

REPRINTS OF RARE ARTICLES ON MOLLUSCA. -- D. W. Barnes "ON THE GENERA UNIO AND ALASMODONTA; WITH INTRODUCTORY REMARKS." -- American Journal of Science, vol. 6, No. 1, pp. 107-127.* (Reprinted with permission of the Editor of the American Journal of Science, Dr. John Rodgers).

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CONCHOLOGY

ART. VI. -- On the Genera Unio and Alasmodontia; with Introductory Remarks: by D. W. BARNES, M. A. Member of the New-York Lyceum of Natural History.

[Read before the Lyceum]

INTRODUCTORY REMARKS

The family of the *Naiades*, according to M. Lamarck, contains four genera of fresh water Bivales, viz. *Unio*, *Hyria*, *Anodontia* and *Iridina*. To this family belong the *Dipsas* of Dr. Leach, and the *Alasmodontia* of Mr. Say. Several undescribed species of the Genera *Unio* and *Alasmodontia*, were brought to our knowledge by the expedition sent by our government in the summer of 1820, under Gov. Cass, to explore the North Western Territory; and others have since been obtained from various sources.

Little has been hitherto been done by our countrymen in describing these interesting productions of our lakes and rivers. The only American work, of the kind, at present known, is that of Mr. Thomas Say, who published at Philadelphia in the year 1819, "A description of the land and fresh-water shells of the United States." This treatise had been previously published in Nicholson's Encyclopedia. It deserves the thanks, and ought to be in the possession of every American lover of Natural Science. It has been quoted by M. Lamarck; and adopted by M. de Ferrussac, and has thus taken its place in the scientific world.

* Published 1823.

But Mr. Say's tract, though a very commendable performance, was necessarily imperfect. The author himself has described thirty new species of univalves since the publication of his book, and a great part of the splendid collection, brought from the N. W. Territory, was unknown to him. For our first view of them we were indebted to the zeal and

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liberality of Mr. H. R. Schoolcraft, Mineralogist to the expedition, who collected them at the expense of much voluntary fatigue, transported them a thousand miles, and generously distributed them among the lovers of Natural Science, in New-York and Philadelphia.

A second parcel was soon after received from Capt. D. B. Douglass, Professor in the Military Academy at West-Point, and topographical engineer to the expedition, whose avowed object, in sending his collection, was that it might be arranged and described for the American Journal of Science and Arts. To this gentleman we feel ourselves much indebted, for his valuable and detailed account of the localities of his specimens. What adds to the value of these collections, is, that independent of the numerous species and varieties before unknown, the specimens of the previously ascertained species are in many instances, remarkably large and beautiful.

M. Lamarck, in the sixth Volume of his "Animaux sans Vertebres," has described twenty-six species of North American Uniones. He was moreover in doubt of the localities of several others, which will probably be found to be American. Whether he

* For eight of these, he quotes Mr. Say's book, which contains nine.

has, as we strongly suspect, described some of our species under four or five different names, cannot be certainly determined, as his book contains no figures, and the descriptions are short and equivocal. The *Unio purpureus* of Mr. Say, *purpurascens* of M. Lamarck, is common in all our eastern waters, and has a different appearance from every locality. In the Hudson it is small and short; in the Housatonic, long and slender; in the Saratoga Lake, of middling size; in the Kayaderoseras, thick and heavy; in the Lakes of New-Jersey, large and ponderous. If these are to be made different species, we may as well make four or five different species of the common clam, *Venus mercenaria*, Linn. from as many different localities around New-York. They are really unlike. Not only is the appearance of the shells different to the eye of the naturalist, but also the taste of the included animals, to the palate of the epicure. Who does not know that the Indian corn *Zea Mays*, assumes a different appearance in every latitude from Quebec to Florida? Yet whoever thought of

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making these varieties, different species? We have examined shells from the localities mentioned by M. Lamarck, and compared them with his descriptions, and, if we do not mistake, he has fallen into the error of making distinctions without a specific difference. But, even if this is admitted, we shall not be disposed very severely to censure, so long as anatomical dissections have not been, and in many cases cannot be called in to decide the question; for it is, after all, upon the knife that we must depend for perfect accuracy in this and similar cases. In the mean time, it has been agreed upon by naturalists, to arrange these animals by their shells; presuming always that a different form and figure of covering belonged to an animal of a different organization. It is impossible to decide whether they are "the common children of common parents," or otherwise. This is a case precisely similar to that which occurred between Linnaeus and Lamarck concerning the Olives. "The former expressed a doubt whether there is more than

one species of the Olive, and the latter has described fifty-nine."*

In most cases wherever M. Lamarck can find a difference, though by his own account, "nothing remarkable,"+ he makes a different species. Too many as well as too few distinctions undoubtedly defeat the object of the Naturalist, which is to make his readers acquainted with the productions he describes. In the present state of our knowledge we cannot perhaps do better than to take a mean course, and where the discriminations are sufficiently obvious, in important parts and essential particulars, to apply a different specific designation. This course has been attempted in the following notice of undescribed species. We have had the opportunity of examining and comparing a great number of specimens, and very rarely have we given a new specific name to a solitary individual. In cases where the contrary has, from necessity, been done, the specimens were by no means of a dubious character; but healthy, well-grown and perfect individuals, so strongly marked and distinctly characterized, as to leave no doubt.

