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A

DESCRIPTIVE CATALOGUE

OF THE

NAIADES, OR PEARLY FRESH- WATER MUSSELS

BY

CHARLES TORREY SIMPSON



PART II

UNIONIDÆ,

UNIO — NODULARIA

Division of Mollusks
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DESCRIPTIVE CATALOGUE OF THE NAIADES

II.

Genus UNIO Retzius, 1788.

Unio RETZIUS, Diss. Hist. Nov. Test. Gen., 1788, p. 16.—BRUGIERE, Choix de Memoirs, I, 1792, p. 106.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 273.

Limnæa POLI (part), Test. Utr. Sic., I, 1791, p. 31.

Lymnium OKEN, Lehrbuch, 1815, p. 237.

Elliptio RAFINESQUE, J. de Phys. Nat. Hist., 1819, p. 426.

Mysca TURTON, Conch. Ins. Brit., 1822, p. 243.

Canthyria SWAINSON, Tr. on Moll., 1840, p. 278.

Uniomerus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 268.

Shell inequilateral, oval to elongated, rounded in front and pointed or biangulate behind, with a more or less developed posterior ridge, often becoming slightly arcuate when old; beaks only moderately full, generally sculptured with coarse ridges, which run parallel with the growth lines, or are somewhat doubly looped, sometimes broken, and showing fine radiating lines behind; surface smooth, slightly concentrically ridged or pustulose; epidermis generally rather dull colored, rayless or feebly rayed; hinge plate narrow; two pseudocardinals and two laterals in the left valve and one pseudocardinal and one lateral in the right, with rarely a vestige of a second lateral; cavity of the beaks not deep or compressed. Animal having the inner branchiæ free from the abdominal sac for from one-half to their entire length; marsupium occupying the

whole length of the outer gills only, forming a thick, smooth pad when filled with young; gills united to the mantle behind to their extreme points, or very nearly so; branchial and anal openings unbranched; superanal opening always closed below.

Type, *Unio tumidus* Retzius.

The above generic description applies to the great majority of the species I have retained under the name *Unio*.

The genus was described in a thesis by Laurentius Münter Philipsson under his master, Retzius, in the University of Lund, Sweden, and it is often credited to the former. I am informed by Professor Joh. Chr. Moberg, of Lund, that by a former law or custom of the university the professor was considered the author of all papers which a student under him defended. According to this, Retzius must be credited with the genus. This law was repealed in Lund in 1852.

Until recently all the species of the family *Unionidæ* having nearly or quite perfect pseudocardinal and lateral teeth were placed in this great group by most conchologists regardless of the form or details of structure of the shell or the characters of the animal. Other species in which the lateral teeth were not quite fully developed, were placed in *Margaritana* by some writers and in *Unio* by others. After a careful study of the obvious anatomy of a large number of these forms and minor shell characters, which seemed to correspond with anatomical peculiarities, I became convinced that it would be better to dismember Retzius' genus and did so in the Synopsis. As there restricted it is still the largest generic group contained in either of the two families treated, and I have given it practically the same limits in this work. The forms, which have all four leaves of the branchiæ closely filled with embryos, seem to me to belong to a somewhat different phylum from those in which only the outer gills are filled. If von Ihering is correct in assuming that the Naiades, which have shells with radial beak sculpture and embryos in the inner gills alone, are the primitive forms, then it would seem reasonable that those that contain them in all four gills represented a step higher in the development of these forms, the highest type of *Unione* life

having the young only in the outer gills. Those forms that have all four of the gills used as a marsupium have generally shorter, solider, more inflated shells than those with the embryos in the outer gills alone, and their beak sculpture is coarser and approaches more nearly to the radial pattern.

The Oriental forms with zigzag beak sculpture and the South American species whose beaks are marked with radial bars, all of which, I believe, contain the young in the inner gills alone, are still wider separated from the true Unios, even though they may have perfect teeth.

In so large and widely distributed a group as even the restricted genus *Unio* there is much diversity of form and structure. Generally the shell is more or less elongated, but such species as *U. littoralis* and some of its allies are short, being subrhomboid or nearly orbicular. *Unio crassidens* is sometimes as ponderous as any of the species of *Quadrula*. *U. pictorum* and some related forms have a bright, even somewhat rayed, epidermis. There is much diversity in the beak sculpture and some forms have a small upper pseudocardinal in the right valve.

Section LYMNIUM Oken, 1815.

Lymnium OKEN, Lehrbuch, 1815, p. 237.

Shell generally smooth; beak sculpture broken, often somewhat corrugated or pustulous; pseudocardinals compressed; beak cavities well excavated, not compressed. Animal highly colored; anal opening crenulate or smooth.

Type, *Unio pictorum* Linnæus.

Group of *Unio pictorum*.

Shell inflated, elongate, oval; anterior end angled above, swollen a little at posterior base; beaks full, their sculpture consisting of numerous slightly doubly-looped bars, which often become pustulous; posterior ridge rather low; epidermis smooth, rather bright, sometimes slightly rayed behind; rest periods well marked; pseudocardinals compressed, often a lit-

tle reflexed, smooth below, those of the left valve partly united; muscle scars smooth; nacre whitish to salmon. Animal the same as described for the section.

UNIO PICTORUM (Linnæus).

Shell elongated, convex to subinflated, inequilateral, sub-solid; dorsal and ventral lines nearly parallel; anterior end rounded or subtruncate, usually slightly angular above; posterior ridge full and rounded, ending behind in a point about at the median line; the outline of the base is generally a little angulated at some distance in front of the posterior end; beaks full and elevated, their sculpture consisting of double-looped ridges, the anterior loop rounded, the posterior one angled, the ridges in a majority of cases more or less broken into nodules, which are often scattered; surface nearly smooth, showing only delicate growth lines; epidermis bright, greenish-yellow, yellowish-green, straw-color, yellow or tawny, occasionally feebly rayed behind and in most cases showing the dark rest periods; left valve with two compressed pseudocardinals, the hinder sometimes partly double and extending forward below the anterior one, with two delicate, straight laterals, the lower the larger; right valve with two compressed pseudocardinals, the upper much smaller and one high, lamellar lateral; beak cavities moderately deep; nacre silvery-white, sometimes flesh-color or salmon, a little thicker in front; muscle scars nearly smooth, impressed in solid shells.

Length 100, height 43, diam. 30 mm.

Length 80, height 34, diam. 23 mm.

Europe generally; Siberia east to the Lena River and perhaps farther; south into Asia Minor?; Algiers?

Mya pictorum LINNÆUS, Syst. Naturæ, 10th ed., 1758, I, p. 671.—PENNANT, Brit. Zool., IV, 1777?, pl. XLIII, fig. 17.—DA COSTA, Hist. Nat. Brit., 1778, p. 228, pl. xv, fig. 4.—SCHRÖTER, Flussconch., 1779, p. 178, pl. III, figs. 2, 4, 5.—STURM, Deuts. Faun., VI, 1803, 2d ed., p. 19, pls. a, b, c.—WOOD, Gen. Conch., I, 1815, p. 104, pl. XIX, figs. 3, 4; Index Test., 1825, p. 12, pl. II, fig. 26c; rev. ed., 1856, p. 15, pl. II, fig. 26.—? CHENU, Bib. Conch., 1st ser., I, 1845, p. 114, pl. 114, pl. XLVII, figs. 8, 9.

Unio pictorum RETZIUS, Diss. Hist. Nat., 1778, p. 17.—DRA-PARNAUD, part. Hist. Moll. Fr., 1806, p. 131, pl. XI, fig. 4.—BRARD, Hist. Coq. Paris, 1815, p. 226, pl. VIII, fig. 1.—BROOKES, Int. to Conch., 1815, p. 51, pl. II, fig. 12.—C. PFEIFFER, L. and Suss. Moll., Pt. I, 1821, p. 115, pl. V, figs. 9, 20.—BOSC, Hist. Nat. Coq., III, 1824, p. 139, pl. XXIII, fig. 3.—BLAINVILLE, Manual, Mal., 1825, p. 539, pl. LXVII, fig. 2.—CROUCH, Ill. Int. Lamarck, 1827, p. 16, pl. IX, figs. 4, 4a, 4b.—ROSSMASSLER, Icon., Pt. I, 1835, p. 118, pl. III, figs. 71, 71a, 71b; III, 1836, p. 23, pl. XIII, fig. 196; VI, 1837, p. 55, pl. XXIX, fig. 409; IX, 1839, p. 10, pl. XLV., fig. 587-590; XI, 1842, p. 14, pl. LV, fig. 741; XII, 1844, p. 30, pl. LVIII, figs. 762-766; p. 31, pl. LIX, figs. 767-769.—FLEMING, Moll. Animals, 1837, pl. XIV, fig. 51.—WYATT, Man. Conch., 1838, p. 67, pl. VIII, fig. 6.—?GRAS, Moll. Isere., 1840, p. 71, pl. I, fig. 8.—STABILE, Faun. Lug., 1845, p. 60, pl. III, fig. 73.—BROWN, L. and F. W. Conch., 1845, p. 107, pl. XIX, figs. 1-4.—STEIN, Die Lebend. Schneck., 1850, p. 104, pls. XXIV, XXV, figs. 1, 2.—MIDDENDORFF, Sib. Reise, II, 1851, p. 276, pl. XXVIII, figs. 1-3.—DUPUY, Hist. M. Fr., 1852, p. 647, pl. XXVI, fig. 20.—FORBES and HANLEY, Hist. Brit. Moll., II, 1853, p. 142, pl. XXXIX, fig. 1.—KUSTER, Conch. Cab. Unio, 1854, p. 88, pl. XXIII, figs. 1, 2; pl. XXIV; XXV, figs. 1, 2.—MOQUIN-TANDON, Moll. Terr. Fluv. Fr., II, 1855, p. 576, pls. L, figs. 8, 10; LI, figs. 1, 10.—NORDENSKIÖLD and NYLANDER, Fin. Moll., 1856, p. 83, pl. V, fig. 72.—DROUET, Nay. Fr., II, 1857, p. 103, pl. VIII.—TURTON, Man. L. and F. W. Shells, 1857, p. 279, pl. II, fig. 11.—H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 491; III, pl. CXVI, figs. 5, 5a, 5b.—SOWERBY, Ill. Index Brit. Shells, 1859, No. 2, pl. VII.—GOODRICH, Ill. Nat. Hist., II, 1859, p. 523, fig.—REEVE, L. and F. W. Moll. Brit., 1863, p. 221, fig. 2.—TATE, L. and F. W. Moll. Brit., 1866, pl. II, fig. 3.—CLESSIN, Deutsche Ex. Moll., 1876, p. 453, fig. 294.—L. ADAMS, Coll. Man., 1884, p. 18, pl. I, fig. 11.—SIMPSON, Syn., 1900, p. 680.

Baphie pictorum MEUSCHEN, Mus. Gevers., 1787, p. 472.

Lymnium pictorum OKEN, Lehrb., 1815, p. 237.

- Mysca pictorum* TURTON, Man. Shells, Brit. Is., 1831, p. 20, fig. 11.
- Margarita (Unio) pictorum* LEA, Syn., 1836, p. 36; 1838, p. 24.
- Margaron (Unio) pictorum* LEA, Syn., 1852, p. 36; 1870, p. 58.
- Mya angusta subflava*, etc., SCHRÖTER, Fluss. Conch., 1779, p. 184, pl. III, fig. 3; pl. IV, fig. 6.
- Mya nodosa* GMELIN, Syst. Nat., 13th ed., 1788, p. 3222.—WOOD, Ind. Test., 1825, p. 12, pl. II, fig. 34a; rev. ed., 1856, p. 16, pl. II, fig. 34.
- ? *Unio conus* SPENGLER, Skriv. Selsk. Nat., III, 1793, p. 60.
- Mya ovalis* DONOVAN, Brit. Shells, III, 1801, pl. LXXXVII.
- ? *Unio ovalis* SOWERBY, Rec. and Foss. Shells, No. XVI, 1823, fig.—? REEVE, Conch. Syst., I, 1841, p. 117, pl. LXXXVII, fig. 1.—CHENU, Bib. Conch., 1st ser., I, 1845, p. 67, pl. XXIV, figs. 1-3.
- Mya nodulosa* WOOD, (part), Gen. Conch., I, 1815, p. 106, pl. XXII, figs. 3, 4.
- Unio nodulosa* LAMARCK, An. sans Vert., VI, 1819, p. 78.
- Unio rostrata* LAMARCK, An. sans Vert., VI, 1819, p. 77.—C. PFEIFFER, Nat. Deuts. L. and Suss. Moll., Pt. I, 1821, p. 114, pl. V, fig. 8.—MICHAUD, Comp. Hist. Moll. Fr., 1831, p. 108, pl. XVI, fig. 25.—BROWN, L. and F. W. Conch., 1836, p. 109, pl. XX, figs. 1, 2; Ill. Rec. Conch., 1844, p. 82, pl. XXXII, figs. 9-12.—GRAS, Moll. Isere., 1840, p. 71, pl. V, fig. 21.
- Unio rostratus* CHENU, Man., II, 1859, p. 137, fig. 658.
- Unio manca* LAMARCK, An. sans Vert., VI, 1819, p. 80.
- Unio mancus* DROUET, Moll. Cote d'Or, 1867, p. 103.
- Unio limosus* NILSSON, Hist. Moll. Svec., 1822, p. 110.—ROSSMASSLER, Icon., III, 1836, p. 24, pl. XIII, fig. 199.—KUSTER, Conch. Cab. Unio, 1854, p. 80, pls. XXI, XXII, XXIII.
- Unio deshayesii* MICHAUD, Comp. Hist. Moll. Fr., 1831, p. 107, pl. XVI, fig. 30.—ROSSMASSLER, Icon., III, 1836, p. 23, pl. XIII, fig. 197.—BROWN, Ill. Rec. Conch., 1844, p. 81, pl. XXXII, figs. 1-4; L. and F. W. Conch., 1845, p. 108, pl. XX, figs. 3, 4.
- Unio dubius* FITZINGER, Syst. Verz., 1833, p. 119.

- Unio michaudiana* DES MOULINS, Actes Soc. Linn. Bord., VI, 1833, p. 27, plate.
- Potamida sicula* SWAINSON, Treatise on Mal., 1840, p. 282, fig. 58.
- Unio siculus* HANLEY, Biv. Shells, 1856, p. 383, pl. xx, fig. 19.
- Unio aradæ* PHILIPPI, Enum. Moll. Sic., III, 1844, p. 49.—KUSTER, Conch. Cab. Unio, 1854, p. 105, pl. xxviii, fig. 6.—KOBELT, Icon., IV, 1876, p. 62, pl. cxvii, figs. 1146, 1147.
- Unio dactylus* MORELET, Moll. Port., 1845, p. 110, pl. xiv, fig. 2. KOBELT, Icon., new ser., VI, 1893, p. 98, pl. cxxx, fig. 1132.
- Unio mucidus* MORELET, Moll. Port., 1845, p. 111.—KOBELT, Icon., new. ser., VI, 1893, p. 98, pl. clxxx, figs. 1130, 1131.
- Unio quinqueannulatus* KUSTER, Conch. Cab. Unio, 1854, p. 93, pl. xxv, figs. 3, 4.
- Unio pallens* KUSTER, Conch. Cab. Unio, 1854, p. 95, pl. xxv, fig. 5; xxvi, fig. 1.
- Unio viridiflavus* KUSTER, Conch. Cab. Unio, 1854, p. 96, pl. xxvi, figs. 2, 3.
- Unio petrovichii* KUSTER, Conch. Cab. Union, 1854, p. 98; pl. xxvi, fig. 5; xxvii, fig. 1.
- Unio maltzani* KUSTER, Conch. Cab. Unio, 1854, p. 106, pl. xxix, figs. 1, 2.
- Unio baletonicus* KUSTER, Conch. Cab. Unio, 1861, p. 231, pl. lxxviii, fig. 1.
- Unio proechus* BOURGUIGNAT, Rev. et Mag., XIV, 1862, p. 19, pl. xix, figs. 1-3.
- Unio actephilus* BOURGUIGNAT, Rev. et Mag., XIV, 1862, p. 20, pl. xix, figs. 7, 8; pl. xx, fig. 3.
- Unio lawleyanus* GENTILUOMO, Bull. Mal. Ital., I, 1868, p. 54, pl. iv, figs. 1-3.

A species having a wide distribution and one that is abundant, yet it does not seem to me to be especially variable or that there is the slightest necessity for the great number of names, which have been bestowed upon it. It is an elongated, rather cylindrical, bright colored and rather smooth form, us-

ually a little higher in front than behind and subangular or very slightly produced on the base line just back of the middle of the shell.

Hanley says of this species [Ipse Linnæi Conchyliæ, p. 27]: "More unioes than one are present in the [Linnæan] collection, but upon the whole the *U. pictorum* of authors [Rossm. Icon., fig. 196] agrees best with synonymy and description. The figure referred to of Lister is *U. pictorum*; Bonanni's drawing is more doubtful and was possibly meant for *U. tumidus*. The descriptions in Fauna Suecica and Systeme are brief and unsatisfactory and might suit either species alike."

Var. *longirostris* Rossmassler.

Shell greatly elongated, olive, brown, or dirty yellowish-green.

Length 70, height 28 mm.

Unio longirostris ROSSMASSLER, Icon., III, 1836, p. 26, pl. XIV, fig. 200; XI, 1842, p. 13, pl. LIV, fig. 738.

Unio pictorum (part), SIMPSON, Syn., 1900, p. 682.

This form may possibly be worthy of varietal rank. It seems to be smaller than the ordinary manifestation of the species, is more elongated and duller colored and lacks rays.

UNIO PLATYRHYNCHUS Rossmassler.

Shell elongated, subinflated, inequilateral, rather thin to sub-solid, dorsal and ventral lines parallel, anterior end subtruncated, pointed above; posterior end compressed and curved downward into a decided beak, which usually extends below the base line; beaks full, slightly elevated, their sculpture consisting of corrugated ridges, which break up into nodules, which are strongly developed on the posterior ridge; posterior ridge rounded; surface with irregular growth lines; epidermis finely folded along the growth lines, generally smooth on the middle of the disk, rough behind, dirty greenish to burnt-brown; left valve with two greatly compressed pseudocardinals, which are sometimes united, and two delicate, straight, lamellar laterals,

the lower higher; right valve with two compressed pseudocardinals, the upper small, and one high lateral; nacre bluish-white, usually rather dull, thickened a little in front.

Length 68, height 26, diam. 18 mm.

Central and southwestern Europe.

Unio platyrhynchus ROSSMASSLER, Icon., II, 1835, p. 22, pl. IX, fig. 130; V, 1837, p. 20, pl. XXIV, fig. 338.—HANLEY, Biv. Shells, 1843, p. 205, pl. XXIII, fig. 53.—KUSTER, Conch. Cab. Unio, 1854, p. 77, pls. XIX, XX.—SOWERBY, Conch. Icon. XVI, 1856, pl. XXX, fig. 154.—SIMPSON, Syn., 1900, p. 683.

Margarita (Unio) platyrhynchus LEA, Syn., 1836, p. 35; 1838, p. 24.

Margaron (Unio) platyrhynchus LEA, Syn., 1852, p. 36; 1870, p. 58.

Unio fiscallianus KLECIACH, Atti. Soc. Ital., XV, 1872, p. 92.—PFEIFFER and KOBELT, Mal. Blatt., XX, 1873, p. 92, fig.

Unio limosus KOBELT, Icon., new ser., VI, 1893, p. 44, pl. CLVII, figs. 1024-1027.

A most distinct and peculiar species, always distinguishable when adult by the curious, compressed beak at the hinder base. Generally the surface is roughened and dull, though the earlier growth is bright and smooth, and until it is near maturity the shell is almost exactly like a young, delicate *pictorum*.

UNIO PLATYRINCHOIDEUS Dupuy.

Shell elongated, subinflated, somewhat ovate or rhomboid, inequilateral, subsolid; beaks full, rather high, their sculpture consisting of fine, doubly-looped, nodulous ridges; posterior ridge high, angled, somewhat double below; anterior end subtruncate, angled above; posterior slope obliquely truncated, plicately corrugated; surface otherwise nearly smooth, having faint growth lines and obsolete radial sculpture anteriorly; epidermis shining, olive-green to burnt-brown, showing the dark rest periods; left valve with two compressed pseudocardinals, which are almost united into one, and two curved, delicate laterals; right valve with two pseudocardinals, the lower

the larger, and one lateral; beak cavities rather deep, nacre bluish or flesh-white, dull, a little thicker in front.

Length 107, height 48, diam. 35 mm.

South France.

Unio platyrinchoideus DUPUY, Cat. Ext. Gall. Test., 1849; Hist. Moll. Fr., VI, 1852, p. 649, pl. XXVIII, fig. 16.—?DROUET, Nay. Fr., II, 1857, p. 100, pl. IX, fig. 1.—SIMPSON, Syn., 1900, p. 684.

Unio platyrhynchoideus WESTERLUND, Faun. Pal. II, Pt. 7, 1890, p. 121.

Unio platyrrhynchoideus SOWERBY, Conch. Icon., XVI, 1868, pl. LXX, fig. 358.

Unio danielis GASSIES, Actes. Soc. Linn. de Bord., XXVI, 1866, p. 132, pl. I, fig. 8.

Unio lardelianus PECCHIOLI, Bull. Mal. It., II, 1869, p. 163, pl. v.

Perfectly distinct from *U. pictorum* and allied species. The differential characters are the somewhat biangulate and drawn-out posterior end, the faint radial sculpture anteriorly, the plications on the posterior slope and the doubly-looped, fine beak sculpture. The shell is often almost sinuate just behind the middle of the base.

UNIO ELONGATULUS C. Pfeiffer.

Shell elongated, thin to subsolid, subovate or subelliptical, subcompressed, inequilateral, beaks neither full nor high, their sculpture consisting of numerous fine, doubly-looped ridges, which are slightly nodulous at the bases of the loops; posterior ridge low, ending at or below the median line in a feeble biangulation; base line sometimes a little sinuate in the middle; anterior end rounded; surface nearly smooth; epidermis ashy-greenish or ashy-brownish, shaded with yellowish, subshining, rayless; left valve with two distinct, compressed pseudo-cardinals and two delicate, slightly curved laterals; right valve

with two pseudocardinals, the upper small, and one lateral; nacre bluish-white, a little iridescent behind, thickened in front.

Length 60, height 27, diam. 15 mm.

Length 55, height 28, diam. 15 mm.

Central Europe.

Unio elongatula C. PFEIFFER, Nat. Deuts. L. and S. Moll., II, 1825, p. 35, pl. VIII, figs. 5, 6.

Unio elongatulus ROSSMASSLER, Icon., II, 1835, p. 23, pl. IX, fig. 132; XII, 1844, p. 27, pl. LVI, fig. 751; VI, 1879, p. 42, pl. CLXII, figs. 1644, 1645.—KUSTER, Conch. Cab. Unio, 1854, p. 104, pl. XXVIII, figs. 4, 5.—DROUET, Nay. Fr., II, 1857, p. 91, pl. VI, fig. 2.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXV, fig. 451.—SIMPSON, Syn., 1900, p. 684.

Margarita (Unio) elongatus LEA, Syn., 1836, p. 37.

Margarita (Unio) elongatulus LEA, Syn., 1838, p. 24.

Margaron (Unio) elongatulus LEA, Syn., 1852, p. 37; 1870, p. 59.

More delicate and compressed, smaller and a trifle more biangulate behind than *U. pictorum*, yet it may be only a variety of it. The beak sculpture is not so nodulous and the pseudocardinals of the left valve are more distinct than in Linnæus' species.

UNIO TUMIDUS Retzius.

Shell long ovate, being wide in front and gradually narrowed and drawn out to a point on the median line behind, subsolid to solid, subinflated, inequilateral; beaks moderately full and high, their sculpture consisting of uneven nodulous or subnodulous ridges, which are corrugated and generally doubly looped; posterior ridge subangular but not high, placed near the dorsal line of the shell; surface almost smooth, with scattered growth lines; epidermis bright and shining, greenish-yellow, yellowish-green, ashy or reddish-brown, often somewhat rayed; left valve with two compressed, ragged pseudocardinals and two delicate, nearly straight laterals; right valve with one pseudocardinal, with sometimes a vestige of another

above it, and one lateral; beak cavities moderately deep; nacre whitish or bluish-white, not brilliant, thickened a little in front.

Length 113, height 52, diam. 39 mm.

Length 77, height 40, diam. 25 mm.

Northern and middle Europe; eastern Siberia.

Unio tumidus RETZIUS, Diss. Hist. Nat., 1778, p. 17.—ROSS-MASSLER, Icon., I, 1835, p. 117, pl. III, figs. 70, 70a, 70b; III, 1836, p. 27, pl. XIV, figs. 202-204; VIII, 1838, p. 41, pl. XL, fig. 543; XII, 1844, p. 32, pl. LX, figs. 772-778.—BROWN, L. and F. W. Conch., 1836, p. 109, pl. XXI, figs. 8, 9.—BROWN, Ill. Rec. Conch., 1844, p. 82, pl. XXXII, figs. 5-8.—STABILE, Faun. Lug., 1845, p. 61, pl. III, fig. 74.—DUPUY, Hist. Moll. Fr., 1852, p. 655, pl. XXVIII, fig. 20.—FORBES and HANLEY, Hist. Brit. Moll., II, 1853, p. 140, pl. XI, fig. 1.—KUSTER, Conch. Cab. Unio, 1854, p. 71, pls. XVII, XVIII.—MOQUINTANDON, Moll. Terr. Fluv., II, 1855, p. 577, pl. LI, figs. 11, 14.—NORDENSKIÖLD and NYLANDER, Fin. Moll., 1856, p. 85, pl. VI, figs. 7, 8.—DROUET, Nay. Fr., II, 1857, p. 110, pl. IX, fig. 2.—SOWERBY, Ill. Int. British Shells, 1859, pl. VII, No. 3.—REEVE, L. and F. W. Moll. Brit., 1863, p. 219, fig. 1.—REEVE, Conch. Icon., XVI, 1865, pl. XXV, fig. 124.—TATE, L. and F. W. Moll. Brit., 1866, pl. II, fig. 2.—CLESSIN, Deuts. Ex. Moll., 1876, p. 458, fig. 299.—L. ADAMS, Coll. Man., 1884, p. 18, pl. I, fig. 10.—KOBELT, Icon., new ed., VI, 1893, p. 87, pl. CLXXIII, fig. 1115.—SIMPSON, Syn., 1900, p. 684.

Margaron (Unio) tumidus LEA, Syn., 1852, p. 36; 1870, p. 58.

Unio tumida C. PFEIFFER, Nat. Deuts. L. and S. Moll., II, 1825, p. 34, pl. VII, figs. 2, 3; pl. VIII, figs. 1, 2.

Mya depressa DONOVAN, Brit. Shells, III, 1801, pl. CI.—CHENU, Bib. Conch., 1st Ser., I, 1845, p. 71, pl. XXVI, figs. 1-3.

Unio depressus PÆTEL, Conch. Sam., III, 1890, p. 150.

Mya ovata DONOVAN, Brit. Shells, IV, 1802, pl. CXXII.—WOOD, Gen. Conch., I, 1815, p. 105, pl. XIX, fig. 5; Ind. Test., 1825, p. 12, pl. II, fig. 27c. rev. ed., 1856, p. 16, pl. II, fig. 27.—CHENU, Bib. Conch., 1st Ser., I, 1845, p. 82, pl. XXXII, figs. 1-3.

Mysca ovata TURTON, Conch. Ins. Brit., 1822, p. 246; Man. Shells Brit. Is., 1831, p. 21, fig. 12.—SWAINSON, Treat. on Mal., 1840, p. 277, fig. 56.

Mysca solida TURTON, Conch. Ins. Brit., 1822, p. 246, pl. XVI, fig. 2; Man. Shells Brit. Is., 1831, p. 22, fig. 13.

Mya ovalis MONTAGU, Test. Brit., 1803, p. 34.

Unio ovalis BROWN, L and F. W. Conch., 1836, p. 101, pl. XVIII, figs. 4, 5; Ill. Rec. Conch., 1844, p. 82, pl. XXXI, figs. 12-14.

Margarita (Unio) ovalis LEA, Syn. 1836, p. 35; 1838, p. 24.

Unio muelleri ROSSMASSLER, Icon., VIII, 1838, p. 41, pl. XL, fig. 541; XI, 1842, p. 13, pl. LIV, fig. 739.

Unio pictorum BROWN, Ill. Rec. Conch., 1844, p. 81, pl. XXXI, figs. 8-11.

Close to *U. pictorum* and in some cases it is well nigh impossible to separate it from that species. In general it is not quite so elongated; it is wider in proportion in front and narrower behind. There is sometimes a slight fulness in the posterior basal outline just behind the middle, but this is not so common or so pronounced as in *pictorum*. Occasionally the posterior point is elevated a little so that it will be found a trifle above the median line. The muscle scars are nearly smooth, shallow in thin shells, and well impressed in solid ones. The anterior end is often subtruncated and slightly angled above.

UNIO TURTONI Payraudeau.

Shell oblong, inclined to be slightly rhomboid, convex to subinflated, subsolid, rounded in front and rarely angled above, inequilateral; beaks slightly elevated, moderately full, their sculpture variable, consisting of a few corrugated, subnodulous ridges that show a tendency to be doubly looped; sometimes the sculpture is faint and reduced to a few nodules; surface nearly smooth; epidermis pale yellowish-ash, ashy-brown, greenish below, yellowish-green or sometimes almost olive, usually rayless and showing the dark rest periods distinctly; left valve with two compressed, ragged pseudocardi-

nals that are often almost united, and two curved, diverging laterals; right valve with two pseudocardinals, the upper feeble, and one lateral; beak cavities not deep; nacre whitish usually tinted with flesh-color, straw or salmon, slightly thicker in front; muscle scars smooth, not deep.

Length 68, height 34, diam. 20 mm.

Length 62, height 30, diam. 20 mm.

Entire circummediterranean region.

Unio turtoni PAYRAUDEAU, Cat. Moll. Corse, 1826, p. 65, pl. II, fig. 65.—ROSSMASSLER, Icon., VII, 1838, p. 25, pl. XXXV, fig. 492.—DUPUY, Hist. Moll. Franc. 1852, p. 651, pl. XXVII, fig. 17.—SIMPSON, Syn., 1900, p. 685.

Unio capigliolo PAYRAUDEAU, Cat. Moll. Corse, 1826, p. 66, pl. II, fig. 4.—ROSSMASSLER, Icon., V and VI, 1837, p. 22, pl. XXIV, fig. 341; XII, 1844, p. 28, pl. LVII, figs. 755, 756.—MOQUIN-TANDON, Moll. Terr. Fluv. Fr., II, 1855, p. 574, pl. L, figs. 3, 4.

Unio capigliolo var. *bandini* PÆTEL, Conch. Sam., III, 1890, p. 147.

Unio pictorum GUERIN, Icon. Regne Anim., II, 1829-1844, pl. XXVIII, fig. 16.—BOURGUIGNAT, Mal. Alg., II, 1864, p. 292, pl. XXII, figs. 6-11.—REEVE, Conch. Icon., XVI, 1865, pl. XXV, fig. 123.

Unio requienii MICHAUD, Comp. Hist. Nat. Moll. Fr., 1831, p. 106, pl. XVI, fig. 24.—ROSSMASSLER, Icon., III, 1836, p. 24, pl. XIII, fig. 198.—STABILE, Faun. Lug., 1845, p. 62, pl. III, fig. 1786.—GASSIES, Moll. Agen., 1849, p. 195, pl. I, figs. 4, 5.—DUPUY, Hist. M. Fr., 1852, p. 652, pl. XXVII, fig. 18.—KUSTER, Conch. Cab. Unio, 1854, p. 126, pl. XXI, fig. 7; XXVI, figs. 1-3; XXXVII, figs. 2-4.—DROUET, Nay. Fr., II, 1857, p. 93, pl. VII, figs. 1-3.

Unio lobata PHILIPPI, Moll. Sic., 1836, p. 67.

Unio bandinii ROSSMASSLER, Icon., V, 1837, p. 22, pl. XXIV, fig. 341.

- Unio pallens* ROSSMASSLER, Icon., XI, 1842, p. 13, pl. LIV, fig. 740.
- Unio hispanus* ROSSMASSLER, Icon., XII, 1844, p. 26, pl. LVI, fig. 747.—BOURGUIGNAT, Moll. Peu. Con., 1863, p. 46, pl. XXIV, figs. 1-3; Rev. et Mag., XVII, 1865, p. 344, pl. XXIII, figs. 1-3.
- Unio aleroni* COMPANYO and MASSOT, Bull. Soc. Pyr. d'Or, VI, Pt. 2, 1845, p. 234, fig.—BOURGUIGNAT, Moll. Peu. Con., 1863, p. 49, pl. XXIII, figs. 1-3; Rev. et Mag., XVII, 1865, pl. XIX, figs. 1-3.
- Unio ravoisieri* DESHAYES, Hist. Nat. Moll. Aceph. Alg., 1848, pl. CVIII, figs. 4-7.—BOURGUIGNAT, Mal. Alg., 1864, p. 291, pl. XX, figs. 5-10.—SIMPSON, Syn., 1900, p. 687.
- Margaron (Unio) ravoisieri* LEA, Syn., 1870, p. 48.
- Unio ravoisieri* var. *issericus* KOBELT, Icon., new ser., I, 1884, p. 65, pl. XXVIII, fig. 215.
- Unio rousii* DUPUY, Hist. Moll., VI, 1852, p. 653, pl. XVIII, fig. 18.—MUSGRAVE, Phot. Conch., 1863, pl. II, fig. 7.
- Unio valentinus* ROSSMASSLER, Icon., III, 1854, p. 37, pl. LXIX, p. 852.—BOURGUIGNAT, Moll. Peu. Con., 1863, p. 45, pl. XXVII; Rev. et Mag. Zool., XVII, 1865, p. 343, pl. XX.
- Margaron (Unio) valentinus* LEA, Syn., 1870, p. 52.
- Unio arduisianus* MOQUIN-TANDON, Hist. Moll. Fr., II, 1855, p. 575.
- Unio graellsianus* BOURGUIGNAT, Moll. Peu. Con., 1863, p. 47, pl. XXIII, figs. 4-7; Rev. et Mag., 1865, p. 345, pl. XIX, figs. 4-7.
- ? *Unio letourneuxi* BOURGUIGNAT, Mal. Alg., 1864, p. 289, pl. XVII, fig. 47.
- Unio courquinianus* BOURGUIGNAT, Moll. Peu. Con., 1863, p. 48; part, Rev. et Mag., 1865, p. 346, pl. XXII, figs. 1, 2.
- Unio siculus* SOWERBY, Conch. Icon., XVI, 1868, pl. LXXI, fig. 364.
- Unio alexandri* KOBELT, Icon., 1st sup., 1895, p. 14, pl. II, fig. 2.

A widely distributed circummediterranean form, which, though somewhat variable in minor characters, is reasonably constant. Of course every possible variation has received specific names and often a single form has been repeatedly named. It differs from *U. pictorum* and *U. tumidus*, its nearest allies, by being almost constantly somewhat rhomboid, the base line being almost straight. Usually the texture differs a little from that of either of those species but this difference is hard to describe in words. It is perhaps a little more smoky externally and the rest periods are usually more plainly marked. A careful comparison of material received since the Synopsis was written convinces me that the *Unio ravoisieri* of Deshayes is only a rather dark *U. turtoni*, which is not so rhomboid as the majority of specimens of that species.

Var. *moreleti* Deshayes.

Shell larger than the average manifestation of *U. turtoni*; epidermis brownish, dirty yellowish or yellow-green.

Length 86, height 37, diam. 22 mm.

Algiers.

Unio moreleti DESHAYES, Hist. Moll. Alg., 1848, pl. cix, figs. 1-4; pl. cxii, fig. 5.—KOBELT, Icon., new ser., II, 1886, p. 4, pl. xxxiii, fig. 228.

Margaron (Unio) moreleti LEA, Syn. 1870, p. 60.

? *Unio macCarthyanus* BOURGUIGNAT, Moll. Nonv. Litis., 1886, p. 220, pl. xxxiv, figs. 8-11.

Unio ravoisieri, (part), SIMPSON, Syn., 1900, p. 687.

I have seen two lots of shells bearing the name *Unio moreleti* from the Morelet collection; one from Orleansville, Algiers, is *U. turtoni* pure and simple, the other, a single shell from La Calle, Algiers, is much like Deshayes' figure of *moreleti* and is probably a variety of *turtoni*.

UNIO MUSSOLIANUS Kuster.

Shell oblong, elliptical, solid, subinflated or inflated, inequilateral; beaks full and elevated, their sculpture consisting of rather faint corrugated, somewhat doubly-looped ridges, but

it is sometimes reduced to a few nodules; posterior ridge faintly narrowly double ending behind in a feeble biangulation about on the median line; anterior end rounded, not angled above; surface smooth or slightly concentrically grooved, fuscous olivaceous or tawny, sometimes pale yellowish-green or greenish-yellow; the rest periods usually well marked, subshining; left valve with two subcompressed pseudocardinals and two laterals, the lower club-shaped; right valve with one pseudocardinal and a vestigial one above it, with one lateral; beak cavities not deep; nacre silvery-white, a little thicker in front; anterior scars deep.

Length 54, height 29, diam. 23 mm.

Length, 49, height 27, diam. 18 mm.

Length 79, height 44, diam. 33 mm.

Assyria.

Unio mussolianus KUSTER, Conch. Cab. Unio, 1861, p. 244, pl. LXXXII, fig. 1.—SIMPSON, Syn., 1900, p. 687.

Unio bourguignatianus, LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 189; Jl. Ac. N. Sci. Phila., VI, 1866, p. 54, pl. XVIII, fig. 51; Obs. XI, 1867, p. 55, pl. XVIII, fig. 51.—KOBELT, Icon., new ed., XVIII, 1912, p. 48, pl. DIV, fig. 2661.

