posterior extremity; pallial line strongly marked, distant from the margin of the valve, extending behind and abruptly recurved to unite with the posterior muscular scar; hinge-tooth strong and broad, somewhat tuberculose.

SURFACE characters not determined.

This species has some resemblance to *M. concentrica*, differing principally in its elliptical form and obtusely pointed extremities, while the latter is broadly rounded posteriorly.

*Formation and locality.* In the coarsely arenaceous layers of the Hamilton group at East Worcester, Otsego county, N.Y.

## MODIOMORPHA ALTA (Conrad).

*Cypricardites alta*: CONRAD, An. Rept. Geol. Surv. N.Y. p. 52. 1841.

"Subovate, rounded and inflated over the umbonal slope; concentric "lines prominent, acute; disk slightly depressed from beak to

" base; posterior side dilated; margin truncated above, obtusely
" rounded inferiorly; basal margin oblique, slightly concave or
" contracted; hinge-margin elevated, slightly arched.
" *Locality.* Ogden's ferry."

SHELL very broadly subovate or sometimes almost subquadrangular, with the posterior cardinal extremity expanded, giving an additional height to the valve. Valves convex, most ventricose along the umbonal ridge, which is broad, rounded, and distinctly arched upward, slightly constricted just anterior to the middle by a broad shallow sinus : beaks subanterior, small, compressed; anterior margin concave above or gradually declining to the point of greatest length, considerably below the middle of the valve. Basal line abruptly rounded toward the extremities, and somewhat flattened or broadly sinuate in the middle; posterior end rounded, longest below the middle, and gradually curving into the cardinal line above. Cardinal line slightly arcuate, a little more than half as long as the shell : hinge-structure not ascertained; muscular scars and pallial line faintly marked.

SURFACE marked by numerous closely arranged threadlike concentric striæ, and often by strong folds or undulations on the umbonal ridge.

This species is distinguished by its broad form, short and rapidly declining anterior end, and by the peculiar surface striæ and undulations on the umbonal ridge, where the striæ are less prominent and sometimes obsolete. It has a length of two and one-half inches, and one and three-fourths inch in height, with varying proportions, and sometimes of larger size.

*Formation and localities.* In the shales of the Hamilton group in Madison and Onondaga counties, and at Ogden's or Kidder's ferry on Cayuga lake, New-York.

## MODIOMORPHA MACILENTA (n. s.).

SHELL large, depressed convex, somewhat regularly arcuate, but most prominent along the umbonal ridge which is low and rounded, broadly subovate in outline, wider posterior to the centre : beaks very small, compressed, scarcely rising above the cardinal line; hinge slightly arcuate, more than half the length of the shell; subalate posteriorly; anterior end short, rapidly declining from the beaks and rounded below to the basal line; posterior end oblique, longest and rounded at the postero-basal angle. Basal line nearly straight for more than half its length, not sinuate : ligament slender, extending to near the extremity of the hinge-line.

SURFACE marked by moderately strong even threadlike striæ, which are not crowded, and do not form undulations along the umbonal ridge.

This species is closely allied to *M. alta*, but attains a much larger size, is never so ventricose along the umbonal ridge, but evenly convex throughout; the striæ are more even, and do not form folds on the posterior portions of the shell as in that species. Shell four and a half inches in length by two and three-fourths inches wide.

*Formation and localities.* In the soft shales of the Hamilton group at North-Bristol in Ontario county, near Bellona in Yates county, and at York in Livingston county, New-York.

## MODIOMORPHA SUBALATA (Conrad).

*Cypricardites subalata* : CONRAD, Ann. Rept. Geol. Sur. New-York, p. 83. 1841.

SHELL small or of medium size, subquadrangular or irregularly subovate in outline, with moderately ventricose valves which are flattened in the middle and umbonal region, and having a distinctly angular umbonal ridge which becomes flattened or only subangular towards the posterior extremity : beaks small, broad, flattened on the back and incurved, situated near the anterior end, and slightly projecting above the cardinal line. Hinge-line straight or sometimes very slightly arcuate, two-thirds as long as the entire length of the shell; subalated posteriorly : anterior end gradually declining from the beak to below the middle of the valve, and rounded into the basal line, which is gently arcuate in the middle and more abruptly rounded toward the extremities; posterior end obliquely truncate, longest below, the margin gently rounded; cardinal slope wide, very slightly concave.

SURFACE marked by fine concentric striæ, which are crowded and fasciculate at the anterior end, and often become obsolete before reaching the umbonal ridge, which is crossed only by a few of the stronger furrows.

This species differs from any of the preceding ones, in the more nearly parallel cardinal and basal margins, in the angular umbonal ridge, more direct truncation of the posterior end, and the fading out of the surface striæ.

*Formation and localities.* In the shales of the Hamilton group at several localities in Onondaga county, at Castleton in Ontario county, Darien in Genesee county, and on the shores of Lake Erie, N.Y.

## MODIOMORPHA QUADRULA (n. s.).

SHELL small, quadrangular or rhomboidal in outline, varying from length and width nearly equal, to almost twice as long as wide.

Valves angularly ventricose, most prominent along the umbonal ridge : beaks small, projecting but little above the cardinal line and closely incurved, situated at about the anterior fourth of the length. Cardinal line straight, more than half as long as the shell; anterior end short, contracted beneath the beaks and rounded at the extremity, the greatest extension below the middle of the valve. Basal margin nearly straight except toward the extremities, where it is abruptly rounded upwards : posterior end obliquely truncate, receding from near the postero-basal angle to the extremity of the cardinal line; anterior muscular scar often distinct, subcircular; posterior scar superficial.

SURFACE marked by fine concentric lines of growth, and sometimes a few stronger undulations.

