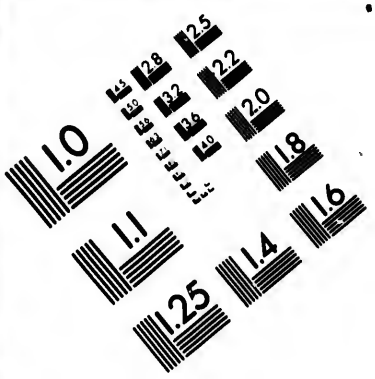

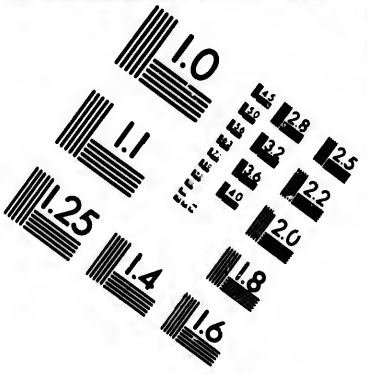

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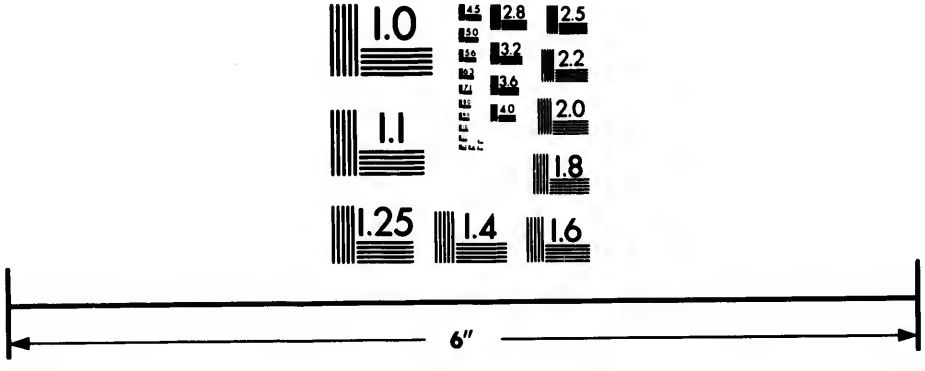

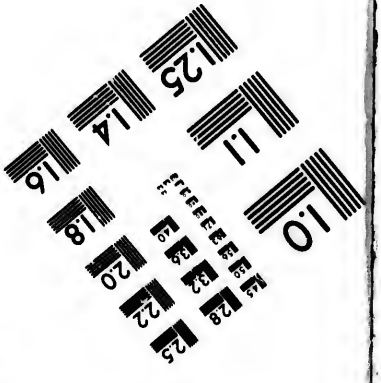

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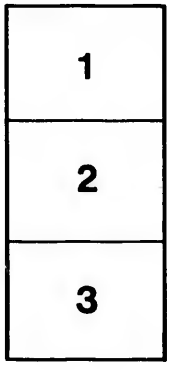

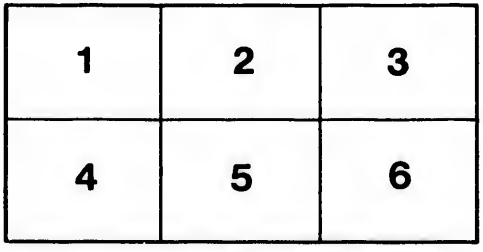


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"UNIONEM IN MARIS PROFUNDO QUAERI,"—PLINY *XII, 1.*

NOTES ON THE UNIONIDÆ FOUND IN THE VICINITY OF OTTAWA, ONT.

BY

F. R. LATCHFORD, B. A.

[READ BEFORE THE OTTAWA FIELD NATURALISTS' CLUB, 10TH MARCH, 1882.]

The family of lamellibranch mollusks known as the *Unionidæ* is represented in every part of the world, but with a very irregular distribution. While only thirteen species are found in Europe, and about fifty recorded from Africa and one hundred and eighty from Asia and the Islands of the Pacific, more than seven hundred have been described from North America. Fully a hundred of these occur in the Ohio River alone; and in Georgia, the Carolinas, Alabama, and the Southern and South-Western States in general, almost every stream has its peculiar forms. Towards the north and east the species become fewer and fewer, until only eleven are found in Massachusetts. In Canada a much greater number have been found by Messrs. D'Urban, Bell, Billings and Whiteaves. In a paper read before the Field-Naturalists' Club in 1880, Mr. Heron noted twelve species from the vicinity of Ottawa. There are, however, at least twice as many to be met with here, within a radius of forty miles. The very low state of the rivers in 1881 afforded me for collecting *Unionidæ* facilities of which I had ample leisure to avail myself during the midsummer vacations. I have in my spare time since then studied carefully these humble creatures; and, not content with my own determinations, have taken much pains to have the species collected identified by the best authorities. All have been checked or named by such eminent conchologists as Mr. Arthur F. Gray, of Danversport, Mass., Mr. George W. Tryon, of the Academy of Sciences, Philadelphia, and Prof. J. F. Whiteaves, F.G.S., of the Geological Survey of Canada. I am therefore certain that, except perhaps in one or two instances, the shells which I found have been correctly determined.

