

FAUNA OF THE BRASSFIELD LIMESTONE OF
JEFFERSON COUNTY, INDIANA.

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ANTHOZOA.

Streptelasma hoskinsoni Foerste

Streptelasma obliquus Foerste. This species is common in Jefferson County. Most of the specimens show a marked flattening of the corallum, one typical example having a length of 17 mm., width 12 mm. and thickness 6 mm. In the upper third of the corallum there is a small additional septum intercalated between the larger septa. The septa are about 35 in number.

Enterolasma geometricum Foerste. Three specimens were found of the larger type described by Foerste (Bos. Proc. Nat. Hist. Soc. p. 346) and two of the smaller type were found. Near the top of the larger specimens, four ribs occur in the space of five mm. but no additional septum is intercalated.

Zaphrentis celator daytonensis Foerste*Favosites cf. favosus* Goldfuss*Halysites catenularia* Linnaeus

HYDROZOA.

STROMATOPOROIDEA.

Aulocerium cf. savagei Parks. Original description: "The general form was probably laminar, and the organism probably attained considerable dimensions. The skeletal matter consists of rows of vesicles, with convexities outwards, about six vesicles appearing in the space of one mm., measured vertically. The maximum extent of a vesicle horizontally is something over one-half mm. The cavities appear to have been hollow, and their walls very delicate. At a fairly uniform interval of two mm. large tubes of one-half mm. diameter pierce vertically through the vesicular tissue. The walls of the tubes are thin about the same calibre as the fibre of the vesicles. The tubes are crossed by 4 or 5 tabulae in a distance of 1 mm. These tabulae are curved and are likewise of about the same weight as the walls of the vesicles. I am of the opinion that these tubes are not foreign to the organism for the following reason. They are the same diameter as a vesicle. They are evenly spaced. Their substance is of the same microscopic appearance as the rest of the conostem. They are intimately united, even blended, with the vesicular tissue."

In this specimen, the general form is roughly circular in outline with laminar structure, having a diameter of about 11 cm., and a maximum thickness of 29 mm. It occurred on the weathered surface of the outcrop and only a part of it has been preserved. Vertical and

tangential sections show the same structure as described by Parks, there being however, a marked difference in the dimensions of some of the parts.

The vesicles are broader and flatter, the maximum extent horizontally being about one mm. instead of one-half mm., in places free of tubes, and about eight to ten vesicles appearing in a vertical distance of one mm., instead of six. The tubes are smaller, averaging one-quarter to one-sixth mm. in diameter instead of one-half mm. and are rather irregularly spaced at an average distance of one mm. instead of two mm. The species has been described from a single specimen, and therefore nothing is known of the variations possible within the species and it seems probable that this specimen belongs to the species *savagei*. The differences mentioned are hardly of specific value.

Two other specimens were found having a similar external appearance but not well enough preserved for identification. Possibly they belong to this species.

CRINOIDEA.

Icthyocrinus (?) sp. undet.

BRYOZOA.

Aspidopora parmula Foerste. This specimen is smaller than those described by Foerste, having a diameter of 17 mm. instead of 25 and they are also more convex, having a convexity of three mm. The general shape is discoid, convex above, and the frond is very thin. The zooecia are regularly spaced, about four to one mm.

Hallopora magnopora Foerste

Ptilodictya whitfieldi Foerste

Ptilodictya expansa Hall and Whitfield

Ptilodictya sp. undet. A section of this specimen shows the arrangement of cells typical for the genus *ptilodictya*, but the external appearance is different from any other species described.

Two fronds were found that have a very narrow, linear form, over 30 mm. in length and only one and one-half mm. maximum width. The width varies only one-half mm. in the entire length of the frond. The base of the frond was not observed so its length presumably is greater than 30 mm.

It is possible that this form represents a young colony of the species *whitfieldi*, which it resembles more closely than any other species described.