This is a small species of quadrangular form, but subject to much variation in its proportions, depending chiefly on the manner in which the lateral compression has been directed, whether in the line of the longitudinal or vertical axis of the shell; those lying in one direction on the surface of the shale being lengthened, and those at right angles being considerably widened and shortened.

This species differs from any of the foregoing in its small size, quadrangular form and high straight subangular umbonal ridge. The specimens, although imbedded in a fine micaceous sandy shale, have had their surface characters entirely destroyed by the deposition of sand, which has become incorporated with the shell, giving them a roughly granulose texture.

*Formation and locality.* In the micaceous sandy shales of the Chemung group at Phillipsburg, Alleghany county, New-York.

## MODIOMORPHA ? AMYGDALINA (Winchell).

*Sanguinolites amygdalinus* : WINCHELL, Proc. Acad. Nat. Sci. Philadelphia, p. 13. 1863.

SHELL elongate-ovate or elliptical in outline, gradually widening from the anterior end to a little beyond the middle of the valve : beaks small, near the anterior end. Hinge-line arcuate; posterior end rather sharply rounded, greatest extension above the middle of the valve; anterior end narrowly rounded, somewhat contracted near the beaks. Basal line nearly straight for about half the length, and rounded upward at the extremities. General surface of the valves flattened, or very slightly convex near the beaks and just below the cardinal border.

SURFACE marked by distinct concentric undulations of growth, which often form undulating folds on the posterior parts of the valves and near the cardinal line. Some of the specimens show evidence of having been marked with obscure radiating lines.

There is considerable variation among the individuals referred to this species, in the form and proportions of the posterior parts of the valves, much of which may be due to compression, being lengthened or shortened according to their manner of imbedding; while others have the umbonal ridge nearer or more distant from the cardinal border, by being flattened obliquely from above or below the centre. There are, however, no characters by which they can be separated into distinct species.

This shell is doubtfully referred to the Genus MODIOMORPHA, but is certainly not a SANGUINOLITES as we understand that genus.

The valves are a little expanded along the cardinal margin, as though it had possessed a smooth flattened hinge-plate or surface for the attachment of a ligament similar to that on *M. concentrica;* and a single individual shows indication of a small tooth below the beak, but our knowledge of the hinge characters is quite unsatisfactory.

*Formations and localities.* In the Hamilton group in Ontario county, and in the Chemung group near Port Crain in Broome county; at Phillipsburg and Rockville in Alleghany county, and near Elmira, N.Y. It likewise occurs in the Yellow sandstones of Burlington, Iowa.

## MODIOMORPHA HYALEA (n. s.).

SHELL transverse, narrowly ovate or flattened, ellipsoid in outline, about twice as long as wide. Valves moderately and evenly convex, not marked by a mesial sinus: broad incurved beaks, situated at about one-fourth of the length from the anterior end. Cardinal line slightly arcuate, more than half as long as the shell; anterior end rounded, a little contracted below the beaks; extremity rounded. Basal line flattened or but little curved for half its length, and rounded upward at the extremities; posterior end rounded, more rapidly receding above the middle of the valve to the extremity of the hinge-line. Umbonal ridge sometimes visible, situated on the upper part of the valve, and leaving a very narrow cardinal slope. SURFACE marked by closely arranged concentric lines, with occasional stronger undulations which are most frequent on the umbonal region. Some of the specimens show evidence of having had fine radiating striæ; though whether it has been an external feature, or due only to a certain condition of exfoliation, can not be satisfactorily determined.

This species differs from any of those preceding, in its flattened ellipsoid outline, giving a somewhat parallel direction to the cardinal and

basal margins for about half the length of the shell; length of the shell from two to three inches.

*Formation and locality.* In the Waverly sandstones of Licking county, Ohio.

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## GENUS TELLINOPSIS (n. g.).

SHELLS thin, fragile, of the general form of TELLINA, with moderately convex valves, small subcentral beaks, having their apices directed backwards with a shallow posterior furrow; hinge apparently edentulous; ligament external, small; muscular impression very faint, situated near the cardinal extremities; pallial line undetermined.

SURFACE smooth or obscurely marked by radiating striæ.

This generic name is proposed for a small group of shells of which the *Nuculites subemarginata* of CONRAD, may be considered a typical form. In general external features they resemble TELLINA; but from evidence derived from an examination of a large number of individuals, they appear to be destitute of hinge teeth, while the muscular impressions and pallial line are so indistinct that they cannot be fully determined. The ligament in *T. subemarginata* is very small and situated close to the beaks, on the posterior side of the shell; (which in most individuals is the shorter) and the beaks are directed backwards as in TELLINA. Shells of this form occurring in Palæozoic strata have usually been referred to SANGUINOLARIA, TELLINA, PSAMMOBIA, and other similar genera existing in the present seas. It is scarcely possible, however, that these shells could have possessed the hinge structure of those genera, without it having been detected in some of the many examples before us. In the "British Palæozoic Fossils," Prof. M$^{c}$Coy has described and figured an example under the name of *Tellinites affinis*, which apparently belongs to this genus.

### TELLINOPSIS SUBEMARGINATA (Conrad)

*Nuculites subemarginata*, CONRAD, Jour. Acad. Nat. Ph. Vol. viii, p. 249, pl. 15, f. 5.

SHELL transverse, subquadrangular, very thin, varying from once and a half to twice as long as wide; cardinal and basal margins subparallel; anterior end broadly rounded or subtruncate at the extremity; posterior cardinal line sloping gradually from the beaks to the extremity of the valve, which is emarginately truncate, a little longer above than below; basal line straight; beaks small and compressed, projecting but little above the hinge-line;

valves depressed convex in the middle; umbonal ridge rounded; a flattened posterior cardinal slope which is marked by a shallow distinct furrow passing from behind the beaks to the emargination just above the postero-basal angle. Ligament very small, situated close behind the beak and extending but a short distance along the cardinal line.

