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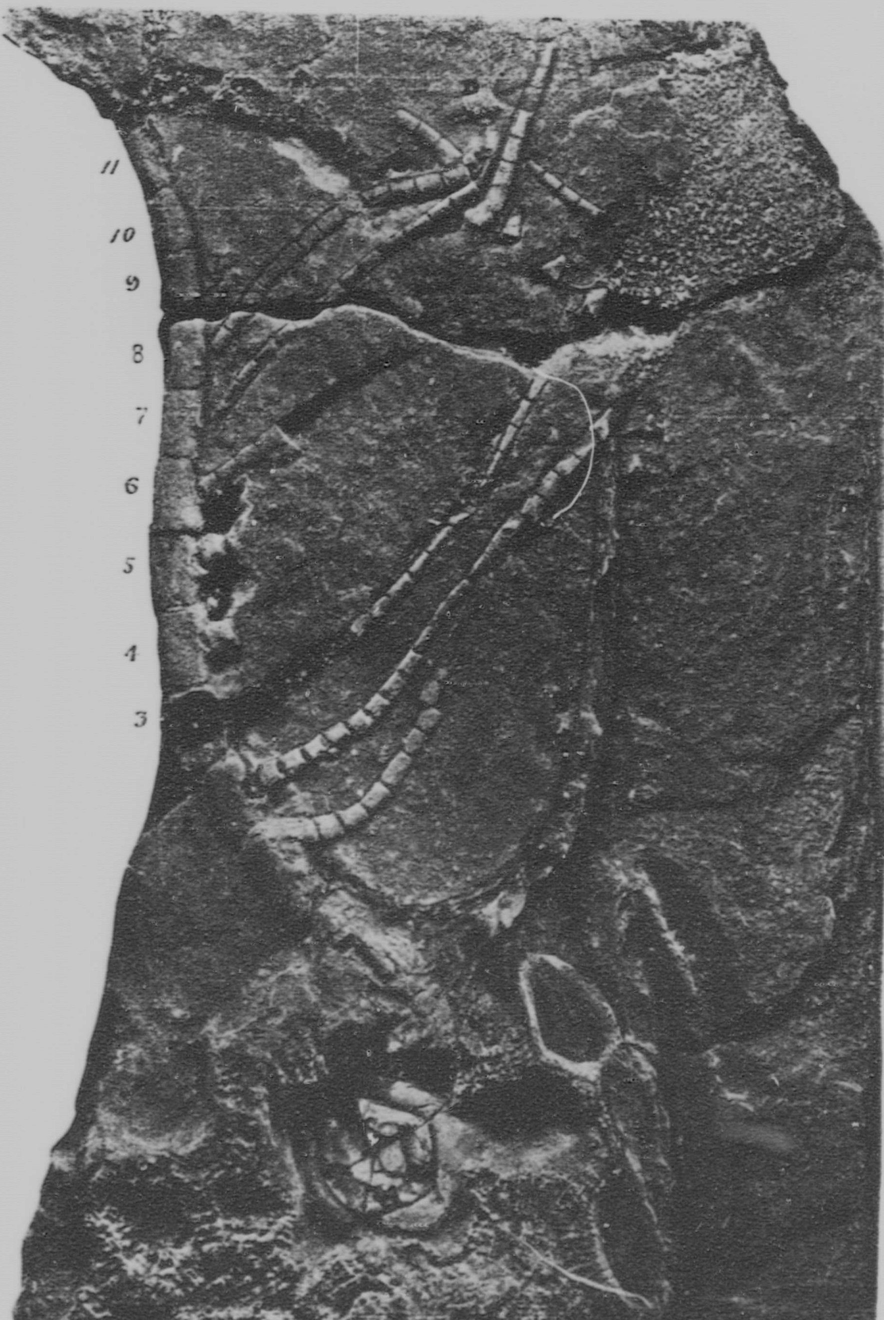
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THE OTTAWA NATURALIST

Vol. XXX. NOVEMBER, 1916. No. 8.

COMAROCYSTITES AND CARYOCRINITES.

CYSTIDS WITH PINNULIFEROUS FREE ARMS.

BY A. F. FOERSTE, DAYTON, OHIO.

(Continued from page 79.)

13. *The structure of the thecal plates.*—The exterior surface of the thecal plates of *Comarocystites punctatus* is deeply concave. The interior surface, however, appears more or less stellately convex. The convex appearance is due, in part, to the slopes of the suture planes, converging toward the center of the theca, and, in part, to the thinning of the plates toward the angles of their polygonal outlines. The stellate character is due to grooves separating the different sets of mesostereom plates, described later in this paragraph. These grooves narrow toward the angles, thus increasing the stellate appearance.

In cross-sections which are vertical to the surface of the thecal plates and perpendicular to the middle parts of the sutures between the plates, the inner surface of the plates presents an almost straight outline between the center of one plate and the center of the next, or there is a moderate outward bending of this outline at the suture. However, toward the angles where three plates meet, the inner surface of the plates curves so strongly outward as to produce the appearance of deep triangular pits at these points of junction. Owing to the deep concavity of the exterior surface of the plates, the thickness of these plates varies from five-tenths to six-tenths of a millimeter at the center to nearly two millimeters along the middle of the suture lines. Toward the angles, however, where three plates meet, and where the inner surface of the plates curves strongly outward, so as to approach the outer surface, the thickness of the plates frequently is reduced to about a quarter of a millimeter. Viewed from the interior of the theca, with the plates still connected, the deep triangular pits or depressions between the ends of the stellate rays characterizing the individual plates, form the most striking features.

