

and at the same time looking for pearls. They have some common names for certain kinds of mussels; and an official of button factories I met at Marietta, was kind enough to verify the names and to give some additional information.

"Mucket." *Lampsilis ligamentina*, also *orbiculata*.

"Pig-toe." *Quadrula obliqua*, and the whole group of approximately the same shape, also *subrotunda*, *æsupus*, etc.

"Warty pig-toe." *Q. cooperiana*, *pustulosa*, etc.

"Nigger-head." *Q. ebena*; sometimes also *Obovaria retusa*.

"Monkey face." *Q. metanevra*.

"Butterfly." *Plagiola securis*.

"Pocketbook." *L. ventricosa*, also *capax*.

"Sand clam," or "Black sand clam." *L. recta*, occasionally also *Unio gibbosus*.

"Lady's finger." *L. anodontoides*, no doubt also *fallaciosa*.

"Three-ridge washboard," or "Three-ridge," or "Washboard." *Q. undulata*, also *plicata*, and *multiplicata*.

"Razor-back," "Rudder-back," "Hatchet-back." *Proptera alata* (and, no doubt, *Symphyn. complanata*).

Some other large and common mussels may have common names, but I failed to find them out, e. g. *U. crassidens*, *Tritogonia*, *Q. lachrymosa*.

ON THE VALIDITY OF UNIO UNDATUS BARNES.

BY BRYANT WALKER.

(Concluded from p. 10.)

III.

Is *U. undatus* Bar. = *U. trigonus* Lea.

Lea's description of his *trigonus* is as follows:

"Shell subtriangular, inflated, nearly equilateral, depressed before the umbonial slope, angular behind; umbonial slope carinate; basal margin emarginate; substance of the shell thick, beaks prominent,

incased and slightly undulated at the tips; ligament short and thick; epidermis brown; rays obsolete; cardinal tooth large, elevated and widely cleft in the left valve and emerging from a pit in the right valve; lateral teeth thick and curved in a direction over the cardinal tooth; anterior and posterior cicatrices both distinct; dorsal cicatrices situated on the under part of the cardinal tooth; cavity of the beaks deep and angular; nacre pearly white and iridescent. Length 2.3; alt. .2; diam. 1.5 in."

It is to be noted that while this description is quite exactly in accord with the Ohio river species commonly called *trigonus*, the figure, while its dimensions are those given in the description, is not in strict accordance with its specifications nor with the shell as usually found. The shell as figured (Pl. II, fig. 1) would scarcely be called "subtriangular," but rather subquadrate; the beaks though prominent are not characteristic of the shell as it actually occurs and there is a decided emargination of the posterior slope, which is not mentioned at all in the description, and which, so far as my experience goes, does not occur in any form of *trigonus*. The figure, as it stands, would do better for a representation of the not uncommon quadrate form of *rubiginosus* than of *trigonus*.

It was probably on this account that the Western Academy of Natural Sciences, in their "Synopsis" of 1849, felt unable to determine exactly what *trigonus* was and doubtfully referred it to *flavus* Raf., of which they considered *rubiginosus* an unquestionable synonym.

Dr. Lea in his "Rectification" (Separate p. 6) speaks in the highest terms of the judicial attitude maintained by the Academy in the preparation of this list and of the impartiality with which they attempted to "render strict justice to every author."

It is to be noted in this connection that the figure of *U. pyramidalis* on Lea's plate is evidently exaggerated and out of proportion and that of *rubiginosus* in the same volume is even more so. It would therefore seem that the figure given cannot be confidently relied upon as an accurate representation either of the species or of the type.

But, however that may be, there is no real question as to what Lea's species is, although it does not appear to be a common one in the Ohio River. I have myself seen only one specimen, that figured (plate II, fig. 2). Of sixty specimens of the group recently submitted by Dr. V. Sterki for examination from the Ohio at Marietta and

intended to be a representative series of the fauna of the river at the place, not a single specimen could be satisfactorily referred to "*trigona*." It would seem as though it did not extend up the river as far as that place.

It is unquestionable that the form I have identified as the *undatus* of Barnes has for the last half-century been uniformly considered to be the *trigonus* of Lea.

It is also true that prior to 1850, Lea's species was considered to be the same as Barnes's by a very large and respectable element among the conchologists of that time.

It is evident, also, that Dr. Lea had considerable difficulty in enforcing the adoption of his disposition of *undatus* (Syn. 4th, Ed., p. 38 n; Rectification 1st Ed. p. 15) at that time.

In considering the question *de novo* it must be admitted at once that the typical forms of the two "species" are not exactly the same.

Conrad in a note to his last Synopsis (1853), in which he considers the two forms to be distinct species states the difference aptly: it (*undatus*) "is much more ventricose anteriorly and over the umbo than *trigonus*; has more elevated beaks and is very inequilateral, whilst the latter is nearly equilateral." Dr. Lea remarks (Syn. 4th Ed. p. 38 n 3) that *trigonus* is always more angular on the umbonial slope and the undulations at the tip of the beaks differ."

This comparison does not apply to the true *undatus* of Barnes, but is correct in the first item when applied to *obliquus*, with which he considered Barnes's species to be synonymous. I have not been able to ascertain the beak characters of *obliqua* from the material at my disposal.

In considering Lea's conception of his species and whether he considered it to include the form believed to be the real *undatus* of Barnes, it may be of service to note his treatment of both species before and after his identification of *undatus* with *obliquus* in 1832.

In his original description of *trigonus* (Obs. I, p. 121) he remarks that his species belongs to the group of species which are known as *mytiloides* Raf. and has been considered a variety of that species, but that he believes that the group may be divided into four species, *mytiloides* Raf., *undatus* Bar., *pyramidatus* Lea, and *trigonus* Lea.

It is to be noted that this was before he had identified *undatus* with *obliquus*, but tends to show that he even then identified Barnes's species with the form, which he subsequently declared to be *obliquus*

Lam., which at that time he had been unable to identify from the original description. In his description of *Unio solidus* (Obs. II, p. 13), read Dec. 19, 1834, he compares that species with *undatus* and distinguishes it by "being more rounded at the basal margin, by its more elevated beaks and by its color."

In his description of *Unio planus* (Obs. III, p. 51), read Oct. 2, 1840, he differentiates that species from both *obliquus* and *trigonus* as being more rounded at the base, the emargination being very small and being higher in the beaks than *trigonus* and more flattened there than *obliquus*.

In the same paper he remarks (p. 54) that his *dolabelloides* stands between *undatus* and *cor*.

It is curious to note that as late as Feb. 19, 1841, he seems still to ignore *obliquus* on occasion and to use *undatus* (Obs. III, p. 69).

But after that date, *undatus* is not referred to except in his Rectification and Synopses.

In his description of *Unio tumescens* (Obs. iv, p. 45), read May 2, 1845, he says that that species is allied to *trigonus*, but differs in being more rounded and in having rays. The comparison is certainly not a very apt one to say the least.

In his description of *Unio chunii* (Obs. ix, p. 18), read June 3, 1862, he states that this species is closely allied to *trigonus*, but may be distinguished by being more lenticular in form and in not having so sharp an umbonial slope. The undulations of the beaks of that species, however, are few, as in *trigonus*, and follow down the angle of the umbonial slope. In the same paper (p. 21) in his description of *Unio riddellii*, he remarks that that species belongs to the group of which *trigonus* may be considered the type, but differs in being rounded, even more inflated and in the character of the undulations, which are "remarkably close," while in *trigonus* they are few and follow down the angle of the umbonial slope for a short distance."

It is evident from these comparative remarks that, in Lea's mind, *trigonus* was a shell with prominent beaks, though less so than in *solidus* and *plenus*, with a rather wide basal emargination, a sharp umbonial angle, and having the beak's undulations few and following down the umbonial angle for a short distance.

These specifications apply accurately to the shell above identified as *undatus* Barnes, and do not apply to any other *Quadrula* of the Ohio drainage.

Of the fourteen species included in the "*trigona* group" by Simpson in his excellent arrangement, seven are found in the Ohio River, viz.:

Q. rubiginosa.

Q. coccinea.

Q. trigona.

Q. solida.

Q. obliqua

Q. plena.

Q. pyramidata.

Of these *coccinea* is quite different from any of the others, and possibly does not belong to the genus at all. (Ortmann, Naut. XXII, p. 10.) At any rate it is so entirely distinct from *trigona*, *undata* and *obliqua* that it may be dismissed from further consideration in this connection. The remaining species may be separated into two very natural groups by a characteristic difference in the form and position of the pseudo-cardinals. In his description of *trigonus*, Dr. Lea states that the "cardinal (is) large, elevated and widely cleft in the left valve and emerges from a pit in the right valve." This is absolutely correct and is one of the most characteristic specific details.

The pseudo-cardinal of the left valve is composed of two deltoid teeth separated by a deep, triangular cavity for the reception of the pseudo-cardinal of the right valve. At their upper extremity they meet and in most cases are completely fused together so that they might well be termed a single "widely cleft tooth" rather than distinct teeth. The anterior tooth is high and sharply beveled upwards to a narrow, nearly rectilinear edge, which is nearly parallel with the lower margin of the lunule. The cavity between them is deep and comparatively narrow and extends obliquely backward and upward until terminated by the fused extremities of the pseudo-cardinals. The pseudo-cardinal in the right valve is triangular in shape, with a sharp apex directed toward the beak. The posterior side is short and nearly straight up and down; the anterior side is much longer and more oblique. On both sides are deep cavities for the reception of the pseudo-cardinals of the left valve, and owing to the fusing of the upper extremities of these teeth these cavities are continued entirely around the pseudo-cardinal, which consequently appears to be "emerging from a pit."

The space between the pseudo-cardinal and lateral teeth ("inter-dentum") is comparatively narrow. This is clearly shown on both Barnes's and Lea's figures. This arrangement of the pseudo-car-

dinals is also characteristic of *rubiginosus*. In the remaining four of the species above mentioned, the character and relative position of the pseudo-cardinals are quite different, and are similar in all.

Taking *obliqua* as an example, the interdentum is very broad. The posterior pseudo-cardinal of the left valve is low and broadly triangular in shape and the blunt apex points obliquely forward and not directly upward; the anterior pseudo-cardinal is very low and bends around the broad and comparatively shallow socket for the opposing pseudo-cardinal. This socket is almost quadrate in shape, extends obliquely forward and a line from the upper to the lower corner is almost perpendicular. The pseudo-cardinal of the right valve is broadly triangular, and the anterior and posterior sides are about equal. It is surrounded above by a "pit" which is very shallow in front of the tooth and longer and shallower behind the tooth than in the *trigonus* group, triangular in shape and quite oblique.

The whole effect of the hinge in this group is that all the teeth are subparallel and project obliquely backwards from the beak; while in the *trigona* group the pseudo-cardinal and lateral teeth met at a decided angle under the beak.

This arrangement of the hinge in *obliqua* and its allies sensibly affects the external form of the shell, so that there is seldom any occasion for mistaking to which of the two groups any particular shell belongs.

It would seem clear, therefore, that there is no occasion for confounding the *undatus* of Barnes with any of the four species grouping about *obliqua* and that in seeking to identify that species, *obliqua* and its allies may be dismissed from further consideration.

If this be conceded, then it follows that Lea's *trigonus* is either identical with *undatus* or *rubiginosus* or is a distinct species from either. That the *trigonus* of Lea is specifically distinct from his *rubiginosus* does not require argument in spite of the tentative union of the two species by the Western Academy of Nat. Sciences caused no doubt by the uncharacteristic figure given by Lea of his type.

Rubiginosus is well characterized by its more broadly triangular or subquadrate and more compressed shape and less prominent beaks, which are less incurved at the tips, and the lack of the pronounced angle on the posterior ridge.

The possibility that *trigonus* and *rubiginosus* can be specifically identical may be consequently most emphatically answered in the

negative. It follows therefore that *trigonus* is identical with *undatus* or is a distinct species.

In considering this question, it is to be borne in mind that nearly all of our *Unionidæ* are subject to a large amount of variation and that the wider the range of a species, the greater the amount of variation it exhibits under the influences of diverse conditions of local environment.

Trigonus (using the term in its broad, current acceptation and not confining it to the form of Lea's type) has a very extensive range.

In the Mississippi Valley from Minnesota (Grant) south to Arkansas (Call) and northern Louisiana (Frierson); in the Ohio drainage it ranges east through Ohio (Sterki) but apparently does not extend into Pennsylvania (Ortmann) nor southwestern N. Y. (Marshall); through the ancient post-glacial connections of Lake Michigan with the Mississippi and Lake Erie with the Ohio, it has invaded the St. Lawrence system and is found in the lake drainage of Wisconsin, Illinois and southern Michigan, whence it ranges east as far as Buffalo, N. Y. (Marshall) and Port Dover, Ont. (Whiteaves), but does not appear in the valley of the Ottawa (Latchford); in Kentucky it has been recorded from the Barren River (Walker) and Warren Co. (Price) in the Ohio drainage; apparently it does not occur in the Tennessee drainage area at all; but, curiously enough it reappears in the Alabama system where it is usually, but erroneously, called *chunii* Lea.

Through Texas, southern Louisiana and Mississippi, the *trigona* group is represented by a number of "species," whose relations with each other and with *trigona* are uncertain, and can only be definitely determined by a much larger amount of material than is apparently accessible at the present time. *Trigona* as such, so far as I have been able to ascertain, has not been listed from any of those States except northern Louisiana.

While *trigona*, commonly so-called, throughout this enormous extent of territory sustains its specific identity sufficiently to be recognized in most cases without difficulty, yet, as might be expected, it exhibits in different parts of its range a considerable amount of variation.

Thus in the Mississippi, Illinois and Fox rivers, the high triangular form, which I have identified with *undatus*, is the prevalent phase; in the Ohio a more equilateral form (typical *trigona*) occurs

and similar shells are before me from the Wisconsin river, Sauk Co., Wis., and the Mississippi River at Davenport, Ia.; while in the Kaskaskia and Spoon rivers, Ills., a shellmore broadly triangular in form is found, which apparently represents the extreme in that direction. The Alabama form is closer to typical *undatus*, but like many of the northern species, that have obtained a foothold in that system and retained their specific identity, is apparently uniformly smaller and resembles a half-grown example of the common Mississippi expression of the species.

But taking the series thus specified as a whole, it exhibits a similarity throughout, which is congruous only with specific identity and which separates it as a whole from union with any other described species. And in this assemblage and united by a series of unmistakable intermediates are the *undatus* of Barnes and the *trigonus* of Lea.

If, in addition to what has already been said, anything further is needed to prove the identity of the two forms, the following comparison of the specific characters of the two species as given in the original descriptions will show that there is no ground for questioning their specific identity.

<i>Undatus.</i>	<i>Trigonus.</i>
Subtriangular.	Subtriangular, nearly equilateral.
Disks swelled before, depressed behind, posterior side slightly produced, rapidly narrowed, angulated.	Inflated, depressed before the umbonial slope, angular behind, umbonial slope carinated.
Basal margin waved.	Basal margin emarginate.
Shell thick.	Substance of shell thick.
Beaks elevated, recurved, projecting forwards nearly as far as the anterior side.	Beaks prominent, incurved.
Ligament passing between the beaks.	Ligament short and thick.
Epidermis horn-colored, wrinkled and finely striated transversely, surface glabrous.	Epidermis brown, rays obsolete.
Cardinal teeth deeply sulcated and crenated.	Cardinal tooth in the left valve large, elevated and widely cleft.

Lateral teeth two in each valve.	Lateral teeth thick and curved in a direction over the cardinal tooth.
Muscular impression deep, posterior one rough.	Anterior and posterior cicatrices both distinct.
Nacre pearly-white.	Nacre pearly-white and iridescent.
Length 2.2. in.	Length 2.3 in.
Alt. 2.1 in.	Alt. 2.0 in.
Diam. 1.5 in.	Diam. 1.5 in.

If then, our contention is correct as to the absolute specific identity of the two species, priority must be given to Barnes's name and the synonymy must be written as follows:

QUADRULA UNDATA (Barnes).

1823, *Unio undatus* Barnes, Am. J1. Sci. VI, p. 121, pl. IV, fig. 4.

1831, *Unio trigonus* Lea, Tr. Am. Phil. Soc. IV, p. 110, pl. XVI, fig. 40.

EXPLANATION OF PLATES I AND II.

- Pl. 1 fig. 1. *Q. undata*, Facsimile of one of Barnes's figures.
 Pl. 1 fig. 2. Copy of Barnes's other figure.
 Pl. 1 fig. 3. *Q. undata*, Fox River, Ill. (original).
 Pl. II fig. 1. Facsimile of Lea's figure of *Unio trigonus*.
 Pl. II fig. 2. *Q. trigona* Lea, Ohio River (original).
 Pl. II fig. 3. *Q. obliqua* Lam. Paint Rock River, Jackson Co., Ala. (original).

NOTES.

THREE SHELLS NOT HITHERTO REPORTED FROM THE DISTRICT OF COLUMBIA.—Recent collecting has added the following hitherto unreported shells to the fauna of the District of Columbia or its environs: *Polygyra palliata* Say (on the Virginia side of the Potomac near Great Falls); *Zonitoides milium* Morse, *Punctum pygmæum* Drap.—G. DALLAS HANNA.

The albino *Oliva angulata*, noticed in the March number, has now found a home with the Academy of Science at Minneapolis, Minn.—A. L. HETTRICH.



Walker, Bryant. 1910. "On the validity of *Unio undatus* Barnes (concluded)." *The Nautilus* 24, 16–24.

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