SURFACE marked by very fine concentric lines of growth which are sometimes crowded, forming stronger undulations; and also by fine radiating striæ which are distant from each other two or three times their own width, and most distinct on the posterior half of the shell or near the umbonal ridge. There are also radiating wrinkles seen on many of the shells, and more frequently on the anterior portions. These markings are irregular and unequal in size, and where present, increase in width with the growth of the shell.

*Formation and localities.* In the shales of the Hamilton group at Fultonham, Schoharie county, and on the shores of Skaneateles, Otisco, Cayuga, Seneca and Canandaigua lakes; at Smyrna, Chenango county, and in other places.

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## GENUS CYPRICARDINIA (HALL).

In the third volume of the Palæontology of New York, p. 266, the Genus CYPRICARDINIA is described, including a group of somewhat small shells which are usually quite ventricose when in their normal condition, and strongly marked by concentric ridges and furrows, parallel to the margin of the shell. For want of a knowledge of the internal characters, the genus was not fully characterised at that time. A further investigation of other species which may be regarded as characteristic forms, has revealed the following:

*Generic characters.* Shell very inequilateral, and inequivalved, the right valve being the most ventricose, and the beak projecting beyond that of the opposite valve, both valves marked by strong concentric furrows or varices; umbonal ridge prominent, that of the right valve strong and inflated, that of the left more compressed, and subangular; both valves usually crossed obliquely by a shallow sinus, passing from the umbones to near the middle of the basal margin; hinge-line straight or slightly curved with a single long ridge-like tooth in the left valve, extending along the hinge from behind the beaks; other characters of the hinge

unknown. There is apparently no posterior escutcheon, but an undefined anterior lunule exists beneath the beaks. The anterior muscular impression is small and situated near the margin of the extremity; the posterior scar is proportionally large and subreniform, placed a little below the cardinal border near the extremity of the hinge-line; pallial line entire, without sinus, distant from the margin of the shell; ligament not observed but believed to be internal, as there is no appearance of it externally, and the cast of the interior shows evidence of a cavity beneath the beak, as if caused by the removal of a projecting spoon-shaped process like that of PERIPLOMA; the shells indeed have much the appearance of a reversed form of that genus with strong concentric ridges.

In the *Synopsis of the Carboniferous Fossils of Ireland*, Prof. McCoy has described the Genus SEDGWICKIA, of which he says the shells are marked on the anterior half by strong concentric ridges, and the posterior half-smooth. The other characters given would agree very well with those of the present genus, but the shells, which properly belong to the genus CYPRICARDINIA, are all marked with concentric furrows passing entirely around the shell from the anterior to the posterior extremity, as shown in the figures of the typical species *C. lamellosa*, Pal. N. Y., Vol. iii, pl. 49 a. (fig. 1 c. should have shown the valves slightly unequal in convexity). Some of the species referred to the genus at the time it was first described are not generically identical with the typical form, but were so referred for want of a better place. It is now proposed to confine the name CYPRICARDINIA to those shells having the characters of *C. lamellosa*.

## CYPRICARDINIA PLANULATA.

*Pterinea planulata:* CONRAD, Jour. Acad. Nat. Sci. Ph., Vol. viii, p. 251, pl. 18, f. 15.

SHELL larger than the prevailing forms of the genus, obliquely subovate; strongly alated posteriorly; beaks anterior, almost terminal; hinge-line shorter than the shell; right valve moderately convex, with a prominent, rounded umbonal ridge; the surface between the ridge and the cardinal line abruptly depressed; a shallow furrow crosses the valve obliquely from the beak, reaching the basal border considerably anterior to the middle, and strongly constricting the margin; left valve flat or very slightly convex; scarcely depressed opposite the furrow of the right valve, the beak smaller than that of the opposite valve, and not projecting beyond

the hinge line; umbonal ridge not prominent but distinctly indicated by the undulations of the concentric ridges; anterior end of the shell oblique, prolonged below; posterior end obliquely truncate; constricted just above the termination of the umbonal ridge; extremely rounded; basal line projecting near the middle or just posterior to the constriction of the border by the oblique furrow; posterior muscular scar large, subreniform, situated below the extremity of the hinge; anterior scar small, marginal; pallial line distinct, pointed behind and recurved to reach the posterior adductor scar.

SURFACE marked by strong concentric rounded or subangular ridges, which are strongly undulated where they cross the depression above the umbonal ridge.

*Formation and localities.* In the Schoharie grit in Albany and Schoharie counties, New-York.

## CYPRICARDINIA INDENTA.

*Cypricardites indenta:* CONRAD, Jour. Acad. Nat. Sci. Ph., Vol. viii, p. 244, pl. 12, f. 12.
*Sanguinolites sulciferus:* WINCHELL, Proc. Acad. Nat. Sci. Ph., Vol. —, p. 14, 1863.

SHELL of medium size, transversely subovate, widest and subalate posteriorly; right valve highly convex or inflated, especially along the strongly rounded umbonal ridge, the posterior slope abruptly declining to the hinge line, and the body of the valve marked by an oblique depression crossing the valve and constricting the basal margin anterior to the middle; left valve about half as deep as the right with a more compressed beak, and smaller subangular umbonal ridge; the posterior slope abruptly depressed; beaks situated near the anterior extremity, small and incurved; anterior end very short, oblique and longest below; posterior end obliquely truncate, rounded at the postero-basal extremity; basal line constricted near the middle by the oblique sinus.