Beneath the thin non-porous epistereom lies the thick mesostereom. That part of the mesostereom which is in contact with the epistereom forms a practically continuous sheet, penetrated only by pores, and from this sheet the greater part of the mesostereom is suspended in the form of vertical lamellæ. (Plate IV, figs. 3 and 1D.) Viewed along the suture planes, where exposed by the dismembering of the theca, these lamellæ appear thin and narrow toward their junction with the continuous exterior part of the mesostereom, but they thicken toward their inner terminations for a distance of almost a millimeter. These lamellæ do not radiate from the center of the thecal plates, but form groups, all lamellæ belonging to the same group being perpendicular to the same suture line between two adjacent plates. If imaginery lines be drawn from the center to the angles of each plate, then the lamellæ will be found grouped in triangles limited laterally by these imaginary lines. In each triangle the lamellæ will be found perpendicular to the suture line forming the base of the triangle, the triangles of adjacent plates forming rhombs, which, however, give no indication of their presence on the unweathered surface of the plates. The adjacent triangular groups of lamellæ are separated usually by grooves, widening toward the center of the plates and narrowing toward the angles. Both the lamellæ and the inter-lamellar spaces are directly connected across the suture planes.

The epistereom is thin and non-porous. However, if only slightly weathered, it is found to be underlaid by pairs of short lunate pores extending parallel to the epistereom, just beneath the latter, appearing on the weathered upper surface of the mesostereom as short lunate grooves, the concave sides of each pair facing each other. The presence of these pairs of lunate pores often is indicated on the exterior surface of the epistereom by short lunate ridges (Plate II, figs. 1A, 1B, also 1D), which correspond in size, form and position with the pores beneath. Three or four series of these pairs of lunate pores may occur between the centers of the thecal plates and the suture lines, the pairs of different series more or less alternating with each other in position.

Each lunate pore is connected near its distal end with a small circular or oblong pore penetrating the outer more or less continuous sheet of the mesostereom, and leading into the spaces between the vertical lamellæ. Pores of the same pair always connect with different inter-lamellar spaces, being separated by one of the lamellæ. The right hand pore of one pair, however, usually is connected with the same inter-lamellar space as the left hand pore of the nearest adjacent pair, proximally or distally, i.e., either nearer the center of the thecal plate or nearer the suture line. In this manner, three or four pores belonging to different pairs may be connected to the same inter-lamellar space. There is no connection between pores belonging to the same pair.

The pores penetrating the outer continuous sheet of the mesostereom are directed perpendicularly toward the suture lines between the plates, but incline more or less obliquely downward. They apparently widen in a direction parallel to the inter-lamellar spaces in passing through the outer sheet of the mesostereom, since, in strongly weathered specimens showing the inter-lamellar spaces (Plate III), the latter frequently appear interrupted by transverse partitions a short distance below the outer continuous sheet of the mesostereom. At the center of each thecal plate there is a space, at least a millimeter wide, within which no trace of the vertical lamellæ appears.

14. *Sections across the anal pyramid and the transverse apical food-groove.*—A cross-section of the anal pyramid of *Comarocystites* shows that the lower margin of the pyramid plates fits into a groove extending along the lower part of the proximal margin of the bordering thecal plates. The upper part of this proximal margin rises sufficiently to admit of the presence of some substance for opening the anal passage on the relaxation of the muscles holding the anal plates shut from within the thecal cavity.

The mouth, or opening into the interior of the thecal cavity, is scarcely a millimeter in diameter, and is located at the posterior end of the suture between the two anterior peristomial plates (a, a, in the text diagrams). In form this opening varies from nearly circular to more or less elliptical, with the longer diameter parallel to the direction of the transverse apical food-groove. From this mouth the lateral primary rays of the food-groove system diverge in opposite directions in such a manner as to produce a slightly curved transverse continuous groove across the apical end of the theca, with the convex side of the groove directed toward the front. This transverse food-groove, between the bases of the arm pairs, is frequently exposed, but the central mouth opening is rarely seen. Cross-sections perpendicular to the length of the transverse apical food-groove in one specimen indicate that the lower part of the posterior peristomial plates, projects slightly beneath the adjoining part of the anterior peristomial plates, especially toward the lateral extremities of this food-groove. To what extent this feature is present in other specimens is unknown.

15. *The arms of Comarocystites punctatus.*—Each pair of arms is supported by a single nodular stereom protuberance, but each protuberance is supplied with two more or less divergent facets (see facet 1, in fig. 1B on plate II.) for the attachment of the arms. Each end of the transverse apical food-groove, on coming in contact with the adjoining protuberance, bifurcates, each branch of the food-groove, together with its covering-plates, extending to one of the arm bases, and then rising along the adoral side of the first brachial.