The species met with belong to the genera *Unio*, *Margaritana*, and *Anodonta*. These are distinguished from one another more by the conformation of the shells than by any peculiarities of the animals themselves. Hence it is of the shells alone that most works on the *Unionidæ* treat: and from this course it is not my intention to depart at present. The shell itself will always enable the student to distinguish one species from another. But the soft parts are by no means undeserving of attention. In species of the same group they are very much alike. In species of different groups, for instance in *U. rectus* and *U. occidens*, they are so dissimilar that the least practised eye can perceive differences in their form and arrangement. In all cases they present the same admirable ordination of structure to purpose that we see elsewhere throughout the works of nature's God. Even the distribution of the *Unionidæ* is provided for, by their young being for a time endowed with hooks by which they can attach themselves to contiguous objects—often the fin of a fish or the foot of a water bird—and be transported far from their place of birth. In the winter and spring the young, having already well formed shells, are extruded from the branchial uterus of the females in hundreds of thousands and even millions. According to a computation made by Dr Isaac Lea, of Philadelphia, who has during fifty years studied *Unionidæ*, and described almost half the species known, a large specimen of *U. multiplicatus*, Lea, contained upward of three millions of embryonic young. Nearly all perish early in their free life, being devoured by fishes, crustaceans and the larvæ of many kinds of insects. Their food consists of algæ, infusoria and entomostraca, which are drawn in through the branchial orifice to the mouth, at the same time that oxygen is supplied to the lamelliform gills. Nor is it only by eliminating from fresh water minute organisms which render it injurious to human life that the *Unionidæ* are designed to exercise a beneficial influence on mankind. Were

it not for the immense quantities of lime which they absorb to form their shells, the water of limestone regions would be so "hard" that it would be unfit without chemical treatment for domestic or economic uses.

GENUS UNIO, *Phillippson.*

Shells of the genus *Unio* are readily distinguishable from those of *Margaritana* and *Anodonta*, by their having both cardinal and lateral teeth. The genus, according to Jeffreys, was established by Phillippson in 1738, but it is generally attributed to Retz, who happened to be chairman of the meeting at which Phillippson read his "*Dissertatio Sistens Nova Testaceorum Genera.*"

Unio complanatus, Solander, is our commonest species. Abounding in almost every stream and lake, it is subject to much variation in size and coloring. What may be regarded as the typical form is common in the Rideau everywhere and in the Ottawa above the Chaudière Falls. It is a moderately thin, brown, depressed, sub-rhomboidal shell, with a nacre of different and often of exceedingly beautiful shades of purple. The average dimensions of ten shells, five from each river, are as follows: length 3·5 in., height 1·7, diameter 0·8.

In company with the typical form, I found near Skead's Mills, in 1880, a specimen of a small variety which is of considerable interest. Although presenting every appearance of maturity, it is only an inch in height by two and a half in length. For its size it is very thick and regularly inflated. I am informed that a similar variety occurs in some streams in Western New York.

A form almost as small is found in the cold, clear waters of Meech's Lake. But it is a thin and not a thick shell; not inflated but depressed. Its color is a very light brown.

About half a mile from Meech's lake, on the creek through which it finds an outlet, are a few shallow ponds, with a bottom of coarse sand and gravel washed down from the surrounding hills. In the warmer water of these ponds, where food also must be more abundant, *U. complanatus* is three times as large as in the neighbouring lake. It also differs from the lake shell in being proportionately less depressed, and more equally rounded at both extremities. Its color is a rich dark brown with a silken lustre, and, not unfrequently, a tinge of bright orange along the umbonal slope.

Near the lower end of Duck Island, about seven miles down the Ottawa, there occurs a form of much interest on account of its curious angular inflation. How extraordinary this is for species whose most constant characteristic is its flatness, may be inferred from the fact that a representative specimen whose height is 1·6 in. measures 1·5 in. in diameter. The inflation is greatest near the dorsal margin behind the hinge-ligament, where a section of the shell would be an almost perfectly equilateral triangle with the base and the angles at the base slightly rounded. A specimen found by Mr. Poirier is 3 in. high, 4·9 long, and weighs 7¾ oz. Ten of the shells from Meech's Lake weigh only 3 oz.