* Dillwyn, page 514.

+ See *U. Georgina* and *Glabrata* of Lamarck.

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M. Lamarck has confessed the great difficulty of determining the species of the genus *Unio* on account of their "shading and melting into each other in the course of their variations." This difficulty is surely not obviated by short and equivocal descriptions. Short definitions may have an appearance of scientific neatness, but their brevity is an insuperable obstacle to a learner, especially when, as it commonly happens, the same terms are applied to different species. M. Lamarck applies the term *ovate*, either by itself or compounded with another word, to the description of thirty-two, out of his forty-eight species. Now it will be apparent to every one that, as this is made a leading feature in his descriptions, it must be the cause of endless perplexity to the unlearned, and of constant uncertainty even to the experienced. For the purpose of

discrimination it is useless, and might almost as well have been omitted, unless it had been placed at the head of a section.

M. Lamarck dwells most on the external form, and with a great latitude of compound epithets, he has not succeeded in making his descriptions intelligible, without danger of mistake to those who have not seen his specimens. Ten or twelve latin words cannot so describe a *Unio* as to identify it, and distinguish it from all others. We have therefore adopted full descriptions, the obvious utility of which needs no comment. If short definitions are insufficient, full descriptions become absolutely necessary. M. Lamarck, generally mentions the breadth of shells in Millimetres, which we have reduced to inches and lines, or what is the same thing, to inches and decimals. The multiplier $\cdot 039371$, which multiplied by any number of Millimetres gives the corresponding English expression, as, *Unio Crassidens* 105 Millim. $105 \times \cdot 039371 = 4 \cdot 133955$ or four inches and 1 line. Dividing the English inches by the multiplier, will reduce Mr. Say's measures to M. Lamarck's by which means they may be more readily compared. For ordinary purposes 12.5 Millim. to half an inch, and 4 inches to 100 Millimetres, will be sufficiently exact.

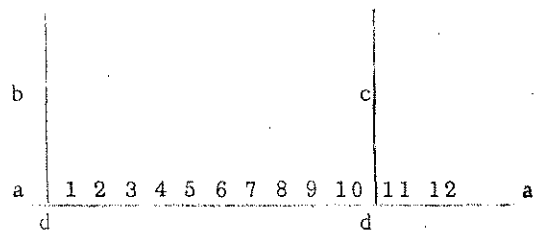
But the breadth, or as Lamarck often says the "apparent length" of the shell is useless without the length; for two shells may be of the same breadth, and yet differ totally in their other dimensions. For instance, the *U. Crassus* and *U. Nasutus* may each be 26 lines broad; but the *Cras-*

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sus may be as long as it is broad, while the *Nasutus* is only 1 inch, or 10 lines long. The former may weigh more than half a pound, the latter less than half an ounce. The former may be half an inch thick, the latter, as thin as paper. And to say that one is broad and the other narrow, does not obviate the difficulty; for these terms are altogether comparative, and, without something for a standard, convey no definite ideas.

We have therefore adopted an improvement which we hope to see become general in the

description of Bivalves, that is, to give the length from the summit to the opposite margin; the breadth between the lateral extremities, and the diameter through the disks, at right angles to both the length and the breadth; that is, the thickness through the most prominent part of the body of the animal. We prefer the term diameter to thickness, because the latter is often applied to the substance of the shell, the former never. In determining these dimensions with ease and accuracy, we have constructed a convenient instrument of the following description;



a, a, is a box-wood ruler, one foot long, graduated on its upper side, in inches and lines. b, c, cross bars, made to stand at right angles, and drop down by hinge joints, d, d, upon the ruler, for the convenience of packing. The bar, c, d, slides upon the ruler by means of a clasp. The shells, to be measured, are placed between the bars, and the length is read off from below. The instrument measures any irregular body or figure, from one line to one foot in diameter. When used for measuring shells, it may be called a *Conchometer*.

One advantage of thus measuring shells, is, that those of the same species, or the same variety, will be found to have very nearly the same proportions which will hold good as it regards all the varieties of age. These proportions may be

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called the law of the species, and every *Unio* which has the same proportions, may be presumed to belong to the same species.