Arms are known only in the case of two specimens, one found and figured by E. Billings, the other found and figured by Sir James

Grant. The first presents a clearly defined view of the lower half of the right posterior arm, with its attached pinnules. The second presents a much less clearly defined view also of what appears to be the right anterior arm, with its attached pinnules. Evidently both the brachials and pinnulars of these two arms are arranged in uniserial order It is assumed that the left pair of arms presented the same characteristics. Only the right posterior arm attached to the Billings type-specimen is here described in detail.

Twelve brachials (Brachials 1 to 11 are numbered in the figure on plate III) are exposed, and each bears a single pinnule on its right side. All of the brachials above the first are flattened slightly from front to rear (Plate II, figs 3A, B, C), the ratio of the lateral diameter to the adoral-aboral diameter being as 10 to 9 (Fig. 3A). The length of each brachial usually equals about three-halves of its lateral diameter. The facets supporting the pinnules are concave (Fig. 3C), their margins being distinctly elevated, especially on their lower sides. The location of these facets is slightly above the middle of each brachial. On that side of the brachial which is opposite the pinnule (Fig. 3B), the brachial tends to be slightly more angular in a direction parallel to the length of the arm. The original length of the complete arm is unknown, but probably it equalled about three-halves of the length of the theca. The rate of tapering of the successive brachials, as far as preserved, is but moderate. Analogy with *Amygdalocystites* and *Canadocystites* suggests that the pinnules of all four arms of *Comarocystites* were attached to the right side of the arms, the aboral side of each arm facing the observer, and the distal end being directed upward.

16. *The pinnules.*—The length of the pinnules probably equalled 30 millimeters, and may have reached 35 millimeters. There is but little variation in the length and width of the pinnulars, about four occupying a length of five millimeters. Except in the case of the first two or three pinnulars, most of the pinnulars are strongly flattened transversely (Plate III; also figs. 4A, B, C, on plate II), the pinnules being placed, for purposes of description, in an approximately vertical position, with the aboral side facing the observer. The ratio of the transverse diameter to the adoral-aboral diameter (Fig. 4A) is about 8 to 5. The lateral edge of the pinnulars (Fig. 4B) tends to be more or less angular in a direction parallel to the length of the pinnule, thus giving the pinnulars a lens-shaped cross-section.

In the Billings type-specimen, here figured, a series of small, flat, quadrangular plates lines one side of two joints of that fragment of the pinnule which is marked D on plate III, and traces of similar small plates are seen at the point C, on one side of the pinnule attached to the eighth brachial. (See also fig. 4C on plate II.) These small quadrangular plates are interpreted as covering-plates. Their number varies from three in a length of one pinnular, to five in a length of two of these pinnulars.

17. *The absence of food-grooves on the brachials.*—In case of the right posterior arm of *Comarocystites,* one of the branches of the transverse apical food-grooves rises for a short distance along the ventral side of the first brachial, but disappears before reaching the top of this brachial. There are reasons for believing that the absence of food-grooves on the arms of *Comarocystites* is secondary and not primitive. The small quadrangular covering-plates along one side of the pinnules, as described above, suggest the former presence of a food-groove. As a matter of fact, no trace of an actual food-groove has been noticed so far on any pinnular, but analogy with *Amygdalocystites* demands that they should be present.

In *Amygdalocystites* the food-groove follows one of the narrower sides of the pinnule, the pinnulars being compressed laterally, and the food-groove faces the mouth. In a similar manner the few covering plates found so far on the pinnulars of *Comarocystites* are on the side facing the mouth, and the sides of these pinnulars are even more compressed than in *Amygdalocystites.* Originally, a food-groove must have followed that side of the pinnule supporting the covering-plates, and a second series of covering-plates must have existed along the same side, but beyond the food-groove. Formerly the food-groove on the pinnulars must have connected with one of the brachials, thus reaching the transverse food-groove along the apical side of the theca, if the analogy between *Comarocystites* and *Amygdalocystites* and *Canadocystis* is as great as here suspected. It should be noted, however, that the facets supporting the pinnules of *Amygdalocystites* are distinctly indented on the side where the branch from the food-groove on the arm passed on the base of the attached pinnule. In *Comarocystites,* however, the facets supporting the pinnules are circular, and show no such indentation. Evidently the absence of a food-groove extends to the lower pinnulars at least.

18. *The column or stem.*—The column or stem is cylindrical, with no evidence of pentamerism either exteriorly or interiorly. The segments or columnals are very thin, alternating in thickness, about 20 occurring in a length of six millimeters in the column attached to that Billings type-specimen which retains the arm. This column has a diameter of four millimeters. The surface of the column is ornamented by minute granules, seven in a width of one millimeter, arranged quincuncially, in diagonally intersecting rows. The lumen equals about one-fourth of the diameter of the column. The flat surfaces of the columnals are striated radially. The only known complete column is attached to the specimen discovered and described by Sir James Grant, and figured by him in the Transactions of the OTTAWA FIELD-NATURALISTS' CLUB, in 1880. In this specimen the

theca is 65 millimeters in height, the length of the column is 108 millimeters, its width near its attachment to the theca is 7 millimeters, at mid-length this width is nearer 5 millimeters, toward the base of the column it increases to 6 millimeters, and then, within a distance of 3 millimeters, the column widens rapidly into a circular attachment disk, about 17 millimeters in diameter. The upper surface of this attachment disk is convex, and the lower surface is sufficiently concave to suggest attachment to a more or less convex object. The outlines of this attachment disk probably were irregularly circular, certain parts extending farther than others from the center. There is no differentiation in size or form between the columnals along the middle third of the stem compared with the columnals toward either end. All are very thin and of approximately the same lateral diameter. During the growth of the stem the columnals probably were added at the top. The stem evidently was sufficiently strong to support the theca in a more or less erect position.

