

A Preliminary Report on the Unionidae of St. Joseph River.

BY FRANCIS WENINGER

The following report was compiled from material collected by the Rev. A. M. Kirsch, C. S. C., Professor of Zoology in the University of Notre Dame. It represents the work of years of collecting, done during such time as could be spared from active duty in the lecture-room or laboratory. The measurements given are from specimens that are believed to be representative, and are all expressed in millimeters. The descriptions are based on the Mollusca of the Chicago Area, by Baker; the Mollusca of Indiana, by Call; and the synonymy is that of Charles Torrey Simpson as given in his Descriptive Catalogue of the Naiades or Pearly Fresh Water Mussels, published by Bryant Walker, Detroit, 1914.

LAMPSILIS VENTRICOSA (Barnes).

- Unio ventricosus* Barnes, Am. Jl. Sci., VI, 1823, p. 267, pl. XIII, fig. 14.
Mya ventricosus Eaton, Zool. Text-Book, 1826, p. 221.
Lampsilis ventricosus Baker, Moll. Chi. Pt. 1, 1898, p. 94.
Unio accidens Lea, Tr. Am. Phil. Soc., III, 1829, p. 435, pl. X, fig. 16.
Unio subovatus Lea, Tr. Am. Phil. Soc., IV, 1831, p. 118, pl. XVIII, fig. 46.
Unio cardium Conrad, New F. W. Shells, 1834, p. 68.
Unio fasciolus Ferrusac, Guer. Mag. 1835, p. 26.
Unio ovata Deshayes, An. sans Vert. 3rd. ed. 1839, p. 669.
Unio lenis Conrad, Monog., XII, 1840, p. 106, pl. LVIII, fig. 2.
Unio canadensis Lea, Proc. Acad. N. Sci. Phila., I, 1857, p. 85.
Unio dolabraeformis Sowerby, Conch. Icon., XVI, 1867, pl. LIX, p. 298.

The species was found in the St. Joseph River near Mishawaka, in 1913. The peculiar slope of the posterior portion of the shell as also the formation of the beak are characteristic of this shell. The shell is inflated, rather thin for its size and heavy. Its shape is elliptical rather than oval. The margin, especially in older specimens, is concentrically sculptured. The epidermis is shining and smooth,—characters that are both lost with age. There are

* January 20, 1921.—Pages 1 to 28.

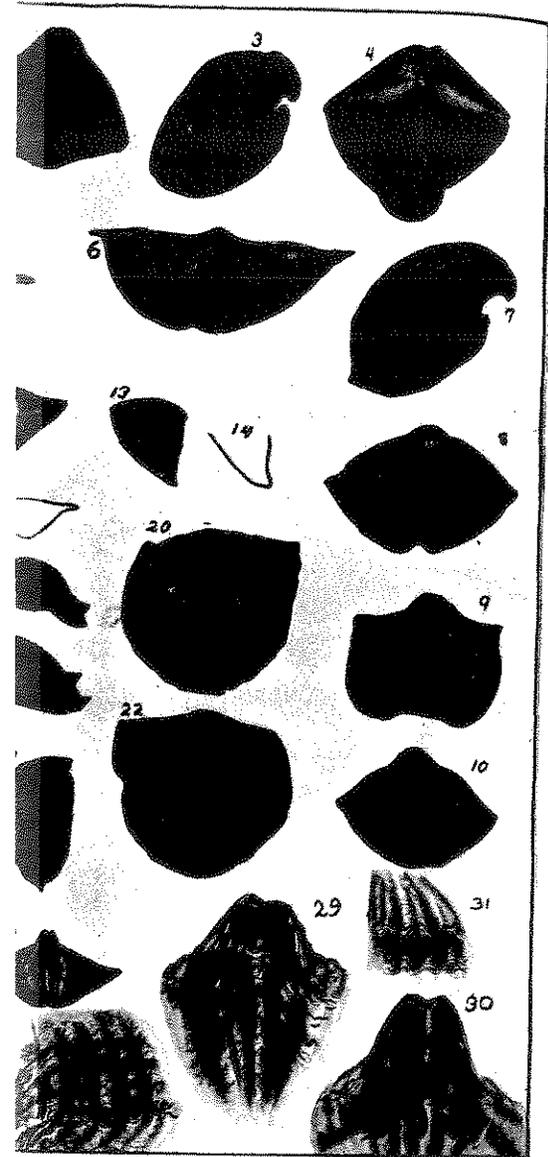


PLATE ON NOTES ON THE GENUS ATRYPA.

from twenty to thirty-five or more bright green rays. In some specimens the rays do not persist in the posterior portion; when present in old specimens they become wide,—about eight millimeters; or there will be an alternation of a wide ray with a narrow one. The ligament is rather stout, short and wide and of a dark chestnut color. The cardinal teeth are double in the left valve and single in the right. The posterior muscle scar is rounded, as wide as long and not much impressed. The protractor pedis muscle scar is wider than long, deeply impressed anteriorly and coarsely striated. The pallial line is deeply impressed anteriorly but only slightly impressed posteriorly. The cavity of the beaks is deep. The nacre is silvery white with little or no iridescence; sometimes pink.