At the same locality is found a still more remarkable variety and one of no little beauty. In some respects it resembles *U. Raleighensis*, Lea, from North Carolina, and in others, *U. tortuosus*, Sowerby, an Asiatic species. It is like the former in shape and in the numerous prominent rays which diversify its surface; and like the latter in the strange peculiarity that its valves meet at the ventral margin not in a straight but in a sinuous line. A correspondent writes that under Dr. Lea's treatment it would be entitled to rank as a species. Whether regarded as a mere variety of *U. complanatus* or a distinct species, it is a unique and most interesting shell.

Unio gibbosus, Barnes, appears to be rare, having occurred to me only in the Ottawa near Gilmour's Mills and at Templeton, always in deep water. It is a brown, elongated shell, attenuated posteriorly, and with the dorsal margin regularly curved. It bears a slight resemblance to some forms of *U complanatus*; but may always be distinguished by its heavier shell, the deeper purple of its nacre, and especially by the great thickness of the lamellar tooth in the right valve.

Unio ellipsis, Lea, is not uncommon on sand bars below Kettle Island, but does not seem to occur in the Rideau or in the Ottawa above this city. It differs from all other species here observed in having the beaks very near the anterior end of the shell, where the muscular impression is of great depth and the shell itself of great thickness. The cardinal teeth are parallel to the lateral teeth and not placed at a right or oblique angle to them as in our other

species. The nacre of many specimens is beautifully iridescent, displaying the colors of the prism and rainbow, chastened, softened, and made perpetual.

Unio rectus, Lamarck, which is easily recognized by its dark color and elongated form, is found in considerable numbers in the Rideau near Billings' Bridge, but is comparatively rare in the Ottawa. The ground color of the epidermis, which at first appears black, proves on closer examination to be yellow, profusely rayed with broad lines of very dark green. Young shells occasionally have a purple nacre, but in mature specimens only a trace of this is seen along the lateral teeth and in the cavity of the beaks. Where *U. complanatus* is found of the normal size in the Rideau and at the Chats Rapids in the Ottawa, *U. rectus* is very large—not unfrequently exceeding six inches in length. But at Duck Island, where *U. complanatus* attains an uncommon size, *U. rectus* is small, though in very fine condition. In fact, all the shells found at this wonderfully prolific locality, with the exception of *U. borealis*, are in an excellent state of preservation.

Unio radiatus, Lamarck, is common almost everywhere in the Ottawa above the Chaudière. At the foot of the rapids near Mechanicsville are a number of islets along whose shores, when the river is low, there may be seen large heaps of shells, of which this species constitutes no inconsiderable part. The muskrat lives chiefly on the *Unionidæ*; and these heaps are the remains of his nightly repasts. I have obtained from them some of my best specimens of *U. radiatus*. At the Chaudière, it seldom attains a greater length than three inches, but is much larger in the Deschênes Lake, above Britannia. It is a flat, obovate shell, of a green, olive or reddish color, with numerous narrow rays.

Unio luteolus, Lamarck, abounds in the Rideau Canal from the Sappers' Bridge upward, and is not uncommon in the Rideau River. Its color is from a greenish yellow to a dark olive, with distinct, dark green rays. In shape it varies even more than in colour. Some shells are so inflated as to be almost cylindrical; others so depressed that they cannot, when the beaks are eroded, be distinguished by any external character from *U. radiatus*. Having probably studied only the exterior of the two species, an esteemed western correspondent writes that they merge into one another in Toronto Bay. I doubt whether they can possibly be more alike in Lake Ontario than they are sometimes here, and however great their outward resemblance, I find that they always differ internally, especially in the form of the cardinal teeth. In *U. radiatus* these are short, erect, and triangular. In *U. luteolus*, they are long, curved, compressed and oblique.

Unio cariosus, Say, occurred to me near Black Bay, Eardley, Quebec, where I was searching for nodules and fossils in the Champlain Clays, which there form the north shore of the Deschênes Lake. It is a thin, small, ovate, inflated shell, of a yellowish color, with a few indistinct rays. Some specimens of an accompanying species of *Leda*, which lived when the clays were deposited in the post glacial period, would be taken for recent shells, so well have they preserved their thin, delicate epidermis and fragile teeth through the many thousand years that have elapsed since then.

Unio occidens, Lea, is quite abundant in the Ottawa, near the mouth of the Gatineau, and along the sandy shores of Duck Island. Its shape is remarkably uniform, varying only with the sex. It is an ovate and very much inflated shell, with large prominent umbones and closely approximate, recurved beaks. The females are more broadly inflated than the males and of a triangular shape, on account of which peculiarities they are liable to be confounded with *U. ventricosus, Barnes*.