Another obvious advantage of this method will appear in the following remark. The *Unio* which we have designated *praelongus*, is perhaps the *Unio purpurata* of M. La-

marck, all the terms of his description may be applied, and probably with truth, to our shell. But then, he "believes that his shell came from the great Rivers of Africa." This caused a doubt. Had he stated the very remarkable proportions of our shell, the identity would have been instantly determined. Had he stated the proportions at all, there could have been no doubt. We have put it into his power to settle the question with certainty.

Writers on Conchology differ very much concerning the right and left, and the base of Bivalves. M. Lamarck and the authors of the New Edinburgh Encyclopedia consider the beaks as the base, and the opposite parts, the upper margin; and they give the following direction for right and left. If the shell is placed upon its base or hinge, with the ligament behind, then the right and left sides of the shell will correspond with those of the observer. Burrow on the contrary considers the opposite part to be the base, and the beaks, the summit, and says, "If the shell be placed on its base, with the area in front, and the valves be then divided, the right valve will be opposite the left hand of the examiner, and the left valve opposite the right." By placing a Bivalve in the manner directed, it will be perceived that the two are directly opposite, the right of one is the left of the other. The view which we have hitherto had of these parts, and with which Mr. Say agrees, is expressed in the following directions: Place the shell upon its base with the beaks upward, and the ligament before, (that is from the observer,) the right and left valves of the shell will correspond with the hands of the observer. With due deference to the high authority of M. Lamarck, there seems to be a propriety in calling the base of a Bivalve, that part which is downward, and from which the foot projects when the animal is in motion. But when the Unio does not, as some authors seem to suppose, move on its beaks. The beaks are upwards, and should therefore be called the back rather than the base. This makes a simplicity, in the language of Con-

a uniform meaning. Having learned in univalves what is the mouth and what is the base of a shell, we apply the same terms to bivalves; but to call the thin, sharp, unconnected edges of a shell, the dorsum or back would sound very strangely. M. Lamarck has not ventured on so strange an expression; but says commonly the upper margin, the same that Mr. Say calls the "basal edge." According to this view of the subject we should agree with M. Lamarck and the Encyclopedia as to right and left, but not as to base; and with Burrow as to base, but not as to right and left. We call the connected part of a bivalve the back and the opposite the base.

If this is determined, there will remain another point to be settled. Authors have very generally agreed in calling that side of the beaks in which the ligament is situated, the anterior, and the opposite, the posterior. "But rigidly speaking," says Mr. Say, "we seem to be all wrong in our adaptation of these relative terms, because the latter is used to indicate that part of the shell which covers the mouth of the included animal, and which is foremost in its progressive movements. In order to be correct in descriptions where the animal is referred to, these terms must be reversed, and if in descriptions which have reference to the animal, certainly the principle applies to all other bivalves, in which the mouth is similarly situated. The mouth ought always to be considered as in the anterior. For this reason, Cuvier reverses the term right and left, applying the former to that valve of the Unioles which has but a single lamelliform tooth, and which is our left valve.* He of course, reverses the anterior and posterior as now applied."† It would surely be deemed safe to follow an author so pre-eminent as M. Cuvier, and this mode of viewing the shell is doubtless most conformable to nature; but as all other authors have a different view, we have resolved, for the present, to adopt the established usage of the term anterior and posterior, and to follow M.

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chology, which is very desirable in every science, that the same terms should have

*This agrees with Burrow. † Mr. Say's MSS.

Lamarck as to right and left.

If we rightly understand the celebrated French Naturalist, he is under a mistake in saying that the Uniones "keep

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themselves buried in the mud, having their beaks turned downward.* If he means by this that they are usually concealed, or that they lie on their beaks; we remark that, as it regards those of our country, such is not the fact. In winter they may bury themselves, but in summer we have found them, generally, when at rest, standing with the posterior side inserted obliquely, and the hinge margin the anterior slope, and a small portion of the basal edge exerted. Even when they sink below the surface the place of their retreat is conspicuous. In streams which have a rough bottom, and rapid current, they choose the narrow crevices between the stones or under the edges of rocks, and thus defend themselves from injury. We have never found a live Unio on its back, or on what M. Lamarck and his followers would call the base.

While standing in the position above described, they have the anterior side slightly gaping, but on being touched they instantly close. They are usually found in company, rarely solitary; and the sand of the bottom is often marked with little furrows made by their passing from place to place. They advance with the posterior end foremost, and the decorticated beaks, seen through the water, bear a strong resemblance to the eyes of a large animal. Deterville says "they have been observed to live for several months of the summer in clay too hard to be cut by the hoe, and with but momentary showers to refresh them." This, if it be a fact, must rest, for the present, on his authority; as we know of no one who has confirmed it by observation.