SURFACE marked by strong concentric ridges or varices, which are rounded on the outer margins and flattened above. These varices are very prominent along the umbonal ridge, and most distinct on the right valve. On specimens of the right valve where the shell is retained without exfoliation (a condition of rare occurrence), the surface is marked, especially along the umbonal prominence, by fine radiating striæ, interrupted at the junction of the varices. On the left valve there are sometimes remains of radiating corrugations, but no distinct radii have been observed.

This species is usually much smaller than *C. planulata;* it is also proportionally narrower and much more ventricose. There are, so far as our

collections at present show, no real specific differences between the specimens from the Hamilton group of New-York, and those from the Waverly sandstones of Ohio. R. P. W.

*Formations and localities.* In the Upper Helderberg limestone near Clarence-hollow, N. Y. A single left valve apparently of the same species has been seen among collections from Sandusky, Ohio. It is found in the Hamilton group on the shores of Seneca, Cayuga and Canandaigua lakes and numerous other localities in this State, and in Hardy county, Va It also occurs in the Waverly sandstones at Richfield, Summit county, and elsewhere in Ohio, and at Burlington, Iowa.

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## GENUS PALANATINA (n. g.).

SHELL transversely elongate, very inequilateral, inequivalve, and gaping at the extremities; left valve the larger, and most convex, with a subangular umbonal ridge, and a broad, shallow, antero-mesial constriction passing obliquely from beak to base; the beak small and prominent; right valve much less convex, with a smaller beak and faint umbonal ridge and sinus; valves united by a small external ligament; hinge without lateral teeth, but provided with a small hooklike process in each valve, just anterior to the beaks, which may have served the purpose of teeth, or more probably for the support of an internal cartilage; muscular impression very small and indistinct; the anterior scar rounded, situated just in front of the beak, and near the cardinal margin; the posterior scar somewhat larger, situated about one-third the distance from the beaks to the posterior extremity; pallial line not satisfactorily determined, but no evidence of a sinus has been detected.

SURFACE marked by fine concentric striæ.

The shells for which the above generic name is proposed have very much the appearance of a species of SOLECURTUS, except that they are inequivalve. Their affinities appear to be with ANATINA more nearly than with any other group; the gaping extremities and external, and probably internal, ligament, together with their inequal valves, would place them in that family, should the pallial line prove to be sinuate, though as yet we have no satisfactory evidence to that effect. A single species of the genus, only, is known at the present time, but its characters are so unlike those of any other shell from rocks of the same age, that it seems necessary to place it under a separate genus.

PALANATINA TYPA (n. s).

SHELL short, soleniform, inequivalve prolonged posteriorly, with parallel cardinal and basal margins, and rounded gaping extremities; hinge-line straight; beaks small, that of the left valve much more prominent than the other and situated at about the anterior third; left valve more ventricose than the right, with a somewhat strong, subangular, umbonal ridge, and a broad shallow sinus passing from beak to base; the cardinal slope having a comparatively strong constriction a little nearer the carninal line than the umbonal ridge, forming a lobe-like elevation above it; the same features are present on the right valve, but much less strongly marked; external ligament short and slender.

SURFACE marked only by fine concentric striæ, which occasionally form irregular undulations of growth.

*Formation and localities.* In a conglomerate and sandstone of the Chemung group, near the village of Portville, Cattaragus county, N. Y., and also less abundantly near the village of Ceres, McKean county, Pennsylvania.

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## GENUS ORTHONOTA (CONRAD).

*Orthonota:* CONRAD, Ann. Rept. Geol. Survey, N. Y. p. 50, 1851.

"Equivalve profoundly elongated; hinge and basal margin straight "and parallel; beaks near the anterior extremity; posterior "extremity truncate."

This genus, described by Mr. CONRAD, embraced a different group of shells from those referred to it by most other writers. The three species described by Mr. C. are *O. pholadis*, *O. undulata* and *O. carinata*, the first from the Hudson River group and the others from the Hamilton group, and so far as known at present they are the only described species properly referable to the genus. Those which have been referred to it by different authors, being of several different types, and most if not all belonging to different families than the true ORTHONOTA. Mr. CONRAD'S species consist of transversely elongate SOLEN like shells, with parallel or subparallel cardinal and basal margins, and small subanterior beaks; the valves are united by an external ligament of considerable length, and are closed at the extremities; all that is known of the hinge at the present time, is the impression of a single hooklike tooth beneath the beak of the right valve of one of the species described. In several specimens of *O. undulata*, where the valves are united and com-

pressed, the beaks of the left valve are broken through by some hard and pointed body, and this may be supposed to result from the more solid substance of the tooth crushing and breaking through the thin beak of the opposite valve. Nothing is yet known of the muscular scars or pallial line; the shells having probably been too thin to leave impressions of such characters.

The *O. undulata* was considered by Mr. CONRAD as the typical form of the genus, and furnished the characters given in his generic description. There are in the collection other species which possess all the essential characters of the genus as described, with the exception of the straight hinge-line, and these are now included under the same designation. They bear the same relation to Mr. CONRAD'S species that the recurved forms of SOLEN do to the straight, and the difference can hardly be of generic importance. Modified accordingly, the generic characters are as follows:

SHELL transversely elongate, with parallel or subparallel cardinal and basal margins, and subanterior beaks, extremities closed or gaping posteriorly; cardinal line extended, straight, or slightly recurved, not bent beneath the beaks, but continuous on the same line to the anterior extremity; ligament external, hinge without lateral teeth, but with one or two small, pointed or hooklike cardinal teeth beneath the beaks; muscular scars and pallial line unknown, surface marked by an oblique umbonal ridge, which is more or less angular; the cardinal slope is vertically striate or plicate, while the body of the shell is marked by concentric striæ or ridges, which are usually interrupted at the umbonal furrow where such exists.