Length	125	Height	100	Diameter	60
	100		65		36
	118		84		52
	126		88		54

LAMPSILIS LUTEOLA (Lamarck).

Unio luteola Lamarck, An. sans Vert., VI, 1819, p. 79
Lampsilis luteolus Baker, Moll. Chi., Pt. I, 1898, p. 103, pl. XI, XXXVI
 fig. 12

Unio inflatus Barnes, Am. Jl. Sci., VI, 1823, p. 266.

Mya inflata Eaton, Zool. Text-Book, 1826, p. 221.

Unio siliquoides Barnes, Am. Jl. Sci., VI, 1823, p. 269, pl. XIII, fig. 150.

Unio childreni Hanley, Biv. Shells. 1843, p. 193, pl. XXIII, fig. 57.

Unio hyadianus Kuster, part. Conch. Cab. Unio, 1861, p. 201, pl. LXVII fig. 1.

Unio distans Anthony, Am. Jl. Conch., I, 1865, p. 156, pl. XIII, fig. 2.

Unio multiradiatus Sowerby, Conch. Icon., XVI, 1868, pl. LXI, fig. 306.

Unio affinis Sowerby, Conch. Icon., XVI, 1868, pl. LXI, fig. 307.

This form, quite abundant in the St. Joseph River, is variable in outline,—a fact that probably gave rise to the extensive synonymy that has been established on this shell. The shell is large, elongated and rather thin. It is rounded anteriorly and somewhat pointed posteriorly. The epidermis is a light horn color, often shading into brown on the posterior slope: There are many bright green, narrow rays, departing from the beaks and covering nearly three-fourths of the disk. The umbones are prominent, slightly elevated, of a brown or green color, usually eroded, and marked by fine undulating ridges. The ligament is stout, short and wide, and of a dark chestnut color. The cardinal teeth are double in both valves. The anterior adductor muscle scar is excavated, longer than wide, large and coarsely striated. The

fty-five or more bright green rays. In some do not persist in the posterior portion; when mens they become wide,—about eight milli- l be an alternation of a wide ray with a narrow is rather stout, short and wide and of a dark cardinal teeth are double in the left valve and The posterior muscle scar is rounded, as wide ch impressed. The protractor pedis muscle ng, deeply impressed anteriorly and coarsely line is deeply impressed anteriorly but only steriorly. The cavity of the beaks is deep. white with little or no iridescence; sometimes

Height	100	Diameter	60
	65		36
	84		52
	88		54

PSILIS LUTEOLA (Lamarck).

An. sans Vert., VI, 1819, p. 79
 , Moll. Chi., Pt. I, 1898, p. 103, pl. XI, XXXVI
 m. Jl. Sci., VI, 1823, p. 266.
 . Text-Book, 1826, p. 221.
 Am. Jl. Sci., VI, 1823, p. 269, pl. XIII, fig. 150.
 iv. Shells. 1843, p. 193, pl. XXIII, fig. 57.
 rt. Conch. Cab. Unio, 1861, p. 201, pl. LXVII fig. 1.
 n. Jl. Conch., I, 1865, p. 156, pl. XIII, fig. 2.
 by, Conch. Icon., XVI, 1868, pl. LXI, fig. 306.
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posterior adductor muscle scar is as long as it is wide, large, shallow. The cavity of the beaks is quite shallow. The pallial line is uni- formly impressed. The nacre is white and somewhat iridescent.

Length	90	Height	50	Diameter	34
	58		30		22
	65		39		27
	78		42		30
	83		44		27

LAMPASILIS LIGAMENTINA (Lamarck).