Phaenopora expansa Foerste

Phaenopora fimbriata Foerste

Phaenopora magna Foerste

Phaenopora multifida Foerste

Clathropora frondosa Foerste

Clathropora frondosa clintonensis Foerste

Pachydictya obesa Foerste

Pachydictya bifurcata var. *instabilis* Foerste

Pachydictya crassa Foerste

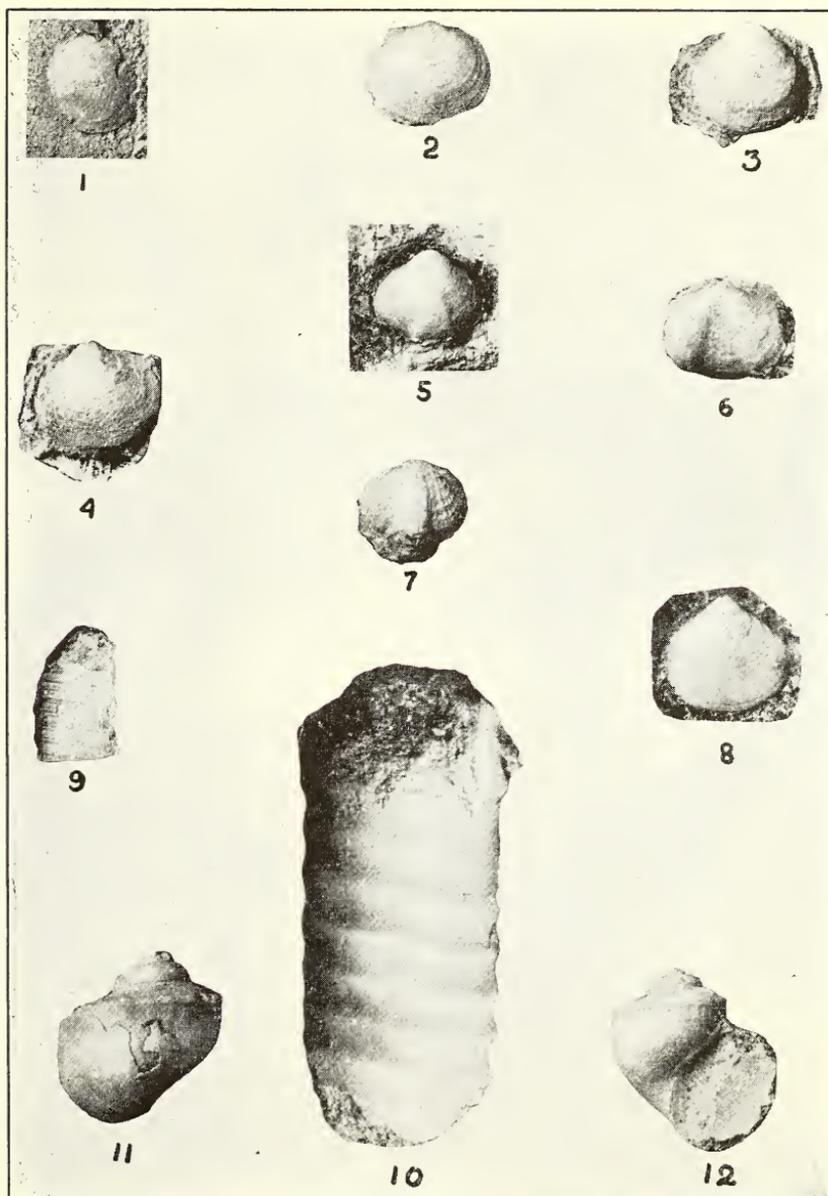


Fig. 1—*Crania* sp. undet. X $2\frac{1}{2}$; 2, *Catazyga* sp. undet. Brachial valve. X $2\frac{1}{2}$; 3, *Catazyga* sp. undet. Pedicle valve. X $2\frac{1}{2}$; 4, *Catazyga* sp. undet. Pedicle valve of a large specimen. Natural size; 5, *Hyattidina* cf. *congesta*. Hall. Brachial valve. X $2\frac{1}{2}$; 6, *Triplecia* sp. undet. Pedicle valve. X $2\frac{1}{2}$; 7, *Triplecia* sp. undet. Brachial valve. X $2\frac{1}{2}$; 8, *Whitfieldella oblata* (?). Natural size; 9, *Dawsonoceras* sp. undet. Natural size; 10, *Dawsonoceras* sp. undet. Natural size; 11, *Lophospira hanoverensis* n. sp. Natural size; 12, *Lophospira hanoverensis* n. sp. Natural size.