The example of *O. pholadis* figured in the first Vol. Pal. N. Y. pl. 82, fig. 6, is not known to be in existence, and no other specimen of the species as far as we know, has ever been discovered. No other true species of the genus has ever been found in the rocks of this country below the Hamilton group,* and the only species figured elsewhere which may be considered as belonging to it, is given by Prof. McCoy in the British Pal. Foss. pl. 1 k. fig. 18–20, as *Sanguinolites anguliferus*. The shells of this genus somewhat resemble ARCA or MACRODON in having the hinge-line continuing on the same plane beneath the beaks and to the anterior end, but there are no crenulations on the hinge of the typical forms.

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* The shells referred to this genus from the Hudson River and Clinton groups, *Palæontology of New York*, vols. i and ii, are not strictly congeneric with Mr. CONRAD'S typical species.

## ORTHONOTA UNDULATA (Conrad).

*Orthonota undulata :* CONRAD, An. Rept. Geol. Survey, N. Y., p. 51. 1841.
*Orthonota undulata :* VANUXEM, Geol. Rept., 3d Dist. N. Y., p. 150, f. 2. 1842.

SHELL transversely elongate, more than three times as long as high, with the cardinal and basal margins subparallel or slightly diverging posteriorly; valves very moderately convex from back to base with closed extremities, beaks small, incurved, situated about one-sixth of the length from the anterior end; cardinal line straight, and from the beaks backward, bordered by a prominent rounded rib, which gradually increases in thickness with the increasing length of the shell; anterior end rounded; greatest extension near the cardinal line; basal line straight; posterior end broadly rounded, a little flattened in the middle and receding more rapidly to the extremity of the cardinal line, which is a little shorter than the extreme length of the shell; body of the shell marked by a narrow oblique furrow crossing from the beak and reaching the basal border, a little more than one-third of the length from the anterior end; umbonal ridge low and rounded; cardinal slope flat or slightly concave, and traversed by three low rounded radiating ridges, the central one narrower than the others, the umbonal one rounded on the lower side by a narrow, abrupt furrow which reaches the basal line just anterior to the postero-basal angle; ligament narrow, extending to near the end of the cardinal line.

SURFACE marked by concentric ridges and furrows which are strong and angular on the anterior end, faint on the body of the shell, and developed into strong nearly vertical folds on the cardinal slope, which are united below in the narrow umbonal furrow, and extending above to the rib bordering the cardinal line.

The shell varies somewhat in its proportional length and breadth, and also in the strength of the surface markings, but always maintaining its general features too distinctly to be mistaken. Length of shell from two to three inches.

*Formation and localities.* In the Hamilton group at Summit and Fultonham, Schoharie county, at several places in Otsego county, on shores of Seneca, Cayuga, and Canandaigua lakes, and in Livingston county, N. Y.

## ORTHONOTA CARINATA.

*Orthonota carinata :* CONRAD, An. Rept. Geol. Survey, N. Y., p. 51. 1841.

"Destitute of undulations and with four prominent obliqued carinæ "on the posterior side; dorsal margin carinated."

SHELL small, very much elongated posteriorly, more than five times as long as wide, with straight and parallel cardinal and basal margins; valves anterior to the umbonal ridge, depressed convex from back to base; beaks small, situated within the anterior fourth of the length; anterior end short, pointed or but slightly rounded close to the cardinal angle, and gradually curving to the basal line; posterior extremity unknown.

SURFACE marked by comparatively strong concentric undulations on the anterior end, which become faint or obsolete before reaching the umbonal ridge; umbonal ridge carinate, with a narrow depressed line below; cardinal slope with a strong angular ridge midway between the umbonal ridge and the cardinal margin, with deeply concave spaces, the lower one of which has a smaller carina running along the bottom of the furrow, making a third carina on the posterior end of the shell.

Mr. CONRAD in his description loc. cit. mentions four carinæ on the posterior end, but the specimen before us, and also a figure made and named by Mr. C. from his original specimen, possesses only three.

This species differs from *O. undulata* in having sharp carinæ on the cardinal slope and no vertical undulations; it is moreover a much smaller species and very much narrower in proportion to its length. Length of the shell about one and a half inches. A rare species.

*Formation and locality.* In the arenaceous shales of the Hamilton group in Schoharie county, N. Y. Mr. CONRAD gives the locality of Tinker's Falls, Onondaga county, which is in the soft shales of the formation.

## ORTHONOTA PARVULA (n. s.).

SHELL very small, transversely elongate with straight and parallel cardinal and basal margins; length varying from a little less to a little more than three times its width; valves regularly and evenly convex from back to base, giving a cylindrical form to the shell when the valves are in contact; beaks small, incurved, situated more than one-third of the length from the anterior end; umbonal ridge carinate; cardinal slope convex; anterior end rounded, posterior end truncate with the margin slightly rounded.

SURFACE smooth or marked only with fine concentric lines of growth.

This is a small smooth species and not readily confounded with any other shell in our rocks, except perhaps *Sanguinolites* (*Cypricardites*) *truncatus*, CONRAD, from which it is distinguished by the straight cardinal line, that one being curved upwards, and also by the general

arcuation of the valves of that species; it varies somewhat in the breadth of the valves, and the umbonal ridge is sometimes elevated, forming a rounded rib.

*Formation and localities.* In the finer arenaceous shales of the Hamilton group near Fultonham and Summit, Schoharie county; in the soft shales of the group on Seneca and Canandaigua lakes, and also in Livingston county, New-York.

