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REPRINTS OF RARE ARTICLES ON MOLLUSCA. --- FRANCIS ROBERT LATCHFORD'S "NOTES ON THE OTTAWA UNIONIDAE." -- Transactions of the Ottawa Field-Naturalists' Club, No. 3, pp. 48-57, Ottawa, 1882. Reprinted with permission of the Council of the Ottawa Field-Naturalists' Club.

FIFTH SOIRÉE

Friday, March 10, 1882. -- Notes on the Ottawa Unionidae. F. R. Latchford.

The family of lamellibranch mollusks known as the Unionidae is represented in every part of the world, but with a very irregular distribution. While only ten species are found in Europe, fewer still in Africa and about eighty in Asia and the Islands of the Pacific, over five hundred have been described from North America. More than a hundred of these occur in the drainage of the Ohio 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 has been met with by Messrs. D'Urban, Bell, Billings and Whiteaves, including several species introduced from the Western States through the great lakes and other avenues of water communication. In a paper read before the Field-Naturalists' Club in 1880, Mr. Heron noted twelve species from the vicinity of Ottawa, but at least twice as many are to be met with here, within a radius of forty miles. The very low state of the water in 1881 afforded me for collecting specimens of the Unionidae

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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. Geo. 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 morally 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 their shells than by any peculiarities of the animals themselves. Hence it is of the shells alone that most works on the Unionidae 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 Unionidae is provided for, by their young being for a time endowed with hooks by which they can attach themselves to contiguous objects, often a fish or 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 the Unionidae, 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 larvae of many kinds of insects. Few, accordingly, attain maturity, which is reached in from six to ten years. Their food consists of animalculae, which the water flowing in through the branchial orifice coveys to the mouth, at the same time that it supplies oxygen to the lamelliform gills.

Of the species found in the vicinity of Ottawa the first to be noticed belong to the genus Unio. Shells of this genus are readily distinguishable from those of the genera Margaritana and Anodonta, by their having both cardinal and lateral teeth. The genus, according to Jeffrys, was established by Phillippson in 1788, but it is generally attributed to Retz, who was chairman of the meeting at which Phillippson read his essay sistens Nova Testaceorum Genera.

Unio complanatus, Solander, is abundant in almost all our streams and lakes, and is subject to much variation in size and colouring. 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 and limpid waters of Meech's Lake. But it is a thin and not a thick shell; not inflated but depressed. Its colour is a very light brown.

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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 differs moreover in being proportionately less depressed, and more equally rounded at both extremities. Its colour is a rich dark brown with a silken lustre, and, not unfrequently, a tinge of bright orange along the umbonial slope.

Near Kettle Island there occurs a form of much interest on account of the curious angular inflation. How extraordinary this is for a 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 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 7 3/4 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. turtuosus, Sowerby, from Maryland. 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 a variety of U. complanatus or a distinct species, it is a most unique and 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 paralled to the lateral teeth and not at a right or oblique angle to them as in our other species. The nacre of many specimens is beautifully iridescent, displaying the colours of the prism and rainbow, chastened, softened, and made perpetual.

Unio rectus, Lamarck, which is easily recognized by its dark colour and elongated form, is found in considerable numbers in the Rideau near Billings' Bridge, but is comparatively rare in the Ottawa. The ground colour of the epidermis, which at first sight 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. In the Rideau it is not unusual to find U. rectus almost six inches in length, and I have observed it quite as large in the Ottawa near Arnprior. Though smaller in the Ottawa here, it compensates for its inferior size by its finer form. The mantle of the animal is fringed with long and delicate vibratile cilia more beautiful than the richest lace.

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 may be seen large heaps of shells, of which this species constitutes no inconsiderable part. The muskrat lives chiefly on the Unionidae;

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and these heaps are the remains of his nightly repasts. To the collector they should generally serve only to point out that living specimens occur in their immediate vicinity; still, by presenting to him larger suites from which to choose than he could possibly obtain by dredging, they may sometimes afford good and even rare shells. I have obtained from them some of my best specimens of U. radiatus. It seldom attains a greater length than three inches, and is a very 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 yellowish green to a dark

olive, with distinct dark green rays. In shape it varies much more than in color. 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, a western correspondent writes that they merge into one another in Toronto Bay. Now they cannot 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 Lac des Chênes. 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 Kettle 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 are of an almost triangular shape, on account of which peculiarities they are liable to be considered forms of 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, producing an effect of chromatic harmony that a painter might study with advantage. 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 is 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 in the fluent light. Moreover, their changeful colours 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 sense that Pliny tells us the word was coined to express - a unique production - "from the circumstance," he says, "that no two uniones - pearls - are ever found alike." The barbarians who found the pearls called them margaritae.

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

Unio subovatus, Lea, which is found in the Rideau Canal and River and in the Des Chênes Lake, is chiefly remarkable for the large size to which it some-

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times attains, a specimen from the canal beyond Hartwell's Locks measuring 5·5 in. in length, 3·4 in height, and 2·2 in diameter. It bears some resemblance in 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 as they here occur would care 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 is no comparison between them.

On the valves of this and other large species in the Rideau River I have observed - 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 - 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 the species described by De Kay as Fluvicola Herrickii.

Unio alatus, Say., was found here by Mr. Heron in 1880, and was recorded from this vicinity twenty years ago, by Mr. Whiteaves in a valuable paper published in the Canadian Naturalist. There are a few specimens in the museum of the Ottawa Literary and Scientific Society, which were probably collected by the late E. Billings, the palaeontologist. As I have not met with it on my many excursions, I think it must be rare, 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 Georgia to Vermont and westward to Nebraska and Manitoba. Certain other species as U. spinosus, Lea., and U. Shepardianus, Lea, are 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 near Kettle Island. 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 slight alated projection. The beaks are finely undulated. Its form, its internal and external color, together with the shape of its cardinal teeth, seem to connect it with the margaritanae.

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 of an oval shape and dark olive colour, 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,

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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. Three out of four shells sent to a conchologist in Cincinnati were referred to U. radiatus, while the remaining one was considered a specimen of U. luteolus. The shells were really not in a condition to admit of being properly determined. 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 as correct my views 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 a new species. The names U. bellus and U. borealis were suggested as appropriate. The latter seems the more fitting, and the species shall 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 describe 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; umbonal 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, 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

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close resemblance to Unio radiatus, Lam., but is more inflated and has a heavier shell. It

[a] 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.

occurs in the Ottawa River at Duck Island; it has also been found in 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.

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. From the interior continental basin it is absent; and although common eastward in Quebec, it has not yet been found in this vicinity. How even a mollusk may affect the destinies of a nation may be inferred from the statement of Seutonius, that it was the hope of obtaining pearls from M. margaritifera which led to the invasion of Britain by Julius Caesar.