Margaron (Unio) bourguignatianus LEA, Syn. 1870, p. 39.

Unio rasmus LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 189; Jl. Acad. N. Sci. Phila., VI, 1866, p. 50, pl. XVII, fig. 47; Obs. XI, 1867, p. 54, pl. XVII, fig. 47.—KOBELT, Icon., new ed., XVIII, 1912, p. 47, pl. DIII, fig. 2660.

Margaron (Unio) rasmus LEA, Syn., 1870, p. 58.

Unio mosulensis LEA, Pr. Acad. N. Sci. Phila., VII, 1863, p. 190; Jl. Acad. N. Sci. Phila., VI, 1866, p. 52, pl. XVII, fig. 49; Obs. XI, 1867, p. 56, pl. XVII, fig. 49.

Margaron (Unio) mosulensis LEA, Syn., 1870, p. 48.

Margaritana mosulensis PÆTEL, Conch. Sam., III, 1890, p. 173.

Unio mossulianus KOBELT, Icon., new ed., XVIII, 1912, p. 46, pl. DIII, fig. 2658.

I have united a number of nominal species under Kuster's name, which seems to be the oldest. His shell, as figured, ap-

pears a little more sulcate than most of the specimens I have seen, but it agrees otherwise in all the characters. The species is more solid, more inflated and less rhomboid than *U. turtoni*; it is shorter and more evenly elliptical than *U. pictorum* or *tumidus*.

UNIO MODIOLA Preston.

"Shell elongately oblong, somewhat curved, solid, covered with a chocolate coloured, laminiferous periostracum, both valves concentrically striate; umbones large, but not prominent, somewhat coarsely corrugate; dorsal margin slightly arched; ventral margin curvedly excavated in the median posterior region; anterior side somewhat produced, rounded above, sloping below; posterior side produced, rounded; cardinal teeth rather anteriorly situate, triangular, erect; lateral teeth anteriorly very short, posteriorly elongate and abruptly terminating; anterior adductor scars deeply impressed; posterior scars slight; interior of shell very slightly iridescent, sculptured with fine, irregular ridges somewhat resembling the marks of coarse finger prints.

Long. 45, lat. 86 mm." (Preston).

Type locality, River Tigris.

Unio modiola PRESTON, Rec. Ind. Mus., VII, 1912, p. 286, pl. VIII, figs. 1-2.

UNIO HUETI Bourguignat.

Shell almost evenly long elliptical, somewhat inflated, sub-solid, inequilateral; beaks slightly elevated, not full, their sculpture not known; posterior ridge low, rounded, ending behind in a rounded point just below the median line; anterior end rounded; base line slightly curved; surface decidedly concentrically sculptured; epidermis yellowish or fuscous green; pseudocardinals subcompressed, ragged; laterals long, slightly curved; anterior muscle scars deep.

Length 68, height 33, diam. 21 mm.

Upper Euphrates in the Pashalic of Ergeroum, Armenia, Asia Minor.

Unio hueti BOURGUIGNAT, Rev. et Mag., VII, 1855, p. 332, pl. VIII, fig. 1-4.—MARTENS, Vorderas. Conch., 1874, p. 35, pl. VII, fig. 54.—SIMPSON, Syn., 1900, p. 687.—KOBELT, Icon., new ed., XVIII, 1912, p. 49, pl. DIV, fig. 2662.

While this species is close to several others it does not seem to absolutely connect with them. Its almost evenly long elliptical form and the somewhat delicate but decided concentric sculpture separate it from *U. turtoni*, *U. tigridis* and *U. mussolianus*.

UNIO EUCIRRUS Bourguignat.

Shell almost regularly elliptical, scarcely subsolid, subcompressed, somewhat inequilateral; beaks but little raised, not inflated, sharp, their sculpture consisting of a double row of low nodules; posterior ridge low, somewhat double and ending behind in a faint biangulation on the median line; surface delicately concentrically sculptured, the posterior slope having apparently slight radial wrinkles; epidermis yellow; pseudocardinals almost lamellar; laterals very delicate and straight; nacre white.

Length 50, height 31, diam. 17 mm.

Asia Minor.

Unio eucirrus BOURGUIGNAT, Mag. Zool., IX, 1857, p. 20, pl. VIII, figs. 4-6.—KOBELT, Icon., VII, 1880, p. 82, pl. CCVI, fig. 2101.—SIMPSON, Syn., 1900, p. 688.

Margaron (Unio) eucirrus LEA, Syn., 1870, p. 46.

This has something the outline of *U. mussolianus*, but is much less inflated and is a thinner, more delicate shell. The pseudocardinals seem to be almost lamellar.

It is probably a form of *hueti*.

UNIO TIGRIDIS Bourguignat.

Shell somewhat wedge-shaped, being thicker, more inflated and higher in front than behind, solid, exceedingly inequilateral; beaks full and quite high, turned forward over a well marked lunule, their sculpture varying from a few small pustules to a number of broken, corrugated ridges, which show

a tendency to break into nodules; anterior end decidedly truncate and angled above in old shells, more nearly rounded in young ones; posterior ridge close to the dorsal line, ending behind in a point above the median line; post-basal part of the shell a little produced; surface almost smooth, having feeble growth lines; epidermis yellowish, greenish-yellow, tawny or brownish, usually showing the rest periods; left valve with two compressed, often united, pseudocardinals and two curved, lamellar laterals, the upper small; right valve with a single compressed pseudocardinal and one lateral; pseudocardinals somewhat reflexed; beak cavities moderately deep; nacre white, silvery, thicker in front; anterior scars very deep; posterior scars shallow.

Length 92, height 47, diam. 37 mm.

Asia Minor; Assyria.

Unio truncatus SWAINSON, Zool. Ill., 2d ser., I, 1829, pl. x.—

SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXV, fig. 453.

Margarita (Unio) truncatus LEA, Syn., 1836, p. 21; 1838, p. 18.

Margaron (Unio) truncatus LEA, Syn., 1852, p. 26; 1870, p. 39.

Unio tigridis BOURGUIGNAT, Test. Nov. Saul., 1852, p. 30; Cat.

Rais. Moll., 1853, p. 77, pl. IV, figs. 7-9.—KUSTER, Conch.

Cab. Unio, 1861, p. 227, pl. LXXVII, fig. 1.—KOBELT, Icon.,

new ser., II, 1886, p. 2, pl. XXXII, fig. 226.—SIMPSON, Syn.,

1900, p. 688.—KOBELT, Icon., new ed., XVIII, 1912, p. 62,

pl. DX, figs. 2683, 2684.

Unio dignatus LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 189;

Jl. Acad. N. Sci. Phila., VI, 1866, p. 51, pl. XVII, fig. 48;

Obs., XI, 1867, p. 55, pl. XVII, fig. 48.—KOBELT, Icon., new

ed., XVIII, 1912, p. 43, pl. DII, fig. 2654.

Margaron (Unio) dignatus LEA, Syn., 1870, p. 39.

Unio dignatus semiramidis KOBELT, Icon., new ed., XIX, 1912,

p. 11, pl. DXVII, fig. 2698.

Unio dignatus assuricus KOBELT, Icon., new ed., XIX, 1912,

p. 13, pl. DXVIII, fig. 2699.

Unio dignatus ninusi KOBELT, Icon., new ed., XIX, 1912, p.

13, pl. DXVIII, fig. 2700.

Margaron (Unio) tigris LEA, Syn., 1870, p. 39.

Unio kisonis KOBELT, Icon., 1st sup., 1895, p. 17, pl. VII, figs. 2, 3.

Unio ciconius KOBELT, Icon., new ed., XIX, 1912, p. 11, pl. DXVII, fig. 2697.

Unio medicus KOBELT, Icon., new ed., XIX, 1912, p. 17, pl. DXX, fig. 2707.

A fine species, which is remarkably inequilateral and in adult specimens is decidedly truncate in front, hence Swainson's name. It is more or less wedge-shaped whether viewed from above or from the side; it has a wide, well-marked lunule and very deep anterior scars.

As the name *Unio truncatus*, which was first applied to this species by Swainson had been previously used by Spengler for another *Unio* in 1793, it was necessary to discard this and I have applied Bourguignat's name, which was next applied to it. Lea's *Unio dignatus* agrees with Swainson's figure.

UNIO PIETRI Locard.

Shell somewhat wedge-shaped, inequilateral, convex or sub-inflated, solid; beaks full and high, placed at some little distance from the anterior end, their sculpture consisting of fine, irregular corrugations with two rows of nodules. Anterior end rounded but angled above; dorsal line nearly straight for some distance behind the beaks, joining the oblique post-dorsal truncation at an angle; posterior ridge full, rounded or slightly biangulate, ending behind below the median line in a point or a feeble biangulation; pseudocardinals subcompressed; laterals delicate and slightly curved; nacre white or pale rose.

The shell is nearly smooth or somewhat concentrically sulcated, and yellowish or yellow-green.

Length 50-77, height 28-31, diam. 20-22 mm.

Length 48, height 24, diam. 19 mm.

Asia Minor.

Unio pietri LOCARD, Comptes Rendus, XCI, 1880, p. 500; Arch. Mus. Lyon, III, 1883, p. 210, pl. XX, figs. 17-19.—SIMPSON, Syn., 1900, p. 688.

Unio petroi PÆTEI, Conch. Sam., III, 1890, p. 163.

- Unio lorteti* LOCARD, Comptes Rendus, XCI, 1880, p. 502; Arch. Mus., Lyon, III, 1883, p. 215, pl. XXI, figs. 7-12.
- Unio tristrami* LOCARD, Arch. Mus. Lyon, III, 1883, p. 209, pl. XX, figs. 15, 16.
- Unio tiberiadensis* LOCARD, Arch. Mus. Lyon, III, 1883, p. 216, pl. XXI, figs. 13-15.
- Unio prosacrus* LOCARD, Arch. Mus. Lyon, III, 1883, p. 219, pl. XXI, figs. 16, 17.—KOBELT, Icon., new ed., XVIII, 1912, p. 60, pl. DIX, figs. 2679-2681.
- Unio ariacus* LOCARD, Arch. Mus. Lyon, III, 1883, p. 242, pl. XX, figs. 20-23.
- Unio subtigridis* LOCARD, Arch. Mus. Lyon, III, 1883, p. 245, pl. XXI, figs. 18-20.—KOBELT, Icon., new ed., XVIII, 1912, p. 61, pl. DIX, fig. 2682.
- Unio aremprosthus* LOCARD, Arch. Mus. Lyon, III, 1883, p. 246, pl. XXI, figs. 21-23.
- Unio chantri* LOCARD, Arch. Mus. Lyon, III, 1883, p. 247, pl. XXII, figs. 1-7.

Locard may not have applied different specific names to every specimen he examined from the lakes Tiberias, Antioch and Honus, but he has evidently named nearly all of them, and given outline figures, which differ in some trivial detail. This form seems to differ from Bourguignat's old *U. terminalis* in not having the beaks quite so near the anterior end, in being angled at the upper anterior part and having an angle at the hinder end of the ligament from which it is obliquely truncated.

UNIO ZABULONICUS Locard.

Shell subrhomboid, inequilateral, solid, rather inflated; beaks full and high, their sculpture not observed; dorsal line somewhat curved, meeting the oblique truncation of the dorsal slope with a low angle; posterior ridge ending in a rounded point at the base of the shell; base line nearly straight; anterior end rounded, angled at its upper part; surface faintly, concentrically striate, smoothish, brilliant, yellowish inclining to burnt

brown or black at the extremities and beaks; pseudocardinals thick, subtriangular; laterals strong, short and curved; nacre white, rose-colored in the cavities.

Length 50, height 31, diam. 22 mm.

Lakes Tiberias and Antioch.

Unio sabulonicus LOCARD, Arch. Mus. Lyon, III, 1883, p. 220, pl. XXII, figs. 11-18.—SIMPSON, Syn., 1900, p. 689.—KOBELT, Icon., new ed., XVIII, 1912, p. 57, pl. DVIII, fig. 2675.

Unio antiochianus LOCARD, Arch. Mus. Lyon, III, 1883, p. 249, pl. XXII, figs. 14-16.

This seems to differ from allied species in being more rhomboidal, in its brilliant epidermis, and the peculiar color, yellowish in the middle of the shell and dark at the beaks and extremities. I cannot see the slightest reason why Locard should separate the form from Lake Antioch under another name,—the only difference which seems to exist between them being that *sabulonicus* is a little larger.

UNIO TERMINALIS Bourguignat.

Shell beautifully and almost exactly long elliptical, subinflated, subsolid, somewhat wedge-shaped when viewed from above; beaks full and somewhat elevated above the hinge line, their sculpture apparently a few fine, uneven corrugations; posterior ridge well developed but not elevated, rounded or feebly biangulate, placed near the dorsal line and ending behind near the median line; surface delicately concentrically striate; the posterior slope plicately wrinkled; epidermis pale yellowish-green, sometimes with one or two darker rays on the dorsal slope; left valve with two compressed pseudocardinals, which are often united and two delicate laterals; right valve with one pseudocardinal and one lateral; nacre bluish-white, subshining.

Length 50, height 28, diam. 19 mm.

Length 52, height 29, diam. 22 mm.

Length 54, height 27, diam. 22 mm.

Lake Tiberias.

Unio terminalis BOURGUIGNAT, Test. Noviss., 1852, p. 31; Cat. Rais. Moll. 1853, p. 76, pl. III, figs. 4-6; Jl. de Conch., IV, 1853, p. 74, pl. III, figs. 10' 10".—KOBELT, Icon., IV, 1876, p. 65, pl. CXIX, fig. 115.—SIMPSON, Syn., 1900, p. 689.

Margaron (Unio) terminalis LEA, Syn., 1870, p. 39.

This species is almost evenly long elliptical, being just a little more rounded on the dorsal than the ventral outline. The beaks are slightly nearer the anterior end than in the nearly allied *U. pictri* and it is not angled at the upper anterior part. This species has the post-dorsal slope wrinkled and in *pictri* there are occasionally traces of folds in this region.

UNIO GRELLOSIANUS Bourguignat.

Shell solid, nearly regularly ovate, inequilateral, inflated or subinflated; beaks somewhat full and elevated, their sculpture consisting of numerous subconcentric ridges that have a tendency to wear into nodules; posterior ridge subangular, placed near the dorsal line, ending behind in a decided point a little below the median line; surface finely, concentrically striate; epidermis yellowish-fulvous; pseudocardinals subcompressed; laterals slightly curved; anterior muscle scars deep; posterior scars triangular.

Length 30, height 18, diam. 15 mm.

Length 60, height 35, diam. 22 mm.

Jordan River.

Unio grelloisianus BOURGUIGNAT, Rev. et Mag., VIII, 1856, p. 227, pl. XI, figs. 1-4.—SIMPSON, Syn., 1900, p. 689.—KOBELT, Icon., new ed., XVIII, 1912, p. 58, pl. DVIII, fig. 2676.

Unio lunulifer BOURGUIGNAT, Rev. et Mag., VIII, 1856, p. 227, pl. XI, figs. 5-8.—KOBELT, Icon., new ed., XVIII, 1912, p. 57, pl. DVIII, fig. 2674.

Margaron (Unio) lunulifer LEA, Syn., 1870, p. 37.

Unio jordanicus BOURGUIGNAT, Rev. et Mag., VIII, 1856, p. 228, pl. X, figs. 1-4.—KOBELT, Icon., new ed., XVIII, 1912, p. 56, pl. DVIII, fig. 2673.

Margaron (Unio) jordanicus LEA, Syn., 1870, p. 44.

The only difference I can see between Bourguignat's *Unio grelloisianus* and his *jordanicus* is that the former is much smaller. The figure of the latter in the *Magazin* shows it to be nearly 28 mm. in diameter instead of 22 as Bourguignat states. Both have the same form, degree of inflation, solidity and sculpture and very similar teeth, and both are from the Jordan River.

UNIO ELLIPSOIDEUS Locard.

Shell subelliptical or suboval, rather solid, somewhat inflated, inequilateral; beaks elevated above the dorsal line, subinflated, their sculpture not observed; posterior ridge rounded, ending behind in a rather blunt point about on the median line; anterior end rounded, scarcely if at all angular above; base line evenly curved; surface with low, concentric ridges; epidermis brilliant, burnt-yellow, darker or greenish anteriorly, blackish behind; pseudocardinals ragged, subcompressed; laterals curved, delicate; nacre white, rose-color in the cavities.

Length 55, height 32, diam. 23 mm.

Lake Tiberias.

Unio ellipsoideus LOCARD, Arch. Mus. Lyon, III, 1883, p. 211, pl. XXI, figs. 1-3.—SIMPSON, Syn., 1900, p. 690.—KOBELT, Icon., new ed., XVIII, 1912, p. 59, pl. DIX, fig. 2677.

Unio genezarethanus LOCARD, Arch. Mus. Lyon., III, 1883, p. 213, pl. XXI, figs. 4-6.—KOBELT, Icon., new ed., XVIII, 1912, p. 59, pl. DIX, fig. 2678.

Unio jauberti LOCARD, Arch. Mus. Lyon., III, 1883, p. 248, pl. XXII, figs. 8-10.—KOBELT, Icon., new ed., XVIII, 1912, p. 54, pl. DVII, figs. 2670, 2671.

Unio sabulonicus KOBELT, Icon., new ser., VI, 1893, p. 96, pl. CLXXXIX, fig. 1129.

Unio lorteti KOBELT, Icon., 1st sup., 1895, p. 14, pl. v, fig. 3.

Unio kobelti ROLLE, Icon., 1st sup., 1895, p. 15, pl. VI, fig. 3.

Unio pictri KOBELT, (part), Icon., 1st sup., 1895, p. 16, pl. VI, figs. 1, 2.

Unio herodes KOBELT, Icon., 1st sup., 1895, p. 17, pl. VI, fig. 4.

I am very doubtful whether this is more than a mere variation of *U. pietri*. It is a little more nearly oval or elliptical and is nearly or quite destitute of the upper anterior angle.

UNIO DELICATUS Lea.

Shell almost evenly elliptical, convex, inequilateral, sub-solid, with rather high but not full beaks, their sculpture consisting of irregular, nodulous ridges, which have a tendency to be doubly looped, the sculpture extending well out on to the disk in the form of uneven nodules; posterior ridge low, rounded, ending at the median line in a blunt point; dorsal line nearly straight; anterior end a little narrowed and rounded; surface with delicate, uneven growth lines; epidermis pale greenish-yellow, with one or two faint rays on the post-dorsal slope; teeth delicate, the pseudocardinals compressed; nacre whitish.

Length 27, height 16, diam. 10 mm.

Orontes River, Syria.

Unio delicatus LEA, Pr. Acad. N. Sci. Phila., VII, 1863, p. 189.—Jl. Acad. N. Sci. Phila., VI, 1866, p. 58, pl. XIX, fig. 56.—Obs. XI, 1867, p. 62, pl. XIX, fig. 56.—SIMPSON, Syn., 1900, p. 690.—KOBELT, Icon., new ed., XVIII, 1912, p. 45, pl. DII, fig. 2657.

Margaron (Unio) delicatus LEA, Syn., 1870, p. 42.

This is no doubt a young shell and really ought not to have been described. It is quite likely that *U. ellipsoideus* is the adult of it. Its only decided character is the beak sculpture, which extends out on to the disk in the form of scattered, irregular nodules or granules.

Group of *Unio littoralis*.

Shell rather solid, subinflated, rounded rhomboid, with a faint posterior ridge, usually slightly biangulate behind, and often becoming arcuate when old; beaks prominent and full; beak sculpture consisting of numerous rather fine, subparallel ridges or corrugations, which are sometimes a good deal brok-

en up, and which extend well out on the disk, but begin at the beaks as normal, somewhat coarse *Unio* sculpture, sometimes with fine radial lines posteriorly; pseudocardinals, rather solid, subcompressed, smooth below; laterals straight or slightly curved; cavity of the beaks rather deep; muscle scars distinct.

I have never seen the soft parts of any member of this group. Quite a number of descriptions have been published of various nominal species, most of which go into details as to the color of the different parts, but do not give an atom of information as to real characters. The animal is dark or highly colored, and seems to be gravid in summer, and no doubt carries the young in the outer gills alone. Gills large, wider behind, inner the larger, especially in front; mantle thickened at the edges; palpi very large, elliptical, rounded behind, hanging at an angle of 45° ; branchial opening large, strongly fringed.

UNIO LITTORALIS Lamarck.

Shell generally subrhomboid, subsolid to solid, subcompressed to convex, somewhat inequilateral; beaks full and elevated, their sculpture consisting of numerous broken ridges, which have often a tendency to become doubly looped. This sculpture quite commonly assumes the appearance of a checkerboard and extends well out on to the disk; posterior ridge well developed, single or faintly double, ending behind near the base of the shell; surface rather rough, the incremental sculpture irregular, rarely feebly tuberculate; epidermis varying from dirty yellow-green in the young to black in old shells; in the lighter colored shells sometimes faintly rayed; left valve with two pseudocardinals, the anterior compressed, occasionally joining the triangular posterior one; right valve with one pseudocardinal, with sometimes a vestigial one in front of and behind it; sometimes the pseudocardinals are all heavy and much torn; there are two straight or curved laterals in the

left valve and one in the right; muscle scars well marked; beak cavities rather deep; nacre white, flesh-color or salmon-tinted, thicker in front.

Length 80, height 51, diam. 32 mm.

Length 63, height 46, diam. 26 mm.

Length 61, height 35, diam. 20 mm.

Southern Europe; Asia Minor; Assyria; Morocco; Algiers.

- Unio littoralis* LAMARCK, Syst. An. sans Vert., 1801, p. 114.—
 DRAPARNAUD, Hist. Moll. Fr., 1806, p. 135, pl. x, fig. 20.—
 DESHAYES, Enc. Method., II, 1827, p. 151, pl. CCXLVIII, fig. 2.—
 ROSSMASSLER, Icon., V, 1837, p. 21, pl. XXIV, fig. 340.—
 SOWERBY, Conch. Man., 1839, fig. 145.—GRAS, Moll. Isere.,
 1840, p. 72, pl. v, fig. 20.—HANLEY, Biv. Shells, 1843, p. 201,
 pl. XXI, fig. 13.—DUPUY, Hist. Moll. Fr., 1852, p. 632, pls.
 XXIII, fig. 8; XXIV, figs. 5, 6, 8.—ROSSMASSLER, Icon., III,
 1854, p. 37, pl. LXIX, fig. 850.—DROUET, Nay. Fr., II, 1857,
 p. 66, pl. III, figs. 1, 2.—REEVE, Conch. Icon., XVI, 1865, pl.
 XXII, fig. 98.—SIMPSON, Syn., 1900, p. 691.
- Unio littoralis* var. *minor* ROSSMASSLER (part), Icon., XI, 1842,
 p. 14, pl. LV, figs. 743, ? 747.
- Unio littoralis* var. *acarranicus* KOBELT, Icon., IV, 1879, p. 40,
 pl. CLXI, fig. 1638.
- Unio littoralis* var. *pianensis* KOBELT, Icon., IV, 1888, p. 43,
 pl. CLXIII, fig. 1648.
- Margarita (Unio) littoralis* LEA, Syn., 1836, p. 32; 1838, p. 22.
- Margaron (Unio) littoralis* LEA, Syn., 1852, p. 34; 1870, p. 54.
- Unio littoralis* var. *umbonatus* ROSSMASSLER, Icon., XII, 1844,
 p. 27, pl. LVI, fig. 754.
- Unio granosus* SCHUMACHER, Ess. Nouv. Syst., 1817, pl. II,
 fig. 1.
- Unio brevisialis* LAMARCK, An. sans Vert., VI, 1819, p. 73.
- Unio nana* LAMARCK, An. sans Vert., VI, 1819, p. 76.
- Unio rubens* MENKE, Syn., 1830, p. 149.—ROSSMASSLER, Icon.,
 V and VI, 1837, p. 56, pl. XXIX, fig. 412.
- Unio subtetragona* MICHAUD, Comp. Hist. Moll. Fr., 1831, p.

- Unio subtetragonus* DUPUY, Hist. Moll. Fr., 1852, p. 634, pl. XXIV, fig. 7.
- Unio incurtus* LEA, Tr. Am. Phil. Soc., IV, 1831, p. 97, pl. XIII, fig. 27; Obs., I, 1834, p. 107, pl. XIII, fig. 27.—CHENU, Ill. Conch. 1858, pl. XI, figs. 1, 1a, 1b.
- Unio draparnaldi* DESHAYES, Desc. Coq. Terr., 1831, p. 38, pl. XVI, fig. 6.
- Unio pianensis* FARINES, Ann des Sci. Nat., II, 1834, p. 118.—DUPUY, Hist. Moll. Fr., 1852, p. 635, pl. XXIV, fig. 4.
- Unio bigerrensis* MILLET, Guer. Mag., 1843, p. 3, pl. LXVI, fig. 1.
- Unio bigorrensis* LOCARD, Coq. de Franc., 1893, p. 153.
- Unio fellmani* DESHAYES, Hist. Nat. Moll. Alg., 1848, pl. CVIII, figs. 8, 9.—KUSTER, Conch. Cab., 1856, p. 151, pl. XLIV, fig. 1.
- Margaron (Unio) fellmani* LEA, Syn., 1870, p. 46.
- Unio barrandii* DUPUY, Hist. Moll. Fr., 1852, p. 635, pl. XXV, fig. 1.
- Unio astierianus* DUPUY, Hist. Moll. Fr., 1852, p. 636, pl. XXIII, fig. 9.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVI, fig. 461.
- Unio cuneatus* ROSSMASSLER, Icon., XIII and XIV, 1854, p. 37, pl. LXXIX, fig. 851.
- Unio rhomboideus* MOQUIN-TANDON, Moll. Terr. Fluv. Fr., II, 1855, p. 568, pl. XLVIII, figs. 4, 9; XLIX, figs. 1, 2.—BOURGUIGNAT, Mal. Alg., 1864, II, p. 284, pl. XVIII.—LOCARD, Coq. de Franc., 1893, p. 152, fig. 165.
- Unio rothi* BOURGUIGNAT, Moll. Nouv., 1863, p. 41, pl. XX, figs. 1-6; Rev. et Mag., XVII, 1865, p. 337, pl. XVI.—KOBELT, Icon., VI, 1879, p. 40, pl. CLXI, fig. 1639.
- Unio umbonatus* BOURGUIGNAT, Moll. Nouv., 1863, p. 42, pls. XXI, XVII; Rev. et Mag., XVII, 1865, p. 339, pls. XVII, XVIII.
- Unio subreniformis* BOURGUIGNAT, Moll. Nouv., 1863, p. 43.—KOBELT, Icon., IV, 1876, p. 64, pl. CXVIII, fig. 1151.
- Unio ater* REEVE, Conch. Icon., XVI, 1865, pl. XXI, fig. 19.
- Unio crassus* REEVE, Conch. Icon., XVI, 1865, pl. XXII, fig. 98.
- Unio valentinus* SOWERBY, Conch. Icon., XVI, 1866, pl. XII, fig. 225.

Unio mauritanicus BOURGUIGNAT, Moll. Nouv., 1868, p. 317, pl. XLV, figs. 1-5.—KOBELT, Icon., II, new ser., 1886, p. 5, pl. XXXIII, fig. 230.

Unio ksibianus MOUSSON, Mal. Blatt., XXI, 1873, p. 156; Jahrb. Deuts. Mal. Ges., I, 1874, p. 104, pl. v, fig. 6.—KOBELT, Icon., IV, new ser., 1876, p. 65, pl. CXIX, fig. 1153.

Unio jolyi KOBELT, Icon., new ser., II, 1886, p. 22, pl. XII, fig. 250.

Unio macCarthyanus KOBELT, Icon., new ser., II, 1886, p. 5, pl. XXXIII, fig. 229.

Unio letourneauuxi KOBELT, Icon., new ser., II, 1886, p. 3, pl. XXXII, fig. 227.

Unio lycicus ROLLE, Icon., 1st sup., 1895, p. 18, pl. II, fig. 1.

Considering the abundance of specimens of this species and its wide distribution, I do not think it a remarkably variable form. It is usually decidedly rhomboid, is subcompressed or convex but rarely subinflated. The lighter colored specimens, which are generally young, quite commonly show rays and there is sometimes a broad ray that covers the whole posterior end. The checker board pattern of beak sculpture is characteristic, sometimes spreading well out on the disk. I have seen no forms that seem to be worthy of varietal rank.

Lamarck refers this in the Animaux sans Vertebres first to his Systeme An. sans Vert., published in 1801, and thirdly to Draparnaud (Hist. Moll. Fr., 1806). Draparnaud published this species under the name *Unio littoralis* without a figure in the Tableau Mollusques de France, 1801, which appeared, according to Moquin-Tandon, about July 1 of that year. I do not know which has priority, but Lamarck refers to a characteristic figure in the Encyclopedia Methodique (1797), thus fixing the species without a doubt, and as he is most generally considered its author I shall credit it to him.

Hannibal, (Proc. Mal. Soc. London, X, 1912, p. 124), has made this species the type of a new genus, *Migranajas*, based on the characters of the beak sculpture and the hinge-teeth.

UNIO DELESSERTI Bourguignat.

Shell subrhomboid, rather short, inequilateral, subcompressed, apparently subsolid; beaks elevated a little above the dorsal line but not full, their surface rugose; posterior ridge widely double, ending behind near the base of the shell in a wide biangulation; surface densely, concentrically striated; epidermis yellow, faintly rayed with brown; pseudocardinals subcompressed, ragged; laterals nearly straight, lamellar; nacre reddish.

Length 49, height 32, diam. 17 mm.

Syria.

Unio delesserti BOURGUIGNAT., Voy. Mer. Mort., 1852, p. 77; Cat. Rais. Moll., 1853, p. 77, pl. III, figs. 7-9.—SIMPSON, Syn., 1900, p. 692.—KOBELT, Icon., new ed., XIX, 1912, p. 33, pl. DXXVII, fig. 2728.

Margaron (Unio) delesserti LEA, Syn., 1870, p. 46.

Extremely close to *U. durieui* apparently and probably only a variety of it. It is higher in proportion to the length than any specimens I have seen of that shell; it is more widely and distinctly biangulate behind and the nacre is reddish, a tint I have never seen in that species.

UNIO SEMIRUGATUS Lamarck.

Shell short, subrhomboid, convex to subinflated, somewhat inequilateral, solid; beaks full and high, their sculpture consisting of broken ridges often arranged in checker board pattern; sometimes they are slightly chevron-shaped or zigzagged; posterior ridge faint, rounded or rarely biangulate; surface usually rudely and unevenly sculptured by the growth lines; epidermis ashy, pale olive or yellowish-green and often rayed in the young, becoming dark brown in the old shells; left valve with two pseudocardinals, the anterior compressed, often joining the more solid posterior one, and two curved laterals; right valve with one pseudocardinal, with vestiges of one in front, and another behind and one lateral; beak cavities rather deep; muscle scars impressed; nacre whitish, some-

times tinted flesh-color or purplish, dirty, a little thicker in front.

Length 55, height 38, diam. 24 mm.

Length 43, height 33, diam. 19 mm.

Asia Minor.

Unio semirugatus LAMARCK, An. san. Vert., VI, 1819, p. 76.—

DELESSERT, Rec. Coq. Lam., 1841, pl. XII, figs. 6, 6a, 6b.—

SIMPSON, Syn., 1900, p. 693.

Unio emesaensis LEA, Pr. Acad. N. Sci. Phila., VIII, p. 286;

Jl. Acad. N. Sci. Phila., VI, 1868, p. 254, pl. XXX, fig. 68;

Obs., XII, 1869, p. 14, pl. XXX, fig. 68.—KOBELT, Icon., new ed., XVIII, 1912, p. 51, pl. DV, fig. 2666.

Margaron (Unio) emesaensis LEA, Syn., 1870, p. 57.

Unio simonis TRISTRAM, Pr. Zool. Soc. Lond., 1865, Pt. 2, p.

544.—LOCARD, Arch. Mus. Lyon, III, 1883, p. 239, pl. XX,

figs. 1-3.—KOBELT, Icon., new ser., VI, 1893, p. 91, pl.

CLXXVI, fig. 1121; first supp., 1895, p. 18, pl. III, figs. 1-3;

new ed., XIX, 1912, p. 18, pl. DXXI, fig. 2708.

Unio luynesi LOCARD, Arch. Mus. Lyon, III, 1883, p. 205.

Unio galilaei LOCARD, Arch. Mus. Lyon, III, 1883, p. 206, pl.

XX, figs. 10-12.—KOBELT, Icon., 1st. supp., 1895, p. 20, pl. VII,

figs. 4, 5.

Unio timius LOCARD, Arch. Mus. Lyon, III, 1883, p. 207, pl.

XX, figs. 13, 14; Moll. Lacs Tiberiade, p. 207, pl. XX, figs.

13, 14.—KOBELT, Icon., new ed., XIX, 1912, p. 29, pl. DXXIV,

fig. 2723.

Unio rhomboidopsis LOCARD, Arch. Mus. Lyon, III, 1883, p.

230, pl. XX, figs. 7-9.

Unio rollci KOBELT, Icon., 1st. supp., 1895, p. 20, pl. IV, figs. 1,

2.

Unio tracheæ KOBELT, Icon., 1st. supp., 1895, p. 21, pl. VIIA,

fig. 2.

Unio wagneri KOBELT, Icon., 1st. supp., 1895, p. 22, pl. VII,

figs. 1, 2.

Unio (Rhombunio) abrus KOBELT, Icon., new ed., XIX, 1912,

p. 10, pl. DXVI, fig. 2696.

- Unio (Rhombunio) halepensis* KOBELT, Icon., new ed., XIX, 1912, p. 20, pl. DXXI, figs. 2709-2711.
- Unio corbiculiformis* KOBELT, Icon., new ed., XIX, 1912, p. 22, pl. DXXII, fig. 2712.
- Unio (Rhombunio) babensis* KOBELT, Icon., new ed., XIX, 1912, p. 22, pl. DXXII, fig. 2713.
- Unio graeteri* KOBELT, Icon., new ed., XIX, 1912, p. 23, pl. DXXII, fig. 2714.
- Unio (Rhombunio) emesaensis* KOBELT, Icon., new ed., XIX, 1912, p. 24, pl. DXXIII, figs. 2715, 2716.
- Unio (Rhombunio) rhomboidopsis* KOBELT, Icon., new ed., XIX, 1912, p. 25, pl. DXXIII, fig. 2717.
- Unio (Rhombunio) naegelei* KOBELT, Icon., new ed., XIX, 1912, p. 25, pl. DXXIII, fig. 2718.
- Unio blanchianus* KOBELT, Icon., new ed., XIX, 1912, p. 27, pl. DXXIV, figs. 2719, 2720.
- Unio beroeus* KOBELT, Icon., new ed., XIX, 1912, p. 29, pl. DXXIV, fig. 2722.

This form seems to replace *U. littoralis* in Asia Minor. It is generally smaller than that species, less rhomboid and more inflated. Some specimens are almost suborbicular, though they preserve the tendency towards being rhomboid; others are almost as rhomboid as *littoralis*, but are, as a rule, shorter. Locard's figure of *U. simonis* in the Archives shows a slightly larger form than I have seen, and it is decidedly rhomboid. He may have known the reason for separating *U. rhomboidopsis* from this species, but I do not.

For this species, *U. rothi* Bgt., and *U. homsensis* Lea Germain, (Bull. Mus. Hist. Nat., 1911, p. 67), has recently proposed a new subgenus, *Rhombunio*, but without specifying the characters upon which it is based.

UNIO HOMSENSIS Lea.

Shell long rhomboid, subcompressed, solid, inequilateral; beaks somewhat elevated but not full, their sculpture not observed; posterior ridge full, widely rounded, ending behind near the base of the shell; dorsal line curved but ending in an angle behind at the oblique truncation of the posterior slope;

surface with moderate growth lines, covered with a thick, rather rough, dark brown or blackish, epidermis, which is inclined to peel off; left valve with two small stumpy, nearly smooth pseudocardinals and two low, club-shaped laterals, the upper small; right valve with one stumpy pseudocardinal and a vestigial one behind it, with a single club-shaped lateral; hinge plate rather wide; beak cavities deep, compressed; muscle scars deep, the anterior roughened; nacre rich purple, thickened in front.

Length 96, height 56, diam. 33 mm.

Length 70, height 41, diam. 24 mm.

Syria.

Unio homsensis LEA, Proc. Nat. Sci. Phila., VIII, 1864, p. 285; Jl. Acad. Nat. Sci. Phila., VI, 1868, p. 249, pl. XXIX, fig. 63; Obs. XII, 1869, p. 9, pl. XXIX, fig. 63.—SIMPSON, Syn., 1900, p. 693.—KOBELT, Icon., new ed., XVIII, 1912, p. 53, pl. DVI, fig. 2669.

Margaron (Unio) homsensis LEA, Syn., 1870, p. 31.

Two opposed valves of this species are all the material I have seen. In the smaller of these the posterior slope is slightly corrugated. It is more elongated than *U. littoralis*, and the nacre is a rich purple.

UNIO PSEUDONYMUS Simpson.

Shell irregularly subrhomboid, much inflated, solid, inequilateral; beaks high and full, with peculiar tuberculated sculpture; posterior ridge not well developed, rounded; posterior end subtruncated; anterior end cut away slightly below; dorsal and basal lines rounded; surface apparently having rather strong concentric sculpture, greenish-yellow, darker behind with a few narrow rays on the posterior half of the shell; ligament large; pseudocardinals solid, crenate; laterals elongated; muscular impressions distinct; nacre white, iridescent.

Length 75, height 42, diam. 34 mm.

Euphrates and Tigris rivers.