### ORTHONOTA ENSIFORMIS (n. s.).

SHELL small, extremely elongated, ensiform, very gradually curving upwards with parallel cardinal and basal margins and rounded extremities; contour of the valves gently convex from back to base; beaks small, situated about as far from the anterior end as the width of the valve; cardinal slope bisulcate, with an angular ridge between.

SURFACE marked only by fine striæ, parallel with the margins of the valves, but which become somewhat stronger at the anterior end.

This species has much the aspect of a slightly curved SOLEN, but possesses the characteristic markings of the Genus ORTHONOTA on the cardinal slope. It is not readily confounded with any other shell in the New-York rocks.

*Formation and locality.* In the fine arenaceous shales of the Hamilton group in Schoharie county, New-York.

### ORTHONOTA SILIQUOIDEA (n. s.).

SHELL soleniform, gaping at the posterior extremity; subcylindrical in form and gradually increasing in width from anterior to posterior, with the cardinal and basal margins straight; valves very convex from back to base; beaks small, subanterior; anterior end most extended on the hinge margin, abruptly depressed in front of the beaks and gradually curving below to the basal border; posterior end truncate, most extended at the postero-basal angle; the cardinal slope has the same convexity as the body of the valve, its limit being indicated by a very faint furrow and the abrupt bending of the striæ towards the cardinal line.

SURFACE marked by fine concentric striæ, anterior to the umbonal furrow, which are abruptly bent upwards at that point, and form faint undulations in crossing the cardinal slope.

This species differs from any of the preceding, by its strongly convex surface, convex cardinal slope, and gaping posterior end.

*Formation and locality.* In the arenaceous beds of the Hamilton group, in the southern part of Schoharie county, N. Y.

# GENUS EDMONDIA (DEKONINCK).

## EDMONDIA PHILIPII (H. S.).

SHELL of medium generic size or larger, ventricose: subcircular or somewhat transversely elliptical in outline, sometimes assuming a general quadrangular aspect; beaks large, tumid, situated subcentrally, nearest the anterior end; projecting but little above the hinge, except from compression; umbonal slope indistinctly angular, and often rising a little above the general convexity of the valve; cardinal line short, slightly arcuate, anterior and posterior extremities rounded, the latter sometimes very little straightened or truncate; basal line not so abruptly rounded as the extremities; anterior end slightly contracted beneath the beaks, but with no distinct lunule.

SURFACE marked by somewhat even, lamellose concentric lines of growth; the only hinge structure detected, consists of a slight folding of the margin of the shell, extending from beneath the beak backwards to near the middle of the cardinal line.

Among the specimens, as they occur in the same layer of rock, there is considerable variation of form, owing chiefly to distortion and compression, some individuals being nearly or quite circular, while others are almost one-third longer than high. The beaks also show a similar variation in their projection above the cardinal line.

*Formation and localities.* In the Chemung group at Philipsburg and Rockville, Alleghany county, and in the vicinity of East Randolph and elsewhere in Cattaraugus county; also in the sandstones of the conglomerate near Panama, Chautauque county, N. Y.

## EDMONDIA BURLINGTONENSIS.

*Edmondia burlingtonensis.* WHITE & WHITFIELD, Proc. Bost. Soc. Nat. Hist., Vol. 8, p. 301. 1862.

SHELL of medium size, transversely elliptical, valves moderately and evenly ventricose with large, tumid, prominent beaks which are situated at or within the anterior third of the length; hinge-line arcuate, slightly declining posteriorly so as to somewhat contract the width of the shell; this feature is, however, subject to variation from compression; anterior and posterior extremities rounded, the latter sometimes slightly truncate and oblique.

SURFACE marked by concentric undulations and by finer concentric striæ of growth, parallel to the margins of the shell; the last, when well preserved, present a somewhat lamellose character.

This species presents considerable variation in form, depending mostly upon the conditions of preservation and upon the nature of material in which specimens are imbedded. The examples from Philipsburg and Rockville, Alleghany county, are in a fine micaceous sandstone, and sandy shale have been subject to considerable distortion, the shells being sometimes lengthened or shortened, giving them different degrees of ellipticity; some have been compressed obliquely, not only giving them a greater or less obliquity, but changing the relative position and prominence of the beak, while others are flattened, destroying their rotundity, and in others this feature is increased. In specimens from other localities where the normal form has been preserved, the characters correspond so perfectly with those of the fossil from the yellow sandstones of Burlington, Iowa, that there seems no propriety in giving them a distinct name. This species differs from the preceding (*E. Philipii*), in being more oblique, in having the beak nearer the anterior end, and in its transversely elliptical form. R. P. W.

*Formations and localities.* In the Chemung group at Philipsburg and Rockville, Alleghany county, at Painted Post, near Ithaca, and at several places in Cattaraugus county, New-York. It occurs in the Yellow sandstones at Burlington, Iowa.

### EDMONDIA UNDULATA (n. s.).

SHELL small, transversely elliptical or oval; once and a half as long as high, valves regularly convex, with large, tumid, and somewhat prominent beaks, situated near the anterior end; hinge-line arcuate; anterior end contracted below the beaks and sharply rounded at the extremity; posterior end broadly rounded; basal line gently and evenly arcuate.

SURFACE marked by strong, deep, irregular concentric furrows extending the entire length of the shell.

A small species characterized chiefly by the strong concentric furrows, but differing also from the preceding forms in its greater length.

*Formation and localities.* In the sandstones of the Chemung group near East Randolph, and at Great Valley, Cattaraugus county, N. Y.

### EDMONDIA DEPRESSA (n. s.).

SHELL moderately large, broadly ovate or quadrate ovate, valves depressed convex; most ventricose near the anterior end, and becoming regularly more depressed and flattened toward the posterior end; beaks large and tumid, projecting but little above the hinge, and situated very close to the anterior end; cardinal

line straight, or but little arcuate; anterior end rounded; posterior end broad, obliquely rounded, shortest at the upper part; basal line scarcely rounded except at the extremities.

SURFACE covered by coarse, distinct, somewhat wiry concentric striæ of growth, which are sometimes crowded, forming slight undulations; posterior ridge not distinct. In one example the middle of the valve is flattened from near the anterior end, to the position of the posterior ridge, but this does not appear to be a constant feature.

This shell differs from any of the preceding species in the flatness of the valves, in the anterior position of the beaks, in the coarse concentric striæ, and in the broadly oval or quadrate oval outline.

*Formation and localities.* In the Waverly sandstones at Granville, Licking county, Ohio, and in the conglomerate near Olean, Allegany county, N. Y.

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## GENUS CARDIMORPHA (DEKONINCK).

### CARDIMORPHA BELLATULA (n. s.).

SHELL small, transversely ovate, widest behind the middle; less than twice as long as wide; valves rather evenly convex, a little the most ventricose in the umbonal region and anteriorly; beaks broad, rather tumid, situated very near the anterior end and closely incurved; cardinal line slightly arcuate; anterior and posterior extremities rounded; basal line regularly curved.

SURFACE marked by numerous fine concentric lines of growth, which sometimes form indistinct undulations in crossing the umbonal ridge.

This species may readily be distinguished from others associated with it by its small size, neat, regular outline and convex surface. The usual size is about five-eighths of an inch in length, but it sometimes attains a length of a little more than one inch. There is a specimen in the collection nearly an inch and one-fourth in length, from Medina, Ohio, which is undistinguishable from the larger forms in the Hamilton group of New-York.

*Formation and localities.* In the soft shales of the Hamilton group in Schoharie, Onondaga, Ontario and Yates counties, N. Y.

### CARDIMORPHA ERIOPIA (n. s.).

SHELL sometimes attaining a large size, circular or sometimes slightly ovate in outline, with strong and prominent incurved beaks,

which are situated a little nearer the anterior than the posterior end; valves subglobose, compressed, most ventricose anterior to the middle, and flattened toward the posterior portion; hinge-line rounded, much straighter than the basal line; greatest length above the middle of the valve.

SURFACE marked by concentric undulations, which are strong and distinct on the anterior portions, becoming obsolete on the umbonal slope and middle of the valve, and again strong towards the posterior slope. There are also distinct, even, thread-like concentric striæ, and similar radiating lines visible under the magnifier. The posterior slope is marked just below the cardinal line by a broad faint ridge, passing from behind the beaks to the posterior margin, and above which the concentric furrows do not pass.

There may be some doubt as to the propriety of placing this species under CARDIMORPHA, but its analogies appear to be more nearly with it than with any other genus. The fine radiating lines of the surface, the structure of the hinge as far as it can be ascertained, the absence of any distinct lunule or escutcheon, and the large curved beak, all indicate that such are its relations, and would remove it from EDMONDIA to which it is allied in general form and aspect.

*Formation and locality.* In the soft shales of the Hamilton group, on the shores of Canandaigua lake, N. Y.

## CARDIMORPHA SUBTEXTILIS.

*Astarte subtextilis:* HALL, 4th Dist. Report, Geol. Sur. N. Y., p. 245, f. 6, 1843.
Compare *C. parvirostris:* WHITE, Jour. Bost. Soc. Nat. Hist., vol. 186.

SHELL orbicular in outline, with small projecting incurved beaks, situated subcentrally, a little nearer the anterior end; valves convex, most ventricose anteriorly, marked by strong concentric undulations, and by fine, somewhat even, concentric striæ, and also by fine radiating striæ.

This shell is closely related, if not identical with the form described as *C. parvirostris*, by C. A. WHITE, from the Burlington sandstones. The imperfect condition of our specimen, however, prevents a positive determination, but the general features of the shell are so near alike as to leave little doubt of their identity. It differs from *C. eriopia*, in the smaller beak, the more equilateral form, the more closely arranged radii, and in having the concentric undulations as strong on the middle as on other portions of the valves. R. P. W.

*Formation and locality.* In the fossiliferous shales of the Portage group six miles N. E. of Portland harbor, N. Y.

# GENUS SCHIZODUS (KING).

Compare NUCULITES (Conrad) in part: ANODONTOPSIS (McCoy).

## CURTONOTUS.

SHELLS small or of medium size, compressed, inequilateral, subrhomboidal or subtriangular in outline, with elevated laterally compressed beaks; anterior end short, rounded, posterior end prolonged; obliquely truncate and pointed below; basal margin rounded; hinge-line shorter than the width of the shell; umbonal slope carinate; hinge with a long curved or hooked tooth in the right valve, and a double in the opposite valve: a more or less elongate lateral tooth in each valve. Muscular impressions situated near the cardinal border; pallial line simple, ligament supposed to be external.

The following species have all the essential characters of Prof. KING's genus, so far as can be ascertained from the specimens in their present condition, and there is little doubt as to the propriety of thus referring them. In their external characters they agree equally well with some of the forms which Prof. MCCOY has included under his genus ANODONTOPSIS, but the "long slender posterior cartilage plate or lateral tooth a little below the hinge line," to which he refers as distinguishing them from SCHIZODUS, has not been detected in any of our species.

### SCHIZODUS TUMIDUS (n. s.).

SHELL of moderate size, ovate, with a somewhat pointed posterior extremity; valves strongly curved a little anterior to the middle; beaks elevated and pointed; cardinal line short; anterior end short, broadly rounded into the basal line, which is somewhat regularly arcuate from the front to beyond the middle, and slightly constricted anterior to the postero-basal angle; posterior margin very oblique and extended below, the extremity rounded, cardinal slope concave, umbonal ridge not distinctly marked, muscular impression strong and deep; pallial line well marked.
SURFACE of shell unknown.