We know but little concerning the generation and propagation of the species of Molluscous animals that inhabit these shells. They are generally supposed to be hermaphrodite per se. If they are really and absolutely so,

* Ils se tiennent enfoncés dans la vase, ayant leurs crochets tournés en bas." -- Lam. An. S. Vertebres, Vol. VI. page 70.

the number of species must be exceedingly great. M. Lamarck supposes that they are propagated by means of a fecundating fluid emitted into the water. If so, they must be male and female. What reason he has for this supposition, we are not informed, but if it be admitted, it will readily account for the numerous varieties of these animals, and it will show also that they are merely varieties, and not different species, that is, they will prove to be the "common

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children of common parents, and as much like them as they are like each other." If the fecundating fluid, emitted by the male, be received by the female, a variety intermediate between them, will be produced. By a second propagation, by one of the parents and the intermediate, a new variety, less different from the former one, than that was from its parents, will be again produced, and so on, in an endless succession of innumerable varieties. The admission of M. Lamarck's supposition would confirm the thought which has frequently and very forcibly struck us, that, properly speaking, there is but one species of the whole genus; and perhaps of the whole family. There is yet wanting a series of minute and well-directed observations on the habits and manners of this interesting tribe of molluscous Bivalves. In the mean time we must follow our guides at the hazard of being sometimes misled.

Brugière established the genus Unio, but his original observation on this subject we have not been able to find. The word signifies a pearl, because "many of them produce very fine pearls," and nearly all of them have a pearly inside called naker or mother-of-pearl. Pliny in his Natural Hist. Lib. IX, Cap. 35, entitled Quomodo et ubi inveniuntur, margaritae, uses the word, gives the reason for its derivation, and makes it constantly masculine. In this he is followed by our countryman Mr. Say who makes it always of the masculine gender except in that species for which he gives credit to M. Le Sueur. Why the celebrated and accurate M. Lamarck, has chosen to make it feminine, we cannot even conjecture. Order of description. No certain order has hitherto been adopted by Naturalists in

their description of Bivalves. The descriptions both of M. Lamarck and Mr. Say are without a definite method. Though they generally begin with the outline of the shell, yet they throw together promiscuously the other parts, both internal and external. I propose to reduce this subject to order in the following manner. In examining a bivalve, the first thing that strikes the eye of the observer is the outside, the second is the inside. Hence the description will be divided naturally into two parts, the External and the Internal. As it is by the interior that we determine the genera of the Naiades, as

* M. Lamarck.

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well as of many Oceanic Bivalves, it might seem most proper to commence with that part in describing. But as the generic characters, standing at the head of the genus are supposed to be known, and are therefore not enumerated in the description, and as the method of commencing with the exterior has been generally adopted, we have not deemed it necessary to depart from the established usage. The parts are two, viz.

(A.) EXTERNAL (B.) INTERNAL.

Each of these comprehends three divisions, viz. I. Form, II. Color, III. Surface. With sub-divisions as follows, viz.

A. EXTERNAL

I. FORM AND SUBSTANCE includes

1. General outline or circumference.
2. Substance of the shell.
3. Disks, right and left.
4. Sides, anterior and posterior.
5. Umbones or bosses
6. Beaks.
7. Ligament.
8. Lunules, anterior and posterior.
9. Eight margins, viz.
 - a. Hinge, or dorsal.
 - b. Basal.

- c. Anterior.
- d. Posterior.
- e. f. Anterior, dorsal and basal.
- g. h. Posterior, dorsal, and basal.

II. COLOR of Epidermis.

III. SURFACE

B. INTERNAL.

I. FORM of

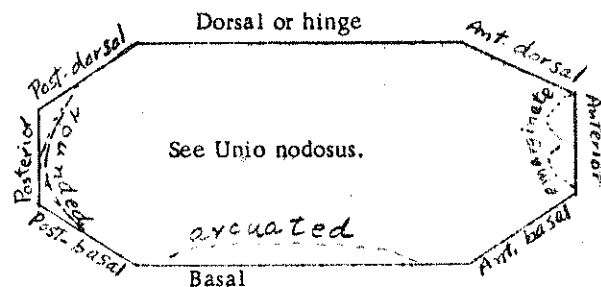
1. Cardinal teeth.
2. Lateral teeth.
3. Muscular impressions, or Cicatrices.
4. Cavity of the beaks.

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II. Color of Naker.

III. SURFACE.

The eight margins explained. Every Bivalve shell may be supposed to be circumscribed by an octagon, which will be more or less irregular, according to the shape of the shell. The eight sides of the octagon will represent the eight margins, as will be seen by the following figure.



This distribution of the circumference of the shell, tends very much to precision in the language of description, for if it be said that any particular margin is rounded, arcuated or emarginate, the part intended cannot be mistaken. To go into an explanation in general, of terms used in description, would carry us too far from our present purpose. We refer to Burrow.

We come now to the description of species of the *Unio*, which we propose to distribute into five* sections, by the form of the Cardinal teeth.

UNIO.

Generic character from M. Lamarck.