Unio hueti KOBELT, Icon., new ser., II, 1886, p. 22, pl. XLI, fig. 225.

Unio pseudonymus SIMPSON, Syn., 1900, p. 694.

Kobelt supposed this to be the *Unio hucti* of Bourguignat and figured and described it for that species. It is however, quite distinct from that and is apparently undescribed. It is greatly inflated, more so than any member of the group that I am acquainted with, is solid, and apparently has strong, concentric sculpture. It is rather remarkable in having the front half rayed and the hinder half rayless.

UNIO FERUSSACIANUS Lea.

Shell irregularly subelliptical or subtrapezoid, subsolid, convex, somewhat inequilateral; beaks somewhat elevated and full, pointed, sculptured with a large number of corrugated, more or less broken, ridges, which show a tendency to be doubly looped, the sculpture extending well out on to the disk; posterior ridge scarcely developed; dorsal line arched, ending behind in a feeble angle at the subtruncation of the posterior slope; base line nearly straight; anterior end evenly rounded and a little narrowed; surface finely concentrically striate, greenish-yellow, feebly rayed behind and showing dark brown rest periods: left valve with two high, compressed, sharp pseudocardinals and two straight laterals; left valve with a high, compressed lower pseudocardinal and a faint upper one with one somewhat double lateral; beak cavities moderately deep; nacre bluish-white, scarcely thicker above.

Length 48, height 31, diam. 19 mm.

Bagdad.

Unio ferussacianus LEA, Jl. Acad. Nat. Sci. Phila., VI, 1868, p. 255. Footnote to description of *U. emesaensis*.—LEA, Obs. XII, 1869, p. 15. Footnote.—SIMPSON, Syn., 1900, p. 694.

Margaron (Unio) ferussacianus LEA, Syn., 1870, p. 46.

This may be only a variety of *U. durieui*, but it is shorter, solidier and a little more inflated than that species. The greatest inflation is at the middle of the shell and from this point it is wedge-shaped in front and behind while *durieui* is almost evenly convex.

UNIO EPISCOPALIS Tristram.

Shell rather large, elongated, subquadrate, solid, subcompressed, somewhat inequilateral; beaks high but not very full, apparently sculptured with undulating plications; posterior ridge widely rounded, ending behind near the base; posterior end with a slightly oblique truncation above, rounded below; base line straight or a little incurved in the middle; surface decidedly concentrically sculptured; epidermis black; pseudo-cardinals high, thick, subacute; laterals strong, elongated; nacre brilliant purple; pallial sinus deep; anterior muscle scars deep; posterior scars well marked.

Length 90-100, height 50-60, diam. 30-35 mm.

Orontes and Leontes rivers, Syria.

Unio episcopalis TRISTRAM, Pr. Zool. Soc. Lond., 1865, p. 544.

—KOEHLT, Icon., VI, new ser., 1893, p. 89, pl. CLXXV, fig.

1119.—SIMPSON, Syn., 1900, p. 604.

Tristram calls this the prince of Oriental Unionidæ. It appears to be close to *U. homsensis*, but is much more squarely truncate behind and is more rounded at the post-basal termination.

UNIO DURIEUI Deshayes.

Shell oblong, subrhomboid, rarely almost elliptical, having the dorsal and basal lines nearly parallel, inequilateral, convex, subsolid; beaks only moderately full and elevated, their sculpture consisting of numerous broken, fine, corrugated ridges, which are sometimes more or less doubly looped and often arranged in imperfect zigzag patterns. This sculpture extends well out on to the disk, gradually changing to subnodulous concentric ridges and lower down into delicate but well-marked growth lines that are strongest on anterior end of the shell. Posterior ridge low, sometimes feebly double and ending at end below the median line in an ill-defined biangulation; epidermis yellowish or ashy-green to smoky-brown, often feebly rayed; left valve with two sub-compressed, ragged pseudo-cardinals and two nearly straight laterals; right valve with one

pseudocardinal, often with a vestigial one above it and one lateral; beak cavities not deep; nacre whitish, often somewhat silvery, a little thickened in front.

Length 63, height 35, diam. 21 mm.

Length 55, height 28, diam. 19 mm.

Length 51, height 31, diam. 19 mm.

Algiers; Tunis; Asia Minor; Assyria; Southeastern Europe.

Unio durieui DESHAYES, Hist. Nat. Moll. Alg. Atlas, 1847, pl. CIX, figs. 5-8.—BOURGUIGNAT, Moll. Alg., II, 1864, p. 288, pl. XIX, figs. 4-8.—SIMPSON, Syn., 1900, p. 694.

Margaron (Unio) durieui LEA, Syn., 1852, p. 39; 1870, p. 48.

Unio sitifensis MORELET, Jl. de Conch., II, 1851, p. 360.

Unio orientalis BOURGUIGNAT, Test. Noviss., 1852, p. 29.

Unio bruguierianus BOURGUIGNAT, Cat. Rais., 1853, p. 78, pl. II, figs. 54-58.—KOBELT, Icon., new ed., XIX, 1912, p. 39, pl. DXXX, fig. 2737.

Margaron (Unio) bruguierianus LEA, Syn., 1870, p. 44.

Unio vescoi BOURGUIGNAT, Rev. et Mag., VIII, 1856, p. 74, pl. II, figs. 4-8.—KOBELT, Icon., IV, 1876, p. 66, pl. CXIX, fig. 1154.

Margaron (Unio) vescoi LEA, Syn., 1870, p. 46.

Unio schwaerzenbachi BOURGUIGNAT, Rev. et Mag., VIII, 1856, p. 75, pl. VIII, figs. 1-5.—KUSTER, Conch. Cab. Unio, 1862, p. 266, pl. XC, fig. 2.—SOWERBY, Conch. Icon., XVI, 1868, pl. XLIV, fig. 241.—KOBELT, Icon., VII, 1880, p. 81, pl. CCVI, fig. 2099.

Unio prusii BOURGUIGNAT, Rev. et Mag., VIII, 1856, p. 76, pl. III, figs. 1-4.

Unio damascensis LEA, Pr. Acad. Nat. Sci. Phila., VII, 1863, p. 190; Jl. Acad. Nat. Sci. Phila., VI, 1866, p. 55, pl. XVIII, fig. 52; Obs. XI, 1869, p. 59, pl. XVIII, fig. 52.—KOBELT, Icon., new ed., XVIII, 1912, p. 45, pl. DII, fig. 2656.

Margaron (Unio) damascensis LEA, Syn., 1870, p. 52.

Unio orontesensis LEA, Pr. Acad. Nat. Sci. Phila., VII, 1863, p. 190; Jl. Acad. Nat. Sci. Phila., VI, 1866, p. 53, pl. XVIII, fig. 50; Obs. XI, p. 57, pl. XVIII, fig. 50.—KOBELT, Icon., new ed., XVIII, 1912, p. 45, pl. DIII, fig. 2659.

Margaron (Unio) orontesensis LEA, Syn., 1870, p. 52.

Unio orphaensis LEA, Pr. Acad. Nat. Sci. Phila., VIII, 1864, p. 285; Jl. Acad. Nat. Sci. Phila., VI, 1868, p. 250, pl. XXIX, fig. 64; Obs. XII, 1869, p. 10, pl. XXIX, fig. 64.—KOBELT, Icon., new ed., XVIII, 1912, p. 52, pl. DVI, figs. 2667, 2668.

Margaron (Unio) orphaensis LEA, Syn., 1870, p. 52.

Unio orfaensis KOBELT, Icon., new ed., XIX, 1912, p. 37, pl. DXXX, figs. 2734, 2735.

Unio (orfaensis var.?) chrmani KOBELT, Icon., new ed., XIX, 1912, p. 38, pl. DXXX, fig. 2736.

Unio mardinensis LEA, Pr. Acad. Nat. Sci. Phila., VIII, 1864, p. 286; Jl. Acad. Nat. Sci. Phila., VI, 1868, p. 252, pl. XXX, fig. 66; Obs. XII, 1869, p. 12, pl. XXX, fig. 66.—KOBELT, Icon., new ed., XVIII, 1912, p. 49, pl. DV, figs. 2663, 2664.

Deshayes' shell is a young specimen, which is straight on the base, but this figure agrees essentially with the shells of a considerable number of so-called species on the south shore and around the eastern end of the Mediterranean. There is some variation in dimensions and color but all agree well in the generally long, subrhomboid form, the sculpture, which is stronger anteriorly, the much broken and wide-spread beak sculpture, the teeth and the nacre.

Var. *kullethensis* Lea.

A little solidier and more inflated than the typical *U. durieui*. The anterior end is greenish-yellow; the posterior end is covered with almost coalescing green rays.

Length 53, height 30, diam. 20 mm.

Near Mardin in a tributary of the Tigris River.

Unio kullethensis LEA, Pr. Acad. Nat. Sci. Phila., VIII, 1864, p. 285; Jl. Acad. Nat. Sci. Phila., VI, 1868, p. 251, pl. XXIX, fig. 65; Obs. XII, 1869, p. 11, pl. XXIX, fig. 65.—KOBELT, Icon., new ed., XVIII, 1912, p. 50, pl. DV, fig. 2665.

Margaron (Unio) kullethensis LEA, Syn., 1870, p. 53.

Unio kallethensis and *kullinthisensis* PÆTEL, Conch. Sam., III, 1890, p. 156.

Unio durieui var. *kullethensis*, SIMPSON, Syn., 1900, p. 695.

UNIO SYRIACUS Lea.

Shell small, subrhomboid, inflated, subsolid, inequilateral; beaks slightly elevated above the dorsal line, not inflated, their sculpture not seen; posterior ridge very full, rounded; dorsal line slightly curved; basal line straight; anterior end rounded; posterior end obliquely subtruncated above, rather widely rounded below; surface with rather strong growth lines; epidermis yellowish-ashy, rather smooth; left valve with two small, subcompressed pseudocardinals and two laterals, the lower the larger; right valve with two pseudocardinals, the upper very small, and one lateral; nacre pale dirty salmon, rather soft and silvery, a little thicker in front; muscle scars small, well impressed.

Length 34, height 22, diam. 17 mm.

Orontes River, Syria.

Unio syriacus LEA, Pr. Acad. Nat. Sci. Phila., VII, 1863, p. 189; Jl. Acad. Nat. Sci. Phila., VI, 1866, p. 56, pl. XIX, fig. 53; Obs., XI, 1867, p. 60, pl. XIX, fig. 53.—SIMPSON, Syn., 1900, p. 695.—KOBELT, Icon., new ed., XVIII, 1912, p. 44, pl. DII, fig. 2655.

Margaron (Unio) syriacus LEA, Syn., 1870, p. 35.

A miserable little specimen with the umbonal and post-dorsal regions entirely eroded away, the type, is the only specimen I have seen. This is decidedly inflated, the greatest swelling being along the line of the very full posterior ridge, and from this it is wedge-shaped in front and behind.

UNIO BYTHINICUS Kobelt.

Shell long rhomboid, the dorsal and ventral lines nearly parallel, the anterior end rounded, the posterior subtruncate above, subcompressed, inequilateral, subsolid; beaks eroded badly in the specimen figured but not raised above the dorsal line and compressed; posterior ridge rounded and ending in a rounded point near the base of the shell; surface concentrically striate, unicolored, brownish-green; hinge rather delicate:

pseudocardinals compressed; laterals slightly curved; nacre bluish-white tinted with salmon, iridescent behind.

Length 57, height 27, diam. 17 mm.

Asia Minor.

Unio bythinicus KOBELT, Icon., new ser., VI, 1893, p. 96, pl. CLXXIX, fig. 1128.—SIMPSON, Syn., 1900, p. 695.

This may group with *U. pictorum*. It is an elongated rhomboid, compressed and unicolored species with no very striking characters.

UNIO MICELII Kobelt.

Shell oblong, subinflated, solid, inequilateral, with very high, rounded and rather full beaks, their sculpture not observed; posterior ridge well developed, rounded, extending towards the posterior base where the shell is widely rounded, above this it is obliquely truncated behind; dorsal line meeting this truncation with an angle; base line lightly incurved; surface strongly concentrically sulcate; epidermis brownish or blackish-olivaceous; pseudocardinals heavy; laterals low but solid; anterior muscle scars large and deep; posterior scars superficial; pallial lines strongly crenate; nacre rose-tinted.

Length 92, height 45, diam. 32 mm.

Tunis.

Unio micclii KOBELT, Nach. Mal. Ges., XVI, 1884, p. 182; Icon., new ser., II, 1886, p. 24, pl. XLIII, figs. 260, 261.—SIMPSON, Syn., 1900, p. 695.

This seems to be a very distinct species, being quite ponderous and having high, widely rounded beaks. The surface is rudely, concentrically sculptured and is a dark brown or blackish-olivaceous color without rays.

UNIO EMARGINATUS Lea.

Shell oblong, slightly arcuate, subrhomboid, subsolid, inequilateral, subcompressed; beaks slightly elevated above the dorsal outline, scarcely inflated, their sculpture apparently a number of broken corrugations that are inclined to be doubly looped; posterior ridge high, rounded above, somewhat dou-

ble below, ending behind at the median line and base in a wide, feeble biangulation; dorsal line irregularly curved; dorsal slope obliquely truncated; base line incurved; surface irregularly, concentrically sculptured; epidermis dirty greenish-yellow, the posterior part green; right valve with one sub-compressed pseudocardinal with a vestige of another above it and one granular lateral; muscle scars shallow; beak cavity not deep; nacre bluish-white, silvery, iridescent behind, thickened in front.

Length 73, height 33, diam. 22 mm.

Locality unknown. I have no doubt that it belongs somewhere in the circummediterranean region.

Unio emarginatus LEA, Tr. Am. Phila. Soc., V, 1834, p. 62, pl. IX, fig. 22; Obs., I, 1834, p. 174, pl. IX, fig. 22.—SIMPSON, Syn., 1900, p. 695.

Margarita (Unio) emarginatus LEA, Syn., 1838, p. 26.

Margaron (Unio) emarginatus LEA, Syn., 1852, p. 39; 1870, p. 62.

Lea's only shell, the type, consists of two opposite, odd valves. One of these may possibly be an elongated *bataeus*, the other appears distinct. This right valve is irregularly and rather strongly concentrically sculptured, it is decidedly arcuate; the front part of the shell is a dirty greenish-yellow while all that part behind the lower angle of the posterior ridge is dirty green. The beak is so eroded that the sculpture is not at all distinct, but it seems to have the character of members of the *littoralis* group.

UNIO CARNEUS Kuster.

Shell subrhomboid or subtrapezoidal, subcompressed to convex, subsolid or rather thin, quite inequilateral; beaks only lightly raised above the dorsal line, not inflated, their sculpture consisting of numerous, wavy, somewhat broken ridges; posterior ridge generally double, the upper angle ending behind on the median line, the lower reaching to about the base of the shell; dorsal line slightly curved, meeting the oblique truncation of the dorsal slope with an angle; posterior end

almost squarely truncated; base line nearly straight; anterior end narrowed and rounded; surface with strong, uneven incremental striæ; epidermis ashy-green, ashy or reddish-brown, dull; pseudocardinals compressed; laterals delicate; beak cavities not deep; muscle scars shallow; nacre flesh-colored, sometimes blue-tinted, a little thicker in front.

Length 56, height 30, diam. 18 mm.

Southern Europe.

Unio carneus KUSTER, Conch. Cab. Unio, 1854, p. 103, pl. XXVIII, figs. 1, 2.—SIMPSON, Syn., 1900, p. 696.

Unio gontierii BOURGUIGNAT, Rev. et Mag., IX, 1857, p. 16, pl. IV, figs. 1-4.

Margaron (Unio) gontieri LEA, Syn., 1870, p. 44.

Unio penchinatianus BOURGUIGNAT, Moll. Peu. Con., 1863, p. 44, pl. XXV; Rev. et Mag., XVII, 1865, p. 342, pl. XXI.—KOBELT, Icon., IV, 1876, p. 66, pl. CXIX, fig. 1155.

Close to forms of *U. batavus* and bearing about the same relation to it that *elongatulus* does to *pictorum*. It is less inflated, is thinner and rougher than *batavus* and is more decidedly widened and biangulate behind.

UNIO BATAVUS (Maton and Rackett).

Shell long elliptical, subrhomboid or when old slightly arcuate, subsolid to solid, convex to subinflated, inequilateral; beaks slightly elevated above the dorsal line and but moderately inflated, sculptured with numerous rather fine, corrugated, broken ridges; sometimes these ridges are somewhat doubly looped and subnodulous; posterior ridge low and rounded; surface with fine or uneven incremental lines, sometimes nearly smooth; epidermis yellowish-green or greenish-yellow, tawny, olive, brownish or almost black, often rayed, especially in the lighter colored examples; left valve with two small, subcompressed or stumpy pseudocardinals and two straight or faintly curved laterals; right valve generally having two pseudocardinals, the upper small, sometimes wanting, and one lateral; beak cavities not deep; muscle scars rounded, the anterior

impressed; posterior scars superficial; nacre bluish-white, white or flesh-tinted, a little iridescent behind, thickened in front.

Length 76, height 36, diam. 29 mm.

Length 70, height 38, diam. 24 mm.

Length 58, height 30, diam. 20 mm.

Europe; Asia Minor; Northwest Africa.

?*Mya pictorum* GMELIN, Syst. Nat., 13th ed., 1788, p. 3218.—

DONOVAN, Brit. Shells, V, 1803, pl. CLXXIV.—?CHENU, Bib.

Conch., 1st. ser., I, 1845, p. 114, pl. XLVII, figs. 8, 9.

Unio pictorum DRAPARNAUD, part, Hist. Moll. Fr., 1806, p. 131,

pl. XI, figs. 1-4.

?*Unio musicus* SPENGLER, Skriv. Selsk., III, 1793, p. 67.—

HAAS, Beil. z. Nachtr. D. Mal. Ges., No. 4, p. 62.

Unio crassus musicus ORTMANN, Ann. Car. Mus., VIII, 1912,

p. 275.

Unio musicus SIMPSON, Syn., 1900, p. 744.

Mya batava MATON and RACHETT, Tr. Linn. Soc. Lond., VIII,

1807, p. 37.—WOOD, Gen. Conch., I, 1815, p. 303, pl. XIX,

figs. 1, 2; Ind. Test., 1825, p. 12, pl. II, fig. 25*b*; rev. ed.,

1856, p. 15, pl. II, fig. 25.

Unio batava LAMARCK, An. sans Vert., VI, 1819, p. 78.—C.

PFEIFFER, Nat. L. and Suss. Moll., Pt. 1, 1821, p. 119, pl.

v, fig. 14.—DESHAYES, Enc. Meth., II, 1827, p. 151, pl.

CCXLVIII, fig. 3; II, 1830, p. 584, pl. CCXLVIII, fig. 3.

Mysca batava TURTON, Man. L. and F. W. Shells, Brit. Is.,

1831, p. xx, fig. 10.

Unio batavus NILSSON, Hist. Moll. Svec., 1822, p. 112.—ROSS-

MASSLER, Icon., II, 1835, p. 20, pl. VIII, figs. 128, 128*a*, 128*b*;

III, 1836, pp. 28, 32, pl. XIV, fig. 205; xv, fig. 214; V and

VI, 1837, p. 56, pl. XXIX, fig. 414; XI, 1842, p. 14; pl. IV,

fig. 745.—BROWN, L. and F. W. Conch., 1836, p. 111, pls.

xviii, figs. 6-8; XXI, figs. 10, 11; Ill. Recent Conch., 1844, p.

82, pl. XXXI, figs. 3, 3*a*, 4-6.—DUPUY, Hist. Moll. Fr., 1852,

p. 638, pl. XXV, figs. 14, 15.—KUSTER, Conch. Cab. Unio,

1854, p. 121, pl. XXXIII, figs. 4-7; XXXIV, figs. 1, 2.—MOQUIN-

TANDON, Moll. Terr. et Fluv. Fr., II, 1855, p. 571, pl. XLIX,

- figs. 7, 8.—DROUET, *Nay. Fr.*, II, 1857, p. 79, pl. VI, fig. 1.—BOURGUIGNAT, *Mal. Alg.*, 1864, p. 286, pls. XIX, fig. 9; XX, figs. 1-4.—SOWERBY, *Conch. Icon.*, XVI, 1866, pl. XLII, fig. 234.—BROT, *Coq. Fam. Nay. Lem.*, 1867, p. 49, pl. IX, figs. 1-5.—CLESSIN, *Deutsche Ex. Moll.*, 1876, 463, fig. 302.—SIMPSON, *Syn.*, 1900, p. 696.
- Margarita (Unio) batavus* LEA, *Syn.*, 1836, p. 26; 1838, p. 20.
- Margaron (Unio) batavus* LEA, *Syn.*, 1852, p. 30; 1870, p. 47.
- Unio batavi* var. ? ROSSMASSLER, *Icon.*, V and VI, 1837, p. 55, pl. XXIX, fig. 410.
- Unio riparia* C. PFEIFFER, *Nat. L. and S. Moll.*, 1821, pt. I, p. 118, pl. v, fig. 13.
- Unio riparius* SCHOLZ, *Schleis L. and W. Moll.*, 1843, p. 129.
- Unio crassus* NILSSON, *Hist. Moll. Svec.*, 1882, p. 108.—ROSSMASSLER, *Icon.*, II, 1835, p. 19, pl. VIII, figs. 126, 127; V and VI, 1837, p. 55, XXXIX, fig. 411.—MOQUIN-TANDON, *Moll. Terr. and Fluv. Fr.*, II, 1855, p. 570; III, pl. XLIX, figs. 3, 4.—NORDENSKIOLD and NYLANDER, *Fin. Moll.*, 1856, p. 84, pl. VI, fig. 72.—DROUET, *Nay. Fr.*, II, 1857, p. 76, pl. IV, fig. 2.—LOCARD, *Coq. de Fr.*, 1893, p. 162, fig. 176.—ORTMANN, *Ann. Car. Mus.*, VIII, 1912, p. 275.
- Unio crassus* variety *batavus* JORDAN, *Jahrb. Deuts. Mal. Ges.*, VI, 1879, p. 307.
- Unio ater* NILSSON, *Hist. Moll. Svec.*, 1822, p. 107.—ROSSMASSLER, *Icon.*, II, 1835, p. 23, pl. IX, fig. 133; VII and VIII, 1838, p. 41, pl. XL, fig. 543.—KUSTER, *Conch. Cab. Unio*, 1854, p. 114, pls. XXI, figs. 1, 2, 6; XXXII, figs. 1-4.—MOQUIN-TANDON, *Moll. Terr. et Fleuv. Fr.*, II, 1855, p. 570, pl. XLIX, figs. 5, 6.—DROUET, *Nay. Fr.*, II, 1857, p. 72, pl. IV, fig. 1.
- Unio atra* DESHAYES, *Encyc. Meth.*, II, 1830, p. 582.
- Unio rugatus* MENKE, *Syn. Moll.*, 1828, p. 90.—ROSSMASSLER, *Icon.*, V and VI, 1837, p. 65, pl. XXIX, fig. 415.
- Unio elongata* MICHAUD, *Comp. Hist. Moll. Fr.*, 1831, p. 113, pl. XVI, fig. 29.
- Unio labacensis* ROSSMASSLER, *Icon.*, II, 1835, p. 21.

- Unio decurvatus* ROSSMASSLER, Icon., II, 1835, p. 22, pls. IX, fig. 131; V and VI, 1837, p. 21, pl. XXIV, fig. 339.—KUSTER, Conch. Cab. Unio, 1856, p. 108, pl. XXX, figs. 1, 2.—MUSGRAVE, Phot. Conch., 1863, pl. II, fig. 4.—SOWERBY, Conch. Icon., XVI, 1867, pl. LVI, fig. 284.
- Unio reniformis* ROSSMASSLER, Icon., III, 1836, p. 31, pl. XV, fig. 213.—KUSTER, Conch. Cab. Unio, 1854, p. 110, pl. XXX, figs. 3, 4.—BOURGUIGNAT, Rev. et Mag., 1865, pl. XXIII, figs. 4-6.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXII, fig. 371.
- Unio carinthiacus* ROSSMASSLER, Icon., III, 1836, p. 30, pl. XV, fig. 209.—SOWERBY, Conch. Icon., XVI, 1856, pl. XXX, fig. 157.
- Unio amnicus* ROSSMASSLER, Icon., III, 1836, p. 31, pl. XV, fig. 212.—KUSTER, Conch. Cab. Unio, 1856, p. 99, pl. XXVII, fig. 2.—LOCARD, Coq. de Fr., 1893, p. 163, fig. 177.
- Unio piscinalis* ROSSMASSLER, Icon., III, 1836, p. 30, pl. XV, fig. 210.
- Unio atrovirens* ROSSMASSLER, Icon., III, 1836, p. 28, pl. XV, figs. 206, 207.
- Unio consentaneus* ROSSMASSLER, Icon., III, 1836, p. 29, pl. XV, fig. 208; VII, 1838, p. 25, pl. XXXV, fig. 491; p. 42, pl. XL, fig. 544; XI, 1842, p. 14, pl. LV, fig. 742.
- Unio fuscus* ROSSMASSLER, Icon., III, 1836, p. 30, pl. XV, fig. 211.—LOCARD, Coq. de Fr., 1893, p. 159, fig. 173.
- Unio?* ROSSMASSLER, Icon., III, 1836, p. 27, pl. XIV, fig. 201.
- Unio bandini* KUSTER, Icon., V and VI, 1837, p. 22, pl. XXIV, fig. 341.
- Unio glaucinus* PORRO, Mal. Como., 1838, p. 115.—STABILE, Faun. Lug., 1845, p. 61, pl. III, fig. 75.—KOBELT, Icon., new ser., II, 1886, p. 19, pl. XL, fig. 251.
- Unio gargotta* ROSSMASSLER, Icon., VII, 1838, p. 26, pl. XXXV, fig. 493.—MONTEROSATO, Nat. Sic., new ser., 1896, p. 6, fig. 1.
- ? *Unio corrugata* MANDUYT, Moll., Vienna, 1839, p. 8.
- ? *Unio rotundata* MANDUYT, Moll., Vien., 1839, p. 9.
- ? *Unio gangrenosus* SCHMIDT, Bull. Imp. N. H. Moscow, 1840, p. ?.—KUSTER, Conch. Cab. Unio., 1854, p. 124, pl. XXXIV, figs. 3, 4.

- Unio pruinus* SCHMIDT, Bull. Soc. Nat. Mosc., 1840, p. 445.
- Unio littoralis* var. *minor* ROSSMASSLER, part. Icon., XI, 1842, p. 14, pl. LV, fig. 744.
- Unio manca* MILLET, Guer. Mag., 1843, p. 4, pl. LXIV, fig. 2.
- Unio mancus* DUPUY, Hist. M. Fr., 1852, p. 642, pl. XXVI, fig. 17.—LOCARD, Coq. Fr., 1893, p. 156, fig. 170.
- Unio moquinianus* DUPUY, Moll. Gers., 1843, p. 80, pl.—ROSSMASSLER, Icon., XII, 1844, p. 31, pl. LIX, fig. 769.—KUSTER, Conch. Cab. Unio, 1854, p. 100, pl. XXVII, figs. 3, 4, 5.—DUPUY, Hist. Moll. Fr., 1852, p. 644, pl. XXVI, fig. 18.—MOQUIN-TANDON, Moll. Terr. and Fluv. Fr., 1855, p. 573, pl. 1, figs. 1, 2.—DROUET, Nay. Fr., II, 1857, p. 88, pl. VI, fig. 3.
- Unio sandri* ROSSMASSLER, Icon., XII, 1844, p. 26, pl. LVI, figs. 748-750.—KUSTER, Conch. Cab. Unio, 1856, p. 101, pl. XXVII, figs. 6, 7.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIX, fig. 413.
- ? *Unio aleroni* COMPANYO and MASSOT, Bull. Soc. Agr. Sc. Pyr. d'Or, VI, Pt. 2, 1845, p. 234, fig. 2.—KOBELT, Icon., IV, 1876, p. 64, pl. CXVIII, fig. 1150.
- Unio badius* KOEHL, Mich. Comp., 1831, pl. XVI, fig. 36.
- ? *Unio wolwichii* MORELET, Moll. Port., 1845, p. 105, pl. XIII, fig. 1.
- Unio jacquemini* DUPUY, Cat. Ext. Gall. Test., 1849, No. 328; Hist. M. Fr., 1852, p. 643, pl. XXV, fig. 17.—KOBELT, Icon., VI, 1879, p. 42, pl. CLXII, fig. 1641.
- Unio droueti* DUPUY, Cat. Ext. Gall. Test., 1849, No. 327; Hist. Moll. Fr., 1852, p. 639, pl. XXV, fig. 14.
- Unio philippi* DUPUY, Cat. Ext. Gall. Test., 1849, No. 335; Hist. M. Fr., 1852, p. 654, pl. XXVIII, fig. 19.
- Unio ovalis* DUPUY, Hist. Moll. Fr., 1852, p. 637, pl. XXV, fig. 13.
- Unio spinellii* VILLA, in Moll. Bres., 1852, p. 50, fig. D.
- Unio moulinsiana* DUPUY, Hist. Moll. Fr., VI, 1852, p. 640, pl. XXIV, fig. 10.
- ? *Unio petterianus* KUSTER, Conch. Cab., 1854, p. 97, pl. XXVII, fig. 4.
- Margaron (Unio) petterianus* LEA, Syn., 1870, p. 49.

Unio capigliolo KUSTER, part, Conch. Cab. Unio, 1854, p. 125, pl. XXXIV, figs. 5, 6.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXV, fig. 392.—DUPUY, Hist. Moll. Fr., 1852, p. 645, pl. XXVI, fig. 19.

Unio heldi KUSTER, Conch. Cab. Unio, 1854, p. 111, pl. XXX, figs. 5-7.

Unio luxurians KUSTER, Conch. Cab. Unio, 1854, p. 119, pl. XXXII, fig. 5.

Unio brevirostris KUSTER, Conch. Cab. Unio, 1854, p. 120, pl. XXXIII, figs. 1-3.

Unio natolicus KUSTER, Conch. Cab. Unio, 1856, p. 144, pl. XLII, fig. 4.

Unio turcicus KUSTER, Conch. Cab. Unio, 1862, p. 267, pl. xc, figs. 3, 4.

Unio merdiger REEVE, Conch. Icon., XVI, 1865, pl. XXVIII, fig. 145.

Var. *requieni* Rossmassler.

Shell small, rather solid, subrhomboid, considerably inflated. Length 45, height, 24, diam. 19 mm.

Unio requieni ROSSMASSLER, Icon., XII, 1844, p. 29, pl. LVII, figs. 757-761.—KUSTER, part, Conch. Cab. Unio, 1856, p. 126, pl. XXXVI, fig. 2.—MOQUIN-TANDON, Moll. Terr. et Fluv. Fr., II, 1855, p. 574, pl. I, figs. 5-7.—KOBELT, Icon., VI, 1879, p. 43, pl. CLXIII, fig. 1647.

Unio nanus DUPUY, Hist. Moll. Fr., 1852, p. 640, pl. XXV, fig. 16.—KOBELT, Icon., VI, 1879, p. 42, pl. CLXII, figs. 1642, 1643.—LOCARD, Coq. de Fr., 1893, p. 154, fig. 168.

Rossmassler figures a number of forms of *batacus* under the name *requieni*. One of these is a small variety that may bear the above name. The *Unio nanus* of Dupuy seems to equal it but, according to Dr. Lea, the original *Unio nana* of Lamarck is a small variety of *littoralis*.

Maton and Rackett do not figure their species, but refer to several figures. The first is in Ginanni, Opere Postume, 1755, pl. iv, fig. 17. This work I have not seen. The figures referred to in Schröter's Flussconchylien, in Chemnitz, and the Ency-

clopedie Methodique (pl. 248, fig. 3) are what we understand as *U. batavus*, the latter being the one cited by Lamarck.

Lamarck does not figure his species, but refers to pl. CCXLVIII, fig. 3, in the Encyclopedie Methodique, which is the species commonly known as *Unio batavus*.

This is a very abundant, widespread and variable form. Every shade of variation long ago received a specific name and all these have been renamed again and again by the members of the new school of conchology. The species has been repeatedly confounded with the much rarer *Margaritana crassa*, which is a larger, ruder and more arcuate form.

Ortmann, (l. c.), follows Thiele. (Suessw. Fauna Deutsch., 19, 1909, p. 35), in considering the *U. crassus* Retz. to be this species. He also follows Haas, (l. c.), in giving priority to *musicus* Speng. over *batavus* Lam. According to Haas, (l. c.), the *batava* of Maton and Rackett is not the same as Lamarck's species of that name, but is probably a form of *pictorum*, as this species is not found in England.

Section CAFFERIA Simpson, 1900.

Cafferia SIMPSON, Syn., 1900, p. 824.

Shell elongated or elliptical, rhomboid when old, solid; beaks full, the sculpture corrugated zigzag, the ridges often extending over the disk; epidermis yellowish-brown to nearly black, dull colored, somewhat sulcate; teeth rather strong; muscle scars deep, well defined.

Type, *Unio caffer* Krauss.

Since the publication of the Synopsis I have had the opportunity of examining gravid specimens of a member of this section and find that it is a *Unio*.

Group of *Unio caffer*.

Characters as in the section.

UNIO CAFFER KRAUSS.

Shell somewhat elongated, subrhomboid, the posterior point often drawn downward in old shells, solid, subinflated to inflated, inequilateral; beak sculpture zigzag, the beaks being

only moderately full; posterior ridge full, angled or narrowly rounded, sometimes partly double, ending below the median line; anterior end rounded; base line straight, incurved in old shells, usually full near the posterior end; dorsal line curved; dorsal slope curved or obliquely subtruncate; surface irregularly concentrically sculptured, the sculpture being sometimes broken, subnodulous or slightly zigzagged; epidermis dirty greenish-yellow or brown; hinge moderately solid; pseudocardinals rugose; laterals somewhat remote; muscle scars well impressed; nacre dirty or lurid, yellowish or lead-colored.

Length 67, height 34, diam. 25 mm.

Length 73, height 39, diam. 28 mm.

South Africa.

Unio caffer KRAUSS, Sud Af. Moll., 1848, p. 18, pl. I, fig. 14.

—KUSTER, part, Conch. Cab. Unio, 1856, p. 143, pl. XLII,

fig. 2.—HANLEY, Biv. Shells, 1856, p. 385, pl. XXI, fig. 40.—

SOWERBY, Conch. Icon., XVI, 1866, pl. XLI, fig. 226.

Margaron (Unio) caffer LEA, Syn., 1852, p. 32; 1870, p. 48.

Nodularia caffer SIMPSON, Syn., 1900, p. 825.

Cafferia caffra CONNOLLY, Ann. S. A. Mus., XI, 1912, p. 271.

Unio zeyheri MENKE, Zeitschr. Mal., 1848, V, p. 28.

Unio cyamus PHILIPPI, Zeitschr. Mal., V, 1851, p. 125.

Unio verreauxianus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p.

94; Obs., VI, 1857, p. 21, pl. XXVII, fig. 16; Jl. Ac. N. Sci.

Phila., III, 1858, p. 301, pl. XXVII, fig. 16.

Unio verreauxianus SOWERBY, Conch. Icon., XVI, 1868, pl. LXIX,

fig. 352.

Margaron (Unio) verreauxianus LEA, Syn., 1870, p. 36.

Unio verreauxi PÆTEL., Conch. Sam., III, 1890, p. 171.

Unio navigoliformis LEA, Pr. Ac. N. Sci. Phila., XI, 1859, p.

152; Jl. Ac. N. Sci. Phila., IV, 1860, p. 248, pl. XXXVII, fig.

124; Obs., VII, 1860, p. 63, pl. XXXVII, fig. 124.—REEVE,

Conch. Icon., XVI, 1865, pl. XXIV, fig. 114.

Margaron (Unio) navigoliformis LEA, Syn., 1870, p. 31.

Unio natalensis LEA, Pr. Ac. N. Sci. Phila., VIII, 1864, p. 113; Jl. Ac. N. Sci. Phila., VI, 1866, p. 59, pl. xx, fig. 57; Obs., XI, 1867, p. 63, pl. xx, fig. 57.—SOWERBY, Conch. Icon., -XVI, 1868, pl. LXXI, fig. 362.

Margaron (Unio) natalensis LEA, Syn., 1870, p. 32.

Unio rectilinearis SOWERBY, Conch. Icon., XVI, 1868, pl. LXV, fig. 332.

Var. *africanus* Lea.

Shell smaller than *U. caffer*, thinner, less inflated, with delicate, uneven, concentric sculpture, appearing almost smooth; umbonal region sometimes corrugated or having irregular, zigzag bars: epidermis lurid greenish or greenish-brown; nacre bluish, somewhat iridescent.

Length 45, height 22, diam. 14 mm.

South Africa.

Unio africanus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 94; Jl. Ac. N. Sci. Phila., III, 1857, p. 300, pl. xxvii, fig. 15; Obs., VI, 1857, p. 20, pl. xxvii, fig. 15.—REEVE, Conch. Icon., XVI, 1865, pl. xxii, fig. 100.

Margaron (Unio) africanus LEA, Syn., 1870, p. 48.

Nodularia caffer var. *africana* SIMPSON, Syn., 1900, p. 825.

Unio caffer KÜSTER, part, Conch. Cab. Unio, 1856, p. 143, pl. XLII, fig. 3.

Unio niloticus KÜSTER, Conch. Cab. Unio, 1856, p. 158, pl. XLV, fig. 5.

Var. *vaalensis* Chaper.

Shell smaller than the type, rather thinner, more compressed; beaks and umbonal region with zigzag sculpture, which changes with the later growth to granularly sulcate and finally plainly sulcate; epidermis dull, tawny greenish, or brownish.

Length 40, height 18, diam. 11 mm.

Vaal River, South Africa.