19. *Geological horizon and geographical distribution.*—*Comarocystites punctatus* Billings is known chiefly from the Trenton, in the vicinity of Ottawa, in Canada. Professor Percy E. Raymond, who has made a special study of the Ottawa area (Guide Book No. 3, International Geological Congress, 1913, p. 151), cites *Comarocystites punctatus* only from the quarry located in the angle between the two railroads, several hundred yards north of Walter's Axe Factory quarry, in Hull, a town on the opposite side of the river from Ottawa, northwestward. Here it occurs in the *Crinoid* zone, associated with *Edrioaster bigsbyi, Cyclocystoides halli, Isotelus latus,* and *Amphilichas cucullus.* The strata in this quarry consist of rather thick-bedded, coarse-grained, gray limestone, separated by black shale partings in which most of the fossils are found. The writer found two specimens of *Comarocystites* on the surface of the highest layer of massive limestone exposed in the Robillard quarry, three miles east of Ottawa, on the south side of the Montreal road. This massive limestone is referred by Raymond to the *Tetradium* zone, and belongs above the *Crinoid* zone. The top of the *Tetradium* zone is exposed also in the quarry immediately behind the axe factory, in Hull. In the overlying *Prasopora* zone Mr. James E. Narraway found several specimens of *Comarocystites.* Several small specimens were found by Mr. Narraway in the lower part of the *Cystid* zone exposures at Nepean Point, within a short distance of the horizon at which *Agelacrinites inconditus* is fairly common. This part of *Cystid* zone is probably not far above the top of the *Prasopora* zone. The well preserved theca illustrated by figure 1 on plate II of the present communication was found by Mr. Narraway, in the quarry at the northeast corner of Bell Street and Carling Avenue, immediately east of the railway leading into the lumber yard east of Dow lake. Here

Agelacrinites chapmani occurs in one of the lower layers of limestone, and the *Comarocystites* was found about five feet above this level. The exposures in the quarry belong to the upper part of the *Cystid* zone. It is evident that the types of *Comarocystites punctatus* were found in the *Cystid* zone, since Billings stated in his original description that the specimens occurred "generally along the water's edge, from the Rideau Falls to the Chaudiere." The remarkable specimen obtained by Sir James Grant from an excavation on St. Patrick street, near Chapel street, in Ottawa, also may have come from the *Cystid* zone, but there are no exposures at present in this area, by means of which the horizon may be established definitely. Evidently *Comarocystites* has a considerable vertical range in the Trenton of the Ottawa area, being unknown so far only from the *Dalmanella* zone, at the base of the Trenton, and from the *Hormotoma* or *Sponge* zone, at the top of the Trenton. In the intermediate zones it evidently occurs at more or less remote intervals, and is a comparatively rare fossil.

Possibly there are two species of *Comarocystites* in the Ottawa area: one of larger size, with more compressed theca, and with nearly smooth thecal plates; the other smaller, less compressed, with minutely granular thecal plates, marked by pairs of distinctly lunate short ridges. The second form is known to occur at the top of the *Tetradium* zone, immediately beneath the *Prasopora* zone, and in the *Cystid* zone. Possibly the smooth form occurs at a different horizon, but the number of well preserved specimens at hand is not sufficient to determine whether the smooth and ornamented forms in reality are distinct or not.

Comarocystites punctatus is cited by Rominger also from the Trenton, in section 17 of township 41, above the big bend in the Escanaba River, north of Little Bay de Noquette, in Michigan.

20. *Literature on Comarocystites punctatus*:—
Comarocystites punctatus Billings:

Billings, Canadian Journal, 2, 1854, p. 270, figs. 1-3.

Figure 1 in this paper corresponds to figure 2 on plate V of Decade III. Figure 2 is an apical view of the same specimen and corresponds to figure 2b in the Decade, but is not identical with the latter; there is no indication of a pair of arms at the upper end of the figure, but only of a single protuberance, and the location of the anal pyramid beneath the pair of arms in the lower part of the figure is shown. Figure 3 corresponds to figure 1 of the Decade.

Geol. Surv. Canada Rep. Progr. for 1853-56, 1857, p. 288.

Geo. Surv. Canada, Dec. 3, 1858, p. 61, pl. 5, figs. 1-1b, 2-2b.