Unio crassus Say, Nich. Encyc., II, 1817, pl. I, fig. 8.
Mya crassa Eaton, Zool. Text-Book, 1826, p. 217.
Unio ligamentina Lamarck, Ann. sans Vert. Vol. VI, 1819, p. 72.
Margarita (Unio) crassus Lea, Syn. 1836, pl. 24.
Nephronajas ligamentina Ortmann, Ann. Car. Mus., VIII, 1912, p. 325
Unio ellipticus Barnes, Am. Jl. Sc. VI, 1823, p. 259, pl. XIII, fig. 19.
Unio carinatus Barnes, Am. Jl. Sc. VI, 1823, p. 259, pl. XI, fig. 10.
Unio ellipsarius Say, Am. Conch., VI, 1834.
Unio fasciatus Say, Am. Conch., VI, 1834.
Unio ligamentinus Lamarck, Anim. sans Vert., Vol. VI. p. 538, 1838.
Mya gravis Wood, Ind. Test. (Hanley) 1856, p. 199, pl. I, fig. 6.
Unio luteolus Sowerby, Conch. Icon., XVI, 1867, pl. LVIII, fig. 239a.
Unio delodontus Sowerby, Conch. Icon., XVI, 1867, pl. LVII, fig. 288.
Unio crassidens Sowerby, Conch. Icon., XVI, 1868, pl. LXII, fig. 312.
Unio pictus Sowerby, Conch. Icon., 1868, pl. LXII, fig. 313.
Unio venustus Sowerby, Conch. Icon., 1868, pl. LXIV, fig. 326.
Unio upsoni Marsh, Conch. Ex. I, 1887, p. 57.
Unio pinguis Lea, Pr. Acad. Natl. Sci., Phil. I, 1857, p. 84.
Lampsilis pinguis Simpson, Syn. 1900, p. 540.

The habitats of this animal are variable. It may be found in- differently in sluggish and muddy bayous, living in sand or mud; or it may live in the gravel of a swiftly moving stream. These differences in environment may account for variableness in form and coloration. The nacre is white, varying to bluish and pinkish iridescence. The shell is large and much thicker anteriorly than posteriorly. The umbones are not prominent. The epidermis is yellowish, straw-colored, or light green with numerous dark green rays extending from the umbones to the central margin. Old specimens are dark reddish brown and show the rays only near the umbones. The cardinal teeth are double in both valves; those in the right valve are unequal, the anterior being very small, the posterior large, triangular and crenulated; in the left valve the teeth are more nearly equal, triangular and crenulated. The lateral teeth are strong, heavy, elevated and curved towards the

ventral margin. The anterior adductor muscle scar is deeply excavated, longer than wide and strongly striated. The posterior adductor muscle scar is but lightly impressed, and in some specimens is highly iridescent. The pallial line is deeply impressed anteriorly but only slightly impressed posteriorly. This shell approaches closely to those of *Unio luteolus* and *Unio ventricosus*. It can be distinguished from *U. ventricosus* by its receding umbones, and it lacks the undulations that are so characteristic on the beaks of *luteolus*.

Length	117	Height	65	Diameter	32
	135		84		40
	122		72		36
	151		86		48
	127		73		36

LAMP SILIS RECTA (Lamarck).

Unio recta Lamarck, An. sans Vert., VI, 1819, p. 74.

Eurynia (Eurynia) recta Ortmann, Am. Car. Mus., VIII, 1912, p. 344, fig. 24.

Unio rectus Conrad, Monog., III, 1836, p. 33, pl. XV.

Lampsilis rectus Smith, Bull. U. S. Fish Com., 1899, p. 290, pl. LXXVIII.

Unio latissima Rafinesque, An. Gen. Sci. Phys. Brux. Pt. 13, V. 1820, p. 297, pl. LXXX. figs 14, 15.

Mya praelonga Eaton, Zool. Text-Book, 1826, p. 220.

Unio leprosus Miles, Rep. Geol. Sur. Mich., 1861, p. 240.

Observations and comparisons made on forty specimens in the museum at Notre Dame warrant the following descriptions and measurements. The shell is large, smooth and elongated; there is lateral compression and the shell is quite thick to very thick anteriorly. The epidermis is thick and blackish and obscurely rayed with numerous bands of green. These bands of color disappear in old specimens and are indistinct in some young ones. The cardinal teeth are double in both valves, those in the left valve are about equal in size. The anterior tooth in the right valve is so small as to be inconspicuous. The teeth generally are recurved posteriorly, stout, triangular and serrated. The lateral teeth are long, straight, lamelliform, elevated and crenulated. The anterior adductor muscle scar is wing shaped, longer than wide and very deeply excavated. The posterior adductor muscle scar is rounded, slightly impressed and concentrically striated. The pallial line is deeply impressed anteriorly, crenulated, but only slightly impressed posteriorly. The cavity of the beaks is very shallow. The nacre is variable showing all shades from pure white to a dark purple.

anterior adductor muscle scar is deeply wide and strongly striated. The posterior is lightly impressed, and in some specimens the pallial line is deeply impressed anteriorly and less so posteriorly. This shell approaches *Unio luteolus* and *Unio ventricosus*. It can be distinguished from *Unio ventricosus* by its receding umbones, and it has characters so characteristic on the beaks of