Margaritana marginata, Say, occurs sparsely in the Rideau and Ottawa in rapid water, which, indeed, is the favourite 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 colour it ranges from a dusky green to a deep brown, with indistinct dark rays. The shells found here are much inferior in size and colouring 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 colour, 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 colour, and may, moreover, be easily distinguished from that shell both by the wrinkles which are situated along the post lateral margin up to the hinge ligament, 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 by actual count, which were living together in apparent harmony in an open space between the rocks but little if any more than a square foot in extent. They were green in colour, 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

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species from the Rideau. They are probably due to injuries received when young through coming into violent contact with a rock 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 as it now stands 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 margaritanae, 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 the Unionidae is the snye, as the lumbermen call it, between Mason's Mill and the opposite island. It is a comparatively thick shell, generally of a dark olive colour; 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 analogous 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 fine 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, often very much larger and of a lighter colour.

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 have thought the two identical. A. undulata is however a thinner shell more obscurely rayed and more angularly inflated. Additional and far 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, 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 colour, with indistinct rays. Old shells are generally abnormal. They are so 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 Unionidae, 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 umbonial 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

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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-coloured 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.

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-coloured nacre.

Anodonta Footiana, Lea, is not uncommon at the Chats. It is a 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 a small lake in Masham, was infested by hundreds of mites, probably of the species found in U. luteolus and A. fluviatilis in the Rideau Canal. 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.

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 colour it ranges from a bright grass green to 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 colouring conspire to make it the finest Anodonta we have.

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 Unionidae are not altogether correct. In his "Descriptions of the embryonic forms of thirty-eight species of the Unionidae," 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. The venerable patron of the Unionidae, now in his ninety-first year, kindly presented me at the same time with the work previously referred to on "Embryonic Forms," and with several other of his valuable publications. Here was observation opposed to observation. To ascertain whether I was right or wrong, I made use of the fine solar microscope of the College of Ottawa, which gives a magnification of two thousand diameters.

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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 Unionidae.

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 does not in my opinion include all the forms that occur in this vicinity. A. plana, Lea, and A. Ferussaciana, Lea, 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 Unionidae.

## NOTE

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REPRINTS OF RARE ARTICLES ON MOLLUSCA. -- D. H. Barnes, 1828, "Reclamation of Unios." --- American Journal of Science, vol. 13, No. 2, pp. 358-364. (Reprinted with permission of the Editor of the American Journal of Science, Dr. John Rodgers).

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ART. XIII. - Mr. BARNES'S Reclamation of Unios.

(Read before the Lyceum.)

TO PROFESSOR SILLIMAN.

New York, Nov. 12, 1827.

Dear Sir - In looking over the continuation of Humboldt and Bonpland's Zoological Observations, just received, I observe, that a portion of that splendid work is devoted to

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American Unios, of which the author, Mons. A. Valenciennes, describes nine species, all of which have been previously described by American naturalists, either under the same or different names; but, in several instances, no notice is taken of the original author, from whom those names were derived. This is a singular oversight, in the French naturalists, who have been distinguished by their liberality towards American authors; inasmuch as these shells have been sent to the Baron Ferussac, and set forth in his excellent Bulletin, with all due praise. It is an act of duty to Mr. Say and myself to notice this departure from the law of naturalists, that priority must have preference, in all regular publications. I have, however, no doubt, that the oversight was unintentional, and such as will sometimes unavoidably occur. After the publication, in your sixth volume, of the shells brought from the northwestern territory, in 1820-1, I was shown a paper by Professor Rafinesque, published in Brussels, without a date, in which I discovered some of those which I had published. I am not sure which had the priority, but if it belongs to Mr. R. that circumstance probably occurred from the delay in printing the paper in your Journal, caused by my absence from the city, during the prevalence of the yellow fever, and several other unfavorable events. The want of a date in Mr. R's paper, sent to Dr. Mitchill, the only one I have seen, was I believe, owing to its being a part of a larger work of which some extra copies were bound up for the author. Mr. R's paper was totally unknown to me at the time of publishing mine, as you will perceive by the introduction, in which Mr. Say's paper is mentioned as the only one then known.

In the paper of A. Valenciennes, which is the subject of this reclamation, Mr. Rafinesque is mentioned but not followed; and the author's view appears just and reasonable, which is to leave the genus as it now stands, and not to constitute other genera from it, by the external form of the shells. Mr. Say is also respectfully mentioned, but no notice whatever is taken of the paper in your sixth volume, though several of the same species are set forth under the same names, even those of which you have given plates; and others are republished under different names. I shall notice them in detail with corrections to each.

Gastrocopta pellucida hordeacella (Pilsbry) 29
Pupoides albilabris (C. B. Adams)
Vertigo milium (Gould)
Vertigo oscariana Sterki 4
Vertigo rugosula Sterki
Vertigo oralis Sterki 43
Vertigo ovata Say
Vertigo teskeyae Hubricht
Vertigo, n. sp. 1
Vertigo, n. sp. 2
Vertigo tridentata Wolf 2
Carychium exile H. C. Lea
Helicina orbiculata tropica Pfeiffer
Pomatiopsis lapidaria (Say) 22
Snail eggs (Zonitoides ?) 2

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## REVIEW

A REVISION OF THE SPHAERIIDAE OF NORTH AMERICA (MOLLUSCA: PELECYPODA), by H. B. Herrington. -- University of Michigan, Museum of Zoology, Misc. Publ. No. 118, 74 pp., 7 pls., 2 text figs. Ann Arbor, Michigan, April 26, 1962. -- $ 2.85.

Friends and correspondents of Rev. Mr. H. B. Herrington have long awaited the publication of this revision; they will not be disappointed in it now that it has finally been issued. Here is the most authoritative, thorough, and detailed analysis of the Sphaeriidae to appear in half a century and one which is certain to revolutionize the attitude of malacologists and paleontologists towards this family. This estimate of the work will meet with agreement from anyone who uses it as a guide to the fingernail clams of North America and it is safe to predict that admiration and respect for the author's work will increase with use.

The author has outlined the story of his attraction to this study in a prefatory statement (pp. 5-6). It should be read with the knowledge that Herrington could devote to sphaeriids only the spare moments of a busy life as a minister until his retirement a few years ago. It should be remembered also that his ability and industry were recognized by the scientific fraternity in Canada and the United States and the grants-in-aid which helped him in his work are a tribute to his sound malacological knowledge. Here is support of scientific work at its best and the various institutions responsible should have a share in our gratitude.

Perhaps the main value of this work lies in the reduction of species from the hundreds previously described to a manageable 35 (Sphaerium 12, Pisidium 22) and the recognition of 15 Eurasian species in North America. Identification of species is rendered relatively easy by means of a key and illustrations of the diagnostic characters of each species, amplified in carefully worded descriptions.