Unio vaalensis CHAPER, Bull. Soc. Zool. Fr., X, 1885, p. 480, pl. XI, figs. 1-3.

Nodularia caffer var. *vaalensis* SIMPSON, Syn., 1900, p. 825.

Var. *pentheri* Sturany.

"Dr. Penther collected in Panda ma tinka, which is next to the middle stream of the Zambezi River, two specimens of a *Unio*, which are most probably to be referred to *U. caffer*, but which differ from the type in shape and proportions, for which reason I shall mention them here under a distinct varietal name. For greater clearness I also give two figures, one of the left side and the other of the dorsal aspect.

The two shells measure respectively: length 51.5 and 57; height 26.5 and 28.5; diam. 18 and 18.5 mm.

The distance from the front and hinder ends is 13 : 38.5 in the smaller specimen and 14 : 43 mm. in the larger.

These proportions point to a near relationship with *U. natalensis* Lea, but that is also a synonym of *U. caffer* Krss., according to E. Smith." (Sturany).

Unio caffer var. *pentheri* Sturany, Denks. Math-Nat. Classe K.

Akad. Wissen., LXVII, 1898, p. 627, pl. III, figs. 64-65.

The above species is an abundant widespread, and variable one, and has consequently received a number of names. The variety *africanus* is much smaller and smoother than the type. *Unio zaalensis* Chaper, of which specimens from the type lot are before me, seems to be merely a small form, possibly young, in which the posterior point is not depressed. Lea's *Unio natalensis* is evidently a young *U. caffer*; his *verreauianus* is one of the adult forms.

Connolly (l. c.), on the authority of Haas refers both *zeyheri* and *cyamus* to this species.

UNIO TRAVERSII Pollonera.

"Shell olive-brown, somewhat shining, concentrically striate, pinkish within, rather thick, inflated, ovate-oblong, subrostrate; umbones anterior, obtuse, not prominent, eroded; anterior end rounded, narrow; posterior end elongated; with the dorsal margin, as far as the angle, slightly curved, thence obliquely curved; ventral margin slightly incurved behind the middle; area lanceolate; cardinal tooth in the right valve elongate,

rather stout, crenulate above; lateral tooth elongate, slightly curved, rugosely granulate posteriorly.

Length 52.5, height 26, diam. 18.5 mm." (Pollonera.)

Type locality, Hawash River, Shoa, Africa.

Unio traversii POLLONERA, Bull. Soc. Mal. It., XIII, 1888, p. 85, pl. III, figs. 14, 15.

Nodularia traversii SIMPSON, Syn., 1900, p. 825.

"This species belongs to the group of *U. dembeæ*, but differs from it very decidedly. Its shell, although not much superior to the latter in its greatest convexity, has however the appearance of being much more inflated and this comes from the fact that in the former the curvature of the valves continues regularly even to the margins, while in the *U. dembeæ* the valves are attenuated and flattened towards the margins. The greatest difference, however, is on account of the fact that the posterior part is more rostrated and the upper dorsal margin more curved, the ventral margin is more distinctly incurved, the lateral tooth is shorter and more curved and the area is larger.

It resembles also the *U. jickelii* Bourg., but may be distinguished from that species by the more anterior position of the beaks, the more pointed posterior end, the more curved dorsal margin and the more incurved ventral margin."

UNIO MASHONÆ Preston.

"Shell elongately ovate, rather tumid, covered with a dark blackish-brown periostracum, sculptured with somewhat coarse and irregular concentric striæ, angled posteriorly; umbones rather large, prominent though much eroded; dorsal margin nearly straight; ventral margin almost straight, but very slightly constricted towards the middle; anterior side rounded above, sloping below; posterior side produced, bluntly acuminate; anterior lateral teeth very short; posterior laterals long and coarse; cardinal teeth in right valve wedge-shaped, solid in left valve, broad, serrated; anterior adductor scar ovate, moderately deep; posterior adductor scar narrowly fan-shaped, well impressed; pallial impression coarse, nacreous, pinkish in colour; outer margins of interior of shell nacreous, bluish-white.

Long. 80; lat. 37.5 mm." (Preston.)

Type locality, A sluit about 16 miles from Eukeldoorn, Mashonaland.

Unio mashonæ PRESTON, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 61, pl. IV, fig. 10.

Cafferia mashonæ CONNOLLY, Ann. S. A. Mus., XI, 1912, p. 273.

"Very similar to *caffra*, from which it may be separable through the absence of the umbonal scar." (Connolly.)

UNIO JICKELI (Simpson).

Shell elongated, solid, inflated, very inequilateral, subrhomboid; beaks apparently neither full or high; anterior end rounded and somewhat truncated; dorsal and ventral outlines nearly straight and parallel, the latter slightly full toward the hinder end; posterior slope having a long, oblique truncation; posterior ridge full, rounded or feebly biangulate, ending below the median line in a faint, narrow biangulation, surface concentrically sulcated; epidermis fuscous-olive; teeth strong; pseudocardinals short and ragged; muscle scars impressed; nacre bluish-white, iridescent.

Length 80, height 30.75, diam. 23.5 mm.

Northeast Africa.

? *Unio teretiusculus* JICKELI, Faun. Moll., N. O. Af., 1874, p. 276, pl. XI, figs. 3, 3a, 3b.

Nodularia jickeli SIMPSON, Syn., 1900, p. 826.

Unio fourtaui PALLARY, Bull. Inst. Egypt, III, 1902, p. 95.

Jickeli figures the above and refers it to *Unio teretiusculus* of Philippi with a question. I am sure that it is not that species at all, but a larger form with much less inflated umbones, solid structure, more decided concentric sculpture and stronger, more ragged pseudocardinals. Jickeli figures the true *teretiusculus* as I understand it.

UNIO ACUMINATUS H. Adams.

Shell somewhat elongated, decidedly rhomboid, inequilateral, subinflated, apparently subsolid, beaks full with strong, nodulous, zigzag sculpture, which extends out on to the disk;

anterior end rounded or subtruncate; base line straight or nearly so; hinge line lightly curved; dorsal slope with a long, decided, oblique truncation; posterior ridge very full, narrowly rounded, ending at or near the base in a blunt point; surface generally having light, concentric growth lines, those becoming stronger and somewhat broken at the anterior end; epidermis yellowish-green; teeth rather delicate; pseudocardinals subcompressed; nacre whitish, iridescent.

Length 29, height 15, diam. 10 mm.

Lake Albert Nyanza.

Unio acuminatus H. ADAMS, Pr. Zool. Soc. Lond., 1866, p. 376.—SMITH, Ann. and Mag., X, 1892, p. 127, pl. XII, fig. 12.—VON MARTENS, Besch. Deuts. Ost. Af., 1897, p. 227, pl. VII, figs. 11, 12.

Nodularia acuminata SIMPSON, Syn., 1900, p. 826.

Distinguished by its decidedly rhomboid form, the high, narrowly rounded posterior ridge and the strong, zigzag, nodulous beak sculpture that extends out on to the disk.

UNIO DEMBEÆ Reeve.

Shell somewhat elongated, subrhomboid or subelliptical, subinflated, solid, inequilateral; beaks moderately full and high; posterior ridge full, more or less double, ending behind in a biangulation at and below the median line; dorsal outline irregularly curved; anterior end rounded, slightly angled above; base line lightly curved; posterior slope obliquely subtruncated; surface with light concentric sculpture; dorsal slope with a few feeble plications; epidermis fulvous-olive, tinged and rayed with green; teeth moderately strong, subcompressed; muscle scars deep; nacre pale flesh-color.

Length 66, height 32.75, diam. 21.5 mm.

Length 59, height 29, diam. 19.5 mm.

Abyssinia.

Unio dembeæ REEVE, Conch. Icon., XVI, 1865, pl. XXIX, fig. 153.—JICKELL, Faun. Moll. Af. 1874, p. 275, pl. IX, figs. 3-4.
Nodularia dembeæ SIMPSON, Syn., 1900, p. 826.

Reeve's description is very brief and his figure does not look like any of the African species I am acquainted with. Jickeli's figures are probably more accurate and represent a shell looking something like a short *Unio pictorum*, to which Reeve likens his shell.

UNIO LOURDELI Bourguignat.

Shell small, somewhat elongated, inflated, rhomboid, inequilateral, with the greatest diameter behind the middle; beaks only moderately full, their sculpture apparently zigzag radial or corrugated; dorsal line a little curved; anterior end rounded; base straight or incurved in old specimens; dorsal slope obliquely truncated or having a curved outline; posterior ridge full, rounded, ending at the base of the shell; surface concentrically sculptured; epidermis greenish-brown; nacre reddish or bluish-white.

Length 31, height 16, diam. 12 mm.

Victoria Nyanza Lake.

Unio lourdeli BOURGUIGNAT, Bull. Soc. Mal. Fr., IV, 1887, p. 271.—SMITH, Ann. and Mag., X, 1892, p. 128, pl. XII, figs. 13-14.

Nodularia lourdeli SIMPSON, Syn., 1900, p. 826.

I have never seen this species but from the figures given by Smith it seems to be closely allied to *U. acuminatus*. It is smaller than that species and has stronger and rougher concentric sculpture.

Var. *smithi* Germain.

"Dr. E. A. Smith has figured a beautiful variety of this species characterized, especially, by its obliquely convex posterior margin and very sinuous ventral margin. I give this shell the name of variety *smithi*." (Germain.)

Unio lourdeli (part). SMITH, Ann. Mag. Nat. Hist. (6), X, 1892, p. 128, pl. XII, fig. 15.

Unio lourdeli var. *smithi* GERMAIN, Bull. Mus. Hist. Nat. 1906, p. 306.

UNIO ABYSSINICUS von Martens.

Shell solid, irregularly ovate or subtriangular, inflated, inequilateral; beaks full and high, sculptured with a few small tubercles; hinge line curved; anterior end rounded; base line evenly curved, full at or behind the middle in young shells, becoming nearly straight in old ones; posterior ridge full, slightly double below, ending below the median line in a narrow, faint biangulation; surface lightly, concentrically sculptured, the anterior part roughened, the dorsal slope with a few broken plications; epidermis olive-yellow, with obscure bands; pseudo-cardinals strong, multisulcate; laterals solid; nacre flesh-colored.

Length (adult) 70, height 43, diam. 32 mm.

Length (young) 56.5, height 38.5, diam. 28 mm.

Frana Lake, Abyssinia.

Unio abyssinicus VON MARTENS, Mal. Bl., XIII, 1866, p. 102.—

JICKELI, Faun. Moll. N. O. Af., 1874, p. 278, pl. IX, fig. 5; pl. X, fig. 10.

Nodularia abyssinica SIMPSON, Syn. 1900, p. 826.

A decidedly heavy shell, which appears to be close to *U. dembeæ* but is shorter, more solid and somewhat triangular. In the young shells the base is well rounded and the general outline is at most regularly oval, but the base line becomes almost straight with age and it is quite probable that very old shells may have the posterior point drawn down a little. Jickeli refers this species to *Unio habessinicus* Henglin, in *Reise nach Abess.*, p. 290. This publication is not accessible to me and I do not know whether this is a mere *nomen nudum* or if it be accompanied with a description. von Martens describes it as a new species in the *Mal. Blätter* under the name of *abyssinicus*.

UNIO MONCETI Bourguignat.

Shell somewhat elongated, rhomboid, inflated, subsolid, quite inequilateral; beaks only moderately full, with strong zigzag sculpture; surface rather strongly concentrically sculptured; posterior ridge full, narrowly rounded, curved, ending

in a blunt point near the base; dorsal and basal outlines nearly straight, parallel; anterior end rounded, cut away a little below; posterior end obliquely subtruncate; epidermis greenish-chestnut; muscle scars well marked; teeth rather delicate; nacre reddish.

Length 22, height 10, diam. 8 mm.

Lake Victoria, Nyanza.

Unio monceti BOURGUIGNAT, Moll. Ny. Ouk., 1883, p. 15, figs 13-15.

Parreysia monceti SIMPSON, Syn., 1900, p. 848.

A considerably elongated, inflated, sulcate species, whose position is somewhat doubtful. It may be closely related to *Unio caffer*. I have never seen it.

UNIO DIMINUTUS Lea.

Shell rather small, subcompressed, subsolid, inequilateral, subrhomboid; beaks small, sharp, somewhat elevated, sculptured with zigzag radial ridges, this sculpture extending well out over the disk and gradually changing into concentric ridges; dorsal outline curved; anterior end rounded; base nearly straight to behind the middle where it is full; outline of dorsal slope obliquely curved; posterior ridge only moderately full, faintly double, ending at and below the median line in a slight biangulation; epidermis straw-yellow, rayless; teeth somewhat compressed; nacre pale, satin-like, iridescent, salmon-tinted.

Length 33, height 20, diam. 10 mm.

East Africa.

Unio diminutis LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 151.

Unio diminutus LEA, Jl. Ac. N. Sci. Phila., IV, 1860, p. 254, pl. XXXIX, fig. 134; Obs. VII, 1860, p. 72, pl. XXXIX, fig. 134.

—REEVE, Conch. Icon., XVI, 1865, pl. XXVIII, fig. 141.

Margaron (Unio) diminutus LEA, Syn., 1870, p. 31.

Nodularia diminuta SIMPSON, Syn., 1900, p. 826.

Unio graciosus PÆTEL, Conch. Sam., III, 1890, p. 154.

A rather short, subrhomboid, somewhat compressed species, quite strongly sculptured. It is something like *U. vaalensis*

or young *caffer*, but is higher in proportion to its length and is not inflated.

The following unfigured species is said to belong here:

Unio mandinguorum ROCHEBRUNE, Bull. Soc. Phil., 7th ser., VI, 1882, p. 34.

Bakoy, Upper Senegal.

Group of *Unio fissidens*.

Shell solid, compressed, subelliptical to subrhomboid, with rather full beaks, which have radiate, corrugate sculpture extending out on the disk as wavy sulcations, and changing near the edge to plain sulcations; posterior ridge low, rounded; hinge strong; right valve with two pseudocardinals, the lower the larger, showing a tendency to split up, and having a gape in the plate behind, and having one lateral; two pseudocardinals in the left, somewhat split, and two laterals; muscle scars deep, distinct.

UNIO FISSIDENS Böttger.

Shell subrhomboid, a little higher in front, inflated, solid and strong, inequilateral: beaks considerably elevated, almost pointed, their sculpture consisting of rugose, wavy or zigzag bars, which gradually change farther down on the disk to strong, concentric ridges; anterior end rounded; base nearly straight; dorsal line behind the beaks very slightly curved, rounding into the obliquely subtruncate posterior slope; posterior ridge rounded, ending in a rounded point near the base; pseudocardinals of the left valve split up into several radial denticles, those of the right divided into three, with a triangular pit behind them; laterals strong, nearly straight; muscle scars deep.

Length 53-58, height 28.5-33, diam. 20-28 mm.

Kalahari Desert. Southwest Africa.

Unio (Hyridella) fissidens BÖTTGER, Ber. Senck. Ges., 1886, p. 27, pl. II, figs. 6a, 6b, 7a, 7b.

Unio fissidens CONNOLLY, Ann. S. A. Mus., XI, 1912, p. 274.

Nodularia fissidens SIMPSON, Syn., 1900, p. 827.

This appears to be a very solid species with rather sharply elevated beaks, the shell being higher in front than behind. It is strongly and irregularly concentrically sculptured, has heavy, split-up pseudocardinals, with a deep triangular pit behind those of the right valve. I am somewhat uncertain as to the generic position of this and the next species, never having seen the shells and knowing nothing of the anatomy, but from the description and figures I am inclined to think them most nearly related to *U. caffer*.

UNIO HYGAPANUS Böttger.

Shell somewhat elongated, subrhomboid, subcompressed, solid, inequilateral; beaks high, rather sharp, indistinctly undulate; anterior end rounded; base line nearly straight; hinge line lightly curved, rounding into an oblique posterior subtruncation; posterior ridge rounded, ending in a blunt point almost at the base of the shell; surface strongly concentrically sculptured; left valve with two pseudocardinals, the anterior elongated and curved, crenulate; muscle scars small, the anterior ones double, deep.

Length 54, height 26.5 mm.

Kalahari Desert.

Unio (Hyridella) hygapanus BÖTTGER, Ber. Senck. Ges., 1886, p. 26, pl. II, figs. 5a, 5b.

Nodularia hygapanus SIMPSON, Syn., 1900, p. 827.

Unio hygapanus CONNOLLY, Ann. S. A. Mus., XI, 1912, p. 274.

Apparently nearly related to *U. fissidens*, but rather more elongated, less inflated and having pseudocardinals less split up.

"Described from a single left valve; possibly only a less highly sculptured form of *fissidens*." (Connolly.)

Group of *Unio kunenensis*.

Shell elliptical, subinflated, solid, narrowly biangulate behind, the point of the shell being about midway up the height, the post-base inflated; beaks full, eroded in the specimen figured, but no doubt zigzag sculptured; whole surface of the shell covered with wavy corrugations; epidermis brownish; one

rather solid pseudocardinal in the right valve, deeply incised, two in the left; nacre yellowish-white; muscle scars deep. Animal unknown.

UNIO KUNENENSIS MOUSSON.

Shell irregularly elliptical or subovate, inequilateral, subinflated, solid; beaks moderately full and elevated; posterior ridge somewhat double, ending behind about on the median line in a distinct biangulation; dorsal outline curved; anterior end rounded; base straight to behind the middle where it is angled and obliquely truncated to the posterior end; dorsal slope obliquely truncated; surface covered with irregular, somewhat granulose, concentric sculpture, which in places becomes zigzagged; epidermis apparently brownish; teeth rather strong; nacre bluish-white, salmon-tinted in the cavities; anterior muscle scars deep.

Length 38, height 25, diam. 23 mm.

Head of Kunene River, North Ovampo, Southwest Africa. *Unio kunenensis* MOUSSON, Jl. de Conch., XXXV, 1887, p. 300, pl. XII, fig. 10.

Nodularia kunenensis SIMPSON, Syn., 1900, p. 824.

The distinct posterior biangulation, and the peculiar sculpture varying from granulous concentric to zigzag will distinguish this species from others. The statement made by Mousson that the length of this shell is 28 millimeters is no doubt an error, as the figure shows it to be 38.

Section ELLIPTIO Rafinesque, 1819.

Elliptio RAFINESQUE, J. de Phys., Chimie, Hist. Nat., LXXXVIII, 1819, p. 426.—ORTMANN, Ann. Car. Mus. VIII, 1912, p. 265.

Shell elongated, rhomboid or oval, usually more or less biangulate behind; beak sculpture consisting of a few rather strong ridges, which are nearly parallel to the growth lines or slightly doubly looped; the surface smooth or feebly corrugated.

Type, *Unio crassidens* Lamarck.

Ortmann, (l. c.), raises this group to generic rank.

Group of *Unio coloratus*.

Shell somewhat rhomboid, solid, slightly biangulate behind, rather compressed, more or less sculptured with concentric sulcations; beaks moderately prominent, their sculpture unknown; epidermis brownish; teeth strong; laterals rather club-shaped; nacre white or purple. Animal unknown.

UNIO COLORATUS Charpentier.

Shell subrhomboid, convex, solid, densely sculptured with fine striations; epidermis brownish-olive; beaks rather full, posterior ridge moderate, scarcely double, ending in a feeble biangulation near the base; pseudocardinals thick, serrated; nacre dark purple, shining.

Medellin River, Vera Cruz, Mexico.

Unio coloratus CHARPENTIER, in Kuster, Conch. Cab. Unio, 1856, p. 155, pl. XLIV, fig. 6.—SIMPSON, Syn., 1900, p. 700.

Unio cuprinus var. *coloratus*, VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 506.

I am strongly inclined to believe that this and Lea's *Unio callosus* are identical. The figures show Charpentier's shell to be a little straighter than Lea's on the base, otherwise the outlines and figures agree very closely. Both authors claim that their shells are compressed, but the outline figures of dorsal views show them to be quite convex. Lea's shell has white nacre while that of Charpentier's is dark purple, but this is often a difference of no importance, for the same thing occurs in *Unio complanatus*, *U. buckleyi*, *Tritogonia tuberculata* and many other species. I have seen a single specimen belonging to Mr. Berlin H. Wright, which I was inclined to refer to this species, though it did not fully agree with the description and figure.

UNIO CALLOSUS Lea.

Shell rhomboid elliptical, convex, solid, inequilateral with a moderate, feebly biangulate posterior ridge, which terminates behind a short distance above the basal line; beaks somewhat prominent but eroded in the type; epidermis yellowish-brown.

darker and wrinkled on the posterior slope; pseudocardinals small, double in both valves; laterals heavy, long, and curved; muscle scars rather deep; beak cavities small and angular; nacre white and iridescent.

Length 57, height 35, diam. 23 mm.

Said to come from the Ohio Canal below Columbus. I am sure that the locality is wrong, and it appears to be a Mexican form.

Unio callosus LEA, Pr. Am. Phil. Soc. II, 1841, p. 31; Tr. Am. Phil. Soc., VIII, 1842, p. 239, pl. XXIII, fig. 54; Obs. III, 1842, p. 77, pl. XXIII, fig. 54.—CHENU, Ill. Conch., 1858, pl. XXVI, figs. 4, 4a, 4b.—SIMPSON, Syn., 1900, p. 701.

Margaron (Unio) callosus LEA, Syn., 1852, p. 33; 1870, p. 33.

I cannot believe it possible that the shell Lea described, which belonged to Dr. Jay, came from the Ohio Canal 12 miles below Columbus. The region around Columbus, Ohio, has been as thoroughly collected out perhaps as any in the United States and nothing like this shell has ever been found there so far as I know. It seems to me to be very closely allied to *U. coloratus* Charpentier, if not absolutely identical with it, and it is in all probability a Mexican species.

UNIO MEXICANUS Philippi.

Shell rhomboid, rather solid subinflated, its greatest diameter being considerably behind the beaks, with a rather strong rounded posterior ridge; beaks high, somewhat full, their sculpture not observed; epidermis fuscous; pseudocardinals strong; laterals elongated, nearly straight; nacre purple and shining.

Length 64, height 37, diam. 23 mm.

Mexico.

Unio mexicanus PHILIPPI, Zeits. für Mal., IV, 1847, p. 95.—PHILIPPI, Abbild. und Beschr., III, 1849, p. 110, pl. VI, fig. 3.—KUSTER, Conch. Cab. Unio, 1862, p. 285, pl. xcv, fig. 7.—SIMPSON, Syn., 1900, p. 701.

Margaron (Unio) mexicanus LEA, Syn., 1870, p. 53.

Philippi gives a miserable colored figure of this species, which is so blurred that it is almost useless for purposes of

identification, while his brief Latin description helps out but little. Kuster copies his figure, but adds nothing to our knowledge of the species. In the Lea collection there is a single, rather young shell, which was received from Wheatley which is labeled "*Unio mexicanus* Philippi, Mexico," and it may be Philippi's species. It is rather more inflated in front than behind, is not quite so decidedly obliquely truncate behind as the figures of *mexicanus* show it to be, but it has a brown epidermis, and pale violet nacre. It may be a young *opacatus*.

Group of *Unio semigranosus*.

Shell triangular rhomboid, solid, inflated, with a distinct posterior ridge; beaks rather full, their sculpture consisting of numerous somewhat irregular corrugations, which pass into the pustulous sculpture of the shell; surface of the valves generally more or less sculptured with chevron-shaped or zigzag ridges or corrugations, which often break into pustules, the posterior slope bearing curved, radiating plications, which are likewise sometimes nodulous; epidermis dark, scarcely rayed; pseudocardinals strong, radial, ragged; laterals heavy, obliquely striated; beak cavities not deep, compressed; muscle scars well impressed; nacre purple, with bronzy or coppery shades.

Animal apparently not different from that of other related Unios. I have not seen any with the marsupium filled.

UNIO PLEXUS Conrad.

Shell subrhomboid, inflated, solid, inequilateral, with a fairly well developed posterior ridge, which is generally feebly biangulate; beaks full and high, their sculpture not observed; dorsal outline behind the beaks curved; anterior end rounded; base straight to slightly rounded; posterior end usually feebly biangulate; surface usually sculptured with radiating, curved corrugations on the disk; these are divaricate on the posterior ridge and they often become somewhat nodulous. Sometimes the shell is destitute of sculpture except on the posterior slope; epidermis black or dark reddish-brown, shining when worn or

rubbed; left valve with two stumpy pseudocardinals and two laterals, the upper smaller; right valve with one ragged pseudocardinal and one, often partly double, lateral; muscle scars impressed, the anterior ones rough; beak cavities shallow, showing numerous dorsal scars; nacre purple or coppery.

Length 55, height 35, diam. 24 mm.

Length 48, height 30, diam. 25 mm.

Mexico, in the vicinity of Vera Cruz.

Margarita (Unio) carbonarius LEA, Syn., 1836, p. 192; 1838, p. 17.

Unio carbonarius LEA, Tr. Am. Phil. Soc., VI, 1838, p. 37, pl. XI, fig. 32; Obs., II, 1838, p. 37, pl. XI, fig. 32.—HANLEY, Biv. Shells, 1843, p. 184, pl. XXII, fig. 10.—CHENU, Ill. Conch., 1858, pl. XXIII, figs. 1, 1a, 1b.

Margarita (Unio) pliciferus LEA, Syn., 1836, p. 13; 1838, p. 14.

Unio pliciferus LEA, Tr. Am. Phil. Soc., V, 1838, p. 61, pl. XVII, fig. 53; Obs., II, 1838, p. 61, pl. XVII, fig. 53.—HANLEY, Biv. Shells, 1843, p. 176, pl. XX, fig. 32.—KUSTER, Conch. Cab., 1848, p. 142, pl. XLII, fig. 1.—CHENU, Ill. Conch., 1858, pl. XXII, figs. 5, 5a, 5b; Manual, 1859, II, p. 142, fig. 702.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXV, fig. 387.—FISCHER and CROSSE, Miss. Sci. II, 1894, p. 580, pl. LXV, fig. 2; LXX, figs. 2, 2a.

Margaron (Unio) pliciferus LEA, Syn., 1852, p. 20; 1870, p. 31.

Unio plexus CONRAD, Monog., X, 1838, p. 89, pl. XLIX, figs. 1, 2.—SIMPSON, Syn., 1900, p. 701.

Var. *minor* Fischer and Crosse.

Shell considerably smaller than the type, the epidermis in the specimens examined brownish and shining.

Length 35, height 20, diam. 14 mm.

Habitat with the typical form in East Mexico.

Unio pliciferus var. *minor*, FISCHER and CROSSE, Miss. Sci. II, 1834, p. 580, pl. LXIX, fig. 4.—VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 515, pl. XXXIX, figs. 4, 4a.

The names *carbonarius* and *pliciferus* were published by Lea for this species two years before *plexus* appeared, but were unaccompanied by descriptions. The species seems to be a very abundant one, but I have not heard of specimens being found elsewhere than in the vicinity of Vera Cruz. It is smaller, darker and more inflated, than any member of this group.

UNIO CROCODILARUM Morelet.

Shell solid, inflated, irregularly elliptical or ovate, more rounded on the dorsal outline than on the base; posterior ridge well developed, sometimes slightly double and ending in a blunt point or feeble biangulation behind; beaks full and high, their sculpture consisting of wrinkled, subpustulous bars; surface either covered with close irregularly radial, subnodulous ridges, which often break into regular pustules or smooth; these nodules do not extend to the border of the shell; epidermis greenish in young shells, becoming brownish later on and black in fully mature shells; left valve with two radial, ragged pseudocardinals, the space between them torn and often arising into a low third tooth, with two remote laterals; right valve with a single strong pseudocardinal and sometimes a small one above, and one somewhat double lateral; beak cavities well impressed, their dorsal scars under the pseudocardinals; muscle scars rather deep, the anterior ones rough; nacre purplish-coppery or bronzy, sometimes white, thicker in front.

Length 90, height 55, diam. 41 mm.

Rio Usumacinta, Guatemala.

Unio crocodilarum MORELET, Test. Nov., I, 1849, p. 28.—REEVE, Conch. Icon., XVI, 1864, pl. x, fig. 37.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 577, pl. LX, figs. 3, 4, 5; LXVII, fig. 3.—SIMPSON, Syn., 1900, p. 702.—VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 495, pl. XXXI, figs. 3, 3a, b, c.

? *Unio rusticus* SOWERBY, Conch. Icon., XVI, 1868, pl. LXIV, fig. 324.

Fischer and Crosse have made two varieties of this in the Mission Scientifique, *semipustulata* with pustules over half the surface and white nacre and *præstricta*, which is shorter, more inflated with tubercles near the beaks. The examination of a number of shells shows so many cross characters that I hardly think these varieties need to stand. The species is more inflated and not nearly so high as *semigranosus*. I have seen a large shell that was absolutely destitute of sculpture save some slight traces of tuberculation near the beaks.

UNIO MORINI Morelet.

Shell very inequilateral, long subrhomboid, compressed, solid, with a distinct double posterior ridge, which ends in a rather wide biangulation behind; beaks rather full, their sculpture not observed; surface covered with decided concentric ridges, which are covered with small granulations or fine nodules, which are arranged in radiating rows, bifurcating on the posterior ridge; epidermis brown; left valve with two pseudocardinals, the anterior one bifid, the posterior small and oblique, with two laterals, the lower larger; right valve with one bifid pseudocardinal and one lateral; anterior muscle scars deep and rough; posterior scars shallow; nacre white, shaded blue or pale rose.

Length 75, height 47, diam. 28 mm.

Rio Usumacinta, Guatamala.

Unio morini MORELET, Test. Nov., II, 1851, p. 24.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 576, pl. LX, fig. 2; LXVII, fig. 4.—SIMPSON, Syn., 1900, p. 702.

This seems to differ from *U. crocodilarum* in having the beaks placed much farther forward. It is more compressed and wider behind than that species or *U. plexus*, and the decided double posterior ridge is a good character, if constant.

UNIO SEMIGRANOSUS von dem Busch.

Shell subtriangular, subcompressed, rather solid with a low, scarcely double posterior ridge; the region of the beaks prominent, but the beaks themselves low and compressed, their sculp-

ture consisting of irregular, subnodulous ridges; surface more or less covered with close set, small tubercles, which sometimes form nodulous or corrugated bars, especially on the posterior slope, the border of the shell smooth; epidermis yellowish-brown; base line straight or slightly curved; post-dorsal line almost evenly curved from the beaks to the base, but sometimes showing a faint, biangulation below; left valve with two ragged, subcompressed pseudocardinals and two remote laterals, the hinge line between the two sets of teeth very narrow; right valve with two pseudocardinals, the upper smaller and one, sometimes slightly double, lateral; beak cavities compressed, moderately deep; muscle scars shallow, the anterior ones rough; nacre coppery, thicker in front; pallial line rather distant from the border.

Length 110, height 65, diam. 32 mm.

Mexico, Vera Cruz to Tampico.

Unio semigranosus VON DEM BUSCH, (in Philippi), *Abbild. und Besch.*, I, 1845, p. 19, pl. I, figs. 1-3.—HANLEY, *Biv. Shells*, 1856, p. 381, pl. XX, fig. 33.—KUSTER, *Conch. Cab. Unio*, 1861, p. 252, pl. LXXXV, fig. 1.—SIMPSON, *Syn.*, 1900, p. 702.—VON MARTENS, *Biol. Cent. Amer., Moll.*, 1900, 493, pl. XXX, figs. 1-4.

Margaron (Unio) semigranosus LEA, *Syn.*, 1852, p. 20; 1870, p. 34.

Quadrula semigranosa PILSBRY, *Pr. Ac. Nat. Sci. Phila.*, 1909, p. 532.

Unio carbonarius var. *semigranosus* PÆTEL, *Conch. Sam.*, III, 1890, p. 147.

The Lea collection contains a fine specimen of this shell presented by von dem Busch, and I have given its measurements above. It is a little straighter on the base, and a trifle more elongated than the specimen figured in Philippi, but it is a more adult shell.

UNIO CORIUM Reeve.

Shell long rhomboid, subcompressed, with a low, somewhat double curved, posterior ridge, with rather high full beaks, whose sculpture is not known; surface covered with close-set

pustules, which fade out at the border of the shell; epidermis dull olive; nacre rose purple.

Length 98, height 64 mm.

State of Chiapas, Mexico.

Unio corium REEVE, Conch. Icon., XVI, 1864, pl. x, fig. 39.—

SIMPSON, Syn., 1900, p. 702.—VON MARTENS, Biol. Cent.

Amer., Moll., 1900, p. 495, pl. XXXI, figs. 4, 4a, 4b.

I am strongly disposed to regard this as merely an old arcuate *Unio semigranosus*. I have seen a shell; which in form stands about midway between Reeve's figure *corium* and that of von dem Busch's *semigranosus*, which I at first referred to this species, and afterwards to that of von dem Busch. The shell figured by Reeve has fuller, higher beaks than *semigranosus*. The group containing this and related species is a very puzzling one and I cannot be certain what species should stand in it from the limited amount of material I have seen.

UNIO DISTINCTUS Crosse and Fischer.

"Shell inequilateral, transversely oval, slightly inflated, subrostrate posteriorly, thick, heavy, covered with an olive-brown epidermis with concentric and strong striæ, regularly and finely reticulate towards the beaks, radiately plicate posteriorly; anterior end subangulate; posterior subtruncated; area obscurely marked and subangulated; ventral margin curved, slightly sinuous; dorsal margin curved in both directions; beaks scarcely projecting, somewhat eroded. Nacre of a beautiful coppery-brown, tinged with purple. Right valve with two short, unequal cardinals much grooved and ragged, (the lower much larger and thicker than the upper), with a small, oblique, grooved denticle behind them; lateral tooth oblong and oblique. Left valve with two cardinals, the anterior thick and larger, the posterior shorter, granular, grooved; lateral teeth two, lamelliform, elongated, unequal, the lower more prominent. Cicatrices of the anterior adductors deep, rugose, irregularly oval; those of the posterior adductors superficial, larger and subcircular. Ligament quite thick, brownish.

Length 79, height 50, diam. 33 mm." (Crosse and Fischer).

Type locality, Rio Cosamalcapam, near Chacoltianguiz, State of Vera Cruz, Mexico.

Unio distinctus CROSSE and FISCHER, Jl. de Conch., XLI, 1893, p. 110;—FISCHER and CROSSE, Miss. Scient. Mex., Moll., II, 1894, p. 579, pl. LXIX, figs. 2, 2a.

Unio semigranosus var. *distinctus*, VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 494.

"*Unio distinctus* belongs to the group of *U. psoricus* Morelet, but it is less elevated, more transverse, more angular in front and the beaks are less inflated. It is to some extent intermediary between that species and *U. crocodilarum* Morelet, a form quite transverse and elongate."

UNIO TESTUDINEUS Morelet.

Shell subequilateral, triangular elliptical, compressed, solid with an olive-green epidermis, with strong concentric growth lines, covered densely with tubercles throughout the surface; posterior ridge low, scarcely biangulate; anterior end obliquely truncate above; base rounded; beaks rather high, their sculpture not observed. Left valve with two ragged pseudocardinals and two laterals, right valve with two pseudocardinals, the upper compressed and small and one lateral; anterior muscle scars deep; posterior scars shallow; nacre coppery-purple.

Length 91, height 70, diam. 34 mm.

Rio Usumacinta, Guatemala.

Unio testudineus MORELET, Test. Nov., I, 1849, p. 28.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 571, pls. LXII, fig. 3; LXX, fig. 3.—SIMPSON, Syn., 1900, p. 702.

Unio semigranosus REEVE, Conch. Icon., XVI, 1864, pl. x, fig. 36.

Unio semigranosus var. *testudineus* VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 493.

This species seems to differ from *U. psoricus* in being more compressed, and in having tubercles all over its surface.

UNIO PSORICUS Morelet.

Shell subtriangular, inequilateral, subdepressed, solid, with a moderate, sometimes double, posterior ridge; anterior end angulated and rounded; beaks rather high but not inflated.

beak sculpture consisting of faint, doubly-looped, granulous ridges; surface covered, except a narrow peripheral border which is wider behind, with strong, irregular, closely set tubercles, the outer border being smooth; epidermis tawny, brownish or greenish, clouded; left valve with two very ragged, partially united pseudocardinals and two curved laterals; right valve with two pseudocardinals, the upper smaller and one lateral, sometimes with a feeble second one; beak cavities moderately deep, compressed; anterior scars rough; nacre coppery-purple, considerably thickened in front; pallial line remote from the border, especially in front.

Length 83, height 63, diam. 43 mm.

Length 74, height 55, diam. 30 mm.

Rio Usamacinta, Guatemala.

Unio psoricus MORELET, Test. Nov., Pt. 2, 1851, p. 25.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 572, pl. LXI, fig. 2.—SIMPSON, Syn., 1900, p. 703.—VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 494, pl. XXXI, figs. 1, 1a, 2.

A fine specimen of this in the Lea collection agrees very well with the description and figure of Fischer and Crosse. It is shorter and more triangular as well as solider than the nearly allied *U. semigranosus* of Lea. The posterior slope of this species shows slight radiating granulous ridges. The beak cavities of this and some related species are compressed and are deeper than they usually are in *Unio* and though the form of the shell is nearest to that of members of this genus it is possible that these species should be placed in *Quadrula*.

Group of *Unio gibbosus*.

Shell solid, compressed or inflated, triangular ovate to elongateovate, arcuate when old, gibbous above, pointed or slightly biangulate behind, with a moderate posterior ridge; beaks low, the sculpture consisting of a few very strong ridges, which run parallel with the growth lines; epidermis dull and cloth-like; pseudocardinals strong, rough; laterals granular or vertically striated, club-shaped; beak cavities very shallow, one or more slight furrows or ridges occur in the cavity of the

shell, which run nearly parallel with the laterals; muscle scars very deep and distinct.