For beauty and diversity of coloring, there is not probably found in the world a fresh water shell which surpasses the *Unio occidens* of the Ottawa River. When young it is of soft and varied shades of yellow, green and red, the primary spectral colors, and sometimes of all three together. Mature specimens are rich as an autumn landscape in tints of yellow-brown and olive-green. All—but especially the young shells—have a porcelain-like lustre, which it seen at its best, when on a sunny day they lie on the clean, white sand, with just enough water to cover them. Then they shine and glow like opals. Moreover, their changeful colors are so differently combined with rays—sometimes few and sometimes many, fine as a hair or broad almost as an iris leaf—that, among hundreds of specimens collected, no two were alike in every respect. Each is, accordingly, a *unio*, in the exact sense that Pliny tells us the word was coined to express. "From the circumstance, he says that no two pearls are ever found alike, Roman luxury called a pearl *unio*,—

from *unus*, one—meaning a unique production." The barbarians who found the pearls called them *margaritae*.

That *U. occidens*, under precisely the same conditions of life, should secrete in almost infinite variety so many different colors is a fact which challenges attention.

Unio subovatus, Lea, which is found in the Rideau Canal and River, is chiefly remarkable for the large size to which it sometimes attains, a specimen from the canal beyond Hartwell's Locks measuring 4·5 inches in length, 3·4 in height, and 2·2 in diameter. In the river it is smaller and more eroded than in the canal. Good shells, however, are to be found near Mr. D. O'Connor's summer residence. This species bears especially when young some resemblance in color and outline to *U. occidens*, of which *Say* considered it only a variety. His opinion on this point is now held by very few; and I hardly think that anyone who compares the two shells as they here occur would venture to pronounce them specifically identical. *U. subovatus* is less inflated than *U. occidens*, and less approximate at the beaks, while with respect to beauty there can be no comparison between them.

Besides the curious spiral follicle of the larva of a phryganaceous insect, *Helicopsyche arenifera*, which was first described as a mollusk of the genus *Valvata*, I have observed on the valves of *U. subovatus*, and other large species from the Rideau River, a small isopod crustacean, which is worthy of note as being probably the best living, though degenerate, representative of the trilobites that once abounded here on the low tidal flats of the Silurian seas. It is, I think, *Fluvicola Herrickii*, De Kay.

Unio alatus, Say., was found here by Mr. Heron in 1880, and was recorded from "Ottawa River, near Ottawa," twenty years ago, by Mr. Whiteaves in a valuable paper published in the Canadian Naturalist. It was also found by Mr. Robert Bell in the Ottawa at the mouth of the River Rouge, a locality I have not yet been able to visit. There are a few specimens in the museum of the Ottawa Literary and Scientific Society, which were probably collected by Mr. Bell. As I have not met with it on my many excursions, I think it must be rare in this vicinity, or at least restricted to a small area. It is the only species found here in which the wing rises higher than the right line of the hinge margin. It occurs from Tennessee to Vermont and westward to Nebraska and Manitoba. Certain other species, as *U. spinosus, Lea*, and *U. Shepardianus, Lea*, are said to be confined within narrow limits to one stream.

Unio gracilis, Barnes, is another winged species which has not, till now, I believe, been recorded from any locality in Canada east of the Welland Canal. It is not at all common, Mr. Poirier and myself having found only five or six specimens during the summer. These were collected on sand bars in the Ottawa between Duck Island and the Ontario shore. It is an exceedingly thin and fragile, depressed, sub-triangular shell, of a greenish yellow color. The hinge margin is straight and prolonged into a large wing, uniting the two valves. It may be distinguished from *U. alatus* by its greater fragility, lighter color, both inside and out, and by its differently formed wing.

Unio pressus, Lea, was found by Mr. Tyrrell, of the Geological Survey, in the Rideau near the Rifle Range. Only one specimen was met with, and that he has with great kindness presented to me. It is but little more than two inches in length, very much flattened, and the hinge margin is straight with a slightly alated projection. The beaks are finely undulated. Its form and external color, together with the shape of its cardinal teeth, seem to connect it with the *margaritanae*.

[I have since collected a number of large *U. pressus* in excellent condition along the right bank of the Rideau, from the Utica Slate outcrop near the Sparks' homestead up to Hurdman's. Over this area it is found sparsely scattered in muddy pools in the rapids; but it does not occur in the next rapids above at Billings' Bridge, nor thence upward. Mr. Weston while collecting fossils at Paquette's Rapids, at the foot of Allumette Island (about 45° 50' N) picked up a dead *U. pressus*. This is the most northerly locality at which the species has been found.]