A minor criticism may be noted here which in no way affects the general usefulness of the work. The synonymy (pp. 52-54) does not dispose of all the names previously applied to North American sphaeriids. Some of these have been dealt with in previous papers (Brooks and Herrington, 1944, Naut. 57: 93-97 and Herrington, 1954, Naut. 67: 97-104, 131-138) but there is still a residue of unsolved puzzles.

To summarize, Herrington's work will henceforth be an indispensable working reference for North American malacologists and he has earned our gratitude for giving us such a clear and complete account of the family.

Aurèle La Rocque
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Ohio State University.

1. UNIO OVATA. (ovatus.) - The gender of the word Unio is again mistaken. It is masculine. This error is noticed in

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your Journal, Vol. VI, page 115; and has since been corrected by Dubois, the translator of Lamarck, in his synoptical table, page 30th. This Unio is referred to Lamarck, vol. vi, page 75, No. 23, and Lamarck in this place quotes Say's American conchology, pl. 2, fig. 7. Now it so happens, that the shell thus referred, is not Mr. Say's Unio ovatus, but his U. cariosus, in a young state, and the author is correct in saying, that it nearly approaches the Unio cariosus, of Lamarck, vol. vi, p. 226. The Unio ovatus, of Mr. Say, is eminently distinguished by a slightly elevated obtuse keel around the anterior slope (posterior of Cuvier and Blainville.) See American Journal of S. and A. vol. vi. p. 113.

2. UNIO DOMBEYANUS. - The author has made two species of Lamarck's Unio Peruvianus. The one is what I have named Unio rugosus, with a plate and description, in the Journal, vol. vi, p. 126, and the other is the

3. UNIO UNDULATUS. - The same shell as that figured in the Journal, with the same name, and from the same locality, the Ohio river. In the Journal, vol. vi, p. 120, Lamarck's Unio Peruvianus is quoted with a mark of doubt. The same reason which caused that doubt, has induced M. Valenciennes to recommend, that Lamarck's name should be discontinued. It comes from the Ohio, and not from Peru. The shell here figured is a younger and smaller one than that figured in the Journal.

4. UNIO VERRUCOSUS. - This, again, is our shell with the same name. It is the variety (b) mentioned on page 124, which is always much less than the one figured in the Journal. The dimensions of the plate, of M. Valenciennes, are the same as those of our shell.

5. UNIO TUBERCULOSUS. - This is the young of our U. verrucosus, and not as the name might seem to indicate, our U. tuberculatus.

6. UNIO ROSTRATUS. - This the author marks Nobis. It is Mr. Say's well known nasutus, but not the nasutA of Lamarck, which circumstance probably led him into the error. Lamarck's name should be changed, and Mr. Say's must have preference. Both the names, nausutus and rostratus,

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are descriptive of the same character of the shell - the unusual extension of the anterior side. (See Journal, vol. vi, p. 110 - 111, and p. 273, No. 26.)

7. UNIO NAVIFORMIS, Lam. - For this, both Lamarck and this author refer to Mr. Say's Unio cylindricus, with a mark of doubt. It is the same. Mr. Say's figure represents an old shell from Dr. Barton's collection, now in the Philadelphia museum, and the figure of this author represents one which is rather younger and smoother than an intermediate one now in my collection, received from Mr. King of Buffalo, and by him brought from the Ohio. This species, of which we have now several specimens, was mentioned, p. 127 of the Journal, but not described as it had been previously described, by Mr. Say, and as one specimen only had then been found; and it seems there is yet only one known in France, which one was carried thither by the younger Michaux, and given to the museum of natural history.

8. UNIO RECTUS. - This shell resembles the Unio praelongus, of the Journal, and, indeed, it has been supposed to be the same. Lamarck's shell is, however, much less in size, and uniformly, as far as my observations have extended, differently colored on the inside. The rectus has the inside either white or with a pale tinge of red, and the praelongus is of a deep and splendid purple. The variety, with the inside

whitish green, mentioned in the Journal is the Unio rectus, of Lamarck, which name, and not his purpuratus, has the preference to ours.

Most beautiful specimens of the Unio rectus are found in Lake Champlain, at Ticonderoga point.

9. UNIO HIANS. - This is the Alasmodonta undulata, of Mr. Say; a genus which the French have not yet admitted into their books. It is, however, a natural genus, of which we have now five or six well characterized species; every one of which may be instantly distinguished from the Unios, by the color and peculiar smell of the animal, and by the yellowish tinge on the inside of the shell. It is a metter of regret that the animals have not yet, to our knowledge, been carefully examined by an acute and discriminating comparative anatomist. They will, no doubt, prove to be different. It is remarkable that this genus should still be included under the Unio, when it has

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not the generic characters of that genus. It always wants the LONG, COMPRESSED LATERAL TOOTH, which Lamarck inserts as a part of his generic description, (alter (sc. dens) elongatus, compressus, lateralis, infra pubem productus,) Lam. Genus Unio, vol. vi, p. 69; and yet Lamarck himself, has put a shell of exactly this kind, at the head of his genus Unio. This fact led me into a mistake concerning the Alasmodonta arcuata, which is Lamarck's Unio sinuatus, and the Mya margaritifera, of authors; and Lamarck has again described the young of this same species, under the name of Unio elongatus. Neither of these ever has the long, compressed, lateral tooth. They, therefore, belong properly to Mr. Say's genus, ALASMODONTA. Am. conch. p. 14-15. Both the young and the old, answering to the two species of Lamarck, just mentioned, are figured in the Journal, vol. vi. pl. 12. The same shell is figured by Pennant and Lister. It is very remarkable, that a shell found in our waters, should be so exactly like one found in Europe. This species, though so well known abroad, was unknown to Mr. Say, when he published his treatise. It was brought to me from Tappan and Canada creek, in this state, and being unknown to Mr. Say, I supposed it new, and so described it.

I find it difficult to believe, what seems to be a very plain fact; I suspect there must be some mistake : the figures and description of this shell seem to show an exact identity, and we have compared ours with specimens labeled, Mya margaritifera, from Liverpool, Eng. They are the same; and yet, if the Unio sinuata, of Lamarck, has the long, lateral, lamelliform tooth, ours is a different shell, and the original name must stand. If that is the fact, neither of us has made a mistake. In the case of the Unio hians, of M. Valenciennes, we seem to perceive the same error as that above imputed to Lamarck. His shell is from our waters, and we have numerous fine specimens, all of which are destitute of the lateral tooth, by which the genus Unio is characterized.

This natural and useful genus contains now six species, as follows: -

1. Alasmodonta margaritifera, Mya L. Unio Lam.
2. " complanata, } American
3. " rugosa, } Journal, vol. vi, p. 75-80.
4. " marginata, Say, Am.
5. " undulata, conch, 1. c.
6. " purpurea, c M. Valenciennes, mentioned below.