Rhinopora verrucosa Hall

Chasmatopora angulata Hall

Chasmatopora sp. undet. In describing the species *angulata*, Hall notes "another variety with equally stout stems has much more elongated fenestrules, exceeding three mm. or even more in length." The specimen here recorded is probably the type he mentioned, some of the fenestrules exceeding four mm. in length and the anastomosing stems are somewhat stouter than in *C. angulata*. It seems that these differences would warrant a specific name for this form.

BRACHIOPODA.

Lingula sp. undet.

Crania sp. undet. Fig. 1. Three specimens were found, two excellently preserved, adhering to the surface of an Orthoceras. The shells are convex conical, the apical point is eccentric and the valves are broader than long. Fine lamellose markings are preserved. The posterior slopes of the shells are slightly but regularly convex, the anterior slopes much steeper and directly in front of the apex, they are concave. The specimens are all practically the same size. Length eight mm., width nine mm., convexity of valve at the apical point two mm. The apical point lies five and one-half mm. from the posterior edge and two mm. from the anterior edge. These measurements are very similar to those of a *Crania* shell described by Foerste and called (?) *Crania dubia*.

Orthis euorthis Foerste

Orthis dinorthis Foerste

Orthis fissiplicata Foerste

Platystrophia daytonensis Foerste

Platystrophia reversata Foerste

Dalmanella parva Foerste

Dalmanella cf. *eugenensis* Williams

Rhipidomella hybrida Sowerby

Plectambonites transversalis Wahlenburg

Plectambonites Prolongatus Foerste

Leptaena rhomboidalis Wilckens

Stropheodonta sp. undet. Four specimens were found belonging to the genus *Stropheodonta*, though not well enough preserved to allow a specific identification. Two of these however, compare favorably with small specimens of *S. corrugata* from the Clinton of New York, described by Hall. The shells are only slightly convex, striae very unequal with the hinge line extending into small acute ears.

Strophonella hanoverensis Foerste

Strophonella daytonensis Foerste

Schuchertella daytonensis Foerste

Triplesia sp. undet. Figs. 6 and 7. This specimen consists of separate brachial and pedicle valves, which answer to the general description of *Triplesia*, by Hall, as follows: "Shell trilobate, transverse, unequally biconvex. Hinge line straight and quite short. Pedicle valve shallow, convex about the beak, but depressed anteriorly by a broad and deep median sinus. Cardinal area low, erect and well defined; delthyrium covered by a narrow convex plate, with a circular foramen at the apex.

The brachial valve is very convex and bears a strong median fold. The cardinal area is very narrow and beak closely incurved. Surface with obscure concentric growth lines and fine radiating striae on the inner laminae; in rare instances there are radiating lines on the exterior."

The distinguishing features of this specimen are strong radiating ribs crossed by concentric lines of growth, especially prominent on the posterior one-third of the pedicle valve and on the brachial valve, giving both valves a reticulate appearance. In the rather high triangular sinus there are four distinct ribs running from the first concentric line to the anterior margin. The beak is exfoliated, consequently they are not discernible on that part of the shell. There are seven distinct ribs on each side of the sinus and two or three very indistinct ones toward the lateral margins. Within five mm. of the beak are four strong lamella and from that point to the anterior margin are at least seven more.

There are six ribs occupying the fold, running from a point two mm. from the beak to the anterior margin. There are nine or ten ribs on each side of the fold, those next the lateral margins being very indistinct. The lamella are eight or nine in number and are regularly spaced.