This species is very similar to *S. appressus*, CONRAD, but is a little more oblique, giving a more pointed posterior extremity, and the valves are more ventricose.

*Formation and localities.* In rocks of the age of the Upper Helderberg group at Columbus, Ohio, and also at Cayuga, Canada West.

## SCHIZODUS APPRESSUS.

*Nuculites appressa:* CONRAD, Jour. Acad. Nat. Sci. Phil. Vol. 8, pl. 15, f. 4, p. 248. 1842.

"Subrhomboidal, much compressed; anterior and basal margins "regularly rounded or arched; posterior margin widely truncated, "extremity angular, umbonal slope angular, undefined below, "beaks about one-third of the length of the shell from the ante-"rior extremity; dorsal margin slightly oblique, extremity "rounded.

"*Locality.* Near Smyrna, Chenango county, New York. Upper "Silurian shale."

SHELL moderately oblique, varying from suborbicular to subrhomboidal in outline, valves depressed convex, with small compressed beaks projecting a little above the cardinal line, and situated nearer to the anterior end, which is regularly rounded from near the beak to the middle of the basal margin, from which point the basal line is nearly straight to the postero-basal angle; posterior end slightly rounded and obliquely truncate; posterior cardinal border arched and rounded at the extremity.

SURFACE smooth or with fine concentric ridges of growth; posterior umbonal slope slightly angular, the space between it and the postero-cardinal border gently concave, when not altered by compression; teeth, as seen in casts, strong; muscular scars small, the anterior one oval, situated near the cardinal margin; posterior scar a little larger and more elongate; pallial line well marked submarginal.

*Formation and localities.* In the Hamilton group in Schoharie and Madison counties, and in many parts of the more western counties of the State.

## SCHIZODUS CAYUGA (n. s.).

A form differing somewhat from that described above, occurs in the Hamilton shales at Ogden's ferry, Cayuga lake, New York, being much more produced posteriorly, the cardinal line sloping more abruptly, and the basal line a little emarginate just anterior to the postero-basal angle, which is more broadly curved than in the *S. appressus*. The basal margin is more sharply rounded and the beaks not so elevated as in that species.

## SCHIZODUS ELLIPTICUS (n. s.).

SHELL small, transversely elliptical in outline, very much compressed, beaks situated a little more than one-third the entire length from the anterior end, and projecting beyond the cardinal line; hinge line shorter than the shell below; umbonal slope slightly angular; anterior end rather sharply rounded; posterior end truncate, nearly vertical or slightly oblique, basal margin broadly rounded.
SURFACE smooth or marked only by faint concentric lines of growth.

This shell differs from any other species in these rocks in its proportionally greater length and elliptical outline.

*Formation and locality.* In the soft shales of the Hamilton group at Canandaigua lake, N. Y.

## SCHIZODUS CHEMUNGENSIS.

*Nuculites chemungensis:* CONRAD, Jour. Acad. N. S. Ph. Vol. 8, pl. 13, f. 13, p. 247. 1842.

"Rhomboidal, convex; anterior margin direct above; obliquely "truncated inwards inferiorly; apex prominent; posterior de- "pression abrupt; posterior margin oblique; slightly emarginate "or contracted, extremity subangulated, hinge margin nearly "straight, slightly declining.

"*Locality.* Chemung Narrows, Devonian shales."

SHELL very much compressed with a strong angular umbonal ridge from the beak to the postero-basal angle; outline subrhomboidal, with the beaks extending considerably above the hinge line; cardinal line straight, posterior end obliquely truncate, the basal and anterior margins uniting in a regular and constantly increasing curvature from the postero-basal angle to its junction with the anterior end of the cardinal line.
SURFACE of the shell marked only by the concentric lines of growth.

This species differs from *S. appressus* in the umbonal slope, being more angular, the hinge-line and posterior margin straighter, while the entire form of the shell is more oblique, and the beaks more elevated. It differs from *S. cayuga* in nearly the same points, except the obliquity of the shell.

*Formation and locality.* In the Chemung rocks at Chemung Narrows, N. Y.

## SCHIZODUS QUADRANGULARIS (n. s.)

SHELL small or of moderate size, orbicular subquadrate in outline, except in compressed specimens which are moderately ventricose; beaks subcentral, prominent, flattened or compressed on the back,

THE following descriptions of species are in type at the date of printing (January, 1870):

SCHIZODUS CREGARIUS n. s.;

S. OBLATUS;

S. RHOMBEUS;

GENUS LUNULACARDIUM (Munster, 1840), (Pinnopsis Hall, 1843, not *Lunilicardia*, Gray, 1847);

L. CURTUM n. s.;

L. MARCELLENSIS;

L. ORNATUM;

L. ACUTIROSTRUM;

L. FRAGILIS.

These species are represented in the horison of the Upper Helderberg limestones, the Marcellus shale, Hamilton, Portage and Chemung groups.

The Genus Cardiola (Broderip) has been recognized in C. Lincklaeni n. sp. of the Marcellus shale, C. VENTRICOSA n. sp. of the Goniatite limestone, C. RADIANS of the Hamilton group, C. SPECIOSA of the Portage group.

The Genas Megambonia is retained for the species heretofore described under that name. LTCINA = Prracyclas is represented in several species.

The Genus PINNA = new s. g. PALÆOPINNA, is represented in a single species.

A species of mytiloid shell, abundant in some localities, is indicated as a distinct genus = MYTILOPS.

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