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All these, except the last, are known to us as well characterized, and perfectly distinct; and to persons less cautious than we are, the northwestern expedition might have afforded an opportunity of increasing the number. (See Journal, vol. vi. p. 279.)

This paper of Mons. Achille Valenciennes, on the Naiades terminates with an account of two Anodontas: the first is called Anodonta glauca, which is said to be new. It is well known to us, and is Mr. Say's Anodonta marginata. The Anodonta has numerous varieties, but I have yet seen no evidence of more than one species; although Lamarck describes fifteen, Mr. Say, two; this author, two; and others, more. In the same way it would be easy to increase the number to a hundred; but they would all be more alike than the numerous varieties of the Unio purpureus. The identical variety here figured has been brought from our southern waters, and laid on the table of the Lyceum, without being supposed worthy of particular notice.

The next the author calls Anodonta purpurea, which without doubt, is another of Mr. Say's genus Alasmodonta. This is evident from the figure, and the following part of the description. "Cette espèce est très remarquable par l'epaissement du bord inférieur, sous les crochets." I believe that no one ever saw an Anodonta thickened about the beaks. They are always thin, and uniformly thin throughout. But this is not all. "Ce bord [illegible] semble montrer un commencement de duret, et conduire ainsi vers la charnière [illegible]." This again is never found in the genus Anodonta, but it is a very good description of a young Alasmodonta before the teeth of the hinge are fully formed. When the shell is again examined the learned author will find, if my conjecture is right, on the inside near the hinge, where the shell is thickest, a tinge of yellow. The animal, when [illegible], was yellow, and had a rank, offensive smell, different from the fresh and not unpleasant smell of the Unios. The description of the Unio hians, mentions the same appearance about the cardinal tooth, "sous cette dent le test est très-épais: il devient ensuite tres-mince." This is an exact description of the Alasmodonta, which is common to several species, but not often seen in the Unio, and never, to my knowledge, in the Anodonta.

We are gratified to perceive, that the method of measuring shells, and inserting the length, breadth, and diameter;

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(which method was commenced and recommended in this Journal,) is uniformly pursued in this paper. It has also been adopted in England. But the French, instead of diameter, use thickness; as it seems to us, with less propriety, for the reasons given, vol. vi, p. 111.

We regret to see the exploded error, of the axolotl's being the larva of a water salamander, again put down as a matter of undoubted science. It rests, indeed, here as elsewhere, on the authority of Cuvier; but even that authority cannot support it against a simple examination of the specimens now in the New-York Lyceum. The animal is, beyond all doubt, mature and distinct from all others.

Your cordial friend,

D. H. BARNES.

REPRINTS OF RARE ARTICLES ON MOLLUSCA. -- S. P. Hildreth, 1828, "Observations on, and descriptions of the Shells, found in the waters of the Muskingum River, Little Muskingum and Duck Creek, in the vicinity of Marietta, Ohio." --- American Journal of Science, vol. 14, pp. 276-291, 2 pls. (Reprinted with permission of the Editor of the American Journal of Science, Dr. John Rodgers).

ART. VII. - Observations on, and descriptions of the Shells, found in the waters of the Muskingum River, Little Muskingum and Duck Creek, in the vicinity of Marietta, Ohio; by S. P. HILDRETH,* M. D.

ALTHOUGH the river Ohio abounds in shells of the same genera as those about to be described, yet they have so generally been noticed by writers on natural history, while those living in the above streams and more immediately within the bounds of the State, have not received attention; that my observations have been confined to those streams almost exclusively.

From the variety of form, color, and outward appearance of bivales, the most careless observer could not but be struck with their beauty, and led to admire their rich pearly luster, and variegated surface. But the more carefully they are inspected, the more beauties he will find to attract his attention and to call forth his wonder. The beds of many of our streams are strewed with the open valves of the numerous family of the Unios; and where the waters are transparent, like those of the Muskingum, they, with the interspersed pebbles, afford all the rich variety and tessellated appearance of a Roman pavement. -- Their beauties were not unknown, or neglected by that ancient race of men who once inhabited the pleasant vales of Ohio; as the valves of some of the most interesting kinds are often found buried in mounds, intermixed with other articles considered as valuable by the builders of those venerable monuments of the dead. They must also have been deemed very valuable as an article of food; as we find vast beds of the calcined shells, in the banks of the river, usually several feet below the present surface, and near them a hearth of stones with ashes and fragments of deer and fish bones promiscuously interspersed. - In those seasons of the year, when the waters were low, and game scarce, they no doubt constituted a large portion of their food. Some of the species are very fine eating,

*Dr. Hildreth, having with great propriety, made Mr. Barnes his authority for his descriptions, it was thought proper to communicate this memoir to that gentleman, in MS. - along with the drawings, and such of the latter have been engraved as were not among those contained in volumes 6 and 7 of this Journal, to which the reader is referred, for the figures now omitted. We have taken the liberty to add, in the form of notes, a few of the remarks of Mr. Barnes, communicated by our request. -- Editor.

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and much admired by the lovers of shell fish at the present day, particularly the Unio elliptious, and Alasmodonta complanata, which are very large, and in the month of September abound in fat, to the extent of one or two ounces of clear oil in a single individual. In the early settlement of this vicinity, shells were much used for the manufacture of lime, being burnt in piles of alternate strata of logs and shells; and affording an article of the greatest purity and whiteness. They were in such abundance that a single individual could collect twenty five or thirty bushels in a day -- But at present, I think they are less numerous, being destroyed in the low stages of water by hogs, which become very fond of them and will spend whole days in the water searching for their favorite food; many times preferring them to corn, which they have been known to leave, and go in search of the more luscious clam. They have also other harrasing enemies in the Muskrats; which collect vast heaps of shells at the mouths of their favorite retreats, in the vicinity of some sunken log, on which they sit and feast upon the choicest of the molluscous race. It is also said that the white perch make use of the more thin shelled varieties, for food; being provided with strong bony plates, thickly studded with smooth round teeth, and placed in the back part of the fauces, well calculated to perform the office of "nut crackers." The favorite haunts of most of the genera are about the heads and sides of sand bars and islands, where they can nestle in the sand and coarse gravel; other kinds prefer the rocky ripples, where they can lie under the projecting edges of the loose stones; in the latter situations, are found most of the crested or winged varieties, which probably accounts for the fact, that very few of the older subjects are found with crest perfect, but generally mutilated and broken. As to their manner of propagating the species, I have been able to learn but little from my own observations, or by enquiries amongst fishermen, or others much about our rivers; and except in one or two varieties, have derived but little aid from writers on Conchology. From the fact, that the young from the size of a pin head, to that of a pea, are found in great numbers in the sand and soft ooze at the bottom of our streams, where the water is still and calm, I am led to believe, that they are male and female, and propagated by a seminal fluid, in the manner of the finny tribe. But this is only a conjecture, which further observations may confirm or refute.