Height	65	Diameter	32
	84		40
	72		36
	86		48
	73		36

SILIS RECTA (Lamarck).
 An. sans Vert., VI, 1819, p. 74.
 Ortmann, Ann. Car. Mus., VIII, 1912, p. 344, fig. 24.
 Zool. Jg., III, 1836, p. 33, pl. XV.
 Bull. U. S. Fish Com., 1899, p. 290, pl. LXXVIII.
 An. Gen. Sci. Phys. Brux. Pt. 13, V. 1820, p. 14, 15.
 Zool. Text-Book, 1826, p. 220.
 Geol. Sur. Mich., 1861, p. 240.
 Comparisons made on forty specimens in the present work warrant the following descriptions and measurements. The shell is large, smooth and elongated; there are two teeth, the anterior is large and the posterior is small. The shell is quite thick to very thick. The umbones are thick and blackish and obscurely marked with bands of green. These bands of color disappear in some young ones. The teeth are double in both valves, those in the left valve are larger. The anterior tooth in the right valve is inconspicuous. The teeth generally are re-entrant, triangular and serrated. The lateral teeth are lamelliform, elevated and crenulated. The anterior adductor muscle scar is wing shaped, longer than the posterior. The posterior adductor muscle scar is deeply impressed and concentrically striated. The pallial line is deeply impressed anteriorly, crenulated, but only slightly so posteriorly. The cavity of the beaks is very variable showing all shades from pure white

Length	50	Height	23	Diameter	10
	83		42		28
	93		44		26
	165		70		45
	175		75		48

LAMPSILIS IRIS (Lea).

Unio iris Lea, Tr. Am. Phil. Soc., III, 1830, p. 439, pl. XI, fig. 18.
Lampsilis iris Baker, Moll. Chi., Pt. I, 1898, p. 105, pl. XIII, fig. I, XIV. 2.
Euryntia (Micromya) iris Ortmann, Ann. Car. Mus., VIII, 1912, p. 341, fig. 23.
Unio creperus Lea, Tr. Am. Phil. Soc., VI, 1838, p. 33, pl. X, fig. 28.
Unio novi-eboraci Lea, Tr. Am. Phil. Soc., VI, 1838, p. 104, pl. XXIV, fig. 114.
Unio cressereri Hanley, Test. Moll., 1842, p. 196.
Unio radiatus DeKay, Zool. N. Y., Pt. 5, 1843, p. 189, pl. XVII, fig. 236.
Unio subrostratus Kuster, Conch. Cab. Unio., 1861, p. 203, pl. LXVII, fig. 3.

But two specimens of this shell are available for description, and both are evidently quite young. The shells are characterized by the beautiful silvery white nacre which, posteriorly, becomes iridescent, the short erect teeth, the interrupted bands of green, and the foldings on the beaks. In outline, the shell is elliptically oval, thin, small and transversely compressed. The lines of growth are widely separated but conspicuous. The cardinal teeth are triangular, small and erect. They are double in the left valve and single in the right. The lateral teeth are long, thin straight and not much elevated. The anterior adductor muscle scar is deeply impressed; the posterior is slightly impressed and very iridescent. The pallial line is quite faint. The cavity of the shell is small and narrow; the beaks, shallow and triangular.

Length	50	Height	26	Diameter	14
	37		19		11

LAMPSILIS ALATA (Say).

Unio alatus Say, Nich. Encyc., II, 1817, pl. IV, fig. 2.
Lampsilis alatus Baker, Moll. Chi., Pt. I, 1898, p. 97, pl. XVIII.
Unio alata Lamarck, An. sans Vert., VI, 1819, p. 76.
Mya alata Eaton, Zool. Text-Book, 1826, p. 219.
Symphynoia alata Lea, Tr. Am. Phil. Soc., III, 1830, p. 448.
Lymnadia alata Swainson, Treat. on Mal., 1840, p. 256, fig. 48.
Mysca alata Swainson, Exotic Conch., 2nd. ed., 1841, p. 28, pl. VII.
Metaptera alata Stimpff, Shells of N. Eng., 1851, p. 14.
Proptera alata Ortmann, Ann. Car. Mus., VIII, 1912, p. 333.