Figure 1 (No. 1391g, in Victoria Memorial Museum) represents the right side of the theca; *o* is the anal pyramid. In figure 1b, the smooth proximal parts of the polygonal plates surrounding the anal pyramid are represented incorrectly as though forming a circle of separate plates surrounding the anal pyramid. In figures 1a and 2a, the non-porous epistereom has been removed by weathering from the marginal parts of the thecal plates. Figure 2 (No. 1391, in Victoria Memorial Museum) presents a view of the anterior side of the theca, with the anal opening on the left upper margin of the figure; the nodular stereom mass supporting the right pair of arms is seen immediately below the number 2, and the angle at the upper right hand margin of the figure indicates the location of the other stereom mass. Figure 2b is a very unsatisfactory representation of the transverse food-groove extending from the central mouth in opposite directions to the base of the stereom mass, where it forks dichotomously at each end.

Grant, Trans. Ottawa Field-Nat. Club, 1, 1880, pl. 1, figs. 1-5.

Figure 1 (No. 333 in Victoria Memorial Museum) probably presents a view of the anterior side of the theca, in addition to a view of the entire length of the column, including its base. Only the lower parts of the arms and pinnules of this specimen are represented in this figure. The remaining figures are re-publications of figures in Decade III, of Billings, figs. 2, 3, 4 and 5 corresponding to figs. 1, 2, 1b and 2b respectively of the Decade

Chapman, Exposition of the Minerals and Geology of Canada, 1864, p. 109.

Haeckel, Amphorideen u. Cystoideen, 1896, p. 70, pl. 1, figs. 4-4c.

Figure 4 is a reproduction of Billing's figure 1 on plate 5 of Decade III, amplified by Haeckel so as to suggest the appearance of a complete arm system and a complete column. The biserial arrangement of the pinnules is incorrect. In figure 4a, the series of small plates surrounding the transverse food-groove is imaginary; the figure evidently is based on figure 2b of the Decade.

Jaeckel, Zeits, d.d. geol. Gesell. 52, 1900, p. 676.

EXPLANATION OF PLATE III.

Comarocystites punctatus Billings. Upper part of type figured by Billings in his monograph on the Cystideae of the Lower Silurian rocks of Canada, in Decade III, of Canadian Organic Remains, in 1858, where it forms figure 1 on plate V. The specimen has been crushed in a direction perpendicular to the anal pyramid. Only the upper part of the right side of the theca is shown in the figure here presented, magnified 3 diameters. A considerable part of the right posterior arm is exposed. The brachials are numbered. The exposed surfaces are interpreted as the dorsal side, most of the brachials showing the facets for the attachment of the pinnules on the right. The pinnules are twisted so as to show both the narrow edges and the flat faces of the pinnulars at different points along the pinnules. The first brachial and several closely appressed pinnules belonging to the right anterior arm occupy the position indicated by B, but can not be distinguished in the figure here presented. Cover-plates may be seen along the right margin of the pinnulars marked D, and along the corresponding margin of several pinnulars marked C in the figure. The position of the anal pyramid and the smooth border of the surrounding thecal plates is indicated at A. The surface of the thecal plates is strongly weathered, except at the center, and indicates clearly the parallel arrangement of all folds and pores of the mesostereom; these are perpendicular to the same edge of the plates; consequently those groups which are perpendicular to different edges form angles with each other along the imaginary lines drawn from the center of the plates to the angles of the latter. The passages of the folds and pores perpendicularly across the sutures from plate to plate, in an apparently continuous manner, also is indicated. For the remainder of the specimen, see the figure presented by Billings. Figure based on photograph supplied by courtesy of the chief photographer of the Geological Survey of Canada. The original specimen is numbered 1391 in the collection of the Survey deposited in the Victoria Memorial Museum, at Ottawa.

NEW SPHÆRIIDÆ.

Dr. Victor Sterki has recently published in the Annals of the Carnegie Museum (Vol. X, Nos. 3 and 4, pp. 429-474), a preliminary catalogue of the Sphæriidæ of North America. The small bivalves of this family are remarkably abundant in the vicinity of Ottawa, and constitute no small part of the food of many fishes and birds. The whole of the material submitted to Dr. Sterki has not yet been thoroughly studied, and what was collected in 1915 and 1916 has not yet been submitted to him. Most of the shells are minute in size, and alike in colour, and for these and other reasons their determination is attended with great difficulty, and, not infrequently, with doubt. The trained eye of Dr. Sterki, and his keen mental apprehension of slight differences, have in my opinion, rendered him capable of accomplishing a task before which other have "backward shrank appalled." While the result of his labors, as published, are modestly stated to be tentative and preliminary, they undoubtedly constitute one of the most valuable contributions made in recent years to the study of our inland mollusca. Several of the species and varieties now described for the first time are from the vicinity of Ottawa, and may be of interest to members of the Field-Naturalists' Club, who wish to spend a little of their leisure riding a delightful if neglected hobby. An hour or two devoted to any elementary work on zoology, dealing—as nearly all do—with the mollusca, will enable any intelligent student to understand Dr. Sterki's descriptions which will then be found to be full, clear and distinctive, though necessarily technical.