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I have as yet noticed but one variety of Univalve, in our streams; neither have I been able to collect all the species of the bivalve, as I have heard of several, which are not in my collection. -- The description of most of my shells is taken from the observations of Mr. Barnes, published in the 6th vol. of the Journal of Science; a gentleman who deserves much credit for his devotedness to American natural history.

Remarks. -- My collection is generally made up of living subjects; and the color, &c. for the drawings, selected from several individuals of the same species. -- The drawings were executed by Mr. Sala Bosworth, a young self taught artist of Marietta.

GENUS UNIO.

Generic character, from M. Lamarck.

"Shell transverse, equivalve, inequilateral, free, beaks decorticated, somewhat carious; posterior muscular impression compound; hinge with two teeth in each valve; the cardinal one short, irregular simple, or divided into two, substriated; the other elongated, compressed, lateral, extending beneath the corslet. Ligament exterior."

Remarks. -- Not expecting by these observations to throw much light on the study of Conchology, but only to describe the shells in this

of the ligament to the anterior basal margin, affording the richest display of colors, in which violet and purple predominate, of any shell in my collection.

No. 5. UNIO PLICATUS. - Fig. 5

Shell sub-quadrangular, tumid with distant oblique folds; hinge margin elevated, compressed, carinated. -- Hab. Muskingum.

Length, 2.8; breadth, 2.9; diameter, 17.

Shell thick, posterior side short, obtusely rounded; anterior side compressed wedge shaped; beaks very prominent and projecting backwards as far as the posterior side; ligament elevated and passing between the beaks; hinge margin higher than the beaks; epidermis greenish, surface glabrous, deeply folded, indenting the anterior basal edge; cardinal teeth, sulcate, crenate; lateral in the left valve, curved, and extending up back of the cardinal tooth; posterior cicatrix rough and deep; cavity of the beaks deep and extended backwards; naker white, iridescent on the fore part, and tinged with gold color on the corslet and anterior edge.

Remarks. -- This shell does not correspond, in all particulars, with Mr. Barnes's Plicatus, but still I think it the same. It will stand erect very firmly when placed on the posterior side. *

No. 6 & 7. UNIO UNDATUS. -- Figs. 6 and 7, two varieties.

Shell sub-orbicular, very tumid; waved; lateral teeth, two in each valve. White variety, length 2.25; breadth, 2.5; diameter, 1.5. -- Hab. Muskingum.

Shell thick, disks swelled behind, depressed before; beaks projecting backwards nearly as far as the posterior side, elevated and recurved, with the ligament passing between them; anterior lunule long heart shaped; disks waved transversely from the beaks to the base; basal margin rounded behind, compressed in the middle, angulated slightly before; epidermis horn color or light chestnut; surface finely wrinkled and glabrous; cardinal teeth deeply sulcated and crenated; lateral teeth, two in each valve; muscular impressions deep and posterior one rough; naker pearly white and iridescent. Variety 7. is smaller than the other, and of a rich pink, or deep flesh color on the inside; both varieties will stand erect, on the posterior side, and are neat, handsome shells.

No. 8. UNIO VERRUCOSUS PURPUREUS. -- Fig. 8.

Shell nearly circular, sub-truncate before, irregularly tuberculated; tubercles transversely compressed; inside purple.

Length, 3.5; breadth, 3.6; diameter, 1.9; (larger than the figure.) -- Hab. Muskingum.

Shell very thick; rounded behind, sub-truncate before; beaks elevated, ligament deeply inserted; hinge margin nearly strait, compressed, alated; basal margin rounded; epidermis light brown, surface of the anterior part studded with transversely compressed tubercles; cardinal teeth very deeply sulcated, broad, and crenated cavity of the beaks very deep, compressed and directed backwards; posterior muscular impressor very rough, anterior one compound; naker bluish purple, and iridescent.

No. 9. UNIO VERRUCOSUS ALBUS. -- Fig. 9.

The exterior of this shell is much like that of No. 8; its form is sub-triangular, and angulated before; surface waved transversely, tubercles round and standing on the tops of the waves; cardinal teeth much smaller, and posterior cicatrix deeper; naker pearly white, and iridescent on the fore part; it is a most beautiful shell. -- Hab. Muskingum.

No. 10. UNIO NODOSUS. -- Fig. 10.

Shell sub-quadrangular, emarginate before, knotted, ridged, corrugated, lateral tooth terminating abruptly.

* Mr. Barnes, we are informed, considers it as a variety of the following. -- Ed.

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vicinity, I shall not divide the genus into classes, or parts, but go on as they are numbered in the drawings - the measure is by inches and decimals.

NO. 1. UNIO CRASSUS. - Fig. 1.

A. outside of the shell, C. inside.

Shell very thick, tumid; cardinal teeth lobed, angulated; posterior cicatrix deep and rough. -- Hab. Muskingum.

Length, 3 inches; breadth, 4 inches; diameter 2 do.

Shell very thick, and oval - rounded behind, slightly angulated before; epidermis light brown; surface waved; beaks projecting; cardinal teeth deeply sulcated; anterior-cicatrix striated; cavity of the beaks capacious, but not deep; naker, (or inside of the shell) pearly white and iridescent.

Remark. -- It is a very common shell, and abounds in varieties.

NO. 2. UNIO ELLIPTICUS. - Fig. 2.

Shell regularly oval; thick, convex, glabrous, beaks depressed; teeth elevated, triangular, striated. -- Hab. Muskingum.

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Length, 3.5; breadth, 5.00; diameter, 2.125.

Shell long before, short behind, equally rounded at both extremities; beaks slightly projecting; ligament elevated above the beaks; epidermis dark brown, lighter in young specimens, and obscurely rayed -- waved on the center of the disks, and wrinkled transversely; teeth deeply divided, elevated and striated; anterior cicatrix wrinkled, posterior cicatrix rough behind and smooth before; cavity of the beaks moderate and angulated; naker pearly and beautifully iridescent on the forepart.

Remarks. -- I have a great many specimens of this shell, from very young to old; they are remarkably uniform in their proportions. Its good qualities for eating, are said to be equal to those of any other shell in these streams.

NO. 3. UNIO CUNEATUS. -- Fig. 3.

Shell ovate, wedge shaped, thick, gibbous; disks swelled; a side view of the shell bearing a strong likeness to the head of the bald eagle; lateral teeth thick; inside a rich rose color. -- Hab. Muskingum.

Length, 3.00; breadth, 4.4; diameter, 2.00.