Marsupium occupying the entire outer gills; branchiae large, curved below, inner the wider except at the posterior end, free from the abdominal sac only part of their length; mantle very thin, with thickened edge; branchial opening generally large.

UNIO GIBBOSUS Barnes.

Shell elongated, generally solid, rarely inflated, sometimes subcompressed, decidedly inequilateral, usually a little higher in front and often arcuate, especially in an adult state; beaks not much elevated above the curved dorsal line, generally subcompressed, turned a little forward over a well-developed lunule, their sculpture a number of strong, often rude, subcorrugated, longitudinal bars, which are sometimes slightly doubly looped; posterior ridge well developed, subangular or rounded, curved and placed close to the dorsal line, rarely double and ending behind in a point or biangulation at or near the base of the shell; surface with uneven growth lines, sometimes concentrically sculptured; epidermis dull, greenish or yellowish-brown in young shells, darker when old, often faintly rayed in young specimens; left valve with two rather small, stumpy or subcompressed pseudocardinals; right valve with one, having occasionally a vestigial tooth in front of and behind it; laterals club-shaped, one in the right valve which is sometimes double, and two in the left; beak cavities exceedingly shallow; dorsal scars immediately under the hinge; muscle scars deep; pallial line impressed, crenate; nacre deep purple, salmon, straw-colored or white, obliquely ribbed.

Length 145, height 68, diam. 45 mm.

Length 125, height 56, diam. 26 mm.

Length 123, height 65, diam. 29 mm.

Length 100, height 47, diam. 30 mm.

Entire Mississippi drainage; St. Lawrence and its tributaries; Alabama River system; southeast into Florida; southwest to the Guadalupe River, Texas.

Type locality, Wisconsin.

Unio nasuta LAMARCK, An. sans Vert., VI, 1819, p. 75.

Unio nasutus AGASSIZ, Arch. für Nat., I, 1852, p. 50.

Unio gibbosus BARNES, Am. Jl. Sci., VI, 1823, p. 262, pl. XI, fig. 12.—HANLEY, Biv. Shells, 1843, p. 207, pl. XX, fig. 54.—KUSTER, Conch. Cab. Unio, 1852, p. 28, pl. IV, figs. 3, 4.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIII, fig. 379.—BAKER, Moll. Chicago, 1898, p. 70, pl. XIV, figs. 3, 4; XV, figs. 1-4.—SIMPSON, Syn., 1900, p. 703.

Margarita (Unio) gibbosus LEA, Syn., 1836, p. 38; 1838, p. 25.

Margaron (Unio) gibbosus LEA, Syn., 1852, p. 38; 1870, p. 61.

Mya gibbosa EATON, Zool. Text-Book, 1826, p. 220.

Elliptio gibbosus ORTMANN, Ann. Car. Mus., VIII, 1912, p. 271.

Unio mucronatus BARNES, Am. Jl. Sci., VI, 1823, p. 266, pl. XIII, fig. 13 (outline).

Mya mucronata EATON, Zool. Text-Book, 1826, p. 221.

Unio dilatatus SAY, Am. Conch., VI, 1834.—CONRAD, Monog., V, 1836, p. 42, pl. XXI.—KUSTER, Conch. Cab. Unio, 1852, p. 38, pl. VI, fig. 4.

Unio torulosus FERUSSAC, Guer. Mag., 1835, p. 28.

Unio arctatus FERUSSAC, Guer. Mag., 1835, p. 29.

Unio arctior LEA, Tr. Am. Phil. Soc., VI, 1838, p. 10, pl. IV, fig. 10; Obs., II, 1838, p. 10, pl. IV, fig. 10.—HANLEY, Biv. Shells, 1843, p. 208, pl. XXII, fig. 46.—KUSTER, Conch. Cab. Unio, 1861, p. 179, pl. LVI, fig. 6.—CHENU, Ill. Conch., 1858, pl. XXI, figs. 2, 2a, 2b.—?SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXV, fig. 2.

Margarita (Unio) arctior LEA, Syn., 1836, p. 39; 1838, p. 25.

Margaron (Unio) arctior LEA, Syn., 1852, p. 38; 1870, p. 71.

A species having an immense distribution in no less than four distinct drainage systems and very abundant in individuals. Certain specimens superficially resemble specimens of *Ptychobranthus phaseolus* in form and the shape of the teeth, but the marsupia are very different in these species and the shells of *gibbosus* have different color pattern and duller colored nacre. Some of the variations of this species are probably worthy of names.

Var. *arcus* Conrad.

Shell small, thick and ponderous, subinflated, arcuate.

Length 50, height 25, diam. 21 mm.

Alabama River drainage, probably merges into *subgibbosus*.

Type locality, Alabama River.

Unio arcus CONRAD, Am. Jl. Sci. XXV, 1834, p. 340, pl. 1, fig.

8.—HANLEY, Biv. Shells, 1843, p. 207, pl. XXIII, fig. 46.

Margarita (Unio) arcus LEA, Syn., 1836, p. 38; 1838, p. 25.

Margaron (Unio) arcus LEA, Syn., 1852, p. 38; 1870, p. 61.

Unio gibbosus var. *arcus* SIMPSON, Syn., 1900, p. 704.

Var. *subgibbosus* Lea.

Shell small, solid, inflated or subinflated, with a high posterior ridge. Typically subrhomboid and slightly full on the base line.

Length 54, height 29, diam. 18 mm.

Alabama River system; Saline River, Arkansas.

Type locality, Oostanaula, Floyd Co.; Etowah River, Ga.

Unio subgibbosus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p.

169; Jl. Ac. N. Sci. Phila., IV, 1858, p. 53, pl. VI, fig. 36;

Obs., VI, 1858, p. 53, pl. VI, fig. 36.—SIMPSON, Pr. U. S.

Nat. Mus., XV, 1892, p. 432, pl. LXXVIII, fig. 5.

Margaron (Unio) subgibbosus LEA, Syn., 1870, p. 61.

Unio lazarus SOWERBY, Conch. Icon., XVI, 1868, pl. LXVIII, fig. 348.

Unio rufus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 171; Jl.

Ac. N. Sci. Phila., IV, 1858, p. 85, pl. XVII, fig. 65.

Margaron (Unio) rufus LEA, Syn., 1870, p. 61.

Unio gibbosus var. *subgibbosus* SIMPSON, Syn., 1900, p. 704.

Varies from the above form into *arcus* and *armathwaitensis*.

Var. *armathwaitensis* B. H. Wright.

Shell narrowed in front, widest behind, subcompressed, sub-solid.

Length 87, height 40, diam. 19 mm.

Length 65, height 34, diam. 17 mm.

Type locality, Branch of South Fork of the Cumberland River, Armathwaite, Fentress Co., Tennessee; also Mammoth Cave, Green County, Kentucky.

Unio gibbosus var. *armathwaitensis* B. H. WRIGHT, Naut., XI, 1898, p. 123.—SIMPSON, Syn., 1900, p. 704.

Var. *delicatus* Simpson.

Shell subsolid or rather thin, subcompressed or compressed, subrhomboid or almost evenly elliptical, never arcuate.

Length 98, height 36, diam. 18 mm.

Greenway, Clay County, Arkansas; widely distributed in the Mississippi valley and into Michigan.

Unio gibbosus var. *delicatus* SIMPSON, Syn., 1900, p. 704.

Much more delicate than the type, rather thin, compressed, not arcuate.

UNIO STONENSIS Lea.

Shell oblong, irregularly elliptical or subrhomboid, solid, compressed or subcompressed, inequilateral; beaks scarcely elevated above the dorsal line, compressed, somewhat pointed and turned forward over a narrow lunule, their sculpture consisting of moderately to quite coarse, subcorrugated ridges that follow the growth lines; posterior ridge well marked, somewhat double, running near the dorsal line and ending behind in a feeble biangulation below the median line; anterior end rounded; dorsal line curved; base line slightly curved or nearly straight; surface with rude, uneven growth lines; epidermis tawny or tawny-brown; left valve with two stumpy, striated pseudocardinals the anterior small and two short, remote, slightly curved laterals; right valve with one pseudo-cardinal, the hinge being radially striate before and behind it and showing vestiges of teeth, with one strong, granulated lateral; beak cavities very shallow; dorsal scars close to the hinge plate; muscle scars deep and smooth; nacre white, sometimes salmon-tinted in the center, a little thicker in front, obliquely furrowed.

Length 84, height 47, diam. 22 mm.

Type locality, Stones River, Tennessee. Also Roanoke River and Southwestern Virginia.

Unio stonensis LEA, Pr. Am. Phil. Soc., I, 1840, p. 286; Tr. Am. Phil. Soc., VIII, 1841, p. 195, pl. VIII, fig. 5; Obs., III, 1842, p. 33, pl. VIII, fig. 5.—CHENU, Ill. Conch., 1858, pl. XXIX, figs. 7, 7a, 7b.—SOWERBY, Conch. Icon., XVII, 1868, pl. LXXXVI, fig. 462.—SIMPSON, Syn., 1900, p. 705.

Margaron (Unio) stonensis LEA, Syn., 1852, p. 27; 1870, p. 43.

The type was received by Dr. Lea from Mr. Edgar, and is said to have come from Stones River, Tennessee. Another shell in his collection agreeing with this was donated by Dr. Showalter and is said to have come from Yellow Sulphur Springs, Montgomery County, Virginia, Roanoke River. Other shells are in the Lea collection from Dr. Showalter, labeled *Unio racensis*, said to come from the Roanoke River, in Washington County, Virginia, which are very close to, if not identical with *stonensis*. Washington County is in the southwestern part of the state and all the streams in it flow into the Tennessee River. Lastly I have seen other specimens in the collection of T. H. Aldrich, said to come from the Roanoke River, Virginia, which agree in most characters with the shell said to be from Stones River, Tennessee. Some of the Virginia shells are a little darker colored and are somewhat more rhomboid than the type; part of them have white nacre and there are others with various shades to deep purple. It seems almost improbable that the species should be found in the Tennessee and Roanoke systems, though it is no more remarkable than the similar distribution of *Lampsilis constricta*. I am at a loss to know where to place this shell. Lea believed it to be near to *Unio gibbosus* and the type would seem to indicate such a relation. Some of the Virginia material seems to show decided relations to *Unio complanatus*.

UNIO LURIDUS (Lea).

Shell irregularly elliptical or subrhomboid, compressed or subcompressed, rather solid, inequilateral; beaks apparently but little elevated, their sculpture not observed; posterior ridge

subangular or somewhat rounded, often somewhat double, ending behind a little below the median line, usually in a faint biangulation; surface unevenly concentrically striate; epidermis, finely lamellose, dull olive or dirty green, rarely showing a few faint rays; left valve with two low, stumpy pseudocardinals and two laterals; right valve with one or two pseudocardinals, the upper apparently small, and one lateral; nacre bluish-white, tinted with flesh-color in the cavities, with an oblique furrow.

Length 50, height 26, diam. 14 mm.

Georgia; Florida; Yadkin River, North Carolina?

Type locality, Coosawattee River, Murray Co., Ga.

Unio luridus LEA, Tr. Am. Phil. Soc., X, 1852, p. 273, pl. xx, fig. 29; Obs., V, 1852, p. 29, pl. xx, fig. 29.—SIMPSON, Syn., 1900, p. 705.

Margarona (Unio) luridus LEA, Syn., 1852, p. 30; 1870, p. 48.

Possibly only a small variety of *U. gibbosus*. It has no decided characters, but is small, compressed, moderately solid, and usually a little produced in the post-basal region.

Group of *Unio discus*.

Shell large, solid, compressed, subtriangular; biangulate behind; beak sculpture not seen; beaks high, but not swollen; epidermis dark, rough; teeth heavy; laterals remote, club-shaped; nacre white, yellow, or purple.

Animal unknown.

UNIO DISCUS (Lea).

Shell large, subtriangular, compressed, solid, inequilateral; beaks high but compressed, their sculpture not seen; posterior ridge low, double, ending behind in a biangulation about at the median line; anterior end narrowed and rounded; base line evenly curved, surface with strong, uneven, concentric sculpture; epidermis, brownish or blackish, rayless; left valve with a strong, triangular pseudocardinal, often with a rudimentary tooth above it and another behind it, with one heavy, club-shaped lateral; right valve with two strong pseudocardi-

nals and two short laterals, with a vestige of a third above them: dorsal scars numerous, placed in a long row under the pseudocardinals; beak cavities not deep; muscle scars large, deep: pallial line deep, crenate: nacre silvery, salmon, light or deep purple, thicker in front, obliquely ridged and grooved.

Length 131, height 88, diam. 32 mm.

Length 135, height 90, diam. 33 mm.

Length 121, height 77, diam. 28 mm.

Mexico; Central America.

Unio discus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 74, pl. XVIII, fig. 57; Obs. II, 1838, p. 74, pl. XVIII, fig. 57.—HANLEY, Biv. Shells, 1843, p. 197, pl. XXII, fig. 12.—CHENU, Ill. Conch., 1858, pl. XIX, figs. 6, 6a, 6b.—SIMPSON, Syn., 1900, p. 705.

Margaron (Unio) discus LEA, Syn., 1852, p. 31; 1870, p. 50.

Lampsilis discus PILSBRY, Pr. Ac. Nat. Sci. Phila., 1909, p. 533.

Unio discus var. *connectans* VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 510.

Unio panucoensis VON DEM BUSCH in Philippi, Abbild. und Besch., I, 1843, p. 75, pl. II.—KUSTER, Conch. Cab. Unio, 1861, pl. LXXXI, fig. 1.

Unio discus var. *panucoensis* VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 510, pl. XXXIII, figs. 2, 2b.

Unio mexicanus SOWERBY, Conch. Icon., XVI, 1867, pl. IV, fig. 281.

Unio lapidosus KOBELT, Nach. Deuts. Mal. Ges., 1893, p. 151: Icon., new ed., VI, 1893, p. 90, pl. CLXXVI, fig. 1120.—SIMPSON, Syn., 1900, p. 700.—VON MARTENS, Biol. Cent. Amer., Moll., 1900, pp. 511, 651.

A magnificent, ponderous species, which does not seem to be very nearly related to anything else, though it has many of the characters of the *gibbosus* group. von Martens in the *Biologia Centrali Americana*, Mollusca, Supplement, page 651, states that he has examined the type of *Unio lapidosus* in the Berlin Museum said to come from the Euphrates River, and that he feels sure that it belongs to this species. The figure of the teeth and muscle scars and a part of the description of

lapidosus in the New Edition of Rossmassler do not agree with the several specimens of *discus* I have examined, and the latter is somewhat more compressed than the measurements given for *lapidosus*, yet I feel sure that von Martens is right. The *U. lapidosus* differs totally from any form found in the Palearctic region or for that matter in the Old World, and I felt a good deal of doubt concerning this remarkable intruder into the circummediterranean region. But I confess that it had not occurred to me that it might be *U. discus* until I read von Martens' statement.

Group of *Unio sloatianus*.

Shell rhomboid, solid, inflated, with a well-defined posterior ridge and a smaller, fainter one above, making the posterior of the shell distinctly biangulate, nearly straight or slightly incurved on the base, rounded in front; beaks only slightly elevated; beak sculpture not observed; surface of the valves covered with somewhat radiately plicate, nodulous corrugations, which become less pronounced in front; posterior slope radially plicate; epidermis dark; pseudocardinals stumpy, radial, granularly striate; laterals double in the left valve, single in the right, with a faint, secondary ridge below; anterior muscle scars deep, nearly smooth; cavity of the beaks moderate, slightly compressed.

Animal unknown.

UNIO SLOATIANUS (Lea).

Shell subrhomboid, somewhat inflated, solid, inequilateral, apparently with rather full, elevated beaks; posterior ridge high, angled, becoming double midway down, and ending at the posterior basal part of the shell in a biangulation; anterior end a little narrowed and rounded; base line straight; posterior slope obliquely truncated; surface mostly covered with subradiating, corrugated ridges. Those on the disk are almost vertical and show a tendency to break into nodules; those on the posterior ridge and dorsal slope are strong and almost

horizontal or slightly up-curved; epidermis thick, chestnut to blackish; left valve with two strong, rough pseudocardinals and two laterals; right valve with one pseudocardinal, a vestigial one above it and sometimes traces of a third behind, with one granular lateral, which often shows vertical striation; beak cavities shallow, with a few scars; anterior cicatrices deep and smooth; nacre whitish-violet or bronzy-tinted, iridescent behind.

Length 120, height 75, diam. 46 mm.

Chattahoochee and Flint rivers, Georgia.

Type locality, Chattahoochee River, Ga.

Unio sloatianus LEA, Pr. Am. Phil. Soc., I, 1840, p. 287; Tr. Am. Phil. Soc., VIII, 1842, p. 217, pl. XVI, fig. 33; Obs., III, 1842, p. 55, pl. XVI, fig. 33.—CHENU, Ill. Conch. 1858, pl. XXXII, figs. 7, 7a, 7b.—KUSTER, Conch. Cab., 1862, p. 286, pl. XXVI, fig. 3.—SIMPSON, Syn., 1900, p. 705.

Margaron (Unio) sloatianus LEA, Syn., 1852, p. 21; 1870, p. 31.

Plectomerus sloatianus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 261.

Unio atromarginatus LEA, Pr. Am. Phil. Soc., I, 1840, p. 288; Tr. Am. Phil. Soc., VIII, 1842, p. 207, pl. XIII, fig. 21; Obs. III, 1842, p. 45, pl. XIII, fig. 21.—CHENU, Ill. Conch., 1858, pl. XXVIII, figs. 6, 6a, 6b.—KUSTER, Conch. Cab. Unio, 1861, p. 250, pl. LXXXIV, fig. 2.

Margaron (Unio) atromarginatus LEA, Syn., 1852, p. 19; 1870, p. 29.

Plectomerus atromarginatus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 260.

Unio aratus CONRAD, Ann. and Mag., IV, 1849, p. 302.

Unio plectophorus CONRAD, Jl. Ac. N. Sci. Phila., I, 1850, p. 277, pl. XXXVIII, fig. 7.

Plectomerus plectophorus CONRAD, Pr. Ac. N. Sci., Phila., VI, 1853, p. 2.

A fine, robust shell, which superficially resembled the *Unio trapezoides* of Lea, but which, I am convinced, is not closely related to it. The external sculpture of the two is really quite

different, that of *trapezoides* though nodulous in an early stage becomes obliquely plicate on the disk as the shell approaches maturity, while that of *sloatianus* is much finer and nearly vertical. The beak cavities of the latter are much shallower than those of *trapezoides* and it lacks the scars in the cavities of the shell, and finally the anterior scars of the latter are very rough while those of *sloatianus* are smooth. A little attention to these characters will enable any one to separate the two species without difficulty.

Lea's type of *sloatianus* is an old, arcuate shell, while the type of *atromarginatus* is young and quite different looking. But the young plicate *atromarginatus* gradually changes into the smoother *sloatianus* as it grows older, and specimens of both show the dark bordered nacre, though it is more pronounced in the young shells.

Group of *Unio crassidens*.

Shell generally solid, rather inflated, rhomboid oval, with a sharp, well-developed posterior ridge; beaks prominent, the sculpture consisting of a few coarse ridges running nearly parallel with the growth lines, and swollen at the posterior ridge; surface of the valves nearly smooth or only marked by growth lines; posterior slope bearing wrinkled, corrugate, radiate ridges; epidermis often faintly rayed.

Animal having the branchiæ very large, rounded below, inner the larger, free nearly or quite their entire length from the abdominal sac; branchial and anal openings large, with many small papillæ; marsupium occupying the entire outer gills.

UNIO CRASSIDENS Lamarck.

Shell ponderous, convex or subinflated, subrhomboid, inequilateral; beaks full and elevated, their sculpture a few coarse ridges running nearly parallel with the growth lines; posterior ridge well developed and angled, sometimes faintly double below and ending behind at the base of the shell usually in a biangulation; base line straight or incurved in old specimens;

outline of posterior slope subtruncate, slightly curved; surface with rude, irregular growth lines; posterior slope often having a few wrinkles; epidermis thick, reddish-brown or chestnut; left valve with two strong, rough pseudocardinals and two heavy laterals; right valve with one strong pseudocardinal with a small tooth in front of and behind it, with one very solid lateral; beak cavities very shallow with a few small scars; muscle scars small and deep; pallial line impressed, crenate; nacre purplish or salmon.

Length 120, height 79, diam. 50 mm.

Length 93, height 68, diam. 40 mm.

Length 128, height 75, diam. 44 mm.

Mississippi drainage generally; Alabama and Tombigbee rivers; southeast to the Chattahoochee River.

Type locality, Mississippi and other rivers and lakes.

Unio crassidens LAMARCK, An. sans Vert., VI, 1819, p. 71.—

HANLEY, Biv. Shells, 1843, p. 184, pl. XX, fig. 46.—CALL, Tr.

Ac. Sci. St. Louis, VII, 1895, p. 12, pl. II.—SIMPSON, Syn.,

1900, p. 706.—WAGNER, Naut., XVIII, 1905, p. 97, pl. VII.

Margarita (Unio) crassidens LEA, Syn., 1836, p. 19; 1838, p. 17.

Margaron (Unio) crassidens LEA, Syn., 1852, p. 24; 1870, p. 37.

Elliptio crassidens ORTMANN, Ann. Car. Mus., VIII, 1912, p. 266, figs. 10, 10a.

?*Unio nigra* RAFINESQUE, Ann. Gen. Sci. Brux., V, 1820, p. 291, pl. LXXX, figs. 1-4.

Unio niger SAY, Am. Conch., VI, 1834.—CONRAD, Monog., VI, 1836, p. 49, pl. XXVI.—KUSTER, Conch. Cab. Unio, 1852, p. 25, pl. IV, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVIII, fig. 408.

?*Unio cuneatus* BARNES, Am. Jl. Sci., VI, 1823, p. 263.—HILDRETH, Am. Jl. Sci., XIV, 1828, p. 279, fig. 3.

Mya cuneata EATON, Zool. Text Book, 1826, p. 220.

Unio discus SOWERBY, Conch. Icon., XVI, 1868, pl. LXII, fig. 310.

Unio crassus SOWERBY, Conch. Icon., XVI, 1868, pl. XCV, fig. 520.

Var. *incrassatus* Lea.

Shell smaller, more rhomboid or quadrate than the type, wrinkled behind the posterior ridge and sometimes having subvertical corrugations on the disks. It is rather smoother than typical *crassidens*.

Length 56, height 36, diam. 23 mm.

Coosa River system; Chattahoochee and rivers of north Florida; east to Savannah?

Type locality, Chattahoochee River, Columbus, Ga.

Unio incrassatus LEA, Pr. Am. Phil. Soc., I, 1840, p. 286; Tr. Am. Phil. Soc., VIII, 1840, p. 217, pl. XVI, fig. 34; Obs., III, 1842, p. 55, pl. XVI, fig. 34.—CHENU, Ill. Conch., 1858, pl. XXX, figs. 5, 5a, 5b.—KUSTER, Conch. Cab. Unio, 1861, p. 192, pl. LX, fig. 5.—REEVE, Conch. Icon., XVI, 1865, pl. XXVI, fig. 127.—SIMPSON, Syn., 1900, p. 707.

Margaron (Unio) incrassatus LEA, Syn., 1852, p. 24; 1870, p. 37.

Usually considered as a valid species, but recent careful study and comparison of a large series of material has inclined me to place it as a variety under *crassidens*. A considerable number of intermediate specimens from the Tennessee and Coosa rivers seem to connect the two completely.

UNIO POLYMORPHUS B. H. Wright.

Shell solid, convex to subinflated, generally more or less rhomboid, inequilateral; beaks rather full, moderately elevated, their sculpture not observed; posterior ridge high and sharp, usually somewhat double below, ending in a point or biangulation at or near the base line; base line straight or slightly curved; rarely incurved in old shells; surface with irregular growth lines, wrinkled on the dorsal slope; epidermis thick, bronzy-green and rayed in the young, reddish-brown to blackish in adult shells; left valve with two stout, ragged pseudocardinals and two laterals; right valve with one pseudocardinal and a small tooth above it, with one, often somewhat double,

lateral; beak cavities rather shallow; muscle scars impressed; nacre white, yellowish, salmon or purple, thicker in front.

Length 96, height 55, diam. 38 mm.

Length 83, height 53, diam. 37 mm.

Type locality, Spanish Creek, Charlton County, Georgia.

Unio polymorphus B. H. WRIGHT, Naut., XIII, 1899, p. 42.—
SIMPSON, Syn., 1900, p. 707.

A large number of specimens of this form from the type locality are before me and I hardly know what to do with them. The species, if species it is, seems to stand between *crassidens* and *forbesianus* in a different way from what *incrassatus* does. It has the form of *forbesianus* to some extent, but is solidier and has a different epidermis. It resembles *crassidens* in its solidity and the comparatively shallow beak cavities. It is very likely a variety of *forbesianus*.

UNIO FORBESIANUS Lea.

Shell subrhomboid, scarcely inflated, inequilateral, subsolid; beaks full and rather high, their sculpture consisting of strong, slightly corrugated ridges that run nearly parallel with the growth lines; posterior ridge high, angled, often narrowly and feebly double below, ending behind in a point or slight biangulation at or near the base of the shell; base line straight or curved a little; surface rather smooth, but having subradial plications on the posterior slope; epidermis yellowish to olive-green and usually rayed in the young shell, tawny or burnt brown and almost or quite rayless in the adult stage, nearly smooth, sometimes shining; left valve with two triangular, rough pseudocardinals and two curved laterals; right valve with one pseudocardinal, sometimes with a vestigial one above it and one lateral; beak cavities deeper than in *U. crassidens*; muscle scars well impressed; nacre white, bluish, cream, salmon or purplish.

Length 80, height 49, diam. 31 mm.

Length 74, height 39, diam. 25 mm.

Length 63, height 40, diam. 23 mm.

Streams from the Congaree River, South Carolina, south to northern Florida.

Type locality, Savannah River, Ga.

Unio forbesianus LEA, Pr. Am. Phil. Soc., V., 1852, p. 251, Tr. Am. Phil. Soc., X, 1852, p. 264, pl. XVI, fig. 17; Obs., V, 1852, p. 20, pl. XVI, fig. 17.—KUSTER, Conch. Cab. Unio, 1861, p. 310, pl. LXXIX, fig. 6.—MUSGRAVE, Phot. Conch., 1863, pl. II, fig. 2.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXI, fig. 361.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 410, pls. XLIX, fig. 3; L, figs. 2, 3; Syn., 1900, p. 707.

Margaron (Unio) forbesianus LEA, Syn., 1852, p. 24; 1870, p. 37.

Unio moussonianus LEA, Tr. Am. Phil. Soc., X, 1852, p. 268, pl. XVIII, fig. 22; Obs., V, 1852, p. 24, pl. XVIII, fig. 22.

Margaron (Unio) moussonianus LEA, Syn., 1852, p. 29; 1870, p. 46.

Unio corvus LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 112; Jl. Acad. N. Sci. Phila., IV, 1859, p. 217, pl. XXVII, fig. 97; Obs., VII, 1859, p. 35, pl. XXVII, fig. 97.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVIII, fig. 411.

Margaron (Unio) corvus LEA, 1870, p. 37.

Unio vestitus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 393; Jl. Ac. N. Sci. Phila., V, 1862, p. 189, pl. XXV, fig. 259; Obs., IX, 1863, p. 11, pl. XXV, fig. 259.

Margaron (Unio) vestitus LEA, Syn., 1870, p. 50.

It is difficult to draw up any description, which will properly cover and yet separate from other forms this and most of the allied species of the *crassidens* group of Unios. In a general way the shells of this species are thinner and smoother than those of *incrassatus* and have deeper beak cavities, but many intermediates are found, which more or less connect not only these two, but this with other so-called species. Indeed the group is one of the most difficult to treat of American Unios. *U. moussonianus*, *U. corvus* and *U. vestitus* of Lea do not seem to me to possess any claims to distinction.

UNIO DANIELSII B. H. Wright.

Shell very solid, subinflated to inflated, inequilateral, subrhomboid; beaks full and high, their sculpture not observed; posterior ridge very full, sharp, becoming double below, behind which the posterior area is often abruptly truncated; surface covered with rather wide growth lines and a thick, black epidermis, the posterior slope strongly plicate and rough; left valve with two triangular, rough pseudocardinals and two strong, curved laterals; right valve with one pseudocardinal, often with a small one above, and one lateral; beak cavities shallow; muscle scars small and deep; nacre whitish, purplish or salmon, thicker in front.

Length 80, height 51, diam. 34 mm.

Length 80, height 62, diam. 46 mm.

Type locality, Spring Creek, Decatur County, Georgia. Also, Escambia River, Florida.

Unio danielsii B. H. WRIGHT, Naut., XIII, 1899, p. 31.—SIMPSON, Syn., 1900, p. 708.

This seems to bear about the same relation to *U. incrassatus* that *polymorphus* does to *forbesianus*. It is a very solid, quite inflated form, decidedly truncated behind the posterior ridge and has a thick, black epidermis.

UNIO PUSILLUS Lea.

Shell subrhomboid, convex to subinflated, rather thin to sub-solid, inequilateral, with moderately full, but not high, beaks, their sculpture not observed; posterior ridge high and angled, often becoming double below, ending in a point or biangulation near the base of the shell; surface rather smooth; dorsal slope having subradial wrinkles; epidermis dirty greenish-yellow, often feebly rayed; left valve with two subcompressed pseudocardinals and two rather delicate laterals; right valve with one pseudocardinal, often with a second small one above it and one lateral; beak cavities shallow; muscle scars slightly impressed; nacre dull, bluish, purplish or lurid brownish.

Length 58, height 34, diam. 22 mm.

Length 43, height 26, diam. 16 mm.

Abbeville district, South Carolina; south to northern Florida.

Type locality, Ogeechee River, Ga.

Unio pusillus LEA, Pr. Ac. N. Sci. Phila., I, 1840, p. 286; Tr. Am. Phil. Soc., VIII, 1842, p. 220, pl. XVIII, fig. 36; Obs., III, 1842, p. 58, pl. XVIII, fig. 36.—CHENU, Ill. Conch., 1858, pl. XXXII, figs. 5, 5a, 5b.—KUSTER, Conch. Cab., 1861, p. 197, pl. LXIII, figs. 3, 4.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 411, pl. LI, figs. 2, 6; Syn., 1900, p. 708.

Margaron (Unio) pusillus LEA, Syn., 1852, p. 31; 1870, p. 48.

Unio buxeus LEA, Tr. Am. Phil. Soc., X, 1852, p. 261, pl. xv, fig. 13; Obs., V, 1852, p. 17, pl. xv, fig. 13.

Margaron (Unio) buxeus LEA, Syn., 1852, p. 29; 1870, p. 46.

Unio anthonyi LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 41; Jl. Ac. N. Sci. Phila., V, 1862, p. 197, pl. XXVII, fig. 266; Obs., IX, 1863, p. 19, pl. XXVII, fig. 266.

Margaron (Unio) anthonyi LEA, Syn., 1870, p. 43.

More inflated and smaller than *U. congaræus*, more elongated than *U. masoni*. It is close to *U. merus* and may be only a form of it. In *pusillus* the greatest degree of inflation is at the posterior ridge and in front of it the shell is somewhat wedge-shaped and it is not a very solid species. In *merus* a dorsal view shows the shell to be exactly doubly convex and it is rather a solid shell.

UNIO MERUS Lea.

Shell small, rhomboid, convex, rather solid, somewhat inequilateral; beaks full, slightly elevated, their sculpture a few strong ridges, the lower ones almost doubly looped, the upper ones curved sharply up behind; posterior ridge full, angled, single, ending behind at the base of the shell; base line nearly straight; posterior end decidedly and obliquely truncated; surface nearly smooth; epidermis greenish-yellow, faintly rayed; left valve with two subcompressed pseudocardinals and two delicate laterals; right valve with one pseudocardinal:

and one lateral; beak cavities moderate; muscle scars small, shallow; nacre creamy white, thicker in front.

Length 30, height 24, diam. 15 mm.

South Carolina.

Type locality, Abbeville District, S. C.

Unio merus LEA, Tr. Am. Phil. Soc., X, 1852, p. 260, pl. xv, fig. 10; Obs., V, 1852, p. 16, pl. xv, fig. 10.—SIMPSON, Syn., 1900, p. 708.

Margaron (Unio) merus LEA, Syn., 1870, p. 54.

Unio castus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 306; Jl. Ac. N. Sci. Phila., IV, 1860, p. 349, pl. LVII, fig. 174; Obs., VIII, 1860, p. 31, pl. LVII, fig. 174.

Margaron (Unio) castus LEA, Syn., 1870, p. 40.

Close to forms of *pusillus* and perhaps only a variety of it. The posterior ridge is single in all the shells I have seen; it is heavier and more distinctly rhomboid than that species. The posterior slope is without wrinkles in all the examples I have seen, and is very feebly radially furrowed.

UNIO MASONI CONRAD.

Shell small, somewhat rhomboid, though rounded above, in front and below, slightly inequilateral, subcompressed; beaks moderately full but not much elevated, their sculpture not known; posterior ridge well developed, angled, ending behind just above the base; epidermis olive, clouded with brown, shining; pseudocardinals prominent, compressed, oblique; beak cavities capacious; nacre bluish-white.

Length of the figure 26, height 20 mm.

Type locality, Savannah River, Augusta, Ga.

Unio masoni CONRAD, New F. W. Shells, 1834, p. 34, pl. v, fig. 2; Monog., III, 1836, p. 28, pl. XII, fig. 2.—HANLEY, Biv. Shells, 1843, p. 201, pl. XXIII, fig. 18.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 18, pl. II, fig. 1.—KUSTER, Conch. Cab. Unio, 1852, p. 34, pl. v, fig. 6.—SIMPSON, Syn., 1900, p. 709.

Margarita (Unio) masoni LEA, Syn., 1836, p. 33; 1838, p. 23.

Margaron (Unio) masoni LEA, Syn., 1852, p. 34; 1870, p. 55.

I have never seen anything, which I could refer to this species and am a little in doubt as to its systematic position. Conrad states that he found it in company with great numbers of *U. congaræus* in the Savannah River, at Augusta, and that it perhaps has more affinity with that than any other species. It is shorter and more rounded than *U. merus* or any of the forms of the *crassidens* group. If it were not that it is said to come from the Savannah River I should think it might be one of the *Pleurobemas*, and I am not sure but that it is.

UNIO FRATERNUS Lea.

Shell somewhat elongated, subsolid, subrhomboid, compressed or subcompressed, inequilateral; beaks apparently not full or high, much eroded in the only shells examined; posterior ridge well developed, angled, single above, faintly double below, ending near the base in a narrow, ill-defined biangulation; surface with feeble growth lines, strongly, radiately wrinkled on the dorsal slope; epidermis dark reddish-brown, scarcely lamellosely wrinkled, subshining; left valve with two low, stumpy pseudocardinals, and two remote laterals; right valve with one pseudocardinal and one lateral; beak cavities shallow, with a row of dorsal scars just at the lower side of the hinge plate; muscle scars shallow; nacre purplish-white, a little thicker in front.

Length 65, height 37, diam. 19 mm.

Length 60, height 32, diam. 15 mm.

Type locality, Abbeville District, South Carolina.

Unio fraternus LEA, Tr. Am. Phil. Soc., X, 1852, p. 263, pl. XVI, fig. 15; Obs., V, 1852, p. 19, pl. XVI, fig. 15.—KUSTER, Conch. Cab. Unio, 1861, p. 201, pl. LXVII, fig. 2.—SIMPSON, Syn., 1900, p. 709.

Margaron (Unio) fraternus LEA, Syn., 1852, p. 32; 1870, p. 51.

A somewhat elongated, compressed shell, with reddish-brown epidermis and purplish nacre. It is more compressed and darker colored than *U. congaræus*, to which it seems nearly allied and its pseudocardinals are more stumpy. Dr. Lea has

shells in his collection labeled *Unio fraternus* from the Chattahoochee River that I am inclined to believe are not that species.

UNIO CONGARÆUS Lea.

Shell rhomboid, subcompressed, rather thin to subsolid, somewhat inequilateral; beaks moderately full and slightly elevated; their sculpture consisting of parallel undulations; posterior ridge high, and angled, double below, the greatest diameter of the shell being along its line; in front of it the shell is wedge-shaped; basal line nearly straight; posterior end obliquely truncated above, somewhat biangulate below; surface with irregular growth lines, wrinkled on the dorsal slope; epidermis dirty greenish-yellow or tawny, generally rayed, especially in young shells, scarcely shining; left valve with two ragged, subcompressed pseudocardinals and two delicate laterals; right valve with two pseudocardinals, the upper small, and one lateral; beak cavities not deep; muscle scars superficial; nacre purplish, often lurid in the shell cavities

Length 81, height 48, diam. 25 mm.

Length 62, height 34, diam. 19 mm.

Cape Fear River, North Carolina; south to Savannah, Ga.

Type locality, Congaree River, S. C.

Unio congaræus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 72, pl. VI, fig. 4; Obs., I, 1834, p. 82, pl. VI, fig. 4.—CONRAD, Monog., III, 1836, p. 27, pl. XII, fig. 1.—HANLEY, Biv. Shells, 1843, p. 200, pl. XXII, fig. 31.—CHENU, Ill. Conch., 1858, pl. III, figs. 5, 5a, 5b.—SOWERBY, Conch. Icon., XVI, 1867, pl. LIX, fig. 296.—SIMPSON, Syn., 1900, p. 709.

Margarita (Unio) congaræus LEA, Syn., 1836, p. 32; 1838, p. 22.

Margaron (Unio) congaræus LEA, Syn., 1852, p. 33; 1870, p. 54.

Unio fulvus LEA, Tr. Am. Phil. Soc., V, p. 96, pl. XIII, fig. 39; Obs., I, 1834, p. 208, pl. XIII, fig. 39.—HANLEY, Biv. Shells, 1843, p. 200, pl. XXIII, fig. 32.—SOWERBY, Conch. Icon., XVI, 1858, pl. LXXXIX, fig. 483.