The shells themselves occur in every stream around the city. A kitchen bowl-strainer, of coarse mesh—procurable at a cost of a few cents—makes an excellent dredge for the larger species. In the shallows on the right bank of the Rideau Canal, above the by-wash at Hartwell's Locks, hundreds of fine specimens, mainly *Musculium transversum*, may be collected in a few minutes; and this and other species may be found without a dredge by turning over small boulders in the Rideau River, in the rapids near Billings' Bridge. Every depression in which water gathers in our deciduous woods contains the beautiful little *Sphaerium occidentale*, a species capable of living through long periods of drought; and in late summer the northern shores of Duck Island, just at the water's edge, are littered with myriads of small bivalves, mainly a variety of *Sphaerium striatinum*, or, perhaps, a species as yet undescribed. More and more material is required. It is with the hope of stimulating interest, and in order to render accessible to members of the Club descriptions not otherwise readily available that, with Dr. Sterki's permission, the following extracts are reprinted from his catalogue:—

21. MUSCULIUM ROSACEUM FULIGIOSUM var. nov.

Mussel small, rather short, subequipartite, moderately inflated, somewhat "pinched" along the margin; beaks nearly in the middle, narrow, somewhat prominent, calyculate; superior margin angular at the beaks, its anterior and posterior parts straight or nearly so, equally sloping; supero-anterior and posterior slopes, or truncations, well marked, nearly straight, the posterior longer and steeper, nearly at right angle with the longitudinal axis, anterior and posterior ends rounded: inferior margin moderately curved; surface shining and with a silky gloss derived from very narrow, membranous, scaly projections of the periostracum on the fine concentric striæ; shell very thin, glassy transparent, with a marked grayish or smoky hue.

The largest specimen measures: Long. 7; alt. 6; diam. 3.8 mm.

The mussel is striking in appearance, and at first sight seems to be distinct, especially since all specimens are remarkably uniform, but young and adolescent individuals reveal features of other forms of *M. rosaceum*.

Habitat.—Scott Graham Creek, Carleton County, Ontario, collected by Mr. Justice Latchford, 1911 and 1913. Specimens are contained in his collection and in the Carnegie Museum, Nos. 6,945 and 7,431. Justice Latchford writes in November, 1913: "No. 2,925 is quite common. I have visited the creek at all seasons and never found any larger shells than those which I send; I therefore regard them--the larger ones—as full-grown."

[The creek referred to flows eastward through Britannia Highlands, about four miles west of the city limits. Near the Shouldice farm it affords remarkably large and beautiful specimens of *Sphaerium sulcatum.*]

13. SPHÆRIUM TORSUM sp. nov.

Mussel inequipartite, oblique, well inflated, posterior part higher, and much more voluminous than the anterior; dorsoventral axis curved and oblique; beaks strongly inclined forward, large, prominent, rounded, not, or slightly, mamillar; superior margin curved, not, or barely, bounded by angles; scutum and scutellum well marked; anterior and posterior ends rounded, inferior margin moderately curved; surface with fine, slight, irregular or subregular concentric striæ and a few lines of growth, shining; yellow, straw-colored in younger specimens; shell moderately strong; hinge long for the shape and size of the mussel, almost regularly curved, rather slight; cardinal teeth small, the left posterior tooth vestigial in some specimens; laminæ rather slight, at almost a right angle to each other; ligament covered, resilium moderately strong. Soft parts not examined. Long. 11 mm.; alt. 9 mm.; diam. 7 mm. (100 : 83 : 64.)

S. torsum appears to range near *emarginatum* of the same region, but is more oblique, of more rounded outlines, more evenly inflated. The beaks are less elevated, less mamillar, and more inclined forward, and the hinge is much slighter.

Habitat.—Quebec, Ontario, along the Ottawa River, near Hull and Ottawa, collected by Justice Latchford, 1911 and 1912. Types in the collection of Mr. Latchford, and No. 6956 for full-grown, and 7286 for young and adolescent specimens. It occurs also in Wisconsin

Fossil.—Goat Island, Niagara, collected by Miss J. E. Letson 1900 (No. 2224a).

[Moore's Creek, on the Aylmer Road, north of the road, affords large numbers of this species.]

32. PISIDIUM LATCHFORDI sp. nov.

Mussell small, inequipartite, oblique, nearly oval in lateral aspect, well inflated; beaks somewhat posterior, rather large, prominent, rounded; superior margin curved, supero-anterior slope slightly marked, short, anterior end rounded, well below the longitudinal axis; posterior part short, subtruncate, or rounded; surface slightly glossy, with very fine and slight microscopic striæ, colorless to whitish, shell translucent to opaque; hinge rather long, curved angular, stout, plate rather broad, short; right cardinal tooth well curved, not much projecting, its posterior end not or but little thicker; between it and the somewhat projecting lower edge of the plate there is an elongate-triangular excavation for the left anterior, well defined all around; left anterior set rather well up on the plate, small, posterior oblique, curved; laminæ rather massive, with their surfaces rugose, the anterior and posterior at right angles to each other; cusps of the left ones pointed, with the proximal and distal slopes steep and almost equal, those of the right inner less pointed, outer anterior about one-third the length of the inner, posterior short and small; ligament short, resilium stout.

Measurements.—Long. 2.6; alt. 2.4; diam. 1.9 mm. (100 : 93 : 73).

Habitat.—Ontario, apparently rare. Collected in 1913 by Hon. Justice Latchford, in whose honour the species is named. It occurs in Scott Graham Creek, Graham Bay Creek, and Hare's Spring, all in Carleton County, Ontario. Specimens are in the collection of Justice Latchford and in the Carnegie Museum, Nos. 7,439 and 7,475. Only a rather small number of specimens are at hand, but markedly uniform, and different from all other described species. Their shape, the formation of the hinge, and the stout, short ligament and resilium place them in a group with *P. aequilaterale, fraudulentum,* etc.

["Hare's Spring" is on the Hare farm, Nepean, near the Watson line, about five hundred yards south of the Richmond Road.]

80. PISIDIUM SUBROTUNDUM CANADENSE var. nov.

Mussel larger. Long. 5.5; alt. 4.6; diam. 3.4 mm. More oblique; beaks more posterior; upper margin markedly straight, slightly alate in front of the beaks and bounded by an agle. In shape they somewhat resemble *P. ovum* from Montana, but are less inflated, and the hinges are different. Some specimens in the same lot have the beaks narrower, and are more markedly different from *P. subrotundum.*

Habitat.—Hare's Spring, Carleton County, Ontario, collected in considerable numbers by Justice Latchford. Represented in his collection, and in the Carnegie Museum, No. 7,437. May be distinct.

84. PISIDIUM VEXUM sp. nov.

Mussel small, slightly inequipartite and oblique, rather well inflated; beaks slightly posterior, rather broad, more or less flattened on top, moderately prominent, descending abruptly towards the posterior part; superior margin nearly straight, bounded by angles, posterior margin subtruncate or rounded, passing into the moderately curved inferior without an angle, anterior end rather broadly rounded, supero-anterior slope marked, nearly straight; surface dullish to somewhat shining, with very fine and slight subregular striæ. Shell thin, translucent to transparent, colorless; hinge rather slight, but well formed, moderately long, plate rather narrow; cardinal teeth rather long, the right curved to nearly straight in its middle, its posterior end thicker and grooved to bifid, left anterior more curved (in plane), not much bent upward, posterior long, nearly straight and a little oblique: laminæ; right anterior inner rather long, its cusp nearer the cardinal; outer short; posterior both short; left: both with the cusps rather abrupt, pointed; ligament short, resilium rather stout.

Measurements.—(Specimen from Ontario) Long. 2.5; alt. 2.1; diam. 1.5 mm. (100 : 84 : 60). (Specimen from Massachusetts) Long. 3; alt. 2.5; diam. 2.1 mm. (100 : 83 : 70).

P. vexum is somewhat like *P. inornatum* in size and shape, but more inflated; the shell and hinge are slighter, and the depressed beaks distinguish it.

Habitat.—Lake Gorman, Renfrew County, Ontario, collected by Justice Latchford, August 29, 1913. Types are in Justice Latchford's collection and in the Carnegie Museum, No. 7455. One specimen, somewhat larger, was collected in Hounds Ditch, Duxbury, Massachusetts, by Mr. William F. Clapp in 1913.

F. R. L.

THE SHARP-SHINNED HAWK.

By W. J. Brown, Westmount, Que.

Acquaintanceship with the Sharp-shinned Hawk (*Accipiter velox*) occurred twelve years ago, in April, in second growth woods. Here we discovered a specimen, under a cedar tree, devouring a small bird. A friend in parting the branches was rather surprised and startled. Sudden impulse, and visions of a Woodcock's nest, prompted further investigation, but the bird was equally alarmed and left the brush spasmodically. Previous to this, and for some time afterwords, I had entertained confused and mixed ideas as to the status and habits of this species. On May 24, 1908, I noticed a male flying in a jerky fashion through a small area of tamarack woods. At that time it did not occur to me to look for the nest, but the following year I investigated this locality with a friend and we found the nest, with five eggs, in a small tamarack. After watching the actions of the female about the nest I decided at once to learn more about these interesting birds. During the next two weeks I came in contact with two more nests, one in a black spruce and the other in a balsam, all three sets, of five eggs each, varying greatly in size and coloration.

At this period of my investigations I looked upon the Sharp-shinned Hawk as rare in the Province of Quebec. Subsequent research, however, has developed the fact that the bird is one of our most abundant raptores and is much more common that was formerly supposed. Any zealous ornithologist could probably locate two dozen nests in a season, but it is by no means an easy task to cultivate the bird's acquaintance at any time. Shyness is one of the hawk's peculiarities, to say nothing of it's retiring habits, especially in the nesting season. The bird is seldom seen during the period of incubation, except when the nest is in danger. If the male bird is present at this time the flicker-like alarm notes are a sure indication that a nest is close by. Experience (I use this term with calm deliberation) has driven me to the conclusion that the male bird is seldom at home while the female is incubating, but is off on some foraging expedition, —in many instances miles from the nest tree. Having become quite familiar with the breeding haunts of this species and meeting casually with the male in the open country, I have been able to form some estimate of the erratic movements of the smaller parent in the nesting season. Looking for sharp-shinned hawks' nests is tedious work, especially in black spruce bogs of any size, but this is the only satisfactory method of meeting the birds.

The early stragglers appear during the first week in April, but migration depends largely on the season. Some pairs start domestic duties early, as nests have been built by the end of April and contained full sets by May 8. The young have been hatched in the first days of June, but these, of course, are exceptional records. The eggs are usually laid by May 24, and the young are out of the shell about three weeks later. The number of eggs laid is three to six, usually four or five. They are richly marked, and there is an endless variety in a large series of sets.

Unfortunately the sharp-shinned hawk makes heavy raids on our song birds, the white-throated sparrow, chickadee and the warblers being the principal sufferers. I notice that the bird selects a mossy stump or squirrel's nest as a perch for plucking it's victims. Again and again I have stumbled across masses of bird feathers adhering to moss on the ground and on stumps in evergreen woods. Occasionally the hawk loses a feather or two in it's wild flight. These are all telltale signs that a pair of these destructive birds are tenants in the wood, and a thorough search always reveals the nest. Where a family has been raised the woods are almost stripped bare of song birds. The majority of nests have been found in black spruce trees, a few in balsam and an occasional one in hemlock, cedar and pine. The height varies from ten to sixty feet from the ground against the base on horizontal branches. The nest does not resemble the bulky structure of the crow as some authorities aver, but is easily distinguishable from the latter by the shallow platform of interlaced spruce twigs. A large number of nests have been built over old foundations, but as a general rule the bird constructs a new nest each season. The usual nest of this hawk is a frail affair of twigs and is sometimes lined with flakes of bark. The tree chosen is on the outskirts of the woods, or at the edge of any clearing or opening in the middle of the woods. A favorite location of the nest is in a thick clump of spruce near a clearing. Any large area of black spruce usually contains a pair of sharp-shins. The bird is generally a close sitter and only a well aimed stick or stub will dislodge her.

There is a certain amount of individuality in this species. Some birds are very quiet after being flushed off the nest, the alarm notes even being absent, while others are very lively and noisy and will return immediately to attack. One pair would not permit packing of the eggs under the nest, but would dart to the ground and almost fly in my face. Some pairs return to the same woods year after year even after bing disturbed. Others may raise their young in a woods, but it does not necessarily follow that the birds will occupy the same locality the next season. Should the first set be taken, the birds have been known to lay a second one in the same nest, or depart a short distance away and start operations afresh, but this is not the rule; the pair generally leave the woods.

The sharp-shinned hawk has two distinct alarm notes when the nest is approached, the usual cackling call in the earlier stages of the nesting season and a series of squealing notes, not unlike those of the grouse, after the young are hatched, alternating from one call to the other when the young are well grown.

En passant, it has occurred to me to point out the characteristics of a pair of hawks which I have kept under observation for a few years.

In the fall of 1912, while exploring some mixed small growth of timber encroaching on a spruce bog, I noticed seven or eight nests of the sharp-shinned hawk placed at low elevations, ten to fifteen feet in height, in black spruce saplings. These were all within a radius of fifty yards and apparently the work of one pair of birds.

On May 24, 1913, I visited this wood again and rapped all spruces containing these small nests . There were no signs of occupancy about the nests and it was quite apparent that no bird was on any of them. No hawk was seen in the neighborhood, nor was one heard, so the trees were not climbed. Four weeks later, on June 22, I passed through this group of nests and was amazed to see a sharp-shinned hawk leaving one of the identical nests I had previously pounded. In a minute I was gazing at five young sharp-shins in white down, probably only a few days old. The female flew in wide circles around the nest, but was peaceful and silent. On my first visit the bird had, no doubt, left the nest on my approach.

On May 29, 1914, Mr. L. M. Terrill and I purposely set out to gather additional information as to this secretive pair of hawks. On the way we decided not to leave anything to hazard, but to climb to all the nests and examine them carefully. The wood was quiet and no birds were in sight. My friend started to ascend one nest and pointed out another a few yards away. The nest looked old and shabby and I held out little hope, but it's easy accessibility prompted inspection. When on a level with the nest I was surprised to see a set of five eggs. My friend evidently noted my amazement, but all he said was: "Come down and let me have a look at them." About half an hour later we were returning through the same bush and were successful in catching the female slipping quietly off the empty nest. She was very shy and disappeared, and had evidently left the nest when we first entered the woods. The male was not seen. This bird is an early breeder, as the eggs were about ten days incubated.

On May 22, 1915, I moved cautiously through this woods, as I desired to observe this hawk on the nest. I noted the down of the hawk clinging to the branches of trees and knew that the pair were again in their old haunts. Twenty yards away I saw a new nest, the rim of which was covered with down and feathers. Looking more closely through the thick shrubbery I saw the hawk gliding furtively off the nest. She disappeared amongst the dense growth without making a sound. This nest was similar to the others, both as to height and construction, and the five eggs were marked like the first set. I remained in the locality for some time, but neither the male nor female returned.

On May 23, 1916, I learned that the pair had changed their quarters, but I decided to look for them in some familiar spruce woods a mile off. In four hours I discovered a small nest about thirty-five feet up in a black spruce at the extreme edge of the woods near a path. After throwing several sticks into the tree a sharp-shinned hawk bolted off and disappeared immediately into the woods and did not return while I was around. The male, as usual, was conspicuous by being absent. I had located the same pair once more, as the eggs are very much like those taken in the other woods and the actions of the bird were the same. The only departure was the size of the tree and the height of the nest.

It is strange, and at the same time interesting, that the male has not been seen, and that the female has shown persistent lack in vocal effort in the nesting season.

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