Shell elongated and subtriangular, thick and ponderous; anterior side narrowed, thin, angulated, wedge shaped, compressed; umboes large and elevated, beaks low and distant, much decorticated; anterior lunule, long heart shaped, with an elevated ridge running from the beaks to the anterior basal margin, and projecting on that part - basal margin slightly rounded and arcuated before; anterior margin narrow and angulated; posterior margin rounded and broad; epidermis blackish brown; surface wrinkled transversely. Cardinal teeth deeply divided and sulcated; lateral teeth long, thick and striated; cicatrices deep; cavity of the beaks small and rounded; naker a rich rose color and iridescent.

NO. 4. UNIO UNDULATUS. - Fig. 4.

Shell rhombic ovate, with numerous waving folds radiating from the beaks.

Length, 4.00; breadth, 5.25; diameter, 2.00. -- Hab. Duck Creek.

Shell thick, obtusely rounded, behind, emarginate before; beaks slightly elevated; hinge margin sub-alated, compressed, carinated with a furrow on each side; anterior dorsal margin sub-truncate; epidermis blackish brown and finely

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wrinkled transversely; oblique folds, deeply indenting the anterior margin, furrows largest and deepest on the center of the disks and extending to the anterior basal margin, decussating the oblique waves; large oblong tubers below the beaks; cardinal teeth sulcated and crenated; posterior cicatrix very rough and shallow; naker pearly, irregularly spotted with olive, and most beautifully iridescent from the termination

Length, 2.725; breadth, 3.25; diameter, 1.7.-- Hab. Duck Creek.

Shell thick, short and obtusely rounded behind; beaks elevated, and approximate; with the ligament passing between them; anterior lunule compressed, alated; hinge margin strait; anterior dorsal, rounded; anterior margin,

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projecting; anterior basal, arcuated; basal and posterior margins, rounded; epidermis, greenish brown; corrugated and tuberculated over the center and anterior parts of the shell; tubercles large near the center of the disks, and very fine and beautiful on the beaks; wrinkled across the transverse striae on the anterior lunule, giving it a feather shaped appearance; a broad, elevated, and nodulous ridge extending from the beaks to the anterior margin, and projecting in front; cardinal teeth sulcated and deeply crenated; lateral teeth, short, thick, rough and terminating abruptly, muscular impressions nearly smooth, and the sulcus in the cardinal tooth as deep as the bed of the posterior cicatrix; cavity, deep and angular; naker, a rich pearl color, tinged with blue, and iridescent on the fore part; a very beautiful shell in its exterior, and not less admirable on the inside.

No. 11. UNIO TUBERCULATUS. -- Fig. 11.

Shell, long ovate; surface, corrugated, waved tuberculated, ribbed, disks compressed; base arcuated.

Length, 3.00; breadth, 5.00; diameter, 1.5. -- Hab. Duck Creek.

Shell, thick and rugged; anterior side compressed, narrowed, thin; posterior side, rounded, short, obtuse and broader than the anterior; beaks flat, and far back; ligament higher than the beaks; hinge margin, nearly strait, elevated, compressed; anterior dorsal, emarginate; anterior basal, emarginate; anterior margin rounded; epidermis, dark brown; surface, thinly and irregularly tuberculated; tubercles, elongated longitudinally; an elevated ridge extending from the beaks and projecting on the anterior basal edge; irregular nodulous undulations, radiating from the elevated ridge to the hinge and anterior margins; cardinal teeth, crenated; lateral teeth, long and beautifully formed; posterior cicatrix, deep, and anterior half rough; cavity, angular, compressed and directed backwards; naker, pearly white, with spots of greenish, and most splendidly iridescent with purple, violet and gold, on the fore part.

No. 12. UNIO RUGOSUS. --Fig. 12.

Shell, broad ovate; surface, tuberculated, ribbed, waved, disks swelled, base falcated.

Length, 1.6; breadth 1.8; diameter, 1.2.; specimen small. -- Hab. Muskingum.

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Shell, narrowed and thin before; rounded and wider behind, beaks slightly elevated; hinge margin, compressed, carinate; basal margin, falcated, emarginate and compressed; anterior margin, rounded; epidermis, dark brown; surface, rough and scaly; waved transversely, having distant, irregular, transversely compressed tubercles; a broad nodulous ridge, extending from the beaks to the anterior basal edge, and projecting on that part; small oblique waves radiating from the ridge to the hinge and anterior dorsal margins; cardinal teeth, sulcated; lateral teeth, striated; posterior cicatrix, deep and not very rough; cavity of the beaks, angular, compressed and directed backwards; naker, white and moderately iridescent.

No. 13.-- UNIO CYLINDRICUS.

Fig. 13.

Shell, much elongated transversely, sub-cylindrical; disks, flattened, beaks not much elevated; teeth, sulcated obliquely.

Length, 1.5; breadth, 3.5; diameter, 1.2.-- Hab. Muskingum.

Shell,thick, and elongated before; ligament much depressed between the valves; hinge margin, strait and elevated; anterior dorsal margin,

truncate and emarginate; posterior dorsal, rapidly narrowed; posterior margin, rounded and shortened; anterior margin, rounded; anterior basal, projecting; basal margin, shortened and arcuated; epidermis, olivaceous, wrinkled transversely, and maculated with deep green pyramidal spots, with the base inverted between the wrinkles; a broad nodulous ridge, extending from the beaks to the anterior basal margin, and projecting in front; with small elevations radiating from the ridge to the hinge and anterior dorsal margins; cardinal teeth, deeply crenated; lateral teeth, long and well defined; cavity of the beaks, deep, and directed backwards; posterior cicatrix, deep and rough; naker, pearly white, with colored spots; beautifully iridescent on the fore part.

Remark. -- I have every size of this shell, from one inch to full grown.

No. 14. UNIO PHASEOLUS. -- Fig. 14*

Shell, long ovate, thick; disks, rather flattened, ligament higher than the beaks; beaks, depressed and decorticated.

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Length, 2.00; breadth, 3.5; diameter, 1.4. -- Hab. Muskingum.

Shell thick and ponderous; anterior side, narrowed, thin, angulated; beaks, low; anterior lunule, carinated; basal margin, arcuated; anterior margin, narrow and rounded; dorsal margin, higher than the beaks; posterior margin, rounded and slightly gaping; epidermis, light olive and finely wrinkled transversely; cardinal teeth, rather small, lightly sulcated, and finely crenated; lateral teeth, very broad and thick; posterior muscular impression rough and deep; anterior one, deep and striated; naker, pearly; cavity of the beaks, shallow, and inner surface marked with several deep folds, running obliquely from the cardinal teeth to the anterior margin.

Remark. -- Quite a common shell in the Muskingum.

NO. 15. UNIO ORBICULATUS. -- Fig. 15.

Shell, nearly round; inflated, beaks somewhat prominent, broad and directed backwards; anterior lunule, broad heart shaped; cardinal teeth, elevated, angulated.

Length, 2.5; breadth, 2.5; diameter, 1.75. -- Hab. Muskingum.

Shell, nearly orbicular; anterior margin, broad, and slightly rounded; posterior, short and narrow; disks, much inflated; dorsal margin, lightly rounded, and basal margin the same; ligament, thick and elevated, passing between the beaks; beaks, a little projecting, distant and decorticated; epidermis, a dark chestnut on the center of the disks, passing into a light brown as it approaches the margin; surface lightly waved on the upper part of the disks, and finely wrinkled below, transversely; cardinal teeth, direct, elevated and deeply sulcated; lateral teeth, thick and prominent; posterior cicatrix, deep, and rough before; anterior cicatrix, broad, finely waved; striated and beautifully iridescent; cavity, broad and deep; naker, flesh color, and very iridescent with purple and violet.

Remarks. -- This shell is a variety of the crassus; but differs so much from any I have seen that it deserves notice.

No. 16. UNIO FOLIATUS, Fig. 16.

Shell, shaped like a grape leaf, surface waved; disks, swelled; base, arcuated, and anterior margin deeply emarginate.

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Length, 2.00; breadth, 2.00; diameter, 1.12. -- Hab. Ohio.

Shell, compressed and deeply emarginate before; rounded and projecting behind; beaks flat and eroded; ligament, more elevated than the

* White variety of Cuneatus, No. 3. (D.H.B.) -- Ed.

beaks, and passing between them: hinge margin, broad and strait; anterior dorsal margin, projecting; anterior margin, emarginate; anterior basal, projecting; basal margin, arcuated; two elevated ridges, extending from the beaks, and projecting on the anterior dorsal and basal margins, with a broad furrow between; epidermis, dark olive; waved transversely, and obscurely rayed with green, across the waves; cardinal teeth small, and that in the right valve deeply sulcated; lateral teeth, short and thick; posterior cicatrix, deep and smooth; anterior one, strongly impressed and rough behind; cavity, broad and shallow; naker, white, tinged with a beautiful pea green; iridescent on the fore part.

Remarks. -- Having but one specimen of this shell, I am unable to determine whether it is a new variety, or only a "lusus naturae."*

* In Mr. Barnes's opinion it is new and distinct. -- Ed.

No. 17. UNIO ALATUS. -- Fig. 17.

Shell ovately triangular; hinge margin elevated into a large wing; valves growing together on the back of the ligament, inside purple.

Length, 4.5; breadth, 6.5; diameter, 1.7. -- Hab. Duck Creek.

Shell moderately thick, disks flat and compressed, long before and short behind; beaks depressed; ligament concealed between the valves; hinge margin nearly strait; anterior dorsal, emarginate; anterior margin, rounded and broad; posterior margin, rounded and narrow; surface deeply wrinkled; teeth elevated and crenate; anterior cicatrix, very broad; posterior composed of three distinct impressions, and also a row of very small impressions across the cavity of the beaks; naker, red-purple, very brilliant, and most splendidly iridescent on the forepart.

Remarks. -- It is difficult to procure a perfect specimen, of a full grown subject, the wing being more or less mutilated. The figure of this specimen has been drawn with great care,

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and I believe is a faithful representation of the individual designed. The inner surface of some shells, is sprinkled over with small grains, like mustard seed in size, while others are nearly or quite free from them, as is the case with the present shell.*

* We are informed by Mr. Barnes, that they may be procured in abundance at Ticonderoga. -- Ed.

No. 13. UNIO PRAELONGUS. --Fig. 18.

Shell much elongated transversely, narrow, thick, turnid, beaks flat, lateral tooth long, thin; inside white, tinged with green or purple.

Length, 2.25; breadth, 5.6; diameter, 1.9. -- Hab. Duck Creek.

Shell, very long oval; anterior side somewhat pointed; posterior side short rounded, obtuse; beaks depressed; ligament elevated above the beaks; basal margin slightly compressed; when young, rounded; epidermis, blackish brown, wrinkled transversely, and rayed obscurely; naker, white, and tinged with spots of green, or purple under the beaks, with a row of small muscular impressions in the cavity; posterior cicatrix deep and not very rough; iridescent on the forepart.

No. 19. UNIO GIBBOSUS. --Fig. 19.

Shell,elongated transversely, thick and gibbous; later tooth thick, incurved, inside purple.

Length, 2.00; breadth, 4; diameter, 1,1.00. -- Hab. Muskingum.

Shell, much elongated transversely, thick and heavy; rapidly narrowed and rostrate before, narrow and rounded behind; disks somewhat compressed; anterior side much produced; beaks flat; ligament elevated; anterior dorsal margin, depressed and flattened; basal margin, nearly strait; epidermis, dark brown, deeply wrinkled transversely; naker, purple; teeth, crenate; lateral tooth, thick and rough, and folded over towards the inside of the shell; posterior cicatrix,

deep, and rather rough; so deep that in old specimens, it is often worn through on this part.

No. 20. UNIO RADIATUS. -- Fig. 20.

Shell, ovate, thin, finely striated, glossy, rayed, within bluish white.†

† In Mr. Barnes's opinion, a young Ventricosus, and not the true Radiatus. -- Ed.

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Length, 2.00; breadth, 3.5; diameter, 1.4. -- Hab. Duck Creek.

Shell, thin and fragile; anterior side, broad; disks, convex; beaks, slightly elevated, and approximate; ligament, elevated; hinge margin, elevated, compressed, carinate; basal margin, a little shortened; in young shells, rounded; anterior margin, narrow; posterior, broad and rounded; anterior dorsal, subtruncate; epidermis, greenish yellow, rayed with dark green, and finely striated transversely; surface, smooth and glossy; cardinal teeth, crenated and long; cavity of the beaks, small; posterior muscular impression, broad; naker, bluish white, or pearl color.

Remarks. -- This is a very neat, and handsome shell - outer surface remarkably clean, and free from parasitic plants*-- It is said to be very superior for eating.

*Because it is young. Mr. Barnes. - Ed.

No. 21. UNIO OVATUS. --Fig. 21.

Shell, roundish ovate, convex, umboes elevated, beaks recurved, and approximate; anterior lunule, flattened; teeth, crest-like, elevated.

Length, 3.75; breadth, 5.00; diameter, 2.25. -- Hab. Muskingum.

Shell, broader before, and narrower behind the beaks; thin and translucent when young; and not thick when old; disks, swelled; umboes, prominent; ligament, partly concealed; anterior lunule flattened, and fuscous, becoming lamelar with striae and wrinkles; epidermis, yellowish, or horn color; surface, glabrous and shining, deeply wrinkled, and rayed in young subjects; cardinal teeth, crest like, elevated, compressed, oblike, nearly on a line with the anterior dorsal margin; lateral teeth, short and elevated; cicatrices, smooth and polished; cavity, large and somewhat angular; naker, pearly white.

Remarks. -- This is one of the most common shells in the Muskingum, and remarkably uniform it its appearance. I think it a near relation of the gracilis.