Shell transverse,¹ equivalve, inequilateral, free, beaks decorticated,² somewhat carious, (presque rongés) Posterior

*M. Lamarck makes two sections, the principal distinction of which is, non en crête and en crête, applied to the Cardinal tooth.

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muscular impression compound, hinge with two³ teeth in each valve; the Cardinal one, short, irregular, simple or divided into two, substriated; the other elongated, compressed lateral, extending beneath the corselet. Ligament exterior.

1 & 2, Generally, but not always when young.

3, Others consider the divisions as separate teeth.

Divisions.

A. Cardinal teeth direct.

B. Cardinal Teeth, Oblique

Sections.

- A { *Cardinal teeth, very thick.
 " " Cardinal teeth, moderately thick.
 " " " Cardinal teeth, small.
 B { " " " Cardinal teeth, broad, compressed.
 " " " " Cardinal teeth, narrow, compressed.
 *Cardinal teeth, very thick, direct.

Species.

1. *Unio Crassus*. Fig. 1 { a. inside.
 { b. outside.
 Shell very thick, tumid; Cardinal teeth, lobed, angulated; Posterior cicatrix, deep, rough.
Unio Crassus. Mr. Say.
Unio Crassidens. M. Lamarck.
Mya ponderosa? Mr. Dillwyn p. 51.
 Mr. Say's Amer. Conch. pl. 1, fig. 8.

Habitat. The Ohio, Mississippi, and the Lakes. Diameter 2.4 Length 3.2 Breadth 4.8 inches.

My Collection.

Shell oval, ponderous, rounded behind, angulated before; Epidermis blackish brown; surface waved. Cardinal tooth deeply sulcated; anterior cicatrix wrinkled and striated; Naker pearly white and iridescent.

Remarks. -- The varieties of this shell are numerous, and they differ considerably in form and surface. In some, the beaks are large, prominent, re-curved, projecting backwards

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with a deep cavity beneath. In others, the beaks are flat, slightly elevated, having only a small cavity within.

Varieties.

- (a.) Oval. Mr. Say's book, pl. 1, fig. 8.
 (b.) Ovate. Mr. S.B. Collins' collection, hab. Ohio.
 (c.) Triangular, do. do. do.
 (d.) Quadrangular. My collection.
 (e.) Orbicular. Mr. Collins's collection.
 (f.) Undulate. do. do.
 (g.) Rugose. do. do.
 (h.) Radiate. Mr. Say's collection Philadelphia, Ouisconsin.
 (i.) *Unio giganteus*. Mississippi. Dr. Mitchell's collection.
 (k.) Deeply folded. Maj. Delafield's collection.
 (l.) With the cardinal tooth oblique. Mr. Collins's collection.

Variety (c.) has the beaks projecting and recurved; cicatrices deep; primary tooth deeply sulcate; lateral tooth long, high, and crenulate. It approaches our *Unio Undatus*.

The variety (i.) deserves particular notice. A single valve sent by Professor Douglass to Dr. Mitchell, weighs fifteen ounces. It is in every respect, a gigantic shell. The distance between the points of the two lobes of the cardinal tooth, is one inch; the length of the lateral tooth, three inches; diameter of the posterior cicatrix, one inch, and its depth one fourth of an inch. This shell of which four specimens were obtained by the N. W. Expedition, might perhaps constitute a separate species under the designation of *Unio giganteus*. It is three times the size of the largest *Unio Crassus*, mentioned by Mr.

Say and M. Lamarck. Three specimens.
 Diam. 2.9 Length, 4.8 Breadth 7.2 inches.
 3.0 4.6 7.0
 3.1 4.7 7.1 are

preserved in Dr. Mitchill's cabinet. Another specimen

Diam. 2.9 Length 4.9 Breadth 7.0 and weighing fourteen ounces, is preserved in Gov. Gass's collection, Detroit. Hab. The Mississippi near Prairie du Chien. Prof. Douglass.

Variety (k.) has the Epidermis dark brownish red, and the shell is deeply folded like U. Plicatus. Hab. Lake Erie.

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Maj. Delafield's collection.

Diam. 1.7 Length, 2.3 Breadth 3.1

Remark. -- This shell is thinner than specimens of the same size usually are.

2. *Unio Undulatus*. Fig. 2 { a. inside.
 b. outside.

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

Unio Peruviana? M. Lamarck.

Taken by Mr. Collins in the Ohio and preserved in his collection.

Diam. 1.9 Length, 3.4 Breadth, 4.6

Shell thick, very short and obtusely rounded behind; beaks slightly elevated; hinge-margin sub-alated, compressed, carinated, distinct with a furrow on each side; anterior dorsal margin sub-truncate; Epidermis blackish brown; surface finely wrinkled transversely; wrinkles becoming lamellar on the anterior side; oblique folds deeply indenting the anterior margin; waves largest and deepest below, not extending to the anterior dorsal margin, fine, numerous, curved upwards, and extending to the ligament above; longitudinal furrows extending from the beaks to the anterior dorsal margin; decussating the oblique waves; the lowest furrow deepest, the other somewhat obsolete; disks tuberculated below the beaks. Cardinal teeth sulcated; posterior cicatrix very rough and deep; Naker pearly white, irregularly spotted with brownish green.