This is a large, oval shell, rather thin for its size and triangular when the alae are present. The umbonal slopes are rounded; the alate postero-dorsal margin is quite compressed. The ventral

margin is slightly rounded. The surface is smooth and shining with coarse lines of growth. The epidermis is yellowish-green and distinctly rayed in young specimens, but this color changes to a dark brown or even black in old specimens,—in these the rays may be partially or even entirely obliterated. There is a solid ligament of a light brown color. The cardinal teeth are double in both valves, about equal in size in the left valve, and unequal in the right. The lateral teeth are long thin, slightly arcuate and smooth. The pallial line is quite distinct. The anterior adductor muscle scar is deeply impressed and striated; the posterior adductor muscle scar is large, indistinct and confluent. The dorsal muscle scar is in the cavity of the beaks and arranged in nearly a straight row; there are six or seven small rounded pits, followed by a single long and narrow scar, very deeply impressed. The naere varies from deep purple to salmon pink; iridescent. The species may be recognized by the rich purple interior and the more or less alate postero-dorsal margin.

Length	138	Height	93	Diameter	35
	92		71		23
	108		82		30

LAMPUSIS LERRONON (Rafinesque).

Unio (Leptodon) leptodon Rafinesque, Ann. Gen. Sci. Phys. Brux., V, 1820, p. 296, pl. LXXX, fig. 5-7.

Unio leptodon Say, Am. Conch., VI, 1834.

Symphynota leptodon Ferrussac, Guer. Mag., 1835, p. 25.

Lampsis leptodon Simpson, Syn., 1900, p. 575.

Anodon purpurascens Swainson, Zool. III, 1st. ser., III, pl. CLX, 1823.

Unio velum Say, New Harm. Dissem., II, Sept. 23, 1829, p. 293

Symphynota tenuissima Lea, Tr. Am. Phil. Soc., III, 1829, p. 453, pl. XI, fig. 21.

Unio tenuissima Hanley, Biv. Shells, 1843, p. 206, pl. XX, fig. 42.

This is one of the thinnest shells to be found in the St. Joseph River. The only shell that approaches it in appearance is *Anodonta*, the resemblance being in the poorly developed character of the teeth. The shell is small, smooth and elongately elliptical in outline. The epidermis varies from a light horn color strongly rayed with green in the young specimens, to a dark brown and even black color with no rays, in old specimens. The lines of growth are inconspicuous except along the ventral margin. The dorsal is straight; the anterior margin rounded; the posterior margin pointed. The umbones are small and hardly project above the

dorsal margin. The ligament is small, short, thin and hardly protrudes above the valves. The cardinal teeth are scarcely evident at all. The lateral teeth are single in both valves, long and straight. The pallial line is weakly impressed. The cavity of the shell is shallow; of the beaks, scarcely noticeable. The naere is bluish to white; some specimens are spotted with yellowish brown.

Length	85	Height	45	Diameter	27
	68		35		22
	78		42		24
	57		28		18

PLAGIOLA DONACIFORMIS (Lea).

Unio donaciformis Lea, Tr. Am. Phil. Soc., III, 1828, p. 267, pl. IV, fig. 3.

Unio zigzag Lea, Tr. Am. Phil. Soc., III, 1829, p. 440, pl. XII, fig. 19.

Unio nervosa Conrad, New F. W. Shells, 1834, p. 70.

Unio nervosa Say, Am. Conch., VI, 1834.

Plagiola donaciformis Baker, Moll. Chi., Pt. I, 1898, p. 92, XIII, 4.

Only one specimen of this species is at my disposal. The specimen measures 54mm. in length, 33mm. in height, and 12mm. in diameter. The specific name was evidently given to this shell on account of its resemblance to the marine genus *Donax*. The species does not seem to be common in this locality as but one specimen was found. It is a small, thick shell that can be recognized by its zigzag epidermis, which, in the specimen before me is greenish and rayed with dark green. All the rays arise from the umbones and cover the entire disk. The shell is elliptically elongated, thick, solid and inflated. The lines of growth are indicated by obtuse ridges. The umbones are slightly elevated, much inflated, light brown in color, and marked by very fine ridges. There is a short ligament, rather wide and of a dark horn color. The cardinal teeth are double in the left and single in the right valve, small, elevated, narrow, somewhat triangular and coarsely serrated. The single tooth in the right valve is acutely triangular. The lateral teeth are long and directed ventrally. The anterior adductor muscle scar is longer than wide and deeply excavated. The posterior adductor muscle scar is barely visible. The pallial line is slightly impressed. The cavity of the beaks is rather deep. The naere is silvery white and iridescent.

ANODONTA GRANDIS (Say).

Anodonta grandis Say, New Harm. Dissem., Vol. II, 22, p. 341, 1829.

Anodonta plana Lea, Tr. Am. Phil. Soc. 2nd. ser. Vol. V., p. 48, 1834.

Anodonta declivis Conrad, Am. J. Sci. & Arts, 1st. ser. Vol. XXV, p. 341, 1836.

Anodonta salmonia Lea, Tr. Am. Phil. Soc. 2nd. ser. Vol. VI, p. 45, 1836.