No. 22. UNIO TRIANGULARIS. -- Fig. 22.

Shell, triangular, gibbous inflated, rayed, gaping, anterior slope, flattened, ribbed, cancelate; inside, white.

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Length, 1.25; breadth, 2.00; diameter, 1.1. -- Hab. Duck Creek.

Shell, moderately thick, acutely angulated before, obtuse, and somewhat angulated behind; disks, inflated; anterior slope, flattened, very broad, ribbed longitudinally, and wrinkled transversely; beaks, one third from posterior extremity, decorticated, approximate, and somewhat elevated; anterior lunule, oval heart shaped, in the smaller, and perfectly heart shaped in the larger specimens; basal margin, a little depressed near the anterior extremity; anterior margin, angulated; posterior margin, rounded and broad; epidermis, yellowish green, rayed with dark green, finely striated transversely, and with from three to six, more conspicuous transverse wrinkles; anterior slope, marked with longitudinal ribs, which are beautifully cancelated; ribs, projecting and forming a dentated edge; cardinal teeth, two in each valve, compressed and crenulate; lateral teeth, short, projecting, and terminating abruptly; naker, bluish white, slightly iridescent.

No. 23. UNIO GRACILIS. -- Fig. 23.

Shell, ovately triangular, very thin and fragile; hinge margin, elevated; ligament, concealed.

Length, 2.5; breadth, 3.5; diameter, 1.25. -- Hab. Little Muskingum.

Beaks, depressed and placed far back; ligament, between the valves, and covered; anterior lunule, distinct; hinge margin, elevated into a large wing, in the perfect specimens; epidermis, sea green, wrinkled and striated transversely, glabrous; cardinal teeth, very small, scarcely projecting; lateral teeth, very thin and delicate; naker, bluish white, tinged with violet, and beautifully iridescent.

Remark. -- This shell is but a small specimen of the gracilis, in these waters. I have heard of one three times the size -- the wing is much mutilated. The contour of the shell, independent of the wing, is much like that of the alatus. It is a more delicate shell, and inside more beautifully irised, if possible -- not a common shell in this vicinity, as I have but one specimen.*

The above, are all the specimens of the Unio, that have as yet fallen under my notice; but as my researches have

*It is abundant in Lake Champlain. (D. H. B.) -- Ed.

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been but partial, I have no doubt, of being able to add a number more to my collection.

## ALASMODONTA.

### Generic Character.

Shell, transverse, equivalve, inequilateral, free; beaks, decorticated; posterior muscular impression, compound; hinge, with prominent cardinal teeth in each valve, but without lateral teeth.

### No. 24. ALASMODONTA RUGOSA. -- Fig. 24.

Length, 2.25; breadth, 4.10; diameter, 1.20. -- Hab. Little Muskingum.

Shell, oblong oval, about equally broad, before and behind; beaks, very slightly elevated, wrinkled and decorticated, wax color beneath; ligament, external, and rather higher than the beaks; anterior lunule, distinct, with a slightly elevated ridge, extending from the beaks to the anterior basal margin; basal margin, a little shortened, or nearly strait, the other margins rounded; epidermis, chestnut brown, with a silky luster; surface of the anterior part folded in a pinnate form; folds deeper and larger as they approach the anterior basal margin; curved upwards, and extending to the hinge, indenting the edge, and appearing on the inside; teeth large and elevated, having in some specimens, a curved appearance; cicatrices, smooth; cavity, small; naker, pale flesh colored in the center, pearly on the margin, with a narrow border of dark chocolate; surface, glossy, with a rich blue tinge, over the fimbriated portion of the shell.

Remarks. -- I have several specimens of this shell, young and old -- in some, the teeth are much deformed, but the valves are equal and uniform.

### No. 25. ALASMODONTA COMPLANATA. -- Fig. 25.

Shell, ovately quadrangular; hinge margin, elevated into a large wing; valves, connate; ligament, concealed; wing, pinnate.

Length, 4.75; breadth, 5.9; diameter, 1.75. -- Hab. Duck Creek.

Shell, short behind; disks, much flattened; beaks, slightly projecting; ligament, between the valves; anterior lunule, much compressed, and folded across the traverse wrinkles;

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hinge margin, elevated into a large wing, which is pinnated, or folded; forming an obtuse angle with the post dorsal margin; basal margin, rounded; anterior dorsal, arcuated; anterior margin, truncate; posterior, rounded; epidermis, dark brown, with a tinge of red below the beaks; surface, wrinkled; slightly elevated ridges and fur-

rows extending from the beaks, to the anterior margin; teeth, elevated, sulcated, and radiating from the beaks; cicatrices, smooth; cavity, small and angular; naker, bluish white, and iridescent on the forepart, with a border of rich reddish brown, on the margin.

Remarks. -- I have several specimens of this shell, in all of which the wing is folded, in some, very beautifully -- generally found in ripples, or rapid water, and rocky bottom.

## GENUS ANODONTA

### Generic Character.

Shell transverse, with three obsolete muscular impressions, hinge simple; destitute of teeth.

### No. 26. ANODONTA UNDULATA. -- Fig. 26

Shell very thin, not thicker than brown paper; convex, nearly oval; epidermis greenish, or olivaceous, darker on the umbo; obscurely rayed and striated longitudinally; rays lighter than the general surface; distantly waved transversely, waves appearing on the inside; beaks prominent, acute, approximate; slightly decorticated, wax color beneath; ligament partly concealed; hinge margin rectilinear; anterior dorsal margin compressed and angulated; anterior margin sub-truncated; posterior margin rounded and projecting; basal margin ovally rounded; surface glossy and polished; destitute of cardinal or lateral teeth; naker light cerulean, tinged with violet; cavity capacious; basal and anterior margins bordered with a broad line of rich brown.

Length, 1.75; breadth, 3.00; diameter, 1.25. -- Hab. Little Muskingum. A very delicate and beautiful shell.

The only specimen of univalve, is figured No. 27, and was found in the Little Muskingum; it is the largest I have seen of that species, smaller ones being very common. -- It appears to belong to the genus Paludina, species Decisa; as described in American Conchology, plate 2. fig. 6. -- It is 1.5 in length, and 1.00 in diameter.

Closing Remarks. -- In the above list of shells there are four varieties, which I have not seen described, and have ventured to

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give them specific names, viz. Orbiculatus, Phaseolus, and Foliatus, of the Unios; and Undulata, of the genus Anodonta -- my other descriptions are generally copied from Mr. Barnes, except in particulars where my specimens differed from his. The subject is in a manner new to me, and lacks the finish of an experienced workman.

EDITORIAL NOTE. This paper is accompanied by two plates which are not reproduced here as it is nearly impossible, judging by previous experience, to obtain satisfactory reproduction by the means available to STERKIANA.

A. L.