Remark. -- A large and very beautiful shell.

3. *Unio Plicatus*. Fig. 3. { a. inside.
 b. outside.

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

Unio plicata. Le Sueur. Mr. Say.

Unio Rariplicata. M. Lamarck.

Hab. Ohio, Mississippi, and Ouisconsin.

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My collection. Cabinets of Lyceum and Dr. Mitchill. Mr. Say's cabinet, Philadelphia.

Diam. .75 Length, 1.0 Breadth, 1.3 inches.

 1.35 1.9 2.4

 1.9 2.3 3.2

Shell thick; posterior side very short, obtusely rounded; anterior side compressed, wedge-shaped; beaks very prominent, large rounded and projecting backwards nearly as far as the posterior side; ligament passing under the beaks, anterior lunule distinct and marked with longitudinal furrows; hinge margin alated, compressed, carinated; epidermis green, becoming blackish as the shell advances in age; surface glabrous, deeply folded; folds indenting the anterior basal edge. Cardinal teeth crenate, sulcate; posterior cicatrix rough; cavity of the beaks deep and directed backwards. Naker very white, tinged on the anterior side with rose colour; surface polished and on the fore part iridescent.

Remarks. -- In young specimens the folds are visible on the inside, but in older ones the edge is not even indented. This shell very much resembles the variety (d.) of the *Unio Crassus*. Both shells will stand erect when placed on the posterior side, being supported by the projecting beaks. M. Lamarck observes that his *Rariplicata* is nearly allied to his *Peruviana*, but if we have not mistaken his short definitions, they are much more unlike than the two above mentioned. Our *undulatus* will not stand on the posterior side, as the beaks project very little.

4. *Unio Undatus*. Fig. 4. $\left. \begin{array}{l} \text{a. inside-} \\ \text{b. outside.} \end{array} \right\}$

Shell, sub-triangular, sub-longitudinal, very tumid, waved; lateral teeth, two in each valve.

Unio Obliqua? M. Lamarck.

Hab. Ouisconsin and Fox Rivers. Mr. Schoolcraft.

Dr. Mitchell's cabinet; My collection. Mr. Say's collection.

Diam. 1.5 Length, 2.1 Breadth, 2.2

Shell thick, disks swelled behind; depressed before; anterior side slightly produced, rapidly narrowed, angulated; beaks projecting backward nearly as far as the posterior

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side, elevated, and recurved, with the ligament passing between them; anterior lunule long-heart-shaped, and separated by a slightly elevated heel; hinge margin depressed, between the beaks; basal margin waved and rounded behind, compressed in the middle, angulated before; epidermis horn-color, exhibiting a light yellowish green where the surface is worn or rubbed, wrinkled and finely striated transversely; surface glabrous. Cardinal teeth deeply sulcated and crenated; lateral teeth two in each valve! internal or lower one of the left valve small, but distinct and elevated, and both marked with fine dotted striae. Muscular impressions deep, posterior one rough. Naker pearly white.

Remarks. -- This shell, as will be seen by its dimensions, has a more globose form than perhaps any other *Unio*. It will stand erect on the posterior side, and in this position has something of a pyramidal appearance.

Variety (a.) Shell less, very slightly compressed, anterior lunule much flattened, and the separating heel more elevated. No posterior lunule; transverse wrinkles deeper; hinge bent to nearly a right angle. Teeth somewhat compressed. Naker, pink or flesh colored; surface polished and iridescent.

Diam. 1.0 Length, 1.4 Breadth, 1.6

Dr. Mitchell's Cabinet.

Remarks. -- This shell differs in so many particulars from the former that we might have given it a different specific designation,

had we not been averse to doing that in the case of solitary specimens. The double lateral tooth of the left valve is distinct.

5. *Unio Cornutus*. Fig. 5. $\left. \begin{array}{l} \text{a. inside} \\ \text{b. outside.} \\ \text{c. Posterior slope.} \end{array} \right\}$

Shell sub-orbicular, divided longitudinally by a regular row of large, distant tubercles.

Hab. Fox River. Schoolcraft.

My Collection.

Diam. 1.0^{*} Length, 1.7 Breadth, 1.8

*Exclusive of the horns.

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Mr. Collins' collection contains a specimen from the Ohio of the following dimensions.