Anodonta decora Lea, Tr. Am. Phil. Soc., 2nd. ser. Vol. VI, p. 64, 1836.

Anodonta gigantea Lea, Tr. Am. Phil. Soc. 2nd. ser. Vol. VI, p. 1, 1838.

Anodonta ovala Lea, Tr. Am. Phil. Soc., 2nd. ser. Vol. VI, p. 2, 1838.

Anodonta karphemensis Lea, Tr. Am. Phil. Soc., 2nd. ser. Vol. VIII, p. 224, 1840.

Anodonta inornata Anthony, Ann. Jl. Conch., Vol. II, p. 145, 1866.

The largest specimen of this species in the collection at my disposal was taken from St. Mary's Lake, Notre Dame,—about half a mile from the St. Joseph River. This shell, collected in 1914, measures 153mm. in length, 80mm. in height and has a diameter of 60mm. All the other shells in the collection are from the river. The shell of the young is thin and fragile; in older specimens it becomes more solid. The surface is strongly marked by lines of growth,—the lines becoming ridges in the older shells. The umbones are prominent, but little elevated, of a greenish or bronze color. In all the specimens of this collection the umbones are eroded and marked by five elevated, wavy wrinkles arranged in two parallel rows. The ligament is quite strong and horn colored. The epidermis varies in color from a greenish yellow in the young to a dark brown in older specimens. The rays mentioned by some writers are wanting in all the specimens before me. The adductor muscle scars and the pallial line are present but not impressed. The naere is silvery white in the young but changes to cloudy in older specimens. Some of the specimens show a deep purple naere and copper blotches; all the specimens show iridescence.

Length	Height	Diameter
153	80	60
99	57	44
84	49	32
72	38	31
61	35	27

SYMPHYNOTA COSTATA (Raftnesque).

Alasmidonta costata Raftnesque, Ann. Gen. Sci. Brux., V, 1820, p. 318, pl. LXXXII, figs. 15, 16.

Complanaria costata Conrad, Proc. Acad. Nat. Sci. Phil., VI, 1853, p. 261.

Symphynota costata Simpson, Syn., 1900, p. 665.

Alasmidonta rugosa Barnes, Am. Jl. Sci., VI, 1823, p. 278, pl. XIII, fig. 21.

Mya rugosa Eaton, Zool. Text-Book, 1826, p. 222.

Uria rugosa Hanley, Biv. Shells, 1843, p. 211, pl. XXI, fig. 8.

Babchia rugosa H & A Adams, Gen. Rec. Moll., II, 1857, p. 500.

Lasmigona rugosum Raftnesque, Cont. Mon., 1831, p. 5.

Alasmidonta hiems Ferrusac, Guer. Mag., 1835, p. 25.

The shell of this species is elliptical in outline, rather thick and heavy. It is rounded anteriorly and obtusely angulated posteriorly. The dorsal margin is straight in both sexes; the ventral margin is straight in the male and curved in the female. The lines of growth are quite heavy and form strong wrinkles on the dorsal part of the posterior angle. The umbones are eroded on all specimens in this collection, and all are marked by three almost straight, elevated ridges. The ligament is long, narrow and dark brown horn colored. The epidermis is yellowish-green to dark brown or black. The cardinal teeth are thick and heavy, pyramidal and striated on the upper surfaces. The lateral teeth are undeveloped and appear as a slight thickening of the hinge plate. The anterior adductor muscle scar is very wide, slightly impressed and iridescent. The pallial line is impressed only on the anterior portion of the shell. The cavity of the shell and of the beaks is shallow. The naere is silvery white, bluish white or salmon colored. Old shells have a dark purple band along the entire margin of the valve.

ALASMDONTA MARGINATA (Say).

Alasmidonta marginata Say, Nich. Encyc., 1819, 1, Jl. Ac. Nat. Sci. Phil. I, 1819, p. 459.

Margarita (*Margaritana*) *marginata* Lea, Syn., 1836, p. 43.

Alasmidonta marginata Baker, Moll. Chi. Pt. I., 1898, p. 62, pl. IV, fig. 4;

VII, fig. 7; XXII, fig. 3.

Uria Margaritans Sowerby, Conch. Icon., XVI, 1866, pl. LI, fig. 267

Alasmidonta truncata Simpson, Syn., 1900, p. 671.