Unio Canadensis, Lea, was originally described from the St. Lawrence near Montreal. Both Mr. Tryon and Mr. A. F. Gray have referred to this species some shells which I collected in Nepean Bay. Mr. Gray writes: "It seems to agree well with the characters of *U. Canadensis*, and with Dr, Lea's figure. From these data, and without a typical shell with which to compare it, I am justified, I think, in referring it to that species." Mr. Tryon says:

"I regard a shell which you sent me from Nepean Bay as the true *U. Canadensis.*" It appears to be rare, only a few specimens having been found. It is somewhat compressed, of an oval shape and dark olive color, with indistinct rays.

Unio borealis, A. F. Gray, is a new species. It occurs in the Ottawa, from the mouth of Brigham's Creek to Templeton, and probably much farther down. Although common, it is very seldom met with in good condition.

I first submitted this shell to Mr Tryon, but the only specimens I had to send were so badly eroded that they could not be determined. A second lot, little if any better, led him to think it doubtfully referable to *U. luteolus,** from some forms of which the females are not easily distinguishable. Not until October of the past year did I succeed in collecting specimens which had the undulations of the beaks well preserved. I was led to go out so late in the season by a letter from Mr. A. F. Gray, relating to the shell in question, of which I had sent him specimens a short time previously. He regarded my views as correct, that it differed essentially from both *U. luteolus* and *U. radiatus,* but thought that further study and comparisons might prove it to possess affinities with some other described species, and expressed a wish to see a large series of the best shells I could obtain. On my next holiday I went down the river to Duck Island and collected a number of male and female shells, including a few in fine condition. I despatched these to Mr. Gray on the day following, but heard nothing more about them until February 28th, when I received the pleasing, though not unexpected information that the shell was undoubtedly new. The names *U. bellus* and *U. borealis* were suggested as appropriate. The latter seems the more fitting, and the species will accordingly be known as *Unio borealis, A. F. Gray.* A description, promised at my request, has not yet been received, and I do not wish to refer more particularly to the shell to-night, lest I should in any way interfere with the priority of my friend's description. The right of naming *U. borealis* belongs to Mr. Gray, as he was the first to recognize its specific distinctness from any described *unio.*

[Mr. Gray's description was received some time after the reading of my paper, and is here given in full:

UNIO BOREALIS,—A. F. GRAY.

Shell smooth, broken only by numerous ridges of growth; obovate, very much inflated in the female form, the male more compressed, very inequilateral, obtusely angulated behind and rounded before, the basal or ventral margin rounded, beaks badly eroded and but slightly raised; ligament thick, moderately long and dark brown; unbonal slope flattened, and but slightly carinated; epidermis variable, some specimens dark olivaceous brown with broad obscure rays of dark green, others yellowish green with numerous fine rays of a brighter green, cardinal teeth rather large, somewhat compressed and corrugate; lateral teeth thick, slightly curved, and with crenulate margins; anterior cicatrices distinct, that of the adductor muscle very deeply impressed; dorsal cicatrices posterior to the centre of the cavity of the beaks; posterior cicatrices confluent and but slightly impressed; cavity of the shell deep and rounded; cavity of the beaks obtusely rounded and deep; substance of shell very thick, thickest before; nacre usually white, occasionally rosy, and sometimes a beautiful pink, and beautifully iridescent.

Transverse diameter, 3·15 inches; altitude, 1·95 inches; lateral diameter, 1·65 inches. These measures are from a large female. A male shell measures: transverse diameter, 3·15 inches; altitude, 1·90 inches; lateral diameter, 1·35 inches.

For this beautiful shell, and the privilege of describing it, I am indebted to Mr. F. R. Latchford, of Ottawa, Ontario, from whom I received quite a large series of this *Unio,* which belongs to the group of which *Unio luteolus* of Lamarck may be considered the type. It differs from that species in being shorter transversely, in having a much thicker shell, and having the beaks badly eroded. In its outline it bears a close resemblance to *Unio radiatus,* Lam., but is more inflated and has a heavier shell. It occurs in the Ottawa River at Duck Island; it has also been found at Leamy's Lake, near Hull, in the Province of Quebec.

The variety with pink nacre has a bright orange-brown epidermis with fine rays of dark green

*After the above was written, I sent some young specimens of *U. borealis. A. F. Gray,* to Mr. Tryon, and they have convinced him, he informs me, that the species is new.

A young specimen is more elongated transversely, has perfect umbones which show four well developed folds, and has a rugose posterior slope similar to *Margaritana rugosa*, Barnes.

The soft parts have not been preserved; in consequence, their arrangement cannot be described.]

GENUS MARGARITANA, *Schumacher*.

The shell of this genus differs from that of *Unio* in having no lateral teeth. These, however, are not always entirely wanting in *M. margaritifera*, the celebrated pearl mussel of Great Britain and the North Atlantic and Pacific border regions of America. Although common eastward in Quebec and to the south in New York and Vermont, it has not yet been found in this vicinity.