Diam. 1.0 Length, 1.5 Breadth, 1.8

Shell thick, rounded behind, sub-biangular before. Beaks somewhat elevated and nearly central, with the ligament passing between them; anterior lunule long-heart-shaped, compressed, distinct by a roundish elevated ridge which ends in a projection on the anterior margin, and marked by small transverse, sub-nodulous wrinkles, and obsolete longitudinal furrows; surface waved and on the fore part compressed; a regular row of large, distant, elevated and transversely compressed tubercles, extends from the beaks to the basal edge, dividing the shell into two nearly equal parts. Cardinal teeth, sulcated. Naker, pearly white, and iridescent.

Remarks. -- This shell resembles the last in its color, outline, and glabrous surface. The teeth very much resemble those of the last, and there is also in the left valve, the rudiment of a second internal lateral tooth. The principal difference is in the smaller size of the present shell, and the remarkable row of horns, which furnish the specific designation. These horns are not opposite each other, but alternate, and the highest one is in the right valve, nearly as high as the summit. In both the above mentioned specimens, the number of horns is three on each valve, and the rudiment of a fourth on the extremity of the basal edge. We rarely find shells from different and distant localities so much alike. Almost the only difference is in the elevation of the beaks of the former being greater than that of the latter. Exclusive of the beaks, the length, breadth and diameter of the shells, is precisely the same.

6. *Unio Verrucosus*. Fig. 6 { a. inside
b. outside

Shell sub-longitudinal, sub-truncate before, irregularly tuberculated; tubercles transversely compressed; inside brownish red.

Hab. Ouisconsin River, Mr. Schoolcraft
Lake Erie, Major Delafield.

The collections before mentioned.

Diam. .9-1.6 Length, 1.7-3.05 Breadth,
1.95 - 3.15

Shell sub-quadrangular, thick, rounded behind, biangulate and sub-truncate before; beaks elevated and recurved

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ligament deeply inserted between the valves; hinge-margin nearly straight, compressed alated, heel-shaped, and making an obtuse angle with the anterior margin; basal margin rounded; epidermis light green, tinged with reddish brown; surface of the anterior part studded with irregular transversely compressed tubercles. Cardinal teeth crenated or sulcated; cavity of the beaks very deep, compressed angular and directed backwards under the cardinal tooth; Naker brownish red with a tinge of blue, or light chocolate colored, slightly iridescent on the anterior part; the other dull and not highly polished; posterior muscular impression deep and rough.

Variety (a.) has the epidermis of an uncommonly light green without the brown tinge.

Hab. Lake Erie, Major Delafield's collection.

Diam. .8 Length, 1.65 Breadth, 1.9

Variety (b.) is a slender and rather thin shell; epidermis very pale green; Naker pearly white, polished and iridescent.

Diam. .9 Length, 1.6 Breadth, 1.9

Locality and authority as before.

Remark. -- If a straight line is drawn from the beak to the base, through the cardinal tooth, it will divide the tuberculated from the smooth part of the shell, in all except the variety (b.) in which the tubercles extend a little farther back.

7. *Unio Nodosus*. Fig. 7 { a. inside.
b. outside.
Shell, sub-quadrangular, sub-longitudinal, emarginate before, knotted, ridged, corrugated; lateral tooth terminating abruptly.

Hab. Ouisconsin, Mr. Schoolcraft.
Collections of Lyceum and Dr. Mitchell.
My Collection.

Diam. 1.8 Length, 2.5 Breadth, 3.0

Shell, thick and ponderous, short and very obtusely rounded behind; beaks distant, elevated, eroded, chalky or greenish white, with the ligament passing between them. Anterior lunule, compressed, wedge-shaped, separated by a deep groove, ending in the emargination in front. Hinge-margin

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gin, straight with the beaks projecting above it; anterior dorsal margin rounded; anterior margin emarginate; anterior basal margin; compressed and a little shortened, basal and posterior margins rounded. Epidermis horn color, surface irregularly corrugated and tuberculated all over, except a small portion of the posterior side. Tubercles largest near the centre of the disks, and often eroded; a strong, elevated and nodulous ridge extending from the beaks to the anterior margin and projecting in front. Cardinal teeth sulcated and crenulated. Lateral teeth short, thick, rough, crenated and terminating abruptly at both ends. Cavity deep and angular admitting the end of the fore finger.

Remarks. -- The breadth from the emargination to the posterior side is equal to the length of the shell. Two specimens in the Lyceum's cabinet are wrinkled regularly and beautifully across the transverse striae on the anterior lunule, giving to that part, a feather-shaped appearance. Other specimens have the lunule wrinkled and granulated. This shell will stand on the posterior side though not quite erect, but leaning towards the hinge.

8. *Unio Tuberculatus*. Fig. 8 {

Shell, long-ovate, surface corrugated, waved tuberculated, ribbed. Disks compressed, base falcated.

Hab. Ouisconsin, Prof. Douglass.

Cabinets of Lyceum and Dr. Mitchell.

Diam. .7 Length, 1.3 Breadth, 2.4

1.3 2.3 4.2

1.3 2.4 4.5

Shell thick and rugged; anterior side compressed, narrowed thin; posterior side rounded, short, obtuse, and broader than the interior. Beaks flat, placed about two ninths from the posterior end; ligament higher than the beaks; hinge-margin nearly straight, elevated, compressed and carinate before; basal margin compressed, falcated; anterior dorsal emarginate, anterior basal, projecting; anterior margin narrow and rounded. Epidermis dark brown or horn color. Surface thickly and irregularly tuberculated, tubercles elongated longitudinally; those near the base larger; an elevated ridge extending from the beaks and

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projecting on the anterior basal edge; irregular profound, nodulous undulations radiating from the elevated ridge to the hinge and anterior margin. Cardinal teeth crenated; lateral teeth long, and striated; posterior muscular impression deep, and the anterior half of it rough. Cavity, angular compressed, directed backward under the cardinal tooth, admitting the end of the finger. Naker pearly white, with irregular spots of greenish, iridescent on the fore part.

9. *Unio Rugosus*. Fig. 9.

Shell broadovate; surface wrinkled tuberculated, ribbed, waved; disks swelled; base falcated.

Hab. Ohio. Mr. Collins.

Mr. Collins's Collection.

Length, 2.3 Breadth, 2.9 Diam. 1.5

Shell narrowed, compressed and thin before; short, obtuse, rounded and wider behind; beaks slightly elevated; ligament more elevated than the beaks; hinge-margin compressed, carinate; basal margin falcate, emarginate, and compressed; anterior margin subangulate; anterior dorsal margin sub-truncate, nearly straight; anterior, basal margin projecting. Epidermis dark brown, under the epidermis pearly white. Surface rough and scaly, wrinkled transversely and waved longitudinally, having distant irregular transversely compressed tubercles; a broad nodulous elevated somewhat double ridge extending from the

beaks to the anterior basal edge, and projecting on that part; a broad furrow or wave behind the ridge ending in the emarginate basal edge; and a furrow before separating the anterior lunule; small oblique waves radiating from the ridge to the hinge and anterior dorsal margin. Cardinal teeth sulcated; lateral tooth striated rough and in the left valve somewhat double. Posterior muscular impression deep and partly rough. Cavity of the beaks angular, compressed and directed backward under the cardinal tooth. Naker pearly white, and on the fore part iridescent.

Remarks. -- This shell agrees in some parts of its description with the *U. Tuberculatus*. It is, however, while of the same length, of only a little more than half the breadth, and yet of longer diameter. The tubercles, also are very different. In the *U. Tuberculatus* they are compressed lon-

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gitudinally, in this transversely, in that they are crowded and small: in this they are distant and rather large. The elevated ridge in that is higher and narrower; in this it is broader and more depressed; in that it continues of nearly the same breadth to the base; in this it diverges at the base, to about four times its breadth at the beaks. The shell above described has the appearance of age. The tubercles, as well as the beaks are much corroded, and the epidermis is cracked and broken in many places.

Remarks on the first section, viz.

*Cardinal teeth, very thick.

To this section belong the *U. Peruviana*, *ligamentina* and *obliqua* of M. Lamarck, and the *U. Cylindricus*? of Mr. Say. The shells in this section bear in many respects, a resemblance to each other. They are all thick, and have a very strong hinge, with, in most cases, deeply sulcated cardinal teeth, and a cavity under the beaks, more or less angular and compressed, extending under the cardinal tooth. They are nearly all waved, wrinkled, or tuberculated on the outside. From the last two characters, however, some varieties of the *U. Crassus* are ex-

excepted, which have little or no cavity under the beak, and a small external surface.

It may perhaps be thought that we have made too many distinctions in this section, and that several of the foregoing ought to belong to the *U. Crassus*, but they are much more unlike than many which are admitted to be distinct species, and therefore they require a separate description. And when it is observed that we have not yet enumerated all that have been supposed to belong to the numerous fam-

ily of the *Crassus* — that the ascertained varieties of that species have already been described to the number of eleven from (a) to (l) inclusive; and that among these varieties are several which M. Lamarck has described as different species — and that the foregoing are all very distinct from each other, so as to be instantly recognized by even an inexperienced observer — we shall perhaps be justified in discriminating the above, and several others also, which belong to the next section.

(To be continued.)

EDITOR'S NOTE. The second part of Barnes' paper will be reprinted in a future issue of *STERKIANA*, together with the plates illustrating both parts.

A. L.

ERRATA

- Page 3, right hand column, para. 2, line 9, for "with" read "will"
- Page 9, left hand column, para. 4, line 1, for "paruvs" read "parvus"
- Page 35, right hand column, para. 2, line 5, after "Edward" add "Island"
- Page 51, Editor's note, line 2, for "places" read "plates"