Margarita (Unio) fulvus LEA, Syn., 1836, p. 32; 1838, p. 22.

Margaron (Unio) fulvus LEA, Syn., 1852, p. 33; 1870, p. 54.

The type is a young shell and is close to *U. pusillus*, in fact Dr. Lea has one lot of shells from Rock River, North Carolina, labeled *U. congarcus* that I am inclined to believe is *pusillus*. The adult shells are larger and more compressed than any I have seen of the latter species.

UNIO DARIENSIS Lea.

Shell large, subrhomboid or subtrapezoidal, convex to inflated, subsolid to solid, inequilateral; beaks moderately full to inflated, somewhat elevated, their sculpture not seen; posterior ridge high and sharply angled, becoming double below and ending behind near the base in a biangulation; dorsal slope often wrinkled, obliquely truncated; anterior end narrowed and rounded; surface with rude concentric growth lines; epidermis olive-green and faintly rayed in young shells, becoming reddish-brown or blackish in old shells; left valve with two ragged, stumpy pseudocardinals and two granular laterals; right valve with one pseudocardinal, sometimes with a feeble second one above it, and one lateral; the laterals show traces of vertical striation; muscle scars well marked; beak cavities shallow to moderately deep; nacre white to purple, a little thicker in front.

Length 125, height 76, diam. 42 mm.

Length 125, height 65, diam. 33 mm.

Length 117, height 68, diam. 48 mm.

Southeast Georgia to north Florida.

Type locality, New Darien, Ga.

Unio dariensis LEA, Tr. Am. Phil. Soc., VIII, 1842, p. 246, pl. xxvi, fig. 61; Obs., III, 1842, p. 84, pl. xxvi, fig. 61.—CHENU, Ill. Conch., 1858, pl. xxxiii, figs. 6, 6a, 6b.—SOWERBY, Conch. Icon., XVI, 1868, pl. xci, fig. 494.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 413, pl. liii, fig. 2; liv, fig. 1; Syn., 1900, p. 710.

Margaron (Unio) dariensis LEA, Syn., 1852, p. 33; 1870, p. 54.

A most variable species, which has close relationships with the *complanatus* group. The disk is often sculptured with subvertical furrows and it is occasionally subnodulous. Some of the compressed specimens approach *U. roanokensis*, but are rougher and have a more distinct posterior ridge. The type is a young shell.

UNIO MONROENSIS Lea.

Shell subrhomboid, convex or subinflated, subsolid, inequilateral; beaks rather full and elevated, their sculpture apparently a few corrugated, longitudinal ridges; posterior ridge well developed, angled, ending behind in a point near the base; base line curved; post-dorsal area obliquely subtruncated; anterior end round; surface nearly smooth, the dorsal slope sometimes having a few wrinkles; epidermis reddish or olive-brown, darker behind; left valve with two small, ragged, subcompressed pseudocardinals and two delicate, curved laterals; right valve with one or two pseudocardinals, the upper, when present, always small, and one lateral; muscle scars rather shallow; nacre brilliant, purplish or violet, iridescent behind.

Length 70, height 43, diam. 25 mm.

.Florida.

Type locality, Lake Monroe, Fla.

Unio monroensis LEA, Desc. of 12 sp. of Uniones, 1843, no pagination; Tr. Am. Phil. Soc., IX, 1845?, p. 279, pl. XLI, fig. 8; Obs., IV, 1848, p. 37, pl. XLI, fig. 8.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 410, pl. LI, fig. 1; Syn., 1900, p. 710.

Margaron (Unio) monroensis LEA, Syn., 1852, p. 29; 1870, p. 46.

Lea has only a single specimen, the type, in his collection and it differs a little from anything else I have seen. The posterior ridge curves up in the middle while in other shells, which seem to be this, it curves down medially. There seems to be an almost absolute transition from this species to *U. hartwrighti* and *U. hinkleyi*.

UNIO HARTWRIGHTI B. H. Wright.

Shell subrhomboid, subinflated, subsolid, inequilateral, with full, high beaks, whose sculpture has not been observed; posterior ridge high, pinched up above almost into a carina, becoming almost double below and ending in a point just above the base; post-dorsal slope obliquely truncated above, somewhat biangulate below; surface nearly smooth, with a few low, concentric ridges, decidedly wrinkled on the dorsal slope; epidermis rich, reddish-brown, faintly rayed; left valve with two subcompressed pseudocardinals and two remote laterals; right valve with one pseudocardinal and one lateral; nacre brilliant, salmon in the cavity, tinted purple at the border, iridescent behind.

Length 79, height 45, diam. 30 mm.

Type locality, Lake Beresford, Florida.

Unio hartwrighti B. H. WRIGHT, Naut., IX, 1896, p. 121, pl. II, figs. 4-6.—SIMPSON, Syn., 1900, p. 710.

The only specimen, which I have seen, is the type and this has a remarkably high, almost pinched up, posterior ridge, decided wrinkles behind and rich colored epidermis and nacre.

UNIO HINKLEYI B. H. Wright.

Shell long rhomboid, inequilateral, subinflated, scarcely subsolid; beaks moderately full, slightly elevated, their sculpture not seen; posterior ridge well developed, angled, ending behind in a point at or near the base of the shell; dorsal slope very faintly wrinkled, obliquely truncated; anterior end cut away a little below, rounded; base line straight or slightly curved; surface nearly smooth; epidermis dark green, shaded brown and almost black behind; left valve with two compressed, reflexed pseudocardinals and two delicate laterals; right valve with one pseudocardinal and one lateral; muscle scars shallow; nacre rather bright, purplish, iridescent behind.

Length 74, height 38, diam. 23 mm.

Florida.

Type locality, Lake Monroe, Fla.

Unio hinkleyi B. H. Wright, Pr. Ac. N. Sci. Phila., 1888, p. 117, pl. IV, fig. 3.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 423, pl. LXV, fig. 4; Syn., 1900, p. 710.

I have before me what is said to be the type from Mr. B. H. Wright, but, if it is, the figure is not correctly drawn. The shell is more pointed behind and straighter on the base than the figure shows. The species, if species it is, would go in the *buckleyi* group as well as in this.

UNIO WEBSTERI B. H. Wright.

Shell somewhat elongated, subrhomboid, convex, rather thin, inequilateral; beaks only moderately full and elevated; posterior ridge angled, becoming almost double below, ending in a rounded point or biangulation a little above the base; basal and dorsal lines somewhat rounded; surface with irregular growth lines sometimes wrinkled behind; epidermis reddish-brown to blackish, somewhat rayed in young shells; left valve with two compressed or subcompressed pseudocardinals and two remote laterals; right valve with one pseudocardinal and one lateral; muscle scars shallow; nacre bluish to purplish.

Length 97, height 55, diam. 32 mm.

Florida.

Type locality, Lake Woodruff, Volusia Co., Fla.

Unio websteri B. H. WRIGHT, Pr. Ac. N. Sci. Phila., 1888, p. 113, pl. II, fig. 2.—SIMPSON, Syn., 1900, p. 711.

A very unsatisfactory species, if it is a species. Mr. Wright has sent three examples to the National Museum, which he claims are typical, but neither of them agree very closely with his figure. The two younger shells are rayed, they are differently shaped from the older one and have heavier pseudocardinals. I confess I am at a loss to know what to do with it.

UNIO DORSATUS Lea.

Shell subrhomboid or sometimes almost subtriangular, inequilateral, convex, subsolid; beaks somewhat elevated but not inflated, their sculpture not observed; posterior ridge full, angled above, becoming double below, ending behind near the

base in a biangulation; anterior end slightly narrowed; posterior slope often wrinkled, obliquely truncated; surface with irregular growth lines; epidermis dirty, tawny-brown, sometimes feebly rayed: left valve with two ragged, stumpy pseudocardinals and two laterals, the lower largest; right valve with one pseudocardinal, sometimes with a small one above, and one lateral; muscle scars well marked; nacre lurid, tinted with purple.

Length 59, height 39, diam. 22 mm.

Type locality, Catawba River, North Carolina. Also, Florida.

Unio dorsatus LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 160; Jl. Ac. N. Sci. Phila., VI, 1868, p. 300, pl. XLV, fig. 112; Obs., XII, 1869, p. 60, pl. XLV, fig. 112.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 411, pl. LI, fig. 7; LII, figs. 1, 2; Syn., 1900, p. 711.

Margaron (Unio) dorsatus LEA, Syn., 1870, p. 37.

This species shows relationships with the *complanatus* group. Some specimens recall *U. congaræus*, but the shells are shorter, rougher and rather more narrowed in front.

UNIO WACCAMAWENSIS Lea.

Shell rather elongated, rhomboid, inequilateral, scarcely sub-solid, subinflated or inflated; beaks not high or full, their sculpture not seen; posterior ridge very high, decidedly angled, ending behind in a point at or near the base of the shell; dorsal slope obliquely truncate, the termination joining the dorsal line at an angle; surface with delicate growth lines; posterior slope often wrinkled; epidermis ashy or smoky-green, with radiating wrinkles; left valve with two compressed pseudocardinals and two delicate laterals; right valve with one pseudocardinal and one lateral; nacre bluish-white.

Length 43, height 21, diam. 17 mm.

Length 37, height 18, diam. 15 mm.

Type locality, Waccamaw Lake, North Carolina.

Unio waccamawensis LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 193; Jl. Ac. N. Sci. Phila., VI, 1866, p. 16, pl. v, fig. 14; Obs., XI, p. 20, pl. v, fig. 14.—SIMPSON, Syn., 1900, p. 711.

Margaron (Unio) waccamawensis LEA, Syn., 1870, p. 36.

An aberrant form, which perhaps might as well go in the *buckleyi* group as here. Young shells remind one somewhat of some of the specimens of *Alasmidonta heterodon*, but this form is more inflated and a little differently colored.

Group of *Unio pigerrimus*.

Shell rather solid, elliptic rhomboid, somewhat inflated, with a low, rounded posterior ridge, sometimes a little arcuate below, biangulate behind; beaks full, sculpture a few coarse ridges, which are curved upward and swollen where they cross the posterior ridge; surface concentrically striate and often sculptured with curved, subradiating or zigzag corrugations, which have a tendency to break into nodules; epidermis brownish; hinge rather heavy; pseudocardinals stumpy, granular; laterals club-shaped; muscle scars well marked.

Animal unknown.

UNIO PIGERRIMUS CROSSE and FISCHER.

Shell inequilateral, subelliptical or subrhomboid, inflated quite solid, with full high beaks whose sculpture has not been observed; posterior ridge rounded, slightly biangulate, ending in a feeble biangulation behind; the posterior slope obliquely subtruncate; surface covered with rude, curved, subradial plications, which are divaricate on the posterior ridge; epidermis blackish-olive; hinge thick; left valve with two pseudocardinals the hinder much higher and two laterals; right valve with two pseudocardinals, the upper small and one lateral; anterior muscle scars deep, very rough; posterior scars shallow; nacre white, tinted with rose.

Length 59, height 38, diam. 27 mm.

Mexico.

Unio pigerrimus CROSSE and FISCHER, Jl. de Conch., XLI, 1893, p. 293.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 582, pl. LXV, figs. 1, 1a.—SIMPSON, Syn., 1900, p. 711.

Unio psoricus var. *pigerrimus* VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 494.

A rather short, solid species with heavy hinge and rude sculpture. According to its authors the nacre is tinted with rose, while that of *mitchelli* is white.

UNIO MITCHELLI Simpson.

Shell subrhomboid, oblong, moderately convex, rather solid, inequilateral, with rather low, somewhat flattened, beaks, whose sculpture consists of a few strong, irregular ridges running nearly parallel to the growth lines; posterior ridge rather low, generally rounded and sometimes double, often ending behind in a feeble biangulation; base line straight or slightly curved, sometimes a little arcuate; surface covered with irregular, rather feeble, concentric ridges and showing sometimes on the posterior slope and rarely on the disk a few faint corrugations; epidermis olive to black, greenish when young, sometimes faintly rayed on the earlier growth; left valve with two rather small, but solid, ragged, nearly equal sized, pseudocardinals and two remote laterals; right valve with one strong pseudocardinal, sometimes with a small second one above, and one lateral; beak cavities shallow, showing numerous scars; anterior scars rather shallow, smooth, posterior scars large, round, impressed; nacre white.

Length 54, height 33, diam. 20 mm.

Length 91, height 58, diam. 33 mm.

Southern Texas to New Leon, Mexico.

Type locality, Guadalupe River, Victoria Co., Texas.

Unio mitchelli SIMPSON (in Dall.), Pr. U. S. Nat. Mus., XVIII, 1896, p. 5; Pr. U. S. Nat. Mus., XIX, 1896, p. 371, pl. xxxii, figs. 1-3; Syn., 1900, p. 711.

Var. *iheringi* B. H. Wright.

Shell with a more decided posterior ridge than the type; beak sculpture irregular and broken up, sometimes somewhat doubly looped; epidermis smoother and more shining than in typical shells.

Southern Texas.

Type locality, San Saba River, Menard Co., Texas.

Unio iheringi B. H. WRIGHT, Naut. XII, 1898, p. 93.—SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 79, pl. IV, fig. 5; Syn., 1900, p. 712.

Var. *elongatus* n. v.

Shell considerably elongated, biangulate and slightly compressed behind; epidermis rather smooth, greenish-brown; beak sculpture irregularly doubly looped.

Length 80, height 43, diam. 24 mm.

Guadalupe River, Kerr County, Texas.

Much longer in proportion to its height than the type or the variety *iheringi*, but having the same kind of epidermis and beak sculpture as the latter.

In deference to the opinions of some of our best conchologists I have reduced the form called *iheringi* to the rank of a variety of *mitchelli*. Typically the two are quite distinct but there seem to be many intermediate forms. *Unio mitchelli* is apparently close to *U. pigerrimus*, but from the figures and description of the latter, it is a shorter, much solidier form, with stronger teeth, and hinge plate, and much more rudely sculptured surface.

UNIO SPHENORHYNCHUS Fischer and Crosse.

Shell very inequilateral, elongated, arcuate, subinflated, its greatest diameter being opposite the beaks, from which to a point one-third of the way from the posterior end there is a gradual narrowing and from this point to the posterior end there is a rapid slope, solid; posterior ridge rather well developed, scarcely double; surface strongly concentrically striate, and having a few, short, subobsolete, radial plications; epidermis brownish-black; beaks moderately full, their sculpture not observed; left valve with two strong pseudocardinals and two remote curved laterals; right valve with one strong, lacerated pseudocardinal and a faint tooth above; anterior scars deep and rough; posterior scars shallow; nacre yellowish in the

cavity of the shell, whitish or bluish and iridescent at the border.

Length 71, height 37, diam. 27 mm.

Mexico.

Unio sphenorhynchus FISCHER and CROSSE, Miss. Sci., II, 1894, p. 617, pl. LXVI, figs. 2, 2a.—SIMPSON, Syn., 1900, p. 712.

This shell is apparently related to *Unio mitchelli*, but is longer and more drawn out posteriorly than the type and is more inflated than the variety *elongatus*. It differs from all allied forms in being decidedly arcuate, the base line being decidedly incurved in the shell figured.

UNIO RUBICUNDUS von Martens.

Shell oblong, subrhomboid, solid, subinflated with a well developed posterior ridge, which is scarcely double; beaks rather high about two-fifths of the way from the anterior end of the shell, their sculpture not noted; surface rather strongly concentrically striate or sulcate, and having curved plications on the posterior slope; posterior end feebly biangulate; post-dorsal margin curved; base very slightly incurved; epidermis fuscous; left valve with two crenulated, strong pseudocardinals and two strongly curved laterals; muscle scars impressed, the anterior ones rough; pallial line remote from the border anteriorly; nacre purple.

Length 89, height 57, diam. 34 mm.

North Guatemala; Coban.

Unio rubicundus VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 514, pl. XXXIV, figs. 3, 3a.

Only a single valve of this is known, and I am somewhat at a loss to say where it groups. I, however, incline to place it with *U. mitchelli* and *pigerrimus*. Its teeth are a good deal like those of old specimens of *mitchelli* and the surface is sculptured somewhat after the manner of the two forms I have placed here. Its widely removed pallial line is a good distinctive character, and in its strong sulcations it differs from any related form.

Group of *Unio liebmanni*.

Shell rather solid, inflated, ovate rhomboid or trapezoidal, with a well-developed posterior ridge, pointed at or near the base behind, but not biangulate, nearly straight or slightly incurved below; beaks full, sculpture not seen; surface smooth or concentrically striate; epidermis dark, scarcely rayed; hinge rather strong; pseudocardinals heavy, compressed; muscle scars distinct; nacre livid to whitish.

Animal unknown.

UNIO LIEBMANNI Philippi.

Shell rather large, inequilateral, elongated, subelliptical to subrhomboid, solid, convex, with a moderately developed posterior ridge, which may be rounded or angled; beaks not greatly elevated, their sculpture not observed; anterior end rounded and angled above just in front of the lunule; dorsal margin curved behind the beaks, sometimes feebly biangulate behind; basal line very slightly rounded, the post-basal point but little elevated; epidermis dark brown or blackish, subshining; left valve with two ragged, subcompressed pseudocardinals, the hinder reflexed, and two laterals, the upper very feeble; right valve with one pseudocardinal and sometimes a faint one above it, with one lateral sometimes slightly doubled; beak cavities shallow, showing the dorsal scars; anterior muscle scars deep and somewhat torn; nacre flesh-colored or purple, thicker in front.

Length 92, height 50, diam. 35 mm.

Mexico.

Unio liebmanni PHILIPPI, Zeits. für Mal., IV, 1847, p. 96; Abbild. und Besch., III, 1849, p. 109, pl. VI, fig. 1.—KUSTER, Conch. Cab. Unio, 1862, p. 281, pl. XCIV, fig. 7.—SIMPSON, Syn., 1900, p. 712.—VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 500, pl. XXXIV, figs. 1, 1a, 1b.

Margaron (Unio) liebmanni LEA, Syn., 1870, p. 48.

I have only seen a single specimen of this species, a fine shell from Passo de Orijo, Mexico, presented to the National

Museum by von Ihering. So closely does this resemble a large *Unio buckleyi* that I know of no characters which constantly differ between the two. It is a little wider and more broadly biangulate behind than most specimens of *buckleyi*; the epidermis is a little different from that of that species and the nacre becomes thin behind a little more suddenly, but occasional specimens of *buckleyi* show the peculiarities of form, nacre and epidermis that *liebmanni* does. I cannot doubt that it is a Mexican species and it is quite probable that a good series showing different stages of growth would furnish good differential characters.

UNIO OPACATUS Crosse and Fischer.

Shell subrhomboid, solid, inflated, with a high, pronounced, curved posterior ridge, with full high beaks, whose sculpture has not been examined; lunule well marked, the epidermal matter extending through under the beaks; there is a sort of rounded anterior ridge and in the region of it there are sometimes curved, radial, elevated lines; anterior end rounded; dorsal line curved from the beaks; base straight or decidedly incurved, ending in a beak behind; epidermis dark brown or blackish, somewhat silky, slightly rayed in the young shell; left valve with two ragged pseudocardinals, which are partly joined together and two short, curved laterals; right valve with two pseudocardinals, the upper generally smaller but sometimes equalling the lower in size, with one lateral and often a vestigial second; beak cavities rather deep; muscle scars impressed, the anterior ones very rough; nacre whitish-salmon or purplish-tinted, dull.

Length 49, height 32, diam. 25 mm.

Length 58, height 36, diam. 29 mm.

Mexico, various localities.

Unio opacatus CROSSE and FISCHER, Jl. de Conch., XLI, 1893, p. 295.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 592, pl. LXVI, figs. 1, 1a.—SIMPSON, Syn., 1900, p. 712.

A very solid shell, shaped much like *U. plexus* Conrad, but entirely destitute of nodules. It has a slightly developed an-

terior ridge, which is well rounded, and sometimes has faint, curved, raised, radial lines in the anterior part of the shell, which are shown in the figure of Fischer and Crosse though they do not call attention to the fact. They state that the pseudocardinals of the right valve are equal in size, which is the case in some specimens but not in all. The shell is often longer in proportion than theirs.

Group of *Unio buckleyi*.

Shell oval, obovate, subtrapezoidal, or elliptical, with a more or less developed posterior ridge, often biangulate behind, compressed or inflated, thin or somewhat solid; beaks generally full, sculptured with several rather strong concentric ridges, which are either nearly parallel with the growth lines or slightly doubly looped; posterior slope often faintly wrinkled; epidermis usually smooth and shining in the younger shells, often rough when old, becoming darker with age, rayed when young. Hinge teeth solid or compressed; nacre mostly brilliant, of many shades. Animal not differing especially from that of closely related groups.

UNIO BUCKLEYI Lea.

Shell generally long ovate, rarely subrhomboid or somewhat obovate, subinflated to inflated, subsolid to solid, inequilateral; beaks rather full and high, their sculpture consisting of numerous, slightly doubly-looped ridges; dorsal slope sometimes carried up, especially in the younger shell, so as to form a small wing, in which case the general outline is somewhat rhomboid; posterior ridge usually full and rounded, ending behind in a blunt point at or below the median line; surface varying from smooth to somewhat rough; epidermis generally smooth and shining in the younger shells, often black and coarse in old ones, tawny, brownish, coppery, greenish-yellow or olive-green, often beautifully rayed when young; left valve with two usually subcompressed, ragged pseudocardinals and two laterals; right valve with two pseudocardinals, the upper

small, and one lateral; beak cavities shallow; muscle scars impressed; nacre white, straw, yellow, salmon to purple, usually bright and iridescent behind.

Length of type 94, height 50, diam. 36 mm.

Length 72, height 38, diam. 26 mm.

Length 70, height 33, diam. 21 mm.

Length 49, height 27, diam. 18 mm.

Florida.

Type locality, Lake George and Lake Monroe, Fla.

Unio buckleyi LEA, Desc. of 12 Uniones, 1843 (no pagination); Tr. Am. Phil. Soc., IX, 1845?, p. 276, pl. XXXIX, fig. 2; Obs., IV, 1848, p. 34, pl. XXXIX, fig. 2.—KUSTER, Conch. Cab. Unio, 1861, p. 177, pl. LVI, fig. 2.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIV, fig. 175.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 417, pl. LVIII, figs. 6, 7; LIX, figs. 1, 2; LX, fig. 2; Syn., 1900, p. 713.

Margaron (Unio) buckleyi LEA, Syn., 1852, p. 30; 1870, p. 48.

Unio buddianus LEA, Desc. of 12 Uniones, 1843; Tr. Am. Phil. Soc., IX, 1845?, p. 277, pl. XL, fig. 5; Obs. IV, 1848, p. 35, pl. XI, fig. 5.—KUSTER, Conch. Cab. Unio, 1861, p. 249, pl. LXXXIV, fig. 1.—REEVE, Conch. Icon., XVI, 1865, pl. XX, fig. 88.

Margaron (Unio) buddianus LEA, Syn., 1852, p. 32; 1870, p. 52.

Unio dalli B. H. WRIGHT, Pr. Ac. N. Sci. Phila., 1888, p. 119, pl. VI, fig. 1.

It is difficult to write a description which will cover the almost infinite variety of forms that I believe should be included under the name of *buckleyi*. Most of the younger shells are smooth and shining, and are often beautifully though rather faintly rayed. Usually the epidermis becomes rough and blackish at maturity or with age, and old specimens are often arcuate. Under very favorable circumstances the shells retain their brilliancy when fully mature or even when old. There is great variation in the degree of solidity of the shell

and teeth as there is in the nacre. A number of varieties might be made but most of them so completely mix with the typical form that it hardly seems worth while to designate them.

Var. *orcuttii* S. H. Wright.

Shell almost evenly ovate, rather inflated, subsolid or solid; epidermis smooth and shining, generally bronzy or coppery, rayed with green; nacre rich and brilliant, frequently golden, coppery or bronzy, and iridescent.

Length 65, height 39, diam. 26 mm.

Type locality, Myakka Lake and River, Manatee County, Florida.

The type of this was collected by the writer and sent to Mr. Wright and it came from the Myakka River or Lake. It is found in other Floridan localities.

Unio orcuttii S. H. WRIGHT, West. Am. Sci., IV, 1888, p. 60, 3 figs.

Unio buckleyi var. *orcuttii* SIMPSON, Syn., 1900, p. 713.

UNIO JAYENSIS Lea.

Shell rather elongated, subovate or subrhomboid, often being slightly winged, in which case it assumes the latter form, convex to subinflated, inequilateral, generally rather thin; beaks only moderately full and elevated, their sculpture consisting of irregular, corrugated, somewhat doubly-looped ridges; posterior ridge rounded or subangular above, generally double below, ending behind in a more or less definite biangulation at or below the median line; surface with uneven growth lines; epidermis often shining yellowish or yellow-green and rayed in young shells, greenish-brown or blackish and dull in old ones; pseudocardinals and laterals delicate; beak cavities shallow; nacre generally purplish, sometimes salmon-tinted, usually dull.

Type locality, Florida.

Unio jayensis LEA, Tr. Am. Phil. Soc., VI, 1838, p. 28, pl. IX, fig. 23; Obs., II, 1838, p. 28, pl. IX, fig. 23.—HANLEY, Biv. Shells, 1843, p. 206, pl. XXII, fig. 53.—CHENU, Ill. Conch., 1858, pl. XXII, figs. 4, 4a, 4b.—SOWERBY, Conch. Icon., XVI, 1867, pl. LX, fig. 301; pl. LXVII, fig. 343?—SIMPSON, Syn., 1900, p. 713.

Margarita (Unio) jayensis LEA, Syn., 1836, p. 37; 1838, p. 24.

Margaron (Unio) jayensis LEA, Syn., 1852, p. 37.

Elliptio jayensis ORTMANN, Ann. Car. Mus., VIII, 1912, p. 270.

Unio prasinatus CONRAD, Am. Jl. Conch., II, 1866, p. 279, pl. XV, fig. 14.

Margaron (Unio) jayanus LEA, Syn., 1870, p. 60.

Unio jayanus B. H. WRIGHT, Check List, 1888.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 419, pl. LXI, fig. 4.

Unio simpsoni E. H. WRIGHT, Check List, 1888.

Unio marshii B. H. WRIGHT, Pr. Ac. N. Sci. Phila., 1888, p. 118, pl. V, fig. 2.

Unio tryoni B. H. WRIGHT, Pr. Ac. N. Sci. Phila., 1888, p. 120, pl. VI, fig. 2.

Generally more elongated, less inflated, thinner and duller colored within and without than *U. buckleyi*. But there are intermediates, which I find very difficult to name and which might about as well be placed in one species as in the other.

UNIO SUBLURIDUS Simpson.

Shell rather small, subrhomboid or subelliptical, convex, solid or subsolid, inequilateral; beaks apparently not full or high; posterior ridge low, widely rounded or widely, feebly biangulate ending behind at and below the median line in a wide rounded point or a biangulation; outline of dorsal slope obliquely subtruncate, but curved; base line curved, sometimes full behind the middle; anterior end narrowed a little, rounded; surface nearly smooth; epidermis tawny-brown or pale reddish-brown, slightly concentrically wrinkled, subshining; pseudocardinals subcompressed, two in the left valve and one

with a faint upper one in the right valve; laterals curved; muscle scars small; nacre dirty copper-colored, iridescent behind.

Length 42, height 23, diam. 14 mm.

Type locality, Orange Springs, Marion County, Florida.

Unio subluridus SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 432, pl. LXXIII, figs. 3, 4; Syn., 1900, p. 743.

I can not be certain as to the relationship of this species, as the beaks are eroded in the only shells I have seen. I placed it in the section *Uniomerus* in the Synopsis, but am rather inclined now to put it near *Unio coruscus* and *buckleyi*. One of the three specimens I have before me is distinctly biangulate behind. The anterior end is rounded in front, not truncate as it is in *coruscus*.

UNIO CORUSCUS Gould.

Shell generally oval, sometimes subrhomboid, subinflated to inflated, subsolid to solid, inequilateral; beaks moderately full, somewhat elevated, their sculpture not observed; posterior ridge full, rounded, sometimes imperfectly double below and ending in a blunt point or slight biangulation at or below the median line; anterior end usually more or less truncated, ending in an angle above; dorsal and basal lines curved; surface commonly smooth; epidermis tawny, yellowish-green to reddish-brown, sometimes clouded or faintly rayed, shining; left valve with two compressed to stumpy, ragged pseudo-cardinals and two curved laterals; right valve with one pseudo-cardinal, often with a second small one above it and one lateral; beak cavities shallow; muscle scars deep in heavy shells, shallow in thin ones; nacre purplish, dull or slightly shining, sometimes iridescent behind. Length of a shell in the Lea collection presented by Dr. Gould, 29, height 17.5, diam. 31 mm.

Length 48, height 24, diam. 17 mm.

Length 70, height 40, diam. 30 mm.

Florida.

Type locality, River St. John's, near Lake Beresford, Fla.

Unio coruscus GOULD, Pr. Bost. Soc. Nat. Hist., I, 1856, p. 15.
—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 419, pl. LXIII, figs. 1, 7. —Syn., 1900, p. 714.—FRIERSON, Naut., XXV, 1911, p. 29, pl. 1, figs. 1, 2, 3.

Margaron (Unio) coruscus LEA, Syn., 1870, p. 48.

This is a remarkably variable and puzzling form and intermediates are abundant leading in the direction of several other species. There is a small shell in the Lea collection from Dr. Gould with the dimensions given above, which has no locality but "Florida" given, which may probably be considered typical. It seems to have the characters of maturity though it may be a young shell. It is a rather solid, inflated, oval, shining shell, the epidermis being clouded tawny, greenish-yellow and green, with a few faint rays, whence its name *coruscus*, no doubt. Nearly all the specimens which I refer to this species, are more or less truncated in front and angled at the upper anterior part. The shells are usually solid, rather inflated and oval in outline, though thinner specimens occur, and others, which are narrowed in front. The nacre is purplish in all the numerous specimens I have seen, and it is generally dull. One or two forms may possibly be worthy of varietal names.

Var. *fryanus* B. H. Wright.

Shell not quite so inflated as is usual, subsolid; epidermis reddish, orange, red-brown and greenish, often finely rayed, very brilliant.

Length 43, height 25, diam. 15 mm.

Type locality, Lake Ashby, Volusia County, Florida.

Unio fryanus B. H. WRIGHT, Pr. Ac. N. Sci. Phila., 1888, p. 113, pl. 11, fig. 1.

Unio coruscus var. *fryanus* SIMPSON, Syn., 1900, p. 714.

Var. *diozensis* S. H. Wright.

Shell subsolid, sometimes almost thin, narrowed at the anterior end and rather high on the dorsal margin at the poste-

rior end of the laterals; epidermis dark, sometimes dull and black.

Length 35, height 20, diam. 13.5 mm.

Length 57, height 28, diam. 20 mm.

Type locality, Lake Diaz, Volusia Co., Fla. Also Lake Beresford; Lake Ashby, Florida.

Unio diazeñsis S. H. WRIGHT, Naut., XI, 1897, p. 5.

Unio coruscus var. *fryanus* (part), SIMPSON, Syn., 1900, p. 714.

This varies insensibly into var. *fryanus* and to the ordinary manifestation, though some of the specimens are remarkably different from typical *coruscus*.

UNIO TENUISCULUS Frierson.

"Shell transversely elliptical, rather solid, quite small, being the smallest member of the great *buckleyi* group yet published; smooth, eradiate (except when quite young), brown-olive, shining on the sides, the posterior area rough and dull; dorsal and basal margins nearly parallel (the former a little arched in some examples). Posterior point low and widely biangulate; truncate in front. Nacre purple and salmon-colored. Teeth double in left, single in right valve, quite stout.

Length 36.5, alt. 20, diam. 14.5 mm." (Frierson).

Type locality, Reedy Lake, Polk Co., Fla.

Unio tenuisculus FRIERSON, Naut., XXV, 1911, p. 29, pl. 1, figs. 4, 5, 6.

"The shell is differentiated from *U. coruscus* by being smaller; by its parallel outline; by its posterior point being lower and biangulate. In proportion to size, it is heavier in texture, and when perfect shells of both are compared, it is not so shining as is *coruscus*. The squarely built anterior end is a character common to a number of Florida Uniones."

UNIO FERRISSII Marsh.

Shell nearly elliptical, solid, convex, inequilateral; dorsal and ventral lines rounded; anterior end subtruncated; dorsal slope obliquely truncated, meeting the dorsal line at a low

angle; beaks rather high, their sculpture not seen; posterior ridge well developed, subangular, ending below the median line in a point; surface nearly smooth; epidermis dark green or blackish with capillary rays, shining; posterior slope somewhat wrinkled; pseudocardinals compressed, solid, single in the right valve and double in the left; laterals short, slightly curved; anterior muscle scars very deep; posterior scars well marked; nacre pink, iridescent.

Length 57, height 30, diam. 22 mm.

Type locality, small creek near Palatka, Florida.

Unio ferrissii MARSH, Naut., V. 1891, p. 30.—SIMPSON Pr. U. S. Nat. Mus., XV, 1892, p. 423, pl. LXVI, figs. 1, 2;—Syn., 1900, p. 719.

Allied to *U. buckleyi* and *dorei*, but I cannot unite it with either. Unlike *U. buckleyi* it has the posterior ridge strong and the dorsal slope wrinkled, and on the other hand it is much less inflated than *U. dorei* and is differently colored. It seems to be one of the nondescripts of the puzzling *buckleyi* group, which can neither be properly separated from other allied forms nor united with them.

UNIO DOREI B. H. Wright.

Shell subrhomboid, the upper and lower outlines being somewhat rounded, solid, inflated, inequilateral; beaks full and high, their sculpture not seen; posterior ridge high, angled above, slightly double below, ending in a feeble, narrow bifurcation below the median line; dorsal slope obliquely truncated, meeting the dorsal line at an angle; anterior end subtruncate, angled above; surface nearly smooth; epidermis reddish-brown, rayless, shining; left valve with two compressed pseudocardinals and two curved laterals; right valve with two pseudocardinals, the upper smaller, and one lateral; muscle scars impressed, nacre brilliant salmon, iridescent behind.

Length 66, height 41, diam. 29 mm.

Type locality, Lake Monroe, Florida.

Unio dorei B. H. WRIGHT, Pr. Ac. N. Sci. Phila., 1888, p. 115, pl. III, fig. 1.—SIMPSON, Syn., 1900, p. 719.

I have only seen the type of this. It is rather short, solid, inflated, with a high, sharp posterior ridge. The epidermis is bright, rich brown, and on the posterior slope there are traces of two faint radial ridges. The pseudocardinals are rather compressed for so solid a shell; the nacre is very rich and brilliant. In some respects it seems close to *U. buckleyi*, but the high sharp posterior ridge and subrhomboid form ally it to the *crassidens* group.

UNIO CUNNINGHAMI B. H. Wright.

Shell usually subrhomboid, sometimes decidedly rhomboid, solid, subinflated to inflated, inequilateral; beaks apparently full and somewhat elevated, but too much crooked in all the examples seen to show any characters; posterior ridge decidedly developed, narrowly rounded, ending in a rather sharp point at or near the base; ventral outline generally straight, occasionally a little incurved; anterior end rounded or truncate, usually angled above; dorsal slope obliquely truncated; surface with irregular growth lines; epidermis shining greenish-yellow, tawny, ashy-brown or brown, sometimes clouded or faintly rayed with green; pseudocardinals compressed to solid, ragged; laterals short and curved; muscle scars small and impressed; nacre silvery, purplish, salmon or reddish, often bright.

Length 52, height 39, diam. 23 mm.

Length 46, height 26, diam. 24 mm.

Florida.

Type locality, Lakes of Sumpter Co., Fla.

Unio cunninghami B. H. WRIGHT, Pr. Ac. N. Sci. Phila., XIII, 1883, p. 58, pl. 1, figs. 1-4.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 422, pl. LXV, fig. 6;—Syn., 1900, p. 714.

Closely related to *U. micans* and *U. coruscus*. It is solid and more inflated than the former, is generally lighter colored than the latter, and is more decidedly rhomboid and has a higher posterior ridge than either.

UNIO MICANS Lea.

Shell subelliptical or subrhomboid, convex, inequilateral, rather thin to subsolid; beak only moderately raised and full, their sculpture a few strong, subconcentric ridges, which are strongest where they cross the posterior ridge; posterior ridge full, narrowly rounded, ending behind in a blunt point below the median line; surface generally smooth; epidermis ashy-green or yellow-green, faintly rayed or rayless; left valve with two small, subcompressed pseudocardinals and two delicate laterals; right valve with one pseudocardinal and one lateral; beak cavities shallow; muscle scars not impressed; nacre bluish-white, rather dull.

Length 50, height 26, diam. 17 mm.

North Carolina to South Georgia and Florida.

Type locality, Catawba River, Gaston Co., and Deep River, Gulf, N. C.

Unio micans LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 85; Jl. Ac. N. Sci. Phila., V, 1862, p. 59, pl. III, fig. 207; Obs., VIII, 1862, p. 63, pl. III, fig. 207.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXV, fig. 182.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 423, pl. LXXV, fig. 3;—Syn., 1900, p. 714.

Margaron (Unio) micans LEA, Syn., 1870, p. 45.

Unio perlucens LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 193; Jl. Ac. N. Sci. Phila., VI, 1866, p. 18, pl. v, fig. 16; Obs., XI, 1867, p. 22, pl. v, fig. 16.

Margaron (Unio) perlucens LEA, Syn., 1870, p. 45.

Close to *cunninghami* but thinner, less rhomboid, and with a lower posterior ridge.

UNIO LEHMANII S. H. Wright.