Margaritana marginata, Say, occurs sparsely in the Rideau and Ottawa in rapid water, which, indeed, is the favorite habitat of our other species also. It is small, seldom of greater length than two and a half inches, moderately thin, and transversely wedge-shaped. In color it ranges from a dusky green to a deep brown, with indistinct dark rays. The shells found here are much inferior in size and coloring to specimens of the same species received from the Mohawk River, New York.

Margaritana undulata, Say, is rare in the Rideau and is not common in the Ottawa, where the least unproductive locality that I know of is above the Little Chaudière along both shores of the river. In Meech's Creek it is quite plentiful, especially near the abandoned rubber factory. It is smaller than *M. marginata*, proportionately more inflated, brighter in color, often so bright as to be really beautiful. The distant concentric and prominent waves on the umbones from which it derives its specific name, are seldom apparent except in young shells. Many old specimens are as thick and strong anteriorly as a *U. ellipsis* of the same size, while towards the posterior margin they are as thin and fragile as the most delicate *anodonta;* and thus, as well as by having cardinal and no lateral teeth, *M. undulata* unites in itself two of the most distinctive characters of the genera between which, in the plan of creation, *Margaritana* has been assigned its place.

Margaritana rugosa, Barnes, the largest we have of the genus, is abundant at many points along the Rideau, but is quite rare in the Ottawa. As found in the former stream it resembles the typical *U. complanatus* in shape, but is of a greener color, and may, moreover, be easily distinguished from that shell both by the wrinkles along the post-lateral margin and, of course, by the absence of lateral teeth. A shorter, truncated form is occasionally met with in the same river.

I observed a few large and exceedingly fine specimens of this *margaritana* at the Chats Rapids, where I found them in a mixed company of *uniones* and *anodontae*, thirty-three in number which were living together in an open space between the rocks but little if any more than a square foot in extent. They were green in color, and had the characteristic wrinkles prominently developed. One shell exhibited in a marked degree the strange deformity that its valves did not meet in a straight line, but, an inch or more from the posterior end, were bent sharply aside about forty degrees. I have noticed a few less striking instances of similar distortion in the same species from the Rideau. They are probably due to injuries received when young through coming into violent contact with a stone or pebble. To such a mishap the young of this species must often be exposed in the rapid water they frequent.

GENUS ANODONTA, *Bruguières*.

The transition from *Margaritana* to *Anodonta* is by no means abrupt: *nihil in natura per saltum*. It is made easy by a shell found here, which was first described by Say, and placed by him in the former genus—or rather in the genus corresponding to it that he had instituted, *alasmodonta*,—but which is at present universally referred to the latter. This species is now known as *Anodonta edentula*, Say. Although its name expresses what may be called the reduplication of toothlessness, the shell is slightly exceptional to the best marked character of the genus—the absence of both cardinal and lateral teeth.

Anodonta edentula, Say, like its relatives the *margaritanæ*, is to be found in water flowing rapidly over a rocky bottom. The best localities along the Ottawa that I have met with are the Little Chaudière and Chats Rapids. A

capital place for collecting it and seven or eight other species of *Unionidæ* is the *anye*, as the lumbermen* call it, between Mason's Mill and the opposite island. It is a comparatively thick shell, generally of a dark olive color; but when the rays are few or narrow, the ground tint, a light brown, predominates. In the left valve of many specimens there is a short though well defined cardinal tooth with a small notch in it analagous to the deep cleft in the primary tooth of the left valve of *Unio* and *Margaritana*.

In the narrowest and most rapid parts of Meech's Creek, and not in the ponds into which it often expands, or the lake from which it flows, there occurs a large though badly eroded form of this shell which appears to be identical with the variety of *A. edentula* described by DeKay, and called by him, after the river in New York in which it is found, *A. Unadilla*. It is more inflated than the *A. edentula* from the Ottawa, and of a lighter color.

Anodonta undulata, Say, is found in the Rideau near Billings' Bridge, and in the Ottawa at Kettle Island. It resembles the preceding species so much that many think the two identical. *A. undulata* differs from *A. edentula* in being a thinner shell, more obscurely rayed, and more angularly inflated. Additional and perhaps more distinctive characters are revealed by the microscopic examination of the young of both species. Botanists, as Mr. Fletcher told us two years ago, cannot always by the leaves and blossoms alone distinguish *Drosera longifolia* from *Drosera rotundifolia*, but their minute seeds present characteristics which place the specific distinctness of the parent plants beyond all doubt. So also with the embryonic young of these two species of *anodonta*. I have not examined them myself; but Dr. Lea's figures show that they differ in outline, and that while the hooks of A. *edentula* end in three points, those of *A. undulata* end in one.