Measurements: Length 11 mm., width 10 mm., length of hinge line 7 mm., convexity of the brachial valve 4 mm., of pedicle valve $2\frac{1}{4}$ mm. Width of fold 3 mm., of sinus 4 mm.

Parastrophia sparsiplicata Foerste

Camarotoechia convexa Foerste

Camarotoechia neglecta var. *cliftonensis* Foerste

Catazyga (?) sp. undet. Figs. 2, 3, and 4. Pedicle valves of six specimens were found and the brachial valves of two, though it was impossible to obtain a complete specimen. As far as can be determined this form is not related generically to any Silurian form described. Its close external resemblance to the Ordovician genus *Catazyga* is very marked as a description will indicate.

The shell is medium sized, sub-circular or ovoid in outline. Both valves are strongly convex, the rotundity of the pedicle valve obscuring the prominent umbonal region.

The beak of the pedicle valve is slightly compressed anteriorly as a faint elevation to about the center of the valve. The median part of this elevation is slightly depressed, forming a faint and rather broad median depression. The brachial valve has a faint median depression near the beak.

The shell is covered with fine radiating striae about seven or eight to the mm. at a distance of six mm. from the beak. Lamellose lines of growth are preserved in every specimen though they are not prominent.

The specimens vary in size, but the measurements of the average specimens are: width 13 mm., length 11 mm., hinge line approximately 9 mm. long, convexity of pedicle valve $4\frac{1}{2}$ mm., convexity of brachial valve $2\frac{1}{2}$ mm.

Atrypa marginalis Dalman

Atrypa lati-corrugata Foerste

Whitfieldella cf. *oblata* Hall, Fig. 8

Hyattidina cf. *congesta* Billings, Fig. 5

Meristella sp. undet.

PELECYPODA.

Pterinea sp. undet.

Mytilarca sp. undet.

GASTEROPODA.

Bucania fiscellostriata Foerste

Bellerophon exiguus Foerste

Lophospira hanoverensis sp. novum. Height 25 mm., width 22 mm., apical angle 85 degrees, volutions $3\frac{1}{2}$, ventricose, body whorl comprises at least three quarters of the height of the shell. Peripheral band prominent and angular on the last whorl and occupying a position about one quarter way from the top. It is less angular on the upper whorls. The slit is about eight mm. long. About midway between the band and the suture lines a low revolving ridge divides the flat upper slopes into two slightly concave surfaces.

The aperture is sub-ovate, rounded anteriorly, and rather straight along the inner side. The shell is imperforate, the inner parts of whorls coalescing to form a columella. Transverse lines of growth are fine, threadlike and numerous. The lunulae of the band are fine and regularly curved.

This species resembles *L. thebesensis* Savage, but it differs from that species in the higher position of the peripheral band; in the lower ridge and less concave portion of the whorl above the band, which gives a flatter appearance to the upper part of the shell; in the absence of a revolving ridge below the peripheral band and in having an imperforate shell.

Liospira cf. *affinis* Foerste. This specimen compares favorably with Foerste's *L. affinis* in size and general shape, though it is not well enough preserved to be sure of specific identification.

Cyclonema daytonensis Foerste

Cyclonema gyronemoides Foerste

Cyclonema cf. *pristina* Savage

CEPHALOPODA.

Orthoceras hanoverense Foerste

Orthoceras cf. *rectum* Foerste. This specimen has the very low rate of divergence and circular outline of *O. rectum*, though only the body chamber is preserved. A small patch of the surface has been preserved however, and consists of numerous fine transverse striae, about 10 in the distance of one mm.

Orthoceras sp. undet. This specimen consists of a small fragment of an *Orthoceras* shell marked with longitudinal flutings. The fragment is about ten mm. long and three mm. in diameter. The flutings are regularly spaced about one-half mm. apart.