Shell short elliptical, solid, convex, inequilateral; beaks only moderately full or high, their sculpture not seen; posterior ridge full, faintly double, ending behind in rather narrow biangulation just below the median line; surface nearly smooth, yellowish-green to olive or brownish, faintly rayed, shining; left valve with two heavy pseudocardinals and two laterals;

right valve with one pseudocardinal, a vestigial one above it and one double lateral; beak cavities shallow; muscle scars small, impressed; nacre dull purple.

Length 70, height 45, diam. 27 mm.

Type locality, St. Mary's River, Florida.

Unio lehmanii S. H. WRIGHT, Naut., X, 1897, p. 138.—SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 80, pl. IV, fig. 9;—Syn., 1900, p. 715.

A short, nearly elliptical, solid, convex shell, with shining epidermis and double laterals in the right valve. The nacre is dull, but slightly iridescent behind.

UNIO BURTCHELANUS S. H. WRIGHT.

Shell long elliptical, subcompressed or convex, solid, inequilateral; beaks apparently only moderately full or high; posterior ridge well developed, somewhat double, ending in a narrow biangulation at or a little below the median line; surface nearly smooth; epidermis tawny, more or less rayed with green; in the type, a young shell, the green color preponderates; left valve with two rather small, ragged pseudocardinals and two curved laterals; right valve with two pseudocardinals, the upper small, and one lateral, which sometimes is partially double; beak cavities shallow; muscle scars small, impressed; nacre copper-colored, sometimes tinted salmon.

Length 53, height 29, diam. 16 mm.

Length 62, height 38, diam. 20 mm.

Type locality, St. Mary's River, Florida.

Unio burtchianus S. H. WRIGHT, Naut., X, 1897, p. 137.—SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 80, pl. IV, fig. 8;—Syn., 1900, p. 715.

Too close to *U. lehmanii*. The only differences I can see are that this species is a little lower in proportion and less inflated than that species. The nacre of the three specimens I have seen is a little warmer in tint, but this is a character of very trifling value. The measurements first given are for the type, a young shell which shows quite green from the large num-

ber of faint, green rays that partly coalesce. The other measurements are from a shell which approaches more nearly to *U. lehmani*.

UNIO CHIPOLAENSIS Walker.

"Shell ovate, not very thick, somewhat inflated in the umbonal region, evenly rounded before and biangulate behind with a slight emargination just above the superior posterior angle; dorsal margin decidedly curved; basal margin slightly but regularly curved; epidermis smooth, chestnut-colored, darkening to black on the umbones, with several darker lines indicating arrested periods of growth. Umbonal slope well rounded towards the beaks, but flattening out and becoming slightly biangulate posteriorly. Beaks prominent, apparently incurved when perfect. Cardinal teeth compressed, crenulate; those in the left valve are nearly in a straight line. Lateral teeth rather long, slender and slightly curved. Cicatrices distinct. Cavity of the beaks large and rounded. Nacre salmon-color, darker anteriorly.

Length 56.5, height 32, diam. 22 mm." (Walker).

Type locality, Chipola River, Fla.

Unio chipolaensis WALKER, Naut., XVIII, 1905, p. 135, pl. IX, figs. 6, 7.

"This species is a member of the group of *U. buckleyi* and is distinguished by the smooth, chestnut epidermis, entirely without rays, but ornamented with concentric dark bands such as occur in *Pleurobema chattanoogaensis*, inflated umbonal slope and biangulated posterior extremity with a slight emargination above. It is related to some forms of *U. burtchianus* B. H. Wr., but differs in being less elongated and more inflated with more prominent beaks. The color both of the epidermis and nacre is also quite different."

UNIO CONFERTUS Lea.

Shell usually more or less rhomboid, though sometimes nearly elliptical or slightly obovate, subsolid to solid, subinflated to inflated, inequilateral; beaks moderately full and high,

their sculpture consisting of numerous ridges that run nearly parallel with the growth lines; posterior ridge full, rounded above, inclined to be narrowly double below, ending behind in a blunt point or faint biangulation below the median line; surface with irregular growth lines, nearly smooth, tawny and feebly rayed with green in young shells, reddish-brown or black, often rough and dull-colored when adult; left valve with two strong, ragged pseudocardinals and two curved laterals; right valve with two pseudocardinals, the upper small, and one lateral; anterior scars impressed; posterior scars shallow; nacre varying from dull pinkish-purple to bluish or whitish.

Length 96, height 55, diam. 37 mm.

Length 68, height 39, diam. 30 mm.

North Carolina to Florida.

Type locality, Santee Canal, S. C.

Unio confertus LEA, Tr. Am. Phil. Soc., V, 1834, p. 103, pl. XVI, fig. 47; Obs., I, p. 215, pl. XVI, fig. 47.—HANLEY, Biv. Shells, 1843, p. 200, pl. XXIII, fig. 24.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXV, fig. 185.—SIMPSON, Syn., 1900, p. 715.

Margarita (Unio) confertus LEA, Syn., 1836, p. 31; 1838, p. 22.

Margaron (Unio) confertus LEA, Syn., 1852, p. 33; 1870, p. 53.

Unio lugubris LEA, Tr. Am. Phil. Soc., VI, 1838, p. 30, pl. IX, fig. 25; Obs., II, 1838, p. 30, pl. IX, fig. 25.—HANLEY, Biv. Shells, 1843, p. 206, pl. XXII, fig. 9.—CHENU, Bib. Conch., 1st. ser., III, 1845, p. 53, pl. XV., figs. 1, 1a; Ill. Conch., 1858, pl. XX, figs. 3, 3a, 3b.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXX, fig. 423.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 424, pl. LXVI, fig. 4; LXVII, fig. 1.

Margarita (Unio) lugubris LEA, Syn., 1836, p. 37; 1838, p. 24.

Margaron (Unio) lugubris LEA, Syn., 1852, p. 38; 1870, p. 53.

Unio geddingsianus LEA, Pr. Am. Phil. Soc. I, 1840, p. 285; Tr. Am. Phil. Soc., VIII, 1842, p. 202, pl. XI, fig. 15; Obs. III, 1842, p. 40, pl. XI, fig. 15.—CHENU, Ill. Conch., 1858, pl. XXXI, figs. 3, 3a, 3b.

Margaron (Unio) geddingsianus LEA, Syn., 1852, p. 33; 1870, p. 53.

Unio limatulus CONRAD, Pr. Ac. N. Sci. Phila., IV, 1849, p. 154; Jl. Ac. N. Sci. Phila., I, 1850, p. 276, pl. XXXVII, fig. 9.

Margaron (Unio) limatulus LEA, Syn., 1852, p. 32; 1870, p. 52.

Unio whiteianus LEA, Tr. Am. Phil. Soc., X, 1852, p. 258 pl. XIV, fig. 8.—Obs., V, 1852, p. 14, pl. XIV, fig. 8.

Margaron (Unio) whiteianus LEA, Syn., 1852, p. 33; 1870, p. 53.

Unio vibex CONRAD, Pr. Ac. Phila., VI, 1853, p. 260.

Unio similis LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 169; Jl. Ac. N. Sci. Phila., IV, 1858, p. 91, pl. XIX, fig. 71; Obs., VI, 1858, p. 91, pl. XIX, fig. 71.

Margaron (Unio) similis LEA, Syn., 1852, p. 52; 1870, p. 53.

Unio protensus LEA, Pr. Ac. N. Sci. Phila., IX, 1865, p. 88; Jl. Ac. N. Sci. Phila., VI, 1868, p. 256, pl. XXXI, fig. 71; Obs., XII, 1869, p. 16, pl. XXXI, fig. 71.

Margaron (Unio) protensus LEA, Syn., 1870, p. 60.

Unio radiolus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 192; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 21, pl. VI, fig. 18; Obs., XIII, 1874, p. 25, pl. VI, fig. 18.

Another very variable species, some specimens of which show an affinity for the *complanatus* group. Generally the shell is rather rhomboid, subinflated and solid. The epidermis is darker and the surface is more concentrically sculptured than in *U. buckleyi*.

UNIO INSULSUS Lea.

Shell rather small, rhomboid, subinflated to inflated, inequilateral, subsolid to solid; beaks full and elevated, their sculpture not made out; posterior ridge well developed, single or double, ending behind at the base of the shell in a blunt point or biangulation; surface sometimes nearly smooth but generally with rude growth lines; epidermis dull ashy-green to brownish or blackish, occasionally very faintly rayed; left valve with two small, subcompressed or stumpy, rough pseudo-

cardinals and two curved laterals; right valve with two pseudocardinals, the upper small, and one lateral; beak cavities generally shallow; nacre dirty bluish or purplish-white.

Length 60, height 34, diam. 22 mm.

Length 48, height 26, diam. 17 mm.

Length 43, height 26, diam. 18 mm.

North Carolina to Florida.

Type locality, Roanoke River, Weldon, N. C.

Unio insulsus LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 86; Jl. Ac. N. Sci. Phila., IX, 1862, p. 53, pl. I, fig. 199; Obs., VIII, 1862, p. 57, pl. I, fig. 199.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 422, pl. LXV, figs. 1, 5; Syn., 1900, p. 716.

Margaron (Unio) insulsus LEA, Syn., 1870, p. 53.

Unio lucidus LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 192; Jl. Ac. N. Sci. Phila., VI, 1866, p. 9, pl. II, fig. 6; Obs., XI, 1867, p. 13, pl. II, fig. 6.

Margaron (Unio) lucidus LEA, Syn., 1870, p. 48.

Unio cistelliformis LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 192; Jl. Ac. N. Sci. Phila., VI, 1866, p. 19, pl. VI, fig. 17; Obs., XI, 1867, p. 23, pl. VI, fig. 17.

Margaron (Unio) cistelliformis LEA, Syn., 1870, p. 52.

Smaller, more generally and decidedly rhomboid than its near ally *U. confertus*. It is usually a rougher, dirtier, duller colored shell than that of *confertus*.

UNIO OBNUBILUS Lea.

Shell subrhomboid, convex or subinflated, subsolid to solid, inequilateral; beaks not much elevated or inflated, their sculpture not observed; posterior ridge well developed, double, ending behind in a faint biangulation below the median line; surface with low, irregular growth lines, rather smooth, covered with a greenish-brown epidermis, which is rarely very feebly rayed, subshining; left valve with two stumpy, roughened pseudocardinals and two curved laterals; right valve with two pseudocardinals, the upper low and indistinct, with

one lateral; beak cavities shallow; muscle scars impressed; nacre purplish, salmon or flesh-color, generally bright.

Length 66, height 38, diam. 22 mm.

Length 67, height 40, diam. 24 mm.

South Carolina to Florida.

Type locality, Buckhead Creek, Burke Co., Ga.

Unio obnubilus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 169; Jl. Ac. N. Sci. Phila., IV, 1858, p. 84, pl. xvii, fig. 64; Obs., VI, 1858, p. 84, pl. xvii, fig. 64.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 424, pl. lxxvi, fig. 3; Syn., 1900, p. 716.

Margaron (Unio) obnubilus LEA, Syn., 1870, p. 53.

Unio opacus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 169; Jl. Ac. N. Sci. Phila., IV, 1858, p. xviii, fig. 66; Obs., VI, 1858, p. 86, pl. xviii, fig. 66.

Margaron (Unio) opacus LEA, Syn., 1870, p. 52.

Unio aquatus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 170; Jl. Ac. N. Sci. Phila., 1858, p. 89, pl. xix, fig. 69; Obs., VI, 1858, p. 89, pl. xix, fig. 69.

Margaron (Unio) aquatus LEA, Syn., 1870, p. 52.

Unio viridicatus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 170; Jl. Ac. N. Sci. Phila., IV, 1858, p. 87, pl. xviii, fig. 67; Obs., VI, 1858, p. 87, pl. xviii, fig. 67.

Margaron (Unio) viridicatus LEA, Syn., 1870, p. 52.

Unio hepaticus LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 154; Jl. Ac. N. Sci. Phila., IV, 1860, p. 348, pl. lvii, fig. 173; Obs., VIII, p. 30, pl. lvii, fig. 173.

Margaron (Unio) hepaticus LEA, Syn., 1870, p. 52.

Unio santeensis LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 193.—Jl. Ac. N. Sci. Phila., VIII, 1874, p. 20, pl. vi, fig. 17; Obs., XIII, 1874, p. 24, pl. vi, fig. 17.

Unio nolani B. H. WRIGHT, Pr. Ac. N. Sci. Phila., 1888, p. 116; pl. iv, fig. 11.

This is a sort of exaggerated *U. occultus*. It is generally more rhomboid, larger and heavier than that species and has a more northerly range. Occasional specimens are somewhat produced in the post-basal region.

UNIO FUSCATUS Lea.

Shell long elliptical or slightly obovate, compressed or sub-compressed, rather thin; beaks low, somewhat compressed, their sculpture consisting of subconcentric, subnodulous ridges; posterior ridge low, usually more or less double, ending behind at and below the median line in a feeble biangulation; surface nearly smooth; epidermis pale reddish-brown or ashy-brown, often feebly rayed with green, shining in the young shells, showing lamellæ in the later growth and often covered behind with hair-like confervæ; left valve with two small, ragged pseudocardinals and two delicate, curved laterals; right valve with two pseudocardinals, the upper small, and one lateral; beak cavities shallow; muscle scars scarcely impressed; nacre coppery or purplish.

Length 67, height 36, diam. 18 mm.

Length of type, 44, height 22, diam. 12 mm.

Length 45, height 27, diam. 14 mm.

Florida.

Type locality, Black Creek, Fla.

Unio fuscatus LEA, Desc. 12 Uniones, 1843, (no pagination).

—Tr. Am. Phil. Soc., IX, 1845?, p. 277, pl. XL, fig. 4; Obs.,

IV, 1848, p. 35, pl. XL, fig. 4.—KÜSTER, Conch. Cab. Unio,

1848, p. 203, pl. LXVIII, fig. 2.—REEVE, Conch. Icon., XVI,

1865, pl. XXI, fig. 95.—SIMPSON, Pr. U. S. Nat. Mus., XVI,

1892, p. 420, pl. LXIII, figs. 2, 4; Syn., 1900, p. 717.

Margaron (Unio) fuscatus LEA, Syn., 1852, p. 30; 1870, p. 48.

Young shells of this species are very close to *U. occultus* and certain specimens of *U. tortivus*, but are generally a little more delicate than either. The older shells are thinner and have a peculiar texture and a coppery tint not seen in either of the above-mentioned forms. The old shells often become somewhat rhomboid, widening out at the posterior end, and the epidermis is roughened on account of being pinched up into delicate lamellæ. Old shells often have a considerable growth of hair-like confervæ at the posterior end. I have a dwarf, stunted form before me from Juniper Creek, Lake George, Florida, which is much narrowed in front.

UNIO OCCULTUS Lea.

Shell somewhat obovate or subrhomboid, a little narrowed in front, inequilateral, subcompressed or convex; beaks only moderately full or high, their sculpture consisting of nearly longitudinal ridges; posterior ridges usually faintly double, ending at and below the median line in a biangulation; post-basal region generally a little produced; surface nearly smooth, tawny-brown, usually closely covered with faint green rays, sometimes almost rayless and dark brown; left valve with two subcompressed pseudocardinals and two curved laterals; right valve with two pseudocardinals, the upper small and one lateral; muscle scars slightly impressed; nacre purple, sometimes a little coppery-tinted.

Length 52, height 28, diam. 18 mm. (type).

Florida.

Type locality, Black Creek and Lake Monroe, Fla.

Unio occultus LEA, Desc. 12 Uniones, 1843 (no pagination).—Tr. Am. Phil. Soc., IX, 1845?, p. 279, pl. XLI, fig. 7; Obs., IV, 1848, p. 37, pl. XLI, fig. 7.—KUSTER, Conch. Cab. Unio, 1861, p. 223, pl. LXXV, fig. 3.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 420, pl. LXIII, figs. 5, 6; Syn., 1900, p. 717.

Margaron (Unio) occultus LEA, Syn., 1852, p. 48; 1870, p. 48.

An exceedingly puzzling form, which varies toward *fuscatus*, *tortivus* and even *coruscus*. It is generally a little solidier, darker and more inflated than *fuscatus* and has a little different texture. It is not quite so rhomboid as most specimens of *tortivus* nor is it arcuate; it is less solid and inflated than *coruscus*. But there seems to be a set of connecting links, which more or less perfectly unite the above and several other so-called species of this excessively variable and puzzling group.

UNIO ARCTATUS Conrad.

Shell elongated, compressed or subcompressed, usually arcuate, inequilateral, subsolid; beak low, compressed, their sculpture strong, corrugated ridges, which nearly follow the growth lines; posterior ridge low, usually faintly double, end-

ing behind below the median line in a somewhat rounded biangulation; dorsal slope obliquely truncated; basal line usually incurved; surface smoothish, or marked with irregular growth lines; epidermis greenish-yellow to tawny-brown, red-brown or black, feebly rayed, smooth and shining in young or finely preserved adult specimens, rough and dark in old ones; left valve with two low, small but stumpy, pseudocardinals and two remote laterals; right valve with one pseudocardinal and one lateral; beak cavities very shallow; muscle scars not deep; nacre purple, rarely white, iridescent behind, usually dull in front.

Length 63, height 29, diam. 14 mm.

Length 50, height 23, diam. 13 mm.

Florida; South Georgia; west to the Black Warrior River, Alabama.

Type locality, Black Warrior and Alabama Rivers.

Unio arctatus CONRAD, Am. Jl. Sci., XXV, 1834, p. 340, pl. 1, fig. 9; New F. W. Shells, 1834, p. 36, pl. v, fig. 4.—HANLEY, Biv. Shells, 1843, p. 207, pl. XXIII, fig. 47.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 19, pl. III, fig. 10.—KUSTER, Conch. Cab. Unio, 1861, p. 195, pl. LXII, fig. 3.—SIMPSON, Syn., 1900, p. 717.

Margarita (Unio) arctatus LEA, Syn., 1836, p. 38; 1838, p. 25.

Margarita (Unio) arctatus LEA, Syn., 1836, p. 38; 1838, p. 25.

This species has a very wide distribution and is exceedingly abundant. Conrad's shell is higher behind than in front, is compressed, black and quite elongated, as well as arcuate. There is every possible variation to shorter, lighter colored, more inflated forms, which are not at all arcuate. The species seems close to *U. lazarus* and, if it did not insensibly run into elliptical or obovate forms in Florida, I should place it in the group of *U. complanatus*.

Var. *tortixus* Lea.

Under this name it may perhaps be well to place the ordinary southern manifestation of this protean species, which generally is not quite so elongated or arcuate as the type. In

many cases shells that I refer to this form are irregularly elliptical or rhombic obovate. *U. purpurellus* seems to me to be only a small, rather inflated form of *tortivus*.

Type locality, Chattahoochee River, Columbus, Ga.

Unio tortivus LEA, Pr. Am. Phil. Soc., I, 1840, p. 287; Tr. Am. Phil. Soc., VIII, 1842, p. 204, pl. XII, fig. 17; Obs., III, 1842, p. 42, pl. XII, fig. 17.—CHENU, Ill. Conch., 1858, pl. XXIX, figs. 6, 6a, 6b.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVI, fig. 193.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 421, pl. LXIII, fig. 8; LXIV, figs. 1, 3, 4.

Margaron (Unio) tortivus LEA, Syn., 1852, p. 33; 1870, p. 53.

Unio arctatus var. *tortivus* SIMPSON, Syn., 1900, p. 718.

Unio tetricus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 170; Jl. Ac. N. Sci. Phila., IV, 1859, p. 195, pl. XXII, fig. 78; Obs., VII, 1859, p. 13, pl. XXII, fig. 78.—KUSTER, Conch. Cab. Unio, 1862, p. 276, pl. XCI, fig. 7; XCIII, fig. 3.

Margaron (Unio) tetricus LEA, Syn., 1870, p. 53.

Unio purpurellus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 171; Jl. Ac. N. Sci. Phila., IV, 1859, p. 19, pl. XXIII, fig. 81; Obs., VII, 1859, p. 16, pl. XXIII, fig. 81.

Margaron (Unio) purpurellus LEA, Syn., 1870, p. 53.

Unio merceri LEA, Pr. Ac. N. Sci. Phila., VI, 1862, p. 169; Jl. Ac. N. Sci. Phila., V, 1862, p. 209, pl. XXXI, fig. 278; Obs., IX, 1863, p. 31, pl. XXXI, fig. 278.

Margaron (Unio) merceri LEA, Syn., 1870, p. 61.

UNIO NIGELLUS Lea.

Shell subrhomboid, narrowed in front, subinflated, inequilateral; beaks slightly elevated and inflated, their sculpture consisting of numerous corrugated, somewhat doubly-looped ridges; posterior ridge full, double, ending behind in a feeble biangulation at or near the base of the shell. The shell is most strongly inflated along the posterior ridge, in front of which it is somewhat wedge-shaped; posterior slope obliquely truncate; base line nearly straight, sometimes a little full behind the middle; anterior end rounded and narrow; surface with irregular growth lines, dirty greenish and rayed in the young

state, dark brown or black when old, subshining; pseudocardinals small, rough, stumpy; laterals short, remote; muscle scars small, well marked; nacre silvery, white, salmon, copper-color or purplish, iridescent behind.

Length 56, height 30, diam. 18 mm.

Length 43, height 24, diam. 14 mm.

Length 39, height 21, diam. 12 mm.

Chattahoochee River system; south into Florida.

Type locality, Chattahoochee River, Columbus, Ga.

Unio nigellus LEA, Pr. Am. Phil. Soc., V, 1852, p. 251; Tr. Am. Phil. Soc., X, 1852, p. 283, pl. XXIV, fig. 42; Obs., V, 1852, p. 39, pl. XXIV, fig. 42.—SIMPSON, Syn., 1900, p. 718.

Margaron (Unio) nigellus LEA, Syn., 1852, p. 30; 1870, p. 53.

Unio denigratus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 171; Jl. Ac. N. Sci. Phila., IV, 1859, p. 200, pl. XXIII, fig. 83; Obs., VII, 1859, p. 18, pl. XXIII, fig. 83.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 422, pl. LXXV, fig. 1.

Margaron (Unio) denigratus LEA, Syn., 1870, p. 52.

Distinguished from related species by being considerably higher behind than in front, by having the greatest diameter at the posterior ridge and by its soft, rich nacre.

UNIO PINEI B. H. Wright.

Shell long rhomboid, subinflated, subsolid, inequilateral; beaks apparently not very high or full, their sculpture not seen; posterior ridge full, angled, narrowly double, ending behind in a feeble biangulation at or near the base of the shell; dorsal and ventral lines nearly straight and parallel; dorsal slope obliquely truncated above; anterior end rounded and slightly angled above; surface nearly smooth; epidermis with delicate lamellæ, but shining, reddish-brown, tawny and green, faintly rayed in fine specimens; pseudocardinals subcompressed, ragged; laterals nearly straight; muscle scars shallow; nacre white, purple, brown or copper-colored, rather rich and bright; iridescent behind.

Length 66, height 31, diam. 20 mm.

North Florida.

Type locality, Lake, Hernando Co., Fla.

Unio pinci B. H. WRIGHT, Naut., XI, 1897, p. 40.—SIMPSON, Pr. Ac. N. Sci., Phila., 1900, p. 80, pl. III, fig. 1; Syn., 1900, p. 718.

Unio suttoni B. H. WRIGHT, Naut. XI, 1897, p. 56.

Possibly a decidedly rhomboid form of *U. buckleyi*. Two shells before me from Saratoga, Florida, agree very well with this, but are darker and practically rayless. *U. suttoni* does not seem to me to be specifically or even varietally different.

UNIO OSCARI B. H. Wright.

Shell elongated, subsolid, inflated, irregularly elliptical or subrhomboid, inequilateral; beaks apparently full and high, their sculpture not seen; posterior ridge high, angled and single above, narrowly and faintly double below, ending in a biangulation at or below the median line; dorsal and ventral lines slightly rounded; dorsal slope subtruncated, anterior end usually a little narrowed, rounded; surface with low, uneven, concentric sculpture; epidermis tawny-brown, shining, rayed in young shells; pseudocardinals low, subcompressed, often partially obliterated; laterals remote, rather feeble; all the teeth granular or somewhat vertically striate; muscle scars well impressed, large; nacre purple, coppery or bronzy.

Length 61, height 28, diam. 24 mm.

Florida.

Type locality, Creek from Lake Osceola, Winter Park, Fla. *Unio oscari* B. H. WRIGHT, Naut., V, 1892, p. 124; IX, 1896, p. 122, pl. II, figs. 1-3.—SIMPSON, Syn., 1900, p. 719.

Close to *U. hazelhurstianus* but more inflated, apparently smaller, with brighter brown epidermis and less perfect teeth.

UNIO HAZELBURSTIANUS Lea.

Shell elongated, irregularly elliptical, inequilateral, convex to subinflated, subsolid; beaks apparently not full or high; posterior ridge double, ending in a biangulation at or below the median line; dorsal and basal lines usually a little rounded; anterior end subtruncate, sometimes cut away slightly below and angled above; epidermis black; left valve with two stumpy

pseudocardinals and two laterals, the upper smaller; right valve with one pseudocardinal and one lateral; muscle scars well marked; nacre pale brownish-purple, rather dull.

Length 77, height 32, diam. 21 mm.

Southern Georgia.

Type locality, Satilla River, Camden Co., Ga.

Unio hazelhurstianus LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 166; Jl. Ac. N. Sci. Phila., IV, 1859, p. 211, pl. xxvi, fig. 92; Obs., VII, 1859, p. 29, pl. xxvi, fig. 92.—SOWERBY, Conch. Icon., XVI, 1866, pl. xxxv, fig. 188.—SIMPSON, Syn., 1900, p. 719.

Margaron (Unio) hazelhurstianus LEA, Syn., 1870, p. 60.

The surface is sculptured with rather fine, concentric ridges, the epidermis is black and thick and unless rubbed is dull. Dr. Lea has placed with his *hazelhurstianus* two shells, which I am sure are *naciculoides*, that being a thinner, more rhomboid form with smoother, lighter colored epidermis.

UNIO PYGMÆUS Lea.

"Shell smooth, elliptical, rather compressed, striate, rounded before and angular behind; substance of the shell rather thin, thicker before; beaks somewhat prominent; ligament short and thin; epidermis dark brown, striate, with obscure rays, and slightly polished; umbonal slope angular; marks of growth indistinct; cardinal teeth small, compressed; lateral teeth rather long, linear, slightly curved and thickened at the posterior end; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices in the centre of the cavity of the beaks; cavity of the shell shallow; cavity of the beaks small and angular; nacre blue and very iridescent behind.

Length 1.2, height .7, diam. .4 inches." (Lea.)

Type locality, Abbeville District, S. C.

Unio pygmæus LEA, Pr. Am. Phil. Soc., V, 1852, p. 252; Tr. Am. Phil. Soc., X, 1852, p. 262, pl. xv, fig. 14; Obs., V, 1852, pl. 18, pl. xv, fig. 14.—SIMPSON, Syn., 1900, p. 715.

Margaron (Unio) pygmæus LEA, Syn., 1870, p. 48.

"This is a very small species and a single valve only, (the right), has been received by me. I do not think this is quite adult. The beak is not sufficiently perfect to observe any undulations. This shell is about the size of *U. fabalis* (nobis), and *parvus* Barnes, but cannot be confounded with either of them. It is a thinner shell than the former and less inflated than the latter." (Lea).

Only a single, broken valve, the right, is known. Lea describes and figures it, but it is evidently a very young shell, too young to furnish reliable characters for identification. It may belong in the *buckleyi* group, but of that I cannot be certain.

UNIO BUXTONI B. H. Wright.

Shell much elongated, decidedly rhomboid, inequilateral, convex; beaks low, scarcely inflated, their sculpture a few longitudinal corrugations; posterior ridge high, angled, leading down to a point at the base of the shell; dorsal and basal lines parallel; dorsal slope obliquely truncated, the truncation meeting the dorsal line at an angle; anterior end cut away below, rounded, subangulate above; surface with delicate growth lines; epidermis tawny, covered with faint green rays, shining; pseudocardinals compressed, two in each valve, the upper one of the right valve small; two straight laterals in the left valve and one in the right; muscle scars well marked; nacre rich copper-color, very bright.

Length 50, height 19, diam. 11 mm.

Type locality, Lakelets of Marion County, Florida.

Unio buxtoni B. H. WRIGHT, Naut., XI, 1897, p. 55.—SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 80, pl. 1, fig. 65; Syn., 1900, p. 719.

A rather remarkable form, the shell being much elongated and decidedly rhomboid. It is probably nearest to *U. pinci*, but is less inflated, more elongated in proportion and more decidedly rhomboid. It is probable that the specimen before me, whose measurements I have given, is young.

Group of *Unio complanatus*.

Shell elongate trapezoidal, moderately solid, but little inflated, nearly straight below; with a posterior ridge, and usually biangulate behind; beaks not prominent, sculptured with several coarse, parallel ridges, which follow the growth lines or are nearly straight. Epidermis sometimes shining and feebly rayed, becoming rough and rayless with age; laterals straight or slightly curved; beak cavities shallow.

Animal with the marsupium occupying all or nearly all of the outer branchiæ; gills long, rounded below, inner much the larger, free nearly or quite their whole length from the abdominal sac.

UNIO COMPLANATUS "Solander" (Dillwyn).

Shell generally rhomboid, inequilateral, subsolid to solid, convex; anterior end rounded; dorsal and basal lines nearly or quite parallel; dorsal slope obliquely truncated; posterior ridge well developed, single or double, ending behind at or near the base in a point or biangulation; beaks not much raised nor inflated, their sculpture consisting of strong ridges, which run nearly parallel with the growth lines and are carried back to the nucleus behind as delicate, radial liræ; surface with irregular growth lines, often nearly smooth in young or well developed shells, rough in old ones; epidermis tawny-green to greenish-brown, often rayed and rather smooth in young shells, becoming rough and dark in old ones; left valve with two ragged pseudocardinals and two nearly straight laterals; right valve with one pseudocardinal and often a small one above it with one lateral; beak cavities shallow; muscle scars large, impressed; nacre white, straw-color, salmon or various shades of purple.

Length 105, height 55, diam. 33 mm.

Length 90, height 55, diam. 30 mm.

Length 60, height 38, diam. 21 mm.

Length 62, height 40, diam. 25 mm.

Atlantic drainage from the St. Lawrence to Georgia; west in the British possessions to Manitoba?

Type locality, Maryland and New Jersey.

Mya complanata SOLANDER, manuscript (no date).—DILLWYN, Cat., I, 1817, p. 51.

Unio complanata DESHAYES, An. sans Vert., 2d ed., VI, 1835, p. 559.

Unio complanatus GOULD, Inv. of Mass., 1841, p. 107, figs. 68-70.—BINNEY, 2d ed., Inv. of Mass., 1870, p. 167, fig. 472.—HANLEY, Biv. Shells, 1843, p. 199, pl. XXI, fig. 20.—DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 188, pl. XXII, fig. 246.—KUSTER, Conch. Cab. Unio, 1856, p. 137, pl. XLI, fig. 2.—HARTMAN and MICHEÑER, Conch. Cest., 1874, p. 86, fig. 181.—SIMPSON, Syn., 1900, p. 720.

Margarita (Unio) complanatus LEA, Syn., 1836, p. 30; 1838, p. 22.

Margaron (Unio) complanatus LEA, Syn., 1852, p. 32; 1870, p. 51.

Elliptio complanatus ORTMANN, Ann. Car. Mus., VIII, 1912, p. 269.

? *Unio violaceus* SPENGLER, Skriv. Nat. Selsk. III, 1793, p. 55.

Unio purpureus SAY, Nich. Enc., II, 1817, pl. III, fig. 1.—SOWERBY, Conch. Icon, XIV, 1868, pl. LXVIII, fig. 346.

Mya purpurea EATON, Zool. Text-Book, 1826, p. 2.

? *Unio purpurea* DESHAYES, Encyc. Meth. II, 1827, p. 151, pl. 249, fig. 5.

Unio rarisulcata LAMARCK, An. sans Vert., VI, 1819, p. 72.

Unio coarctata LAMARCK, An. sans Vert., VI, 1819, p. 73.—? SOWERBY, Conch. Icon., XVI, 1866, pl. xxxiv, fig. 178.

Unio purpurascens LAMARCK, An. sans Vert., VI, 1819, p. 73.

Unio georgina LAMARCK, An. sans Vert., VI, 1819, p. 74.

Unio rhombula LAMARCK, An. sans Vert., VI, 1819, p. 74.—? DELESSERT, Rec. Coq. Lam., 1841, pl. XII, fig. 8.

Unio carinifera LAMARCK, An. sans Vert., VI, 1819, p. 74.—KUSTER, Conch. Cab. Unio, 1861, p. 176, pl. LVI, fig. 1.

Unio glabrata LAMARCK, An. sans Vert., VI, 1819, p. 75.

- Unio sulcidens* LAMARCK, An. sans Vert., VI, 1819, p. 77.—
 ? DELESSERT, Rec. Coq. Lam., 1841, pl. XII, fig. 3.—CHENU,
 Ill. Conch., 1858, pl. XII, figs. 5, 5^a.
- Unio virginiana* LAMARCK, An. sans Vert., VI, 1819, p. 79.
- Unio fluviatilis* GREEN, Jl. Mac. Lyceum, 1827, p. 41.
- ? *Unio raveneli* CONRAD, New F. W. Shells, 1834, p. 39, pl. VI,
 fig. 4.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 9, pl. III,
 fig. 8.
- Margarita (Unio) watereensis* LEA, Syn., 1836, p. 31; 1838,
 p. 22.
- Margaron (Unio) watereensis* LEA, Syn., 1852, p. 33; 1870,
 p. 53.
- Unio watereensis*, H. and A. ADAMS, Gen. Rec. Moll., II, 1857,
 p. 493.
- Unio griffithianus* LEA, Tr. Am. Phil. Soc., V, 1834, p. 103,
 pl. XV, fig. 46; Obs., I, 1834, p. 215, pl. XV, fig. 46.—HANLEY,
 Biv. Shells, 1843, p. 199, pl. XXIII, fig. 28.—KUSTER, Conch.
 Cab. Unio, 1861, p. 208, pl. LXXIX, fig. 2.—SOWERBY, Conch.
 Icon., XVI, 1868, pl. LXXXIX, fig. 449.
- Margarita (Unio) griffithianus* LEA, Syn., 1836, p. 31; 1838,
 p. 22.
- Margaron (Unio) griffithianus* LEA, Syn., 1852, p. 33; 1870,
 p. 52.
- Unio planilaterus* CONRAD, Monog., XII (no date after 1838),
 p. 103, pl. LVII, fig. 1.
- Margaron (Unio) planilaterus* LEA, Syn., 1870, p. 51.
- Unio rufusculus* LEA, Pr. Am. Phil. Soc., V, 1852, p. 252; Tr.
 Am. Phil. Soc., X, 1852, p. 258, pl. XIV, fig. 7; Obs., V, 1852,
 p. 14, pl. XIV, fig. 7.—SOWERBY, Conch. Icon., XVI, 1868, pl.
 LXXIII, fig. 377.
- Margaron (Unio) rufusculus* LEA, Syn., 1852, p. 33; 1870, p.
 54.
- Mya rigida* WOOD, Ind. Test. Rev., 1856, p. 200, pl. 1, supp.
 fig. 10.
- Unio abbevillensis* LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 84;
 Jl. Ac. N. Sci. Phila., IV, 1858, p. 51, pl. VI, fig. 34; Obs.,
 VI, 1858, p. 51, pl. VI, fig. 34.
- Margaron (Unio) abbevillensis* LEA, Syn., 1870, p. 52.

- Unio contractus* LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 86; Jl. Ac. N. Sci. Phila., V, 1862, p. 203, pl. XXIX, fig. 272; Obs., IX, p. 25, pl. XXIX, fig. 272.
- Margaron (Unio) contractus* LEA, Syn., 1870, p. 61.
- Unio virens* LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 169; Jl. Ac. N. Sci. Phila., IV, 1858, p. 80, pl. XVI, fig. 60; Obs., VI, 1858, p. 80, pl. XVI, fig. 60.
- Margaron (Unio) virens* LEA, Syn., 1870, p. 52.
- Unio savannahensis* LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 169; Jl. Ac. N. Sci. Phila., IV, 1858, p. 81, pl. XVI, fig. 61; Obs., VI, 1858, p. 81, pl. XVI, fig. 61.
- Margaron (Unio) savannahensis* LEA, Syn., 1870, p. 51.
- Unio subflavus* LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 170; Jl. Ac. N. Sci. Phila., IV, 1858, p. 90, pl. XIX, fig. 70; Obs., VI, 1858, p. 90, pl. XIX, fig. 70.
- Margaron (Unio) subflavus* LEA, Syn., 1870, p. 52.
- Unio neusensis* LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 41; Jl. Ac. N. Sci. Phila., V, 1859, p. 60, pl. IV, fig. 208; Obs., VIII, 1860, p. 64, pl. IV, fig. 208.
- Margaron (Unio) neusensis* LEA, Syn., 1870, p. 51.
- Unio exactus* LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 41; Jl. Ac. N. Sci., Phila., V, 1862, p. 62, pl. IV, fig. 210; Obs., VIII, 1860, p. 66, pl. IV, fig. 210.
- Margaron (Unio) exactus* LEA, Syn., 1870, p. 43.
- Unio roswellensis* LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 165; Jl. Ac. N. Sci. Phila., IV, 1859, p. 205, pl. XXIV, fig. 87; Obs., VII, 1859, p. 23, pl. XXIV, fig. 87.
- Margaron (Unio) roswellensis* LEA, Syn., 1870, p. 51.
- Unio postellii* LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 165; Jl. Ac. N. Sci. Phila., IV, 1859, p. 214, pl. XXVI, fig. 94; Obs., VII, 1859, p. 32, pl. XXVI, fig. 94.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLVII, p. 255.
- Margaron (Unio) postellii* LEA, Syn., 1870, p. 51.
- Unio baldwainensis* LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 170; Jl. Ac. N. Sci. Phila., IV, 1860, p. 330, pl. LI, fig. 155; Obs., VIII, 1860, p. 12, pl. LI, fig. 155.
- Margaron (Unio) baldwainensis* LEA, Syn., 1870, p. 51.