Anodonta subcylindracea, Lea, a very distinct species which I have met with only at the Chats, is one of the most widely distributed shells of the genus extending hence through the middle and western states as far south as Louisiana. Our shell in its ordinary form is identical with Dr Lea's type. It is small, thin, inflated, almost elliptical in outline, and olive green in color, with indistinct rays. Old shells are generally abnormal. They are constricted along the basal margin opposite the hinge and so much elongated that instead of being elliptical they are kidney shaped This reniform appearance is observable in old shells of many species of the *Unionidæ*, *U. complanatus*, for instance, and notably *M. margaritifera*. An examination of the lines of growth will show that after a certain age the shell does not increase symmetrically. It grows rapidly in the direction of the umbonal slope, slowly in front, and scarcely at all opposite the hinge. The change produced in this way in the form of shells is very remarkable.

Anodonta Benedictii, Lea, occurs in several localities near the city, but nowhere in great numbers. I have found it at the Chats, and in a small lake on Meech's Creek. Mr. Fletcher collected a few fine specimens of the typical form in the Ottawa near the outlet of Leamy's Lake. It is a trapezoidal, slightly compressed, horn-colored shell. The dorsal margin is nearly straight and is extended behind, where it forms a well marked wing.

Anodonta Lewisii, Lea, occurred to me in the Mississippi at Almonte, where it appears to be abundant. It has a much smaller wing than *A. Benedictii*, which it resembles, is more elongated, and somewhat less inflated. The beaks in perfect specimens have sharp prominent tubercles, which are arranged in a manner characteristic of the species. With *A. Lewisii*, I found at Almonte *U. complanatus*, *U. luteolus*, *M. rugosa*, *M. undulata*, and *A. undulata*.

Anodonta implicata, Say, is a species of which only a single living specimen has been obtained. It was found in a deep pool near the upper end of the old Chats Canal, after a search of an hour's duration, which I was led to engage in by seeing on the shore a few broken valves of an *anodonta* not previously met with. It is a large, thick, olive-brown, elongated, cylindrical shell, with a salmon-colored nacre.

Anodonta Footiana, Lea, is not uncommon at the Chats Rapids. It is a

* These hardy *voyageurs* relish a dish of "clams" occasionally and obtain them by an ingenious process. While the rafts are being towed slowly down Lake St. Peter the men immerse top downward in the shallow water, a number of the long birch withes used for tying the timber. The open unios feeling the birch *a posteriori*, close upon the withes which are drawn up from time to time and the shells picked off until a sufficiency has been obtained.

thin, inflated, oblong, brownish species, obscurely radiated, and tinged with yellow posteriorly. A darker and less elongated form from Meech's Creek is said to be "identical with shells determined by Dr. Lea as his *A. Footiana*," which are now in Mr. Gray's cabinet.

Anodonta lacustris, Lea, inhabits lakes in the County of Ottawa. It is brown when aged, but young shells are greenish yellow. The tubercles on the beaks are arranged in close, concentric waves. Every specimen found in September, 1881, in Kidder's Lake, in Masham, was infested by hundreds of small mites, which moved freely over the surface of the gills. The same lake, which is about thirty miles from Ottawa, contains a plant, *Eriocaulon septangulare*, not recorded in the "Flora Ottawaensis" of Mr. Fletcher.

Anodonta fragilis, Lamarck, is common in Meech's Lake, near the outlet. It is an elongated, thin, depressed shell of a yellowish colour, with a straight dorsal margin, and pearly iridescent nacre. That the form regarded as *lacustris* is distinct from this appears to me somewhat doubtful. *U. carinatus* is the only other shell which may not be correctly determined.

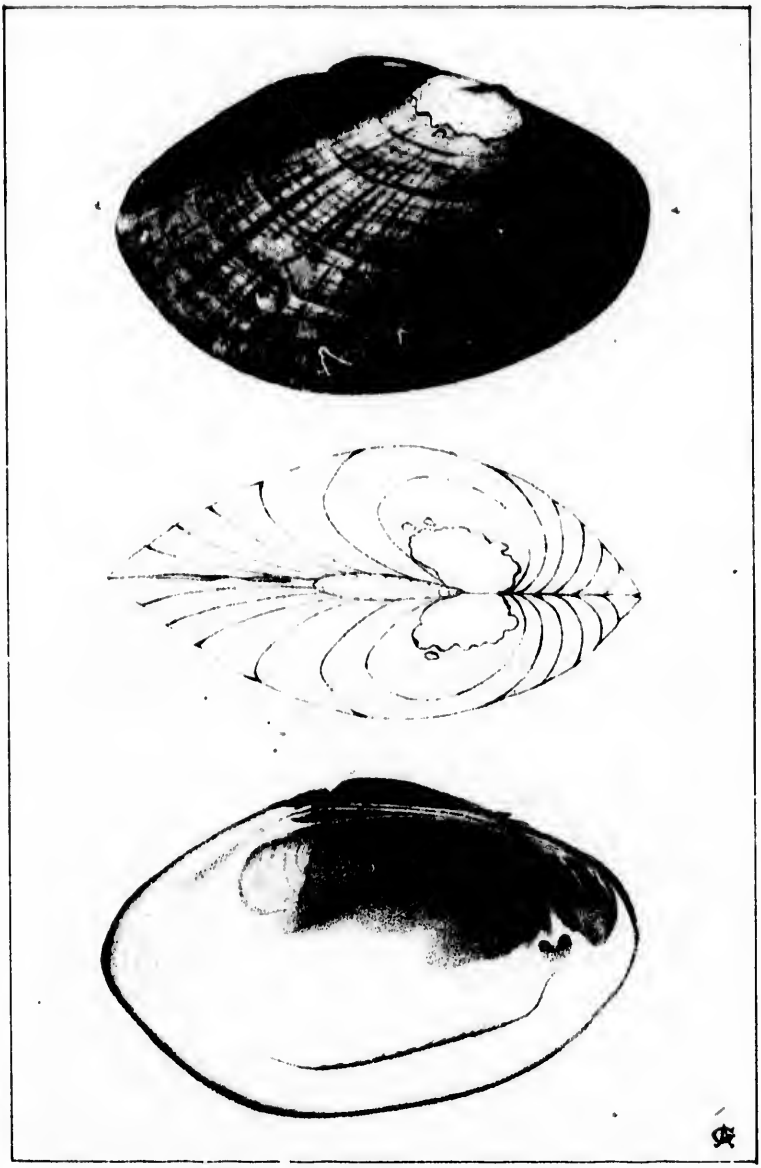
A mite found in the gills of *A. fragilis* in Meech's Lake, is as large as a pellet of buck-shot, and differs vastly from any species I have ever seen. Mr. Tyrrell will doubtless soon publish a description of it.

Anodonta fluviatilis, Dillwyn, occurs in great numbers in McKay's Lake, New Edinburgh, and in the Rideau Canal; but is rare in the Ottawa, where it is found only in bays in which there is little or no current. In color it ranges from a bright grass green to an an olive-brown, with concentric yellow bands, and innumerable narrow, obscure rays. Sometimes it attains a length of six inches, but is generally about a third smaller. Its large size and brilliant coloring conspire to make it the finest *Anodonta* we have. Toward the end of April, when the ice has melted, and before the water has been let into the Canal, very fine specimens may be collected at St. Louis Dam. Still finer, though smaller shells are to be obtained—but only by dredging—in McKay's Lake.

Repeated microscopic examinations of the young of this shell lead me to believe that the only observations which I find published on the young of the *Unionidæ* are not altogether correct. In his "Descriptions of the embryonic forms of thirty-eight species of the *Unionidæ*," Dr. Lea says: "The base in all the species always presented the anterior and the posterior margins equal, which is not the case with any of the species when fully grown. That is, if a perpendicular line be raised from the middle of the basal margin to the middle of the dorsal line, *the right and the left divisions will be exactly symmetrical.*" Now, I thought that precisely the contrary was evident when the young of *A. fluviatilis* were observed under a high power; and Mr. Tyrrell and Mr. Fletcher, whose attention was called to the matter, thought so too. Dr. Lea, however, to whom I sent some of the young, wrote that on carefully examining them, he failed to notice the asymmetrical difference which I described. Here was observation opposed to observation. To ascertain the truth with regard to the point at issue, I made use of the fine solar miscroscope of the College of Ottawa, which gives a magnification of two thousand diameters. As the outline of shell after shell was cast upon the screen, each was observed to be decidedly asymmetrical and unequally curved on the sides. The young of *U. luteolus* and *U. borealis* proved also to be inequilateral; and I have little doubt that the same want of symmetry obtains in the young of almost all other species. It seems, therefore, that Dr. Lea was mistaken in describing and figuring as symmetrical the embryonic forms of many species of the *Unionidæ*.

With *A. fluviatilis* closes the record of the species so far observed here. Extended as it is, for a place so distant from the metropolis of the *Unionidae* in the Ohio Valley, it certainly does not include all the forms that occur in this vicinity. *A plana, Lea*, and *A. Ferussaciana, Lea*, a shell which is found at Montreal and at Toronto, probably occur here: and when the numerous lakes and streams around our city are more diligently searched, they will, I feel confident, furnish very material additions to the present list of the Ottawa *Unionidæ*.

A. S. Woodburn, Printer and Publisher, Elgin Street, Ottawa.



UNIO BOREALIS.—A. F. GRAY.