Dawsonoceras inceptum var. *acceleratum* (?) Foerste

Dawsonoceras cf. *annulatum* Sowerby

Dawsonoceras sp. undet. Fig. 10. The annulations run obliquely around the shell, about six or seven mm. apart, instead of transversely, at right angles to the length of the shell. In this respect it differs from *D. annulatum* Sowerby.

Dawsonoceras sp. undet. Fig. 9. This specimen is a fragment about 30 mm. long and retaining the exterior markings over a part of the surface. The annulations are evenly spaced about one and one-half mm. apart and are sharply keeled. Between the annulations are two parallel, transverse, sharp ridges, which divide the space between the annulations into three equal parts. These ridges are sharper than the annular markings, though smaller and less elevated. There is a marked equal concavity between each ridge and between the ridges and annular rings. The outline is circular and the specimen is ten mm. in diameter. The siphuncle is very nearly central in position.

TRILOBITA.

Iliaenus daytonensis Hall and Whitfield

Iliaenus ambiguus Foerste

Calymene vogdesi Foerste

Dalmanites werthneri Foerste

Metapolichas breviceps clintonensis Foerste

Paleogeography. The conditions of deposition in different areas were probably somewhat as follows: The Sexton Creek limestone of southern Illinois was deposited on the west side of a southern embayment and rather near the western shore line. The deposition was probably continuous across the embayment to the Indiana-Ohio region, where the Cincinnati uplift furnished another comparatively shallow water tract in which the Indiana-Ohio-Kentucky Brassfield fauna lived. From this area to the Niagara Falls region, there was continuous deposition, the limestone changing however to a sandstone, as the high lands of Appalachia and Acadis are approached. To the west and northwest away from the highlands, the deposits grade again into limestones with some dolomites and shales, represented by the Manitoulin dolomite and the Cabot Head shales, of the Manitoulin Island, Ontario, and by the Severn River limestone, of the Hudson Bay region. A connection with the sea to the northeast through the St. Lawrence basin, deposited the Gun River formation of Anticosti. Noting the positions of these formations it is not difficult to see how somewhat provincial conditions existing near shore lines in the different areas would give rise to certain faunas with characteristic differences.

Correlations.

In the above list of fossils there are about 50 species that are also present in the Brassfield formation east of the Cincinnati anticline in Ohio and Kentucky, which indicates that the strata of the two localities are identical in age and were undoubtedly parts of the same embayment, which came in from the south.

In describing the fauna of the Sexton Creek limestone of Illinois and Missouri, Savage notes the absence of certain species that are common in the Ohio Brassfield and the presence of certain other species not present in the Ohio Brassfield. This is interpreted as "indicating the presence of a land barrier (the enlarged Cincinnati anticline) extending sufficiently far to the south to prevent the easy intermigration of the

organisms from one basin to the other, and thus permitted the development in them of somewhat different faunas." The similarity of the Brassfield fauna of Jefferson County, Indiana, on the west side of the anticline, to that of Ohio and Kentucky on the east side, hardly warrants a barrier sufficient to prevent easy intermigration. Physical evidence seems to indicate that the central part of the anticline was land or covered by shallow seas. The organisms could easily have migrated either around the edges or across the anticline in shallow water, under such conditions.

The Sexton Creek and Brassfield formations undoubtedly represent the same general period of deposition, and the difference in the faunas of the two localities seems to be no greater than would be expected in different localities, or on opposite sides of an embayment like the "Illinois embayment". The thickness of the Sexton Creek formation about 70 feet, as well as the fauna, seems to indicate a longer period of deposition and an encroaching sea from the south would bring in earlier species that probably did not reach the southeastern Indiana area, and the retreating sea, remaining longer in the Illinois area would contain later species not present in the Brassfield of Indiana.

The following species are common to the Brassfield of Jefferson County and the Sexton Creek of Illinois: *Favosites favosus*, *Halysites catenularia*, *Rhinopora verrucosa*, *Atrypa marginalis*, *Camarotoechia convexa*, *Dalmanella parva*, *Leptaena rhomboidalis*, *Orthis flabellites*, *Platystrophia daytonensis*, *P. reversata*, *Plectambonites transversalis*, *Iliaenus ambiguus*, *I. daytonensis*.

There are many more genera in common and some of the new species described by Savage are closely related to the Brassfield species.

The Brassfield period of deposition is undoubtedly represented in the New York Medinian section, but the sandstone fauna is not easily compared with the limestone fauna of Indiana. Schuchert states that "the typical Medina formation shades through lateral alteration into the typical Cataract formation of Ontario", which is equivalent to the Brassfield.

The Cataract formation is composed of several members whose faunas may be compared to that of the Brassfield of Indiana.

Species common to the Brassfield and Manitoulin dolomite member: *Streptelasma hoskinsoni*, *Enterolasma geometricum*, *Halysites catenularia*, *Hallopore magna*, *Leptaena rhomboidalis*, *Dalmanella cf. eugenensis*, *Rhipidomella hybrida*, *Camarotoechia neglecta*, *Bucania exiguus*, *Orthoceras hanovernsis*.

Species common to the Brassfield and Cabot Head shale member: *Enterolasma geometricum*, *Streptelasma hoskinsoni*, *Rhinopora verrucosa*, *Leptaena rhomboidalis*, *Plectambonites transversalis*, *Orthis flabellites*, *Dalmanella eugenensis*, *Rhipidomella hybrida*, *Camarotoechia neglecta*.

Species common to Brassfield and Dyer Bay dolomite: *Enterolasma geometricum*, *Streptelasma hoskinsoni*.

Species common to Brassfield and Grimby sandstone member: *Dalmanella eugenensis*, *Camarotoechia neglecta*.

Schuchert says (Bull. G. S. A. 25, pp. 277-320) "Even though the Medina, Cataract, and Brassfield are correlates of one another, it does

not follow that each one is wholly equivalent of any other. Each formation invades eastern North America from a different direction and each one has its own peculiar faunal assemblage. They, therefore, represent three physical provinces and marine basins. The Medina is of the Northern Appalachian province, is a sandstone formation, and finally invades to a slight extent the area of the Cataract. The Brassfield province lies, in the main, west of the Cincinnati axis, is of southern origin, with limestone making seas, spreads also up the southern portion of the Appalachian province and finally, in northeast Ohio, (known from Clinton oil wells) unites with the other two provinces; but as the Medina waters form a shoal sandy area in northeast Ohio, between the other two provinces, very few of the species of either area intermigrate. Probably it would be more correct to state that the normal marine junction of the Cataract and Brassfield is prevented by the Medina delta. For these reasons the Medina, Cataract, and Brassfield are to be retained as names for independent marine faunas and formations."

According to Twenhofel, the Cataract formation is probably to be correlated with the lower portion of the Gun River formation of Anticosti Island. No sediments in the Silurian section at Arisaig have been identified as being as old as the Medina-Cataract though it is possible that the base of the Beechhill Cove formation may be of this age.

Species common to the Brassfield and Severn River formation of the Hudson Bay region: *Favosites favosus*, *Orthis flabellites*, *Dalmanella parva*, *Halysites catenularia*, *Plectambonites transversalis*.

There are many common genera, such as *Camarotoechia*, *Bellerophon*, *Illænus Pachydictya*, *Calymene*, *Orthoceras*, *Lophospira Schuchertella*, *Zaphrentis*, *Streptelasma*, and several *Stromatoporoids*, but the species are different.

Savage and Van Tuyl correlate the Severn River limestone of the Hudson Bay region with the lower part of the Silurian rocks of the Lake Timiskaming region, the lower part (Hendricks dolomite and Fibour limestone of the Silurian of north Michigan, and the upper part of the Silurian rocks west of Lake Winnipeg, and the Brassfield, Cataract and Sexton Creek formations.

Bassler correlates the Medina-Cataract with the Lower Llandovery of Wales and Scotland and the Lower Birkhill of Scotland.