- Unio racensis* LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 171; Jl. Ac. N. Sci. Phila., IV, 1860, p. 331, pl. LII, fig. 156; Obs., VIII, 1860, p. 13, pl. LII, fig. 156.
- Margaron (Unio) racensis* LEA, Syn., 1870, p. 52.
- Unio quadratus* LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 172; Jl. Ac. N. Sci. Phila., IV, 1860, p. 338, pl. LIV, fig. 163; Obs., VIII, 1860, p. 20, pl. LIV, fig. 163.
- Margaron (Unio) quadratus* LEA, Syn., 1870, p. 4.
- Unio squameus* LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 391; Jl. Ac. N. Sci. Phila., V, 1862, p. 200, pl. XXVIII, fig. 269; Obs., IX, 1863, p. 22, pl. XXVIII, fig. 269.
- Margaron (Unio) squameus* LEA, Syn., 1870, p. 51.
- Unio lugubris* KUSTER, Conch. Cab. Unio, 1861, p. 234, pl. LXXIX, fig. 1.
- Unio weidonensis* LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 191; Jl. Ac. N. Sci. Phila., VI, 1866, p. 11, pl. III, fig. 8; Obs., XI, 1867, p. 15, pl. III, fig. 8.
- Margaron (Unio) weidonensis* LEA, Syn., 1870, p. 51.
- Unio gastonensis* LEA, Pr., Ac. N. Sci. Phila., VII, 1863, p. 191; Jl. Ac. N. Sci. Phila., VI, 1866, p. 20, pl. VI, fig. 18; Obs., XI, 1867, p. 24, pl. VI, fig. 18.
- Margaron (Unio) gastonensis* LEA, Syn., 1870, p. 51.
- Unio aberrans* LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 191; Jl. Ac. N. Sci. Phila., VI, 1866, p. 7, pl. I, fig. 3; Obs., XI, 1867, p. 11, pl. I, fig. 3.
- Margaron (Unio) aberrans* LEA, Syn., 1870, p. 52.
- Unio mecklenbergensis* LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 191; Jl. Ac. N. Sci. Phila., VI, 1866, p. 17, pl. V, fig. 15; Obs., XI, 1867, p. 21, pl. V, fig. 15.
- Margaron (Unio) mecklenbergensis* LEA, Syn., 1870, p. 51.
- Unio raleighensis* LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 191; Jl. Ac. N. Sci. Phila., VI, 1866, p. 6, pl. I, fig. 2; Obs., XI, 1867, p. 10, pl. I, fig. 2.
- Margaron (Unio) raleighensis* LEA, Syn., 1870, p. 52.
- Unio mediocris* LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 192; Jl. Ac. N. Sci. Phila., VI, 1866, p. 24, pl. VII, fig. 22; Obs., XI, 1867, p. 28, pl. VII, fig. 22.
- Margaron (Unio) mediocris* LEA, Syn., 1870, p. 52.

- Unio indefinilus* LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 192.
- Unio indefinitus* LEA, Jl. Ac. N. Sci. Phila., VI, 1866, p. 15, pl. IV, fig. 12; Obs., XI, 1867, p. 12, pl. IV, fig. 12.
- Margaron (Unio) indefinitus* LEA, Syn., 1870, p. 51.
- Unio humerosus* LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 161; Jl. Ac. N. Sci. Phila., VI, 1868, p. 301, pl. XLV, fig. 113; Obs., XII, 1869, p. 61, pl. XLV, fig. 113.
- Margaron (Unio) humerosus* LEA, Syn., 1870, p. 51.
- Unio beaverensis* LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 161; Jl. Ac. N. Sci. Phila., VI, 1868, p. 297, pl. XLIV, fig. 109; Obs., XII, 1869, p. 57, pl. XLIV, fig. 109.
- Margaron (Unio) beaverensis* LEA, Syn., 1870, p. 52.
- Unio blawerensis* PÆTEL, Conch. Sam., III, 1890, p. 146.
- ? *Unio neglectus* SOWERBY, Conch. Icon., XVI, 1868, pl. LXV, fig. 329.
- Unio tortuosus* SOWERBY, Conch. Icon., XVI, 1868, pl. LXV, fig. 330.
- Unio uharcensis* LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 145; Jl. Ac. N. Sci. Phila., VI, 1868, p. 304, pl. XLVI, fig. 116; Obs., XII, 1869, p. 63, pl. XLVI, fig. 116.
- Margaron (Unio) uharcensis* LEA, Syn., 1870, p. 52.
- Unio nubilus* LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 161; Jl. Ac. N. Sci. Phila., VI, 1868, p. 298, pl. XLIV, fig. 110; Obs., XII, p. 58, pl. XLIV, fig. 110.
- Margaron (Unio) nubilus* LEA, Syn., 1870, p. 51.
- Unio yadkinensis* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 156; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 32, pl. x, fig. 29; Obs., XIII, 1874, p. 36, pl. x, fig. 29.
- Unio amplus* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 157; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 39, pl. XIII, fig. 36; Obs., XIII, 1874, p. 43, pl. XIII, fig. 36.
- Unio ligatus* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 157; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 49, pl. XVII, fig. 47; Obs., XIII, 1874, p. 53, pl. XVII, fig. 47.
- Unio subparallelus* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 158; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 46, pl. XVI, fig. 44; Obs., XIII, 1874, p. 50, pl. XVI, fig. 44.

- Unio irwinensis* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 159; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 44, pl. xv, fig. 42; Obs., XIII, 1874, p. 48, pl. xv, fig. 42.
- Unio infuscus* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 160; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 51, pl. xvii, fig. 49; Obs., XIII, 1874, p. 55, pl. xvii, fig. 49.
- Unio ratus* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 160; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 52, pl. xviii, fig. 51; Obs., XIII, 1874, p. 56, pl. xviii, fig. 51.
- Unio basalis* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 161; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 48, pl. xvi, fig. 46; Obs., XIII, 1874, p. 52, pl. xvi, fig. 46.
- Unio subolivaceus* LEA, Pr. Ac. N. Sci. Phila., III, 1873, p. 422; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 57, pl. xx, fig. 56; Obs., XIII, 1874, p. 61, pl. xx, fig. 56.
- Unio infulgens* LEA, Pr. Ac. N. Sci. Phila., III, 1873, p. 422; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 60, pl. xxi, fig. 59; Obs., XIII, 1874, p. 64, pl. xxi, fig. 59.
- Unio cirratus* LEA, Pr. Ac. N. Sci. Phila., III, 1873, p. 422; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 55, pl. xix, fig. 53; Obs., XIII, 1874, p. 59, pl. xix, fig. 53.
- Unio corneus* LEA, Pr. Ac. N. Sci. Phila., III, 1873, p. 423; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 59, pl. xx, fig. 58; Obs., XIII, 1874, p. 63, pl. xx, fig. 58.
- Arconaia provancheriana* PILSBRY, Nat. Canadienne, XX, 1890, p. 171; Pr. Ac. Phila., 1892, p. 132, pl. vii, figs. 4-6.

This species was described by Solander in Latin, but the manuscript was never published and is now in the British Museum. Mr. Edgar A. Smith kindly examined it for me and informed me that Dillwyn's description in the catalogue is a translation from Solander. The name *Mya complanata* was used by Lister in Hist. Sive. Conch. (1770, p. 150), but Lister was not a binomial author. The Portland Catalogue is anonymous and a mere sale list.

Complanatus Dillwyn and *purpureus* Say both date from 1817, and it is now impossible to determine which name had actual priority. But in view of the fact that the name *com-*

planatus had been used for this species by Lister and Solander long before Say's name was applied I think that the preference should be given to the well-known name of Solander.

The above description is intended merely to cover the more typical manifestations of this abundant and protean form. The shells are often larger than the largest dimensions given, they are sometimes smaller than the smallest measurement, they may be more compressed or inflated in proportion to the length, they may vary in form so that occasional specimens are almost evenly elliptical. In many cases the greatest diameter of the shell is at the posterior ridge and it is wedge-shaped in front of this; other specimens are regularly lenticular when viewed from above. Dr. Lea and a number of other American conchologists agreed on uniting under the name of *Unio complanatus* nearly all the forms of this group found north of about the latitude of Washington. South of that they began to apply specific names to the different variations, most of which were no more divergent than the northern mutations. When this was once begun there seemed to be no place to stop for no two lots of shells of this exceedingly puzzling group just agreed. The result was a great multiplication of names and almost endless confusion. I believe that the group of which *Unio complanatus* may be taken as the type is one of the most difficult to satisfactorily arrange of any of the Naiades. I have gone over a large proportion of the types and great quantities of material again and again in the endeavor, not to name up all the specimens before me, for that would be impossible, but to draw some kind of specific lines by which a majority of the material might be named and I have found it well nigh a hopeless task. I have given varietal rank to a few of the forms, which have somewhat marked and constant characters.

Var. *jejunus* Lea.

Shell much compressed; posterior ridge widely double, ending behind near the base in a wide biangulation; epidermis

cloth-like. Sometimes slightly produced behind the center of the base.

Length 98, height 50, diam. 21 mm.

Length 95, height 45, diam. 20 mm.

North Carolina and northward.

Type locality, Roanoke River, between Winton and Tarboro, N. C.; Camden, S. C.

Unio jejunus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 9, pl. IV, fig. 9; Obs., II, 1838, p. 9, pl. IV, fig. 9.—HANLEY, Biv. Shells, 1843, p. 199, pl. XXII, fig. 47.—KUSTER, Conch. Cab. Unio, 1862, p. 265, pl. XC, fig. 1.—?SOWERBY, Conch. Icon., XVI, 1868, pl. LXVIII, fig. 347.

Margarita (Unio) jejunus LEA, Syn., 1836, p. 30; 1838, p. 22.

Margaron (Unio) jejunus LEA, Syn., 1852, p. 32; 1870, p. 51.

Unio complanatus var. *jejunus* SIMPSON, Syn., 1900, p. 725.

Unio percoarctatus LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 85; Jl. Ac. N. Sci. Phila., V, 1862, p. 59, pl. III, fig. 206; Obs., VIII, 1862, p. 63, pl. III, fig. 206.—SOWERBY, Conch. Icon., XVI, 1866, pl. LIV, fig. 277.

Margaron (Unio) percoarctatus LEA, Syn., 1870, p. 51.

Var. *quadrilaterus* Lea.

Shell decidedly rhomboid; posterior ridge distinctly double, ending in a well-marked biangulation at the posterior base; base line generally incurved in old shells. Nacre whitish, lurid purplish or purple.

Length 71, height 41, diam. 23 mm.

Length 55, height 33, diam. 23 mm.

South and North Carolina; Florida.?

Type locality, Abbeville District, S. C.; Neuse River, Raleigh, N. C.

Unio squalidus LEA, in part, Pr. Ac. N. Sci. Phila., VII, 1863, p. 192; Jl. Ac. N. Sci. Phila., VI, 1866, p. 22; Obs., XI, 1867, p. 26.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 429, pl. LXXI, fig. 14.

Margaron (Unio) squalidus LEA, Syn., 1870, p. 51.

Unio quadrilaterus LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 192; Jl. Ac. N. Sci. Phila., VI, 1866, p. 5, pl. 1, fig. 1; Obs., XI, 1867, p. 9, pl. 1, fig. 1.

Margaron (Unio) quadrilaterus LEA, Syn., 1870, p. 51.

Unio complanatus var. *quadrilaterus* SIMPSON, Syn., 1900, p. 725.

Variable in color of nacre and degree of inflation.

UNIO ROSTRUM Lea.

Shell elongated, rhomboid, convex, subsolid, generally fullest at the posterior ridge; dorsal and basal lines parallel, the latter incurved; beaks scarcely inflated or elevated, their sculpture not seen, posterior ridge high, single and angular above, showing a tendency to become double below, ending at or very near the base line in a blunt point or biangulation; surface with strong, uneven growth lines; epidermis tawny, tawny-brown or greenish-brown, sometimes feebly rayed, rather smooth and shining; pseudocardinals rough, double in each valve, the upper in the right valve small; laterals remote, straight; beak cavities shallow; muscle scars large and impressed; nacre whitish or flesh-colored.

Length 98, height 44, diam. 26 mm.

North Carolina.

Type locality, Catawba River, Gaston Co., N. C.

Unio wheatleyi LEA, Pr. Ac. N. Sci. Phila., 1857, I, p. 85; Jl. Ac. N. Sci. Phila., V, 1861, p. 54, pl. 1, fig. 200; Obs., VIII, p. 58, pl. 1, fig. 200.

Margaron (Unio) catawbensis LEA, Syn., 1870, p. 52.

Unio catawbensis SIMPSON, Syn., 1900, p. 725.

Unio rostrum LEA, Pr. Ac. N. Sci. Phila., VIII, 1861, p. 391; Jl. Ac. N. Sci. Phila., V, 1862, p. 201, pl. XXIX, fig. 270; Obs., IX, 1863, p. 23, pl. XXIX, fig. 270.

Margaron (Unio) rostrum LEA, Syn., 1870, p. 52.

Unio oblongus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 158; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 52, pl. XVIII, fig. 50; Obs., XIII, 1874, p. 56, pl. XVIII, fig. 50.

An elongated, rhomboid, somewhat arcuate form with a high posterior ridge and almost shining epidermis. Many of the shells are almost sulcate.

UNIO TUOMEYI Lea.

Shell somewhat elongated, solid, varying from subrhomboid to nearly elliptical, subcompressed to subinflated, inequilateral; beaks scarcely elevated or inflated, their sculpture not seen; dorsal line curved; basal line rarely incurved, generally straight or rounded; posterior ridge well developed, single and often angular above, often becoming feebly and narrowly double below, ending behind in a point or narrow biangulation below the median line; surface usually rather smooth; epidermis tawny to brownish, often more or less rayed, smooth and shining; left valve with two ragged pseudocardinals and two laterals; right valve with one pseudocardinal, sometimes with a faint one above it, and one lateral; beak cavities shallow; muscle scars impressed; nacre generally tinted purple.

Length 90, height 46, diam. 25 mm.

Length 77, height 41, diam. 21 mm.

North Carolina to Alabama.

Type locality, Abbeville District, S. C.

Unio tuomeyi LEA, Tr. Am. Phil. Soc., X, 1852, p. 256, pl. XIII, fig. 4; Obs., V, 1852, p. 12, pl. XIII, fig. 4.—SIMPSON, Syn., 1900, p. 726.

Margaron (Unio) tuomeyi LEA, Syn., 1852, p. 33; 1870, p. 53.

Unio barrattii LEA, Tr. Am. Phil. Soc., X, 1852, p. 256, pl. XIII, fig. 5; Obs., V, 1852, p. 12, pl. XIII, fig. 5.

Margaron (Unio) barrattii LEA, Syn., 1852, p. 37; 1870, p. 245.

Unio barrotti PÆTEL, Conch. Sam., III, 1890, p. 145.

Unio pullatis LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 262.

Unio pullatus LEA, Jl. Ac. N. Sci. Phila., IV, 1858, p. 57, pl. VIII, fig. 39; Obs., VI, 1858, p. 57, pl. VIII, fig. 39.—KUSTER, Conch. Cab. Unio, 1871, p. 247, pl. LXXXIII, fig. 3.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXVI, fig. 335.

Margaron (Unio) pullatus LEA, Syn., 1870, p. 60.

- Unio sublatus* LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 169;
Jl. Ac. N. Sci. Phila., IV, 1858, p. 82, pl. XVI, fig. 62; Obs.,
VI, 1858, p. 82, pl. XVI, fig. 62.
- Margaron (Unio) sublatus* LEA, Syn., 1870, p. 57.
- Unio fumatus* LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 171;
Jl. Ac. N. Sci. Phila., IV, 1858, p. 88, pl. XVIII, fig. 68; Obs.,
VI, 1858, p. 88, pl. XVIII, fig. 68.
- Margaron (Unio) fumatus* LEA, Syn., 1870, p. 52.
- Unio viridiradiatus* LEA, Pr. Ac. N. Sci. Phila., III, 1859, p.
154; Jl. Ac. N. Sci. Phila., IV, 1860, p. 336, pl. LIII, fig. 161;
Obs., VIII, p. 18, pl. LIII, fig. 161.
- Margaron (Unio) viridiradiatus* LEA, Syn., 1870, p. 46.
- Unio viridans* LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 170;
Jl. Ac. N. Sci. Phila., IV, 1860, p. 337, pl. LIV, fig. 162; Obs.,
VIII, 1860, p. 19, pl. LIV, fig. 162.
- Margaron (Unio) viridans* LEA, Syn., 1870, p. 52.
- Unio hallenbeckii* LEA, Pr. Ac. N. Sci. Phila., III, 1859, p.
170; Jl. Ac. N. Sci. Phila., IV, 1860, p. 328, pl. LI, fig. 154;
Obs., VIII, 1860, p. 10, pl. LI, fig. 154.
- Margaron (Unio) hallenbeckii* LEA, Syn., 1870, p. 52.
- Unio salebrosus* LEA, Pr. Ac. N. Sci. Phila., XI, 1859, p. 170;
Jl. Ac. N. Sci. Phila., IV, 1860, p. 332, pl. LII, fig. 157; Obs.,
VIII, 1860, p. 14, pl. LII, fig. 157.
- Margaron (Unio) salebrosus* LEA, Syn., 1870, p. 52.
- Unio verutus* LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 171;
Jl. Ac. N. Sci. Phila., IV, 1860, pl. LIII, fig. 160; Obs., VIII,
1860, p. 17, pl. LIII, fig. 160.
- Margaron (Unio) verutus* LEA, Syn., 1870, p. 57.
- Unio chathamensis* LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p.
191; Jl. Ac. N. Sci. Phila., VI, 1866, p. 21, pl. VI, fig. 19;
Obs., XI, 1867, p. 25, pl. VI, fig. 19.
- Margaron (Unio) chathamensis* LEA, Syn., 1870, p. 53.
- Unio hastatus* LEA, Pr. Ac. N. Sci. Phila., III, 1873, p. 423;
Jl. Ac. N. Sci. Phila., VIII, 1874, p. 56, pl. XIX, fig. 54;
Obs., XIII, 1874, p. 60, pl. XIX, fig. 54.
- Unio dooleyensis* LEA, Pr. Ac. N. Sci. Phila., III, 1873, p. 424;
Jl. Ac. N. Sci. Phila., VIII, 1874, p. 64, pl. XXII, fig. 60;
Obs., XIII, 1874, p. 68, pl. XXII, fig. 60.

Unio invenustus LEA, Pr. Ac. N. Sci. Phila., III, 1873, p. 424; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 66, pl. XXII, fig. 62; Obs., XIII, 1874, p. 70, pl. XXII, fig. 62.

Unio gesnerii LEA, Pr. Ac. N. Sci. Phila., III, 1874, p. 424; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 65, pl. XXII, fig. 61; Obs., XIII, 1874, p. 69, pl. XXII, fig. 61.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIV, fig. 446.

An abundant and somewhat variable form. I have thrown together under the name *Unio tuomeyi* a number of so-called species, some of which seem to be absolutely identical. In general this form is somewhat elongated, subcompressed or only moderately inflated, and it has a rather smooth, shining, though not brilliant, brownish, rayed or rayless epidermis. It is not so rhomboid as *rostrum*, is rarely arcuate, is not so sulcate as that form and does not have quite so high a posterior ridge. The epidermis is rarely a little roughened.

UNIO OCMULGEENSIS LEA.

Shell usually long ovate or elliptical, rarely subrhomboid, convex or subinflated, solid, inequilateral; beaks not full or high, their sculpture not observed; posterior ridge full, rounded, sometimes double behind, ending at or below the median line in a blunt point or biangulation; anterior end often subtruncate; surface with irregular growth lines; epidermis dark greenish-brown to almost black, lighter and rayed in the young shell; left valve with two strong, ragged pseudocardinals, and two heavy laterals; right valve with one pseudocardinal, often with vestiges of one in front and another behind it, with one lateral; muscle scars large, impressed; beak cavities shallow; nacre lurid purplish, somewhat shining.

Length 104, height 51, diam. 32 mm.

Georgia.

Type locality, Little Ocmulgee River, Lumber City, Ga.

Unio ocmulgeensis LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 38; Jl. Ac. N. Sci. Phila., V, 1862, p. 95, pl. XIV, fig. 243; Obs., VIII, 1862, p. 99, pl. XIV, fig. 243.—SIMPSON, Pr. U. S. Nat.

Mus., XV, 1892, p. 424, pl. LXVII, fig. 5; Syn., 1900, p. 727.

Margaron (Unio) ocmulgeensis LEA, Syn., 1870, p. 57.

This species has more the form of a member of the *buckleyi* group than of that of the *complanatus* group, but it has the nacre and epidermis of the latter. It is duller colored than the average manifestation of the *tuomeyi* combination, and is more nearly elliptical or ovate than that species.

UNIO AQUILUS Lea.

Shell elongated, nearly evenly elliptical, compressed, rather thin to subsolid, inequilateral; beaks low, subcompressed, their sculpture numerous strong ridges which are curved up behind, the sculpture extending well on to the disk; posterior ridge distinct though not high, subangular, scarcely double, ending behind in a point just below the median line; above this point there is a short, oblique subtruncation and on the dorsal slope there are two or three faint radiating ridges; growth lines uneven; epidermis dirty greenish or greenish-brown, scarcely rayed, dull; pseudocardinals rough, subcompressed; laterals nearly straight, two in the right valve and a somewhat double one in the left; muscle scars shallow; nacre bluish-white to purplish, rather bright.

Length 65, height 30, diam. 16 mm.

South Georgia and northern Florida.

Type locality, Flint River, Macon and Chattahoochee River, Roswell, Ga.

Unio aquilus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 172; Jl.

Ac. N. Sci. Phila., IV, 1858, p. 92, pl. xx, fig. 72; Obs., VI, 1858, p. 92, pl. xx, fig. 72.—SIMPSON, Syn., 1900, p. 727.

Margarona (Unio) aquilus LEA, Syn., 1870, p. 60.

The disk is often ornamented by a number of faint, almost vertical, corrugations, which sometimes become subnodulous. It is smaller, more compressed, thinner and duller colored than *U. ocmulgeensis*. There are sometimes a few dark rays on the dorsal slope.

UNIO ICTERINUS Conrad.

Shell oblong, subelliptical or subrhomboid, convex, solid, inequilateral; beaks moderately full and elevated, their sculpture a number of strong concentric ridges; posterior ridge prom-

inent, somewhat double, ending behind in a narrow faint bian-
gulation at or below the median line; surface nearly smooth;
epidermis greenish-yellow to tawny or tawny-brown, usually
showing dark rest marks, scarcely rayed, shining; pseudocar-
dinals subcompressed to solid, rough; laterals long, curved;
muscle scars large, impressed; nacre white, often silvery, a
little thicker in front.

Length 103, height 57, diam. 34 mm.

Length 87, height 45, diam. 26 mm.

North Carolina to Georgia.

Type locality, Savannah River, Augusta, Ga.

Unio icterinus CONRAD, New F. W. Shells, 1834, p. 41, pl. VI,
fig. 5; Monog., IV, 1836, p. 39, pl. XVIII, fig. 2.—CHENU,
Bib. Conch., 1st ser., III, 1845, p. 20, pl. I, fig. 5.—SIMPSON,
Syn., 1900, p. 727.

Unio fuliginosus LEA, Pr. Am. Phil. Soc., V, 1845, p. 164; Tr.
Am. Phil. Soc., X, 1848, p. 78, pl. VII, fig. 19; Obs., IV,
1848, p. 52, pl. VII, fig. 19.

Margaron (Unio) fuliginosus LEA, Syn., 1852, p. 33; 1870, p.
53.

Unio curatus LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 193;
Jl. Ac. N. Sci. Phila., VI, 1866, p. 23, pl. VII, fig. 21; Obs.,
XI, 1867, p. 27, pl. VII, fig. 21.

Margaron (Unio) curatus LEA, Syn., 1870, p. 46.

Unio datus LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 161;
Jl. Ac. N. Sci. Phila., VI, 1868, p. 299, pl. XLIV, fig. 3; Obs.,
XII, 1869, p. 59, pl. XLIV, fig. 3.

Margaron (Unio) datus LEA, Syn., 1870, p. 45.

Unio vatus PÆTEL, Conch. Sam., III, 1890, p. 172.

Unio cuspidatus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 159;
Jl. Ac. N. Sci. Phila., VIII, 1874, p. 43, pl. XIV, fig. 40;
Obs., XIII, 1874, p. 47, pl. XIV, fig. 40.

Unio curvatus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 159;
Jl. Ac. N. Sci. Phila., VIII, 1874, p. 38, pl. XIII, fig. 35;
Obs., XIII, 1874, p. 42, pl. XIII, fig. 35.

Unio subsquamosus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p.
160; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 47, pl. XVI, fig. 45;
Obs., XIII, 1874, p. 51, pl. XVI, fig. 45.

Under this name, *Unio icterinus*, I have united a number of nominal species, none of which possess any very striking characters. In general the form is oblong, elliptical or subrhomboid, and not much inflated; the shell is solid; the epidermis smooth, shining, and some shade of tawny color. It is a more solid species than *errans* and it has a different texture and color from *tuomeyi*, being more waxy.

UNIO CUVIERIANUS Lea.

Shell elongated, elliptic rhomboid, subinflated or convex, solid, inequilateral; beaks slightly elevated; posterior ridge prominent, subangulate above, becoming somewhat double below, ending above the base in a faint biangulation; surface with irregular, concentric sculpture, more or less smooth and shining; epidermis tawny-brownish, sometimes tinged with green; pseudocardinals double in each valve, the anterior one of the right valve small, the others stumpy; laterals curved; muscle scars large, impressed; nacre white or purplish, rather dull.

Length 100, height 57, diam. 36 mm.

Type locality, Washington County, Georgia.

Unio cuvierianus LEA, Tr. Am. Phil. Soc., IX, 1852, p. 263, pl. XVI, fig. 16; Obs., V, 1852, p. 19, pl. XVI, fig. 16.

Margaron (Unio) cuvierianus LEA, Syn., 1852, p. 32; 1870, p. 51.

Unio icterinus (part) SIMPSON, Syn., 1900, p. 727.

In the Synopsis I placed this in the synonymy of *U. icterinus* Conrad, and it approaches that species quite closely. Recent study has, however, led me to believe that it may be distinct. It is somewhat more elliptical than Conrad's shell, is more inflated and generally rather less elongated.

UNIO ROANOKENSIS Lea.

Shell large, elongated, subrhomboid or sometimes subobovate, compressed or subcompressed, inequilateral, subsolid or solid; beaks low, subcompressed, their sculpture apparently a few longitudinal corrugations; posterior ridge moderately de-

veloped, double, ending behind in a wide biangulation at and below the median line; anterior end often cut away, below, rounded; basal line straight, rarely a little incurved, sometimes quite full behind the middle; surface generally rough, with uneven growth lines; epidermis dirty tawny or tawny-green and faintly rayed in young shells, becoming reddish-brown or black in old specimens; pseudocardinals often blurred, low and strongly cross striate; laterals remote, heavy, one in the right valve and two in the left; beak cavities shallow; dorsal scars in a row under the hinge plate; muscle scars shallow; the anterior ones rough; nacre dirty purplish, often thicker in front.

Length 143, height 67, diam. 35 mm.

Length 140, height 68, diam. 43 mm.

Length 106, height 55, diam. 25 mm.

Connecticut River at Northampton, Massachusetts; south to the Savannah River, Georgia.

Type locality, Roanoke River, between Norfolk and Tarboro, N. C.; Altamaha River, Ga.

Margarita (Unio) roanokensis LEA, Syn., 1836, p. 30; 1838, p. 21.

Unio roanokensis LEA, Tr. Am. Phil. Soc., VI, 1838, p. 27, pl. VIII, fig. 21; Obs., II, 1838, p. 27, pl. VIII, fig. 21.—CHENU, Ill. Conch., 1858, pl. XX, figs. 6, 6a, 6b.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXVI, fig. 341.—SIMPSON, Syn., 1900, p. 728.

Margaron (Unio) roanokensis LEA, Syn., 1852, p. 32; 1870, p. 51.

Unio macer LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 86; Jl. Ac. N. Sci. Phila., VI, 1862, p. 202, pl. XXIX, fig. 271; Obs., IX, 1863, p. 24, pl. XXIX, fig. 271.

Margaron (Unio) macer LEA, Syn., 1870, p. 51.

Unio latus LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 171; Jl. Ac. N. Sci. Phila., IV, 1860, p. 334, pl. LIII, fig. 159; Obs., VIII, 1860, p. 16, pl. LIII, fig. 159.

Margaron (Unio) latus LEA, Syn., 1870, p. 57.

A large, elongated, compressed form, which approaches *hopetonensis*, but is less inflated and less rhomboid than that species and has a duller nacre. The young shells of this species never have that peculiar olive-green tint found on the young of *hopetonensis*.

Var. *northamptonensis* Lea.

Shell subelliptical or subovate, rather long, compressed, the biangulation often a little higher up than in the type; epidermis tawny or tawny-greenish, generally rayed in old ones; nacre whitish or dirty purplish.

Length 110, height 58, diam. 24 mm.

Type locality, Connecticut River at Northampton, Springfield and below Hartford, Mass.; Neuse River, N. C.

Unio northamptonensis LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 392; Jl. Ac. N. Sci. Phila., V, 1862, p. 190, pl. xxv, fig. 260; Obs., IX, 1863, p. 12, pl. xxv, fig. 260.

Margaron (Unio) northamptonensis LEA, Syn., 1870, p. 51.

Unio roanokensis var. *northamptonensis* SIMPSON, Syn., 1900, p. 728.

This agrees so closely with specimens of *roanokensis* that I have been induced to consider it as a variety of that, notwithstanding its widely separated distribution. I have before me *roanokensis* from the Savannah River, named by Dr. Lea and belonging in his collection, that agree in all essential characters with *northamptonensis* from the type locality. Both have the same general form, the inflation behind, the middle of the base and the same color within and without. The variety has the same low, ill-defined, strongly cross-striated pseudocardinals as the type.

UNIO HOPETONENSIS Lea.

Shell rather large, subrhomboid, a little narrowed in front, subcompressed to subinflated, the greatest diameter being at the posterior ridge, in front of which the shell is wedge-shaped: posterior ridge well developed, single and narrowly rounded above, double below, ending in a wide biangulation at or above

the posterior base; base line nearly straight, sometimes produced a little towards the posterior end; surface with fine, uneven growth lines; epidermis dirty or brownish-green and sometimes rayed in young shells, brown or blackish in old shells, scarcely shining; pseudocardinals small and low, generally cross striated often ill-defined; there are two short laterals in the left valve and one in the right; beak cavities shallow; muscle scars impressed; nacre flesh-color or purplish, generally bright and iridescent behind.

Length 120, height 65, diam. 38 mm.

Length 96, height 43, diam. 28 mm.

Length 135, height 65, diam. 33 mm.

Length 140, height 75, diam. 43 mm.

Georgia, in streams flowing into the Atlantic; Santee Canal, South Carolina.

Type locality, Hopeton, near Darien, Ga.

Unio hopetonensis LEA, Tr. Am. Phil. Soc., VI, 1838, p. 29, pl. IX, fig. 24; Obs., II, 1838, p. 29, pl. IX, fig. 24.—HANLEY, Biv. Shells, 1843, p. 198, pl. XX, fig. 21.—CHENU, Ill. Conch., 1858, pl. XX, figs. 5, 5a, 5b.—KUSTER, Conch. Cab. Unio, 1861, p. 196, pl. LXIII, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXVIII, fig. 349.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 412, pl. LII, fig. 3; LIII, fig. 1; SYL., 1900, p. 728.

Margarita (Unio) hopetonensis LEA, Syn., 1836, p. 30; 1838, p. 21.

Margaron (Unio) hopetonensis LEA, Syn., 1852, p. 32; 1870, p. 51.

A rather fine, large species with a peculiarly tinted epidermis and usually rich, brilliant nacre. In a great many specimens the pseudocardinals are feebly developed and not well separated, and are decidedly cross-striated.

UNIO LIVINGSTONENSIS Lea.

Shell subrhomboid, being narrower in front than behind, thin, not inflated, its greatest diameter being at the posterior ridge and in front of this it is wedge-shaped, inequilateral; beaks low, somewhat compressed, their sculpture not seen;

posterior ridge imperfectly double, the main ridge ending behind at the base of the shell, above this the outline is irregularly curved up to the dorsal line; surface with uneven growth lines; epidermis of different shades of greenish-brown, cloth-like when fresh; pseudocardinals small, double in the left and single in right valves; laterals remote, delicate, curved; muscle scars shallow; nacre bluish or greenish-white to purplish.

Length 68, height 40, diam. 22 mm.

North Carolina to Georgia.

Type locality, Livingston's Creek, Brunswick Co., N. C.

Unio livingstonensis LEA, Pr. Ac. N. Sci. Phila., VII, p. 192;

Jl. Ac. N. Sci. Phila., VI, 1866, p. 14, pl. IV, fig. 11; Obs.,

XI, 1867, p. 18, pl. IV, fig. 11.—SIMPSON, Syn., 1900, p. 729.

Margaron (Unio) livingstonensis LEA, Syn., 1870, p. 52.

Quite a distinct species for a member of the *complanatus* group. So far as I have seen the shell is always rather thin and narrower in front, its greatest inflation is at the posterior ridge and from that point forward it is wedge-shaped when viewed from above. The wide posterior end is bounded by an uneven curved line, which shows one or two faint angles. The epidermis is rough, dark and cloth-like.

UNIO INUSITATIS Lea.

Shell subrhomboid, higher behind than in front, inequilateral, rather thin, scarcely inflated, its greatest diameter being at the posterior ridge; beaks moderately full and elevated, their sculpture not seen; posterior ridge high, subangulate, ending below in a blunt point at the base of the shell; surface with irregular, concentric sculpture; epidermis tawny-brownish and greenish, rather bright; pseudocardinals small, subcompressed, double in the right valve and single in the left; laterals remote, short; muscle scars shallow, smooth; nacre lurid, purplish, brownish or coppery, brilliant and iridescent behind.

Type locality, Swift Creek, below Macon, Georgia.

Unio inusitatus LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 171; Jl. Ac. N. Sci. Phila., IV, 1860, p. 333, pl. LII, fig. 158; Obs., VIII, 1860, p. 15, pl. LII, fig. 158.—SIMPSON, Syn., 1900, p. 729.

Margaron (Unio) inusitatus LEA, Syn., 1870, p. 51.

Unio insitatus B. H. WRIGHT, Check List, 1888.

I do not know what to do with this. I have only seen the type, and it appears to be injured. It is shaped something like *U. livingstonensis*, but it has a higher, single posterior ridge. The epidermis and nacre are much brighter than they are in *livingstonensis*.

UNIO DIFFERTUS Lea.

Shell irregularly rhomboid, a little higher behind, inequilateral, subsolid, its greatest diameter being at the posterior ridge; beaks neither full or high, their sculpture apparently irregular corrugated ridges; posterior ridge high, subangulate, inclined to be double below, ending below the median line in a very faint biangulation; base line curved up a little behind, nearly straight the rest of its length; surface with uneven growth lines, nearly smooth at the middle of the disk, strongly sulcate in front; epidermis tawny or tawny-green, scarcely rayed, showing the dark, widely spaced rest marks; pseudocardinals subcompressed, elevated, double in each valve, the upper one in the right valve small; laterals high, granular; beak cavities impressed; muscle scars well marked; nacre flesh-color, purplish-pink and iridescent behind.

Length 84, height 47, diam. 30 mm.

Savannah River, Georgia.

Type locality, Georgia?

Unio differtus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 158; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 42, pl. XIV, fig. 39; Obs., XIII, 1874, p. 46, pl. XIV, fig. 39.—SIMPSON, Syn., 1900, p. 729.

I cannot connect this with any other form. It is a smooth almost waxy, rather attractive shell, evidently of rapid growth as the largest specimen seen shows only two rest marks. The nacre is rather soft and silvery, of a decidedly rich tint behind.

UNIO PLANTII Lea.

Shell nearly elliptical or a little obovate, compressed, sub-solid, inequilateral; beaks apparently low and compressed, their sculpture not seen; posterior ridge low, ending behind just below the median line; anterior end a very little narrowed, rounded; posterior end feebly subtruncated above, rounded below; basal and dorsal line curved; surface with irregular, concentric sulcations; epidermis greenish-brown, subshining; pseudocardinals small, roughened, double in each valve, the upper in the right valve small; laterals remote; muscle scars impressed; nacre lurid purplish, iridescent behind; pallial line crenate.

Length 93, height 56, diam. 26 mm.

Type locality, Flint River; near Macon, Georgia.

Unio plantii LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 171; Jl. Ac. N. Sci. Phila., IV, 1859, p. 192, pl. XXI, fig. 76; Obs., VII, 1859, p. 10, pl. XXI, fig. 76.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVII, fig. 473.—SIMPSON, Syn., 1900, p. 729. -

Margaron (Unio) plantii LEA, Syn., 1870, p. 43.

The only shell seen, the type, appears to be a little injured behind. It is a peculiar disk-like form, nearly evenly elliptical, the least trifle rhomboid, and unevenly sulcate.

UNIO STRUMOSUS Lea.

Shell subrhomboid, rather short, slightly inequilateral, sub-solid, scarcely inflated; beaks apparently neither full nor high; posterior ridge full, narrowly rounded, ending behind in a blunt point at or near the base; surface with uneven growth lines; epidