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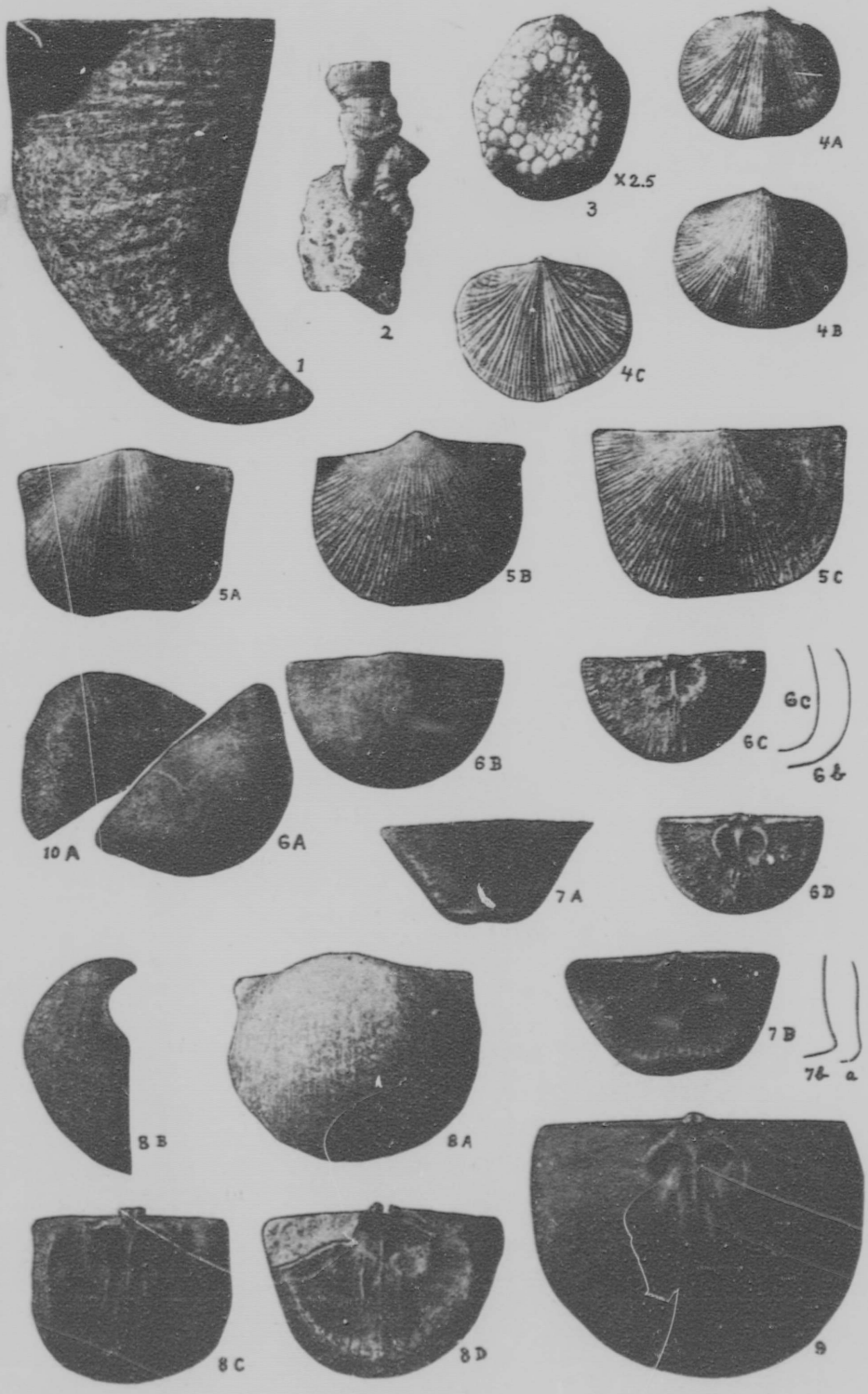
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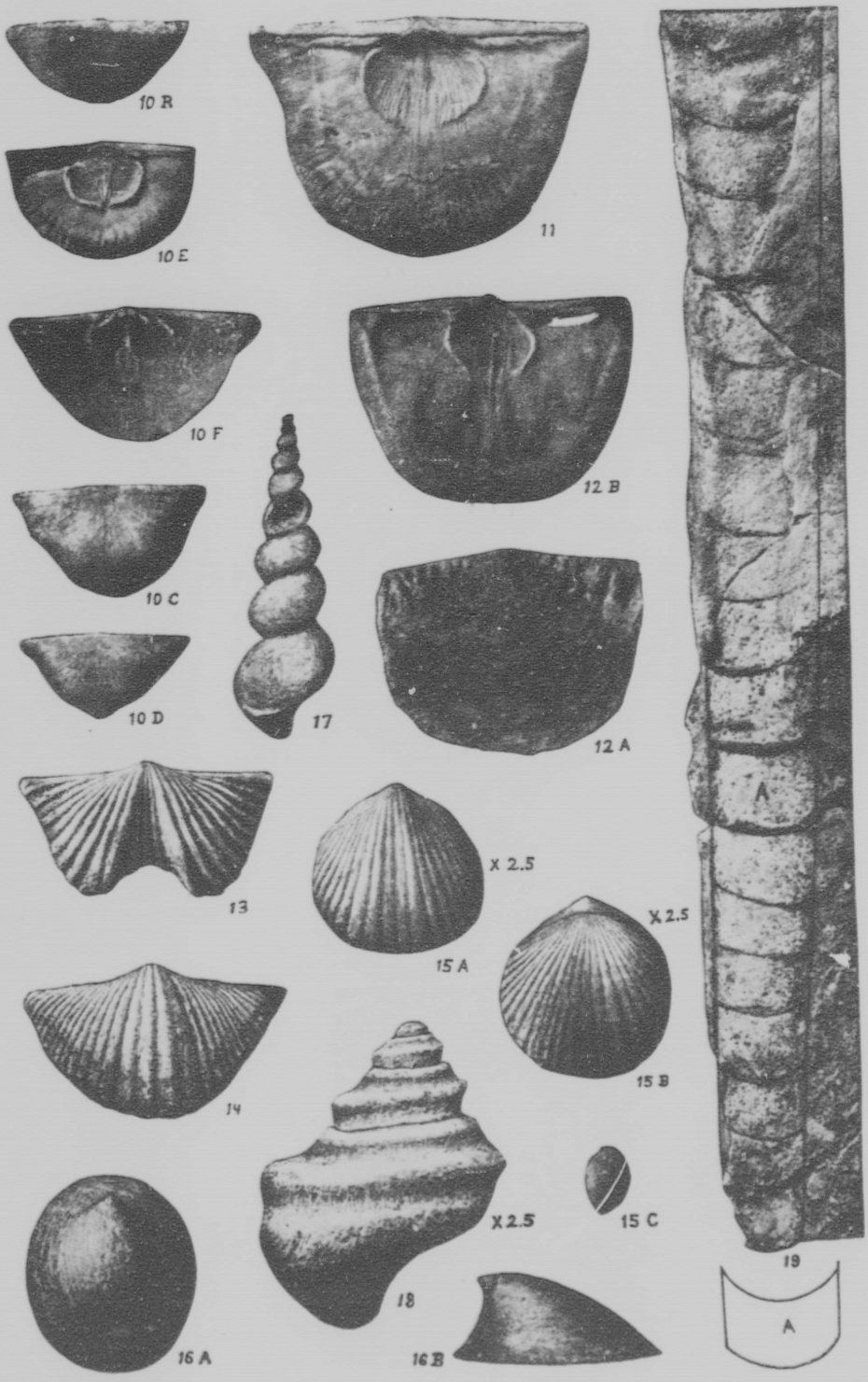
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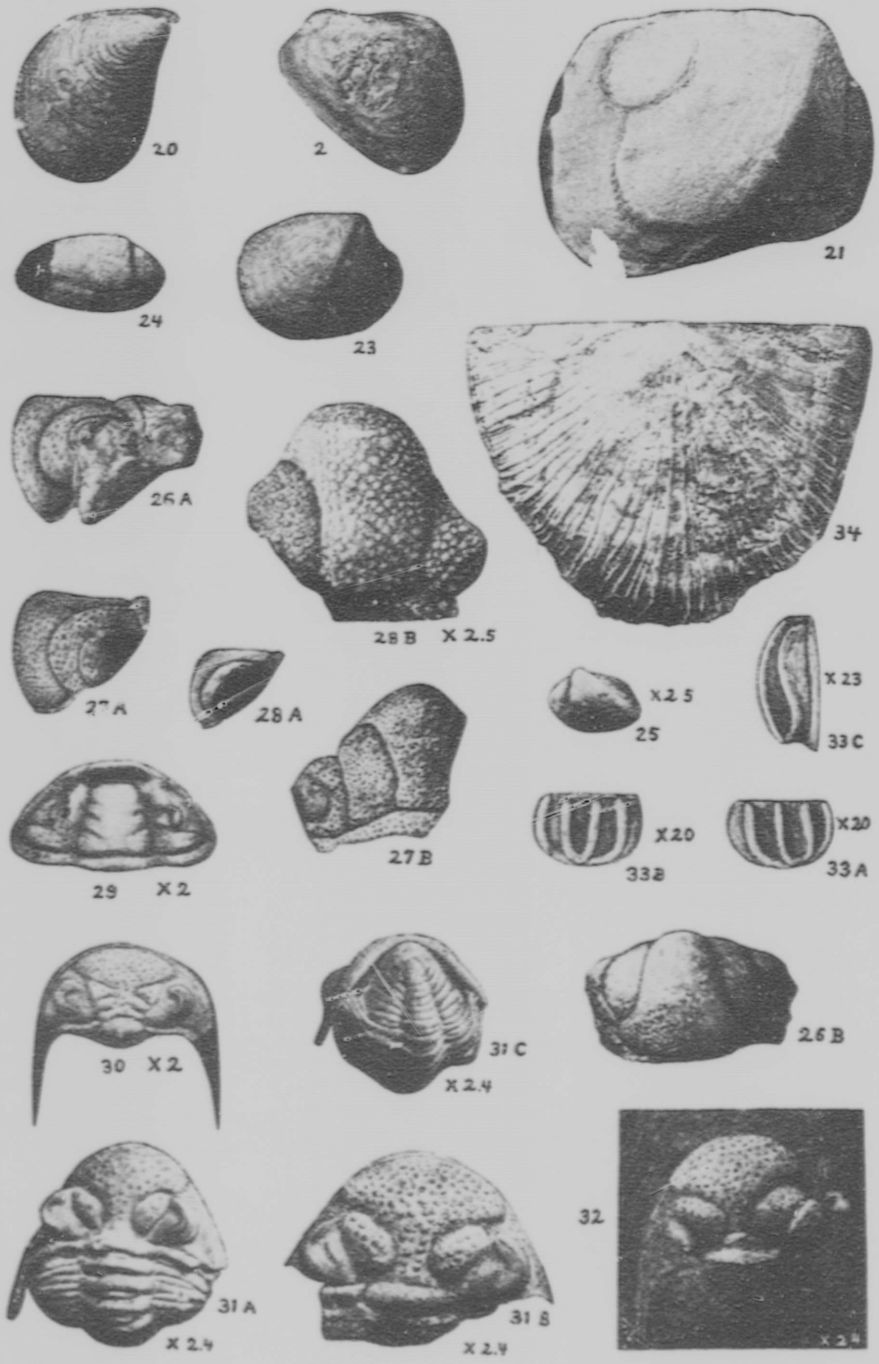
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THE OTTAWA NATURALIST

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THE RICHMOND FAUNAS OF LITTLE BAY DE NOQUETTE, IN NORTHERN MICHIGAN.

A. F. FOERSTE.

The fauna of the Richmond exposures along the northern shore of Drummond island evidently is merely a western continuation of that found on Manitoulin island, and extending thence eastward along the southern shore of Georgian Bay and north of the western half of Lake Ontario, almost as far east as Toronto. It contains the same abundance of coralline growths, such as *Stromatocerium huronense* Billings, *Tetradium huronense* Billings, *Columnaria alveolata* Goldfuss, *Calapoecia huronensis* Billings, *Streptelasma rusticum* Billings, and *Protarea richmondensis* Foerste. It contains also the associated fauna known from the Richmond of the Canadian localities just mentioned.

Nothing is known at present of the Richmond fauna on St. Joseph island nor of that part of the northern peninsula of Michigan extending between Lakes Superior and Michigan, until we reach the eastern shore of Little Bay de Noquette, about four miles east of Escanaba, on the opposite side of the bay. Here only the faunal list published by Rominger (Geol. Surv. Michigan, 1873, part III, page 52) is available, and it was for the purpose of supplying further data that the following studies were undertaken.

A lighthouse is located at the southern end of the peninsula between Little and Big Bay de Noquette. The Skaug Brothers store is located two miles north of the lighthouse, and two miles farther north is the present location, in a farm house, of the post office called Stonington. A short distance southward, an east and west section road leads down to the Farmer's Dock. Two miles farther north, at another east and west section road, is the store of J. B. Stratton, and a mile and a half farther north is another road corner, immediately south of which the shallow ditch following the road exposes the basal part of the cherty Richmond, the top of the underlying argillaceous Richmond strata being exposed a short distance farther southward. Passing

from this road corner westward across the farm lands, the following section was measured approximately, with a Locke level:

Base of cherty Richmond.

Interval, upper part consisting of argillaceous Richmond, lower part not exposed	57 ft.
Very coarsely granular limestone	5 ft.
Clay shale with some indurated clay layers and some very thin limestone layers interbedded	21 ft.

The clay shale here mentioned contains *Bollia permarginata*, at various levels. *Clidophorus noquettensis* and *Rafinesquina alternata-varicosa* occur chiefly in the five-foot limestone section.

Three-quarters of a mile south of the Stratton store the base of the cherty Richmond is 32 feet above the level of the bay; directly west of the Stonington post office this interval is 23 feet, and at the Skaug Brothers store it is 19 feet. The dip evidently is southeastward.

The greatest thickness of the cherty Richmond known at present is 14 feet, and this is exposed directly west of Stonington post office, but the top of this part of the Richmond is not exposed here, so that its total thickness is unknown at present. Only the upper part of the underlying argillaceous Richmond was readily accessible at the time of my visit. This presented the following section at the home of Andrew Rheinholdson, three-quarters of a mile south of the Stratton store:

Cherty Richmond, cream-colored limestone	5.5 ft.
Argillaceous Richmond, abundantly fossiliferous, and readily accessible. At the very base of the section *Streptelasma* (?) *divaricans* and *Strophomena sulcata* were collected, and at the very top *Dinorthis subquadrata* occurred. Thickness	11 ft.
Indurated clay layer, spalling off in larger masses, containing *Pholadomorpha pholadiformis* and specimens related to *Modiolopsis concentrica*	2 ft.
Fossiliferous grey-blue argillaceous limestone carrying the same fauna as the overlying layers	6 ft.

Directly west of Stonington post office, the *Pholadomorpha* layer is 16 feet below the base of the cherty limestone, and only 5 feet above the bay. At no locality were the exposures below the *Pholadomorpha* layer well exposed for collecting and practically all the fossils described from the argillaceous Richmond were obtained above the level of this layer.

DESCRIPTION OF FOSSILS.

Streptelasma rusticum (Billings), Fig. 1. Coralla frequently strongly curved as in the specimen figured, but in some individuals the curvature is only moderate. Occurs in the cherty Richmond and in the immediately underlying part of the more argillaceous Richmond. Small specimens of *Streptelasma* (Fig. 2) occur also 10 feet below the cherty Richmond, immediately above the *Pholadomorpha pholadiformis* zone. These specimens have a general resemblance to *Streptelasma divaricans* (Nicholson), especially such forms as occur in the upper part of the Liberty formation in various parts of Clinton county, Ohio, the attachment of the corallum being more or less lateral, frequently with somewhat radicular expansions.

Cornulites corrugatus (Nicholson). Specimens resembling figure 27 on plate 115 of the Palaeontology of New York, volume VII, Supplement, occur in the cherty Richmond.

Lichenocrinus tuberculatus Miller, Fig. 3. Specimens with the plates not as prominently convex, and therefore not presenting as tubercular an appearance as typical forms of the species, occur in the cherty Richmond. The part here figured forms the attachment disk at the basal part of the stem of a crinoid probably belonging to the *Heterocrinidae* (Scyphocrinus and its bulbous root Camarocrinus, Springer, 1917, page 11).

Perenopora decipiens (Rominger) and *Rhombotrypa quadrata* (Rominger) are common in the upper part of the argillaceous Richmond, within ten feet of the cherty Richmond. *Proboscina auloporoides* (Nicholson) occurs in the cherty Richmond.

The specimens of *Crania* occurring in the upper part of the argillaceous Richmond are more or less granulose, but the granules are only about a tenth of a millimeter wide and the distances between them average from one-fifth to one-fourth of a millimeter. In outline they are more or less irregular, as in *Crania scabiosa* (Hall). The diameters of one specimen are 11 and 13 millimeters respectively.

DALMANELLA JUGOSA SUBPLICATA, var. nov., Figs. 4, A, B, C. Specimens resembling the forms figured are common in the upper part of the argillaceous Richmond. Compared with *Dalmanella jugosa* (James), from the Waynesville formation of southern Ohio and neighboring states, they show a tendency toward low folds corresponding to the more prominent fascicular areas among the radiating striae, especially in case of the pedicel valve. The median depression of the brachial valve tends to be narrower, with the immediately adjoining low folds on each side forming a less divergent angle. The term *Dalmanella meeki* was proposed by Miller (Cincinnati Quarterly Journal of Science, 1875, page 20) for specimens described and figured by Meek (Ohio Palaeontology, vol. I, 1873) and which Meek

regarded as identical with *Dalmanella emacerata* (Hall), but which Miller, owing to his more intimate knowledge with Cincinnatian fossils, recognized as distinct. The type of this species evidently is the specimen represented by figures 1 a, b, and c on plate VIII of the Ohio Paleontology. This specimen Meek describes as "of the same form as one of the typical examples." Under the heading: Locality and position, on page 111, he gives its horizon as "Cincinnati group, Cincinnati, Ohio, at an elevation of 250 feet above the Ohio; this being the typical form, like Prof. Hall's fig. 1, in the Regents' Report," the reference being to the 15th Regents' Report on the State Cabinet of Natural History of New York. The elevation mentioned is 50 feet above the top of the great range of strata in which different varieties of *Dalmanella multisecta* (Meek) are more or less common. Here it occurs in the lower part of the Fairmount member of the Maysville group, immediately above the *Strophomena planoconvexa* Hall horizon. It formerly was well exposed at this horizon at the Avondale power house, on Hunt street, and at many other localities within the limits of Cincinnati. Figure 1d, on the same plate, also from Cincinnati, is a typical specimen of *Dalmanella fairmountensis* Foerste; the same species occurs at the top of the hills on the western side of the river at Hamilton. The various specimens represented by figures 2 a-g, on the same plate, probably are representative of the species which is so abundant in the Waynesville member of the Richmond in southern Ohio and neighboring states, and which later (Paleontologist No. 4, 1879) was described by James as *Orthis jugosa*. It evidently was the intention of Meek to describe these specimens from a higher horizon as a separate species, probably owing to the suggestions of James who supplied him with the various brachiopoda described by him from the Cincinnatian localities. Before final publication, however, he evidently abandoned this idea.

Specimens (Figs. 5 A,B, C) identical with *Hebertella alveata* Foerste occur in the upper part of the argillaceous Richmond, but these specimens are associated with others in which the median depression is confined to a limited area near the beak, as in *Hebertella occidentalis* Hall.

Dinorthis subquadrata (Hall) occurs both in the cherty Richmond and in the immediately underlying part of the argillaceous Richmond.

Most of the specimens of *Platystrophia* occurring in the upper part of the argillaceous Richmond have an aspect somewhat similar to that of *Platystrophia clarksvillensis* Foerste (Fig. 13), from the Waynesville and Liberty members of the Richmond in southern Ohio and adjacent states, however, an occasional specimen resembling *Platystrophia acutilirata* (Conrad) (Fig. 14) from the Whitewater member of the Richmond, also occurs.

Leptaena unicostata (Meek and Worthem), Figs. 7 A, a, B, b. Types used for figures 11a, and 11b, on plate IV, accompanying the original description in volume III, of the Geology of Illinois, 1868. From Maquoketa strata at Savannah, Illinois. Types numbered 12017 in the Worthen collection at the University of Illinois, and examined owing to the courtesy of Prof. T. E. Savage. Figures introduced here for comparison with *Rafinesquina breviusculus*. Notice the relative flattening of the greater part of the pedicel valve, the geniculation of the anterior part of both valves, the straightening of the anterior margin and the consequent angulation of the anterior outline on both sides of this straightened part. The radiating striations, although numbering 4 or 5 in a width of one millimeter, are distinctly leptaenoid, being broad and flat and separated by very narrow interspaces.

RAFINESQUINA BREVIUSCULUS, sp. nov., Figs. 6 A, B, b, C, c, D. The size and general outline of this species is sufficiently indicated by the accompanying illustrations. Figures b and c indicate the amount of curvature, along the median line, of the exterior of the pedicel and brachial valves illustrated by figures 6 B and C. The interior of the brachial valve is thickened along the anterior margin along a narrow area crossed by vascular markings, and here the interior of the shell has a somewhat leptaenoid appearance. However, there is no geniculation such as that characteristic of the genus *Leptaena*. The curvature of the pedicel valve increases slightly toward the beak and much more rapidly toward the anterior border. The muscular area of the pedicel valve, not figured, is broad and flabellate, similar to that of other species of *Rafinesquina*, but only weakly defined. From 4 to 6 radiating striae occur in a width of one millimeter at a distance of 20 millimeters from the beak, averaging about 5 in one millimeter. The median striation often is more distinct than the remainder, but not prominent. Common in the upper part of the argillaceous Richmond. Readily distinguished from *Strophomena parvula*, in the same strata, by the convexity of the posterior parts of the pedicel valve.

RAFINESQUINA PERGIBBOSA, nov. sp., Figs. 8 A, B, C, D. Pedicel valve strongly convex, almost hemispherical in the more obese specimens, with the greatest convexity about two-fifths of the length of the shell from the beak. This strong convexity is maintained to within a short distance of the postero-lateral angles and sometimes produces an abruptly auriculate appearance here. The more prominent radiating striations occur at intervals of less than a millimeter, and the intermediate spaces are occupied by three much finer striae. The interior markings of the brachial valve are boldly defined and are well represented by the accompanying figures. Usually there is a well defined ridge parallel to the anterior prolongation of the median

elevation on each side of latter near the central part of the valve. In the upper part of the argillaceous Richmond.

RAFINESQUINA ALTERNATA (Emmons). Mose of the specimens in the upper part of the argillaceous Richmond are nearly flat (Fig. 9) or are only moderately curved, but specimens with stronger curvature also occur. In the limestone interbedded with the shale on the lake shore, about a mile and a half north of the store of J. B. Stratton, specimens occur in which the strong radiating striae are unusually prominent, suggesting the name RAFINESQUINA ALTERNATA VARICOSA, var. nov. (Fig. 34). These shells are of medium curvature, the curvature being greatest about 35 millimeters from the beak.

STROPHOMENA PARVULA, sp. nov., Figs. 10 A-F. Numerous specimens of a small species of *Strophomena* occur in the upper parts of the argillaceous Richmond and also in the overlying cherty Richmond. These are characterized chiefly by their considerable lateral and short anterior extension. The anterior outline varies from more or less evenly rounded to subtriangular and subnasute. This species evidently belongs to the *Strophomena planumbona* group. There is nothing characteristic about the interior of either the brachial or pedicel valve. The surface striations are fine, about 5 or 6 in a width of one millimeter, interrupted at intervals by slightly more prominent striae. This species may be readily distinguished from *Rafinesquina breviusculus* by the flattening of the brachial valve toward the beak, usually accompanied by a gentle concavity, as in all species of *Strophomena*.

Specimens resembling *Strophomena huronensis* Foerste, from the equivalent of the Waynesville member of the Richmond in Manitoulin island, Ontario, occur occasionally in the upper part of the argillaceous Richmond, accompanied by occasional specimens resembling *Strophomena nutans* Meek, and much more numerous specimens of *Strophomena vetusta* (James), Figs. 12 A, B. *Strophomena neglecta* (James), Fig. 11, is fairly common at the same horizon and occurs in the overlying cherty Richmond. In *Strophomena vetusta* the radiating striae on the brachial valve are relatively coarse; those on the pedicel valve are very fine and often are crossed by fine irregular concentric wrinkles; along the hinge line both valves are wrinkled more or less perpendicularly; and the muscular area of the pedicel valve is subrhomboidal in outline. In *Strophomena neglecta* the radiating striae on both valves are fine and subequal in size, the size of the shell is larger, and the muscular area of the pedicel valve is circular and supplied with flabellate markings. In typical *Strophomena planodorsata* the flattened area occupying the posterior part of the brachial valve forms a larger part of the valve and the muscular area of the pedicel valve is relatively larger.

Strophomena sulcata (Verneuil) occurs 10 feet below the base of the cherty Richmond, immediately above the *Pholadomorpha pholadiformis* horizon, and also at higher horizons in the argillaceous Richmond, associated with *Dinorthis subquadrata* and *Dalmanella jugosa subplicata.*

ZYGOSPIRA RECURVIROSTRIS TURGIDA, var. nov., Figs. 15 A, B, C, evidently is closely related to *Zygospira recurvirostris* (Hall) and *Zygospira kentuckiensis* James. In all of these forms the plications are subequal in size, the median area of the pedicel valve is not distinctly limited laterally, and the median depression of the brachial valve anteriorly is broad and relatively shallow. In the variety *turgida* the brachial valve is more convex than in either of the other two forms when specimens of the same small size are compared. The variety evidently is nothing but a Richmond representative of the Trenton species *Zygospira recurvirostris.* It occurs in the upper part of the argillaceous Richmond.

Specimens resembling *Clidophorus neglectus* Hall (Fig. 24), from the Maquoketa of Wisconsin, in outline and general appearance, occur in the cherty Richmond. A much smaller species, CLIDOPHORUS NOQUETTENSIS, sp. nov., Fig. 25, 3 to 4 millimeters in length, is very abundant in certain layers of limestone interbedded with the shales on the lake shore a mile and a half north of the store of J. B. Stratton. This species is referred to *Clidophorus* on account of the incision made by the clavicular ridge defining the posterior part of the anterior muscular scar, and the absence of any distinct elevation of the casts of this muscular scar in interior casts of this shell, such as occurs commonly in interior casts of typical species of *Ctenodonta.* The shell is relatvely shorter than in *Clidophorus neglectus,* and is less produced anterior to the clavicular ridge; the latter is strongly defined and is either vertical or slightly inclined toward the front. In the casts of the interior the beak rises distinctly above the level of the upper margin of that part of the cast which lies anterior to the impression of the clavicular ridge. The umbonal ridge is fairly strong and is sufficiently oblique to give the shell a ctenodontoid appearance.

In Rominger's list of fossils from the area here discussed, along the east shore of Little Bay de Noquette (Geology of Michigan, vol. I, Part II, 1873, page 52) an undetermined species of *Cyrtodonta* is included. Specimens having a general cyrtodontoid appearance occur in the cherty Richmond, and two of these are here figured, but the hinge and teeth are not distinctly defined in the specimens collected so far and hence their generic relations are not definitely determined. One of these, Fig. 22, bears some resemblance in outline to *Cyrtodonta affinis,* Ulrich, and the other, Fig. 23, to *Cyrtodonta persimilis,* Ulrich, both of which are Black river forms occurring in the Minnesota area.

(*To be continued*)

SOME HABITS OF TWO BURROWING SPIDERS IN MANITOBA.

BY NORMAN CRIDDLE, DOM. ENTOMOLOGICAL LABORATORY, TREESBANK, MAN.

Among the various natural objects met with in the vicinity of the writer's home in Manitoba, none have induced more enquiries as to their origin than the numerous open holes made by the large burrowing spider *Lycosa missouriensis* Banks. These holes are, in fact, met with wherever the soil is sandy and towards winter become very conspicuous on account of the ring of sand thrown around them by the digging spiders. The writer has long since been interested in these creatures and, more than twenty years ago, commenced some observations relating to their winter habits. Owing to the difficulty of securing their names at that time, however, the notes were laid on one side. During the summer of 1917 the old interest was revived through a visit to Treesbank, of Mr. J. H. Emerton, of Boston, Mass., the following notes being a result.

Two species of burrowing spiders are involved in these studies both sand-loving but partial, nevertheless, to certain local conditions of soil. *Lycosa missouriensis* is always found close to vegetation and prefers a situation where dead herbage of some sort is available for the construction of a turret around the entrance to its hole. *Lycosa wrightii* Em., on the other hand, inhabits the bare sand dunes only and constructs no turret. Hence, while these two species may be met with in close proximity they seldom, if ever, invade the other's territory for burrowing purposes. In life *L. wrightii* is at once told from *L. missouriensis* by its black venter.

The life-habits of these two species have already been described by Mr. Emerton* and need not, therefore, be repeated here. This paper, consequently, will be confined to a description of the burrowing habits and such other features as have not previously been touched upon.

In summer time, the excavations of both of these spiders are comparatively shallow, those of *L. missourienses* being about 9 inches in depth, while those of *L. wrightii* are slightly deeper. It is not unusual to find females, when the young are upon their backs, with holes only three or four inches deep. As autumn approaches both these spiders commence to either deepen their burrows or prepare new ones. There is much variation in the dates when individuals begin to do so. In 1917, some were at work on August 2, while others did not commence to dig for more than a month later. There is good reason to

*Phyche, Vol. XIX, No. 2, 1912.

suspect that this variation has to do with the pairing of the sexes and that females do not commence to burrow until after they have become fertilized. The mature males, of course, die before winter sets in.

On September 16, 36 adult burrows of *L. missouriensis* were measured and were found to have attained an average depth of 3 feet 1 inch, the deepest being 5 feet 3 inches and the shallowest 1 foot 4 inches. The deeper burrows had not been further extended for some days, while the spiders were busily at work with the shallower ones. By October 1, many holes had been closed and a measurement of 9 of these indicated an average depth of 3 feet 9 inches. 17 holes still open, but showing no recent signs of digging, averaged 4 feet 1 inch in depth. 15 holes in which the spiders were still digging showed an average depth of 3 feet 7 inches. The deepest closed hole was 4 feet 5 inches, the deepest open one 4 feet 10 inches. Closed holes are thoroughly covered in with grass, leaves and sand fastened together with web in such a way as to make them practically water tight. It was observed that the earliest closed burrows were always in shady situations which would indicate that the shadow had induced an earlier closing than in the case of those exposed to the sun. Burrows in low, wet, lands are shallower than those on the higher lands. 33% of the spiders were still digging on the above mentioned date.

On October 5, about 22% of the adults had closed their holes though all the young were still digging.

On October 8, cold weather seemed to have induced a closing of nearly all burrows, only a few of the smaller ones remaining open. 20 adult holes on high land had an average depth of 5 feet 1 inch, the deepest being 5 feet 8 inches and the shallowest 4 feet 4 inches. Measurement of young spider burrows indicated an approximate depth similar to those of adults.

On November 5, a mature individual was dug out at 4 feet 7 inches. This burrow though perpendicular in direction, had numerous small curves, due to the spider having encountered obstacles in digging. For the first 3 feet this hole was rather densely lined with web but became less so towards the bottom. It had also been stopped with sand at several places, the sand being held in place by web. This spider was found, at the bottom of her burrow slightly sluggish but with sufficient energy to defend herself. A young example provided a similar burrow but slightly deeper. It was stopped at two places. The ground at this time had been frozen to a depth of four inches for some days but at the time of observation was thawed out. These two individuals were placed in the warm sun and became quite active; they refused, however, to dig a new burrow and had moved but little by the next day.

As *L. wrightii* was not found in such close vicinity it did not receive the careful attention given to *L. missouriensis*. Judging from

hasty visits to its home, however, it does not appear to differ very markedly in habits from the latter. A full day spent in the Spruce Woods Reserve on October 13, where the species is numerous, discovered most of the burrows closed but here and there spiders would be found busily at work. The holes were always in pure sand, though occasionally they might be located in places where the grass was sparse or even near ground cedar, *Juniperus horizontalis*. It often happens, with this species, that the coverings of the holes are broken away by the drifting sand, thus giving them the appearance of having never been closed. In several instances of this sort the spiders had abandoned their burrows, while on other occasions a stoppage of the hole lower down had protected them from the falling sand. Abandoned holes of both this spider and of *L. missouriensis* are quite frequently met with, doubtless due to the death of their owners. There is reason to suspect that very late burrowing individuals are those which have been obliged to abandon a previously prepared home. The fact that *L. wrightii* does not construct a turret around its hole is doubtless due to the fact that a turret would catch the wind in such an exposed situation and so be blown away. The holes, unlike those of *L. missouriensis*, are closed entirely with a mixture of sand and web, no vegetation being used in the process. 22 adult burrows were measured, the average depth of which was 4 feet 7 inches, the deepest being 5 feet 7 inches, and the shallowest 4 feet 1 inch. These holes were all closed and had been so for some time.

The burrows of *L. wrightii* being in pure sand are more thoroughly lined with web than are those of *L. missouriensis*. This, of course, serves a double purpose, namely, to enable the spiders to climb up readily and to prevent the loose sand from dislodging. During the summer, holes have to be continually cleaned out owing to the drifting condition of the sand and in late autumn a majority of the closed holes are very soon hidden through the same agency. The opening of burrows in spring time is largely governed by meteorological conditions, and is doubtless induced by a thawing out of the ground around the hibernating spiders. Thus, during an early spring, the holes are opened by the end of April, while in other years they have remained closed until the middle of May.

Both these large spiders are much attacked by parasitic and predacious wasps which they greatly fear. The males are particularly subjected to these attacks while wandering in search of females during September, and fall ready victims to the determined onslaught of their dreaded foes. It is true that the spider will fight in desperation when overtaken but the result is, apparently, always the same. Some species of *Pompilus* boldly enter the spider's burrows and attack the occupants. On July 7, 1916, the writer observed an example of *Pompilus scelestus* Cr. enter a burrow of *L. wrightii* and shortly afterwards

emerge again. An examination revealed the spider in a torpid condition with a large cylindrical shaped white egg attached to the under side of its abdomen. This spider was placed in a glass vial and on the 8th had fully recovered its activities. It ate flies readily thereafter and was kept alive until July 15, when being unable to longer resist the sapping of its vitality by the large larva, which the *Pompilus* egg had produced, it died. This *Pompilus* larva had in seven days attained a truly remarkable size and was almost 20 mm. long at the time of the spider's death. It only survived its host, however, for a short time, so that the further stages of its life could not be ascertained. This is but a single example of the many tragedies that occur in, or around, the spiders' homes Wasps of many kinds roam these sand dunes in large numbers and there is no doubt that spiders form quite a large percentage of their prey. That the spiders in their turn, have found it a profitable hunting ground is equally demonstrated by the large number present in the neighbourhood.

A NOTE ON THE MIGRATION OF THE BARREN GROUND CARIBOU.

BY E. M. KINDLE.

There is perhaps no more curious and interesting phenomenon connected with the wild life of Northwestern Canada than the semi-annual migration of the Caribou, *Rangifer arcticus*. The vast herds of these deer, which summer in the barren lands far to the east of the Mackenzie river, move southward in the late autumn from the treeless barrens of the Arctic slope and seek the shelter of the forested region east of the Slave and Athabasca rivers. The writer traversed both of these rivers and a part of the Mackenzie river during the past summer but neither saw nor heard of any caribou having been observed during the summer. With the coming of winter, however, they appeared east of the Slave river in vast numbers, as the following letter from Inspector K. F. Anderson of the R. N. W. Mounted Police clearly indicates.

R. N. W. M. Police,
Fort Fitzgerald,
December 15, 1917.

E. M. Kindle, Esq.,
Ottawa.

My dear Mr. Kindle:

There is nothing new here except the Caribou. They are within forty-five miles of this place in tens of thousands and the natives are getting numbers of the animals and will therefore have plenty to eat this winter. The Deer (Caribou) are passing

north coming from the Southeast, most likely from Fondu Lac on Lake Athabasca. They could not cross there on account of late frosts and swung around towards Great Slave Lake. They say the animals are scattered over hundreds of miles, and literally in millions; the farther east one goes, so they say, the more there are and the buffalo on the plains in the long ago is not a patch on this for numbers. Eventually they land in the barren grounds where nobody bothers them until they take another treck. I sent the Sargeant out on a patrol to see and he reported that the snow is tramped down for miles as close as ice by the animals feet where they passed in great numbers. It is most wonderful!

It is cold up here now and has been for about twenty days, always from 20° to 36° below zero and sometimes blowing.*

I remain,

Yours sincerely,

(Sgd.) K. F. Anderson.

It appears from Inspector Anderson's letter than an important element in directing the course followed by the caribou in their winter wanderings is the date of the freezing of the narrows of Lake Athabasca at Fondu Lac. The early coming of ice there permits the herds to cross and winter farther to the south, so that they would be likely to pass at a great distance to the east of Fort Fitzgerald. When the lake remains open at that point till late, as happened this season, the migrating columns seem to be diverted in a northwesterly direction.

Preble** reports that "During the winter of 1900 the caribou approached the Slave river within a half day's journey east of Fort Smith (sixteen miles north of Fort Fitzgerald) for the first time in many years."

Mr. W. J. McLean,§ a former chief factor of the Hudson Bay Company who observed the arrival in late summer of the caribou in the region north of Lake Athabasca several years ago, described their movements as follows: "It was very interesting to watch these animals which were then marching in their annual tour. They scarcely appeared to take any rest, or halt, excepting for three or four hours in the middle of the night. They kept travelling in continuous bands along the lake towards its north-east extremity and appeared to be impelled by some mighty power over which they had no control. They have regular and well trodden paths which they keep without deviation even when fleeing from their enemy."

With reference to the extraordinary number of the caribou reported by Inspector Anderson it may be noted that his estimates are in accord with those which have been recorded by various other observers.

*A letter from W. G. A. McNeil Wood, Buffalo Range, dated Jan. 18, reports a maximum temperature to that date of 71½° at Fort Smith.

**North Amer. Fauna No. 27, p. 137.

§Man. Hist. and Sci. Soc., Trans. No. 58, Feb. 12, 1901, p. 6.

During the summer of 1893 while travelling northward between Athabasca lake and Chesterfield Inlet the Tyrrell brothers† saw on the shores of Carey lake about latitude 62° 15′ a herd estimated to contain from 100,000 to 200,000 individuals.

In 1877 the caribou are reported to have crossed the north arm of Great Slave lake on the ice in an unbroken line which was fourteen days in passing and in such a mass that in the words of an eye witness "daylight could not be seen" through the column.‡

Wharburton Pike saw enormous numbers of caribou at Mackay lake, October 20, 1889 and says:—

"I cannot believe that the herds of Buffalo on the prairie ever surpassed in size *La Foule* (the throng) of the Caribou. *La Foule* had really come and during its passage of six days I was able to realize what an extraordinary number of these animals still roam the Barren Grounds."

Ernest Thompson Seton gives the following description of the migration of caribou as observed by Colonel Jones (Buffalo Jones) in October at Clinton Golden in the Barren Lands:

"He stood on a hill in the middle of the passing throng with a clear view ten miles each way and it was one army of Caribou. How much further they spread he did not know. Sometimes they were bunched, so that a hundred were on a space one hundred feet square; but often there would be spaces equally large without any. They averaged at least one hundred caribou to the acre; and they passed him at the rate of about three miles an hour. He did not know how long they were in passing this point; but at another place they were four days and travelled day and night. The whole world seemed a moving mass of Caribou. He got the impression at last that they were standing still and he was on a rocky hill that was rapidly running through their hosts."

Even halving these figures to keep on the safe side, we find that the number of Caribou in this army was over 25,000,000. Yet it is possible that there are several such armies."

It is reassuring as regards the future of Canada's big game to learn from Inspector Anderson that the caribou still exists in numbers which are comparable with those reported by these earlier observers.

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†Can. Geol. Surv. Ann. Rept. vol. IX, n. ser. 1898, p. 165.

‡Frank Russell Expl. in the Far North, p. 88, 1898.

NOTES ON THE EVENING GROSBEAK (HESPERIPHONA VESPERTINA).

BY F. W. WARWICK, B.Sc., BUCKINGHAM, P. Q.

As about this time of the year, ornithologists are on the lookout as to the probability of the Evening Grosbeak visiting this district, a few notes I have made upon the species may not prove altogether uninteresting, and go to show that we cannot depend upon its reappearance year after year.

January 7th, 1910.—A flock of Evening Grosbeaks numbering twenty birds have been around town for a week, or more, spending a good part of their time in the mountain ash trees in our grounds, and feeding upon the seeds thereof. The branches of one of these trees coming within five feet of some of our windows, gives us a good chance to study them. They are very handsome, tame, and interesting.

December, 1914.—The Evening Grosbeaks are with us again.

December 15th, 1916.—A flock of seventeen birds of this species put in an appearance to-day, and are gorging themselves on the Rowan and Barberry seeds. This flock remained with us all winter, and had increased by April to forty-two specimens which were doubtless congregating for their flight westward. Any hour of the day they were to be seen in the Rowan trees, on the ground, or adjacent trees, and made a beautiful sight. They became exceedingly tame and fed within four feet of us, helping themselves occasionally to grit from the ash pile. As the snow disappeared they would feed upon the seeds laid bare.

May 2nd, 1917.—A flock of some twenty birds are still with us, now feeding upon the seeds of the Manitoba maple, and other seeds they find amongst the grass.

May 9th, 1917.—Two males still around in the garden. This was the last date they were seen by us.

December 27th, 1917.—At present date have not as yet put in an appearance. An abundance of their favorite food exists.

Children in various parts of Great Britain have been busily collecting the horse chestnuts required for the manufacture of war munitions. The nuts ripened more quickly in some districts than in others. Indications are that at least 25,000 tons of nuts will reach the Ministry of Munitions, but this is only about one eighth of the estimated crop for the country.

NOTES BY "DIGRESSOR."

Recent experiments by British investigators go to show that butter and some forms of oleomargarine contain a substance that promotes growth in the young. Young rats fed on a ration from which all butter and its substitutes had been eliminated, continued to live but did not increase in weight; while adult females fed on the same food failed to produce young. This growth-promoting substance is found in oleomargarine made from beef fats, but is absent from the other butter substitutes manufactured, as many of them are, from other animal fats or vegetable oils.

The conclusion drawn from these facts by an English writer is that while the presence of this substance in food is probably of little importance to adults whose growth is completed, it may have much to do with the health and robustness of children. Plenty of butter in their diet, he says, is indicated. But as the substance is known to exist in eggs and some other comestibles, it seems likely that the ordinary mixed diet long recognised as the most wholesome, will, even in the absence of butter or beef-fat margarine, supply all the needful constituents for growth and health.

This growth-promoting substance seems to belong to a class of food elements, the very existence of which was scarcely suspected until quite recently. Dietetists used to prescribe certain proportions of proteids, carbohydrates and fats producing so many calories, and they told us that if we did not thrive on these, it was our own fault. But it is now recognized that these methods of food valuation were far too coarse. Besides largely ignoring the sapidity of food, which has a great deal to do with digestion and consequently with nutrition, they knew nothing whatever of the astonishing influence of the "vitamines," the first of which was discovered a few years ago in connection with the study of the fatal oriental disease, beri-beri.

Beri-beri, which has been known in China and the East for hundreds of years, is a distressing disease with a mortality as high as 50 per cent. It was formerly attributed to all sorts of causes, such as damp situations, lack of ventilation, decayed food, and fungoid growths on grain. But it was finally traced to an exclusive diet of "polished" rice,—that is damaged rice which, in order to improve its appearance, has been put through a process that removes its outer coating,—and a rapid cure was effected by the use of unpolished rice, or by the addition of the polishings of the treated rice. From this it was evident that the disease was due to the lack of something removed in the polishing process, and eventually the all-essential substance was isolated from the outer layers of the rice grain, and named "vitamine."

It is present only in extremely small quantities, there being not more than 10 grains of it to a ton of rice. But minute as this quantity is, its absence from the rice diet means disease and death.

Similar substances have since been discovered in other foods, always in very small quantities—the vitamine of limes is in the proportion of 1 to 100,000 parts—and their presence in many food-products appears very probable.

The discovery of these unsuspected food constituents throws a great light on scurvy. At one time scurvy was thought to be caused simply by an excess of salt in the diet. Smollett attributed the prevalence of scorbutic affections in the south of France in the 18th century to the salt-laden breezes from the Mediterranean. Generally, however, the dread disease was blamed on imperfectly preserved food, and lack of vegetable diet. But scurvy broke out in modern polar expeditions (such as Scott's in the "Discovery" and Charcot's in the "Pourquoi pas?") which were supplied with the very best of tinned meats and vegetables, all rigidly inspected by the surgeons before being issued to the men, and undoubtedly in sound condition. The explanation is that the preserving process, tinning or salting or drying, destroys the vitamines, and while the foods are otherwise perfectly wholesome, and may be consumed for limited periods without ill results, as a long continued diet, they are fatal.

Up to 20 or 25 years ago, a form of scurvy known as "black-leg" was common among the shantymen of the Ottawa Valley and more particularly among the river-drivers. At that time the shanty bill-of-fare consisted of little but salt pork, beans, bread and tea. But with the variety of food now supplied, the disorder has entirely disappeared.

Scurvy was prevalent in the early mining days in the Yukon, and a gold-seeking adventurer of the writer's acquaintance tells that when he developed symptoms of the malady, his friends made light of ., and advised him to eat raw potatoes and he would be well in a few days. But he felt anxious about his condition, and determined to enter the hospital at Dawson for treatment. In the hospital they charged him $10.00 a day and simply fed him on raw potatoes!

CHARLES MACNAMARA, ARNPRIOR, ONT.

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