This species should be easy to recognize on account of its heavy shell, inflated umbones that are characteristically marked with three very coarse, undulating ridges, and its truncated posterior border. The ligament is wide, not very long and of a very dark horn color. The epidermis is brownish or greenish with wide dark rays extending from the umbones to the ventral border, and dotted with black spots and dashes. The cardinal teeth are thin, elevated and striated; there is one in the right and two in the left valve. The lateral teeth are simply a thickening of the hinge. The anterior muscle scar as also the protractor are marked by lines of growth. The posterior muscle scar is only slightly impressed. The cavity of the shell is deep; that of the beaks is shallow. The pallial line is well impressed. The naere is a bluish white, pearly and iridescent, especially on the edges of the valves.

Length	Height	Diameter
28	18	14
42	20	18
60	35	24
73	37	22
84	43	30

QUADRULA UNDLATA (Barnes).

Unio undulatus Barnes, Am. Jl. Sci., VI, 1823, p. 120, pl. II.
Margarita (Unio) undulatus Lea, Syn., 1836, p. 12; 1838, p. 14.
Mya undulata Eaton, Zool. Text-Book, 1826, p. 219.
Unio undulata Valenciennes, Rec. Obs. Zool. Anat., II, 1835, p. 229, pl. IIV, figs. 3, 3a, 3b.
Quadrula undulata Baker, Moll. Chi., Pt. I, 1898, p. 82, pl. XXII, fig. 1, 2.
Crenodonta undulata Ortman, Ann. Car. Mus., VIII, 1912, p. 246.
Unio costatus Conrad, Monog., II, 1836, p. 17, pl. VII.
Plectomerus costatus Conrad, Proc. Acad. N. Sci. Phila., VI, 1853, p. 260.
Unio plicatus Kuster, Conch. Cab., 1856, p. 137, pl. XI, fig. 3.
Unio atrocostatus Sowerby, Conch. Icon., XVI, 1868, pl. LXXVII, fig. 404.

This is a very heavy shell, somewhat elongated and irregularly rhomboid in outline. A characteristic feature of this species is the sculpture consisting of five strong ridges that are swollen where they cross the posterior ridge. There are oblique folds on the posterior portion of the disk; they run nearly parallel with the posterior ridge and are sometimes broken into corrugations or pustules. The epidermis is greenish or yellowish green in young specimens; in old specimens the color changes to dark brown or black. The dorsal margin is straight; the ventral margin is slightly rounded. The lines of growth are often raised into thin scales on the ventral border. The cardinal teeth are double in both valves, equal in the left, and the anterior much smaller in the right valve. All the teeth except the anterior in the right valve are heavy thick, triangular, striated and grooved. The lateral teeth are long, thick, curved ventrally and serrated. The pallial line is deeply impressed throughout. The cavity of the beaks is broad and shallow. The nacre is silvery white and iridescent on the posterior portion; some specimens show brown blotches.

Length	Height	Diameter
64	43	23
80	55	30
122	78	46
112	74	43
155	115	53

QUADRULA RUBIGINOSA (Lea).

Unio rubiginosus Lea, Tr. Am. Phil. Soc., III, 1829, p. 427, pl. VIII, fig. 10.
Quadrula rubiginosa Baker, Moll. Chi., Pt. I, 1898, p. 77, pl. XIX, fig. 2;
 XX, 1.
Fusconaja rubiginosa Ortman, Ann. Car. Mus., VIII, 1912, p. 241, figs 4, 4a.

Unio flavus Conrad, Monog. m. IX, 1837, p. 74, pl. XLI, fig. 2.
Unio trigonus Sowerby, Conch. Icon., XVI, 1868, pl. LXIV, p. 322.

There are five specimens of this shell in the collection at my disposal. The measurements vary considerably from those given for the species by Call and Baker, showing that these shells are smaller. The shell is quadrate in outline and of moderate thickness. There is lateral compression and striation. The epidermis is brown or olive green,—some young specimens have rays in the umbonal region. The lines of growth are numerous and raised into ridges. The anterior margin is round; the posterior margin is curved; the ventral margin is emarginate. The umbones are small and slightly raised. The ligament is dark brown in color, thick, and short. The cardinal teeth are double in the left and single in the right valve. The lateral teeth are long, thin and plate-like. The pallial line is well marked, in some specimens, it is nearly obliterated towards the posterior end. The nacre is pure white to salmon colored. There is considerable variation within the species, especially in the shape of the posterior portion, and in its copulency. This shell may be distinguished from *Quadrula coccinea*, which it resembles most closely, by its more angular posterior slope and its stouter and diverging cardinal teeth.

Length	Height	Diameter
90	64	33
88	61	32
23	17	12
71	50	33

QUADRULA COCCINEA (Conrad).

Unio coccineus Conrad, Monog., III, 1836, p. 29, pl. XIII, fig. 1.
Quadrula coccinea Baker, Moll. Chi., Pt. I, 1898, p. 79, pl. XIV, fig. 1; pl. XIX, fig. 3.
Pleurobema coccineum Ortman, Ann. Car. Mus., VIII, 1912, p. 263.
Unio rubens Menke, Syn., Meth. Moll., 1828, p. 90.
Unio cabillus Conrad, Monog., III, 1836, p. 30, pl. XIII, fig. 2.
Unio goulletanus Ward, Jay's Catalog, 3rd. ed. 1839, p. 24.
Unio cuneus Call, Tr. Ac. Sci. St. Louis, VII, p. 14.

This is an exceedingly variable species and one of the most difficult to diagnose. Its nearest relative is *Q. solida*. It may be

distinguished from this by a greater compression, lower beaks, no full median radial swelling and an absence of a radial depression in front of the posterior ridge. There are, however, intermediates that can not be satisfactorily named. The shell is roundly quadrate or roundly elliptical, rounded before and squarely truncated behind. The surface is roughened by sharp and elevated lines of growth; older specimens show considerable erosion. The umbones are elevated and bear three large, elevated undulating wrinkles and many fine lines of growth. There is a short, wide and strong ligament, of a dark brown or horn color. The epidermis is brown or reddish brown; in very old specimens it becomes chalky. The cardinal teeth are double in both valves, nearly equal in the left, the anterior tooth only a rudiment in the right valve. The cardinal teeth are depressed, triangular, heavy and strongly serrated. The lateral teeth are long, elevated serrated and directed ventrally. The single lateral in the right valve has a depression into which the ventral tooth in the left valve fits. The anterior adductor muscle scar is deeply excavated and striated, and longer than wide; the posterior adductor muscle scar is slightly impressed, striate and confluent. The cavity of the beaks is shallow. The pallial line is barely visible to quite deeply impressed. The naeacis variable from a cloudy white to rose, pink or salmon color.

Length	Height	Diameter
47	35	22
71	53	28
78	59	34
96	64	38
108	79	50

QUADRULA TUBERCULATA (Rafinesque).

Obliquaria (*Rolandaria*) *tuberculata* Rafinesque, Ann. Gen. Sci. Brux. V.

1820, p. 103.

Rolandaria tuberculata Agassiz, Arch. fuer Naturg., I, 1852, p. 48.

Unio tuberculatus Conrad, Monog., V, 1836, p. 43, pl. XXII.

Quadrula tuberculata Simpson, Syn., 1900, p. 795.

Unio verrucosus Barnes, Am. J. Sci., VI, 1823, p. 123, pl. V, fig. 6.

Margarita (*Unio*) *verrucosus* Lea, Syn., 1836, p. 16.

Mya verrucosa Eaton, Zool. Text-Book, 1836, p. 216.

Quadrula verrucosa Baker, Moll. Chi., Pt. I, 1898, p. 85, pl. XXIII.

Unio tuberculosa Valenciennes, Rec. Obs. Zool. Anat., II, 1833, p. 232.

The shell of this species is quadrate, thick, heavy and pustulate. The dorsal margin is nearly straight while the ventral margin is rounded to straight. The surface of the shell is very rough,—the roughness being caused by coarse lines of growth, tubercles and

pustules. The anterior portion is quite smooth, the pustules occupying the center of the shell from the umbones to the ventral margin. The umbones are small, directed anteriorly and marked by heavy ridges. The ligament is a dark horn color, long and wide. The epidermis varies from a dark yellow to a dark brown. The cardinal teeth are single in the right and double in the left valve, flat, large and deeply grooved. The lateral teeth are very strong, and much striated in older specimens. The anterior adductor muscle scar is oval, deeply excavated and markedly striated. The pallial line is deeply impressed anteriorly but almost not at all posteriorly. The naeacis varies between a whitish hue in young specimens to a deep purple in older specimens. There is a satin finish near the beaks. The space between the pallial line and the ventral margin is a dark purple, with a thin white line running along the ventral margin.

Length	Height	Diameter
75	64	44
118	90	48
112	90	46
78	63	36
120	91	50

The river area over which collections were made is about six miles in length, extending from a point about two miles south of South Bend to Bertrand, a village just above the Michigan state line.

Notes on the Genus *Atrypa*, with Description of New Species.

BY CLEMENT L. WEBSTER, M. SC.

INTRODUCTION.

For many years I have been engaged in bringing together from the rocks of all geological ages containing them from various parts of the world, a very large collection of all available species and variations of the Genus *Atrypa*, for the purpose of a monographic revision of the group, and for the further purpose of, in so far as possible, ascertaining the genesis of species of this group. The amount and nature of the material and evidence secured has been very gratifying; and can not but aid somewhat in the solution of at least some of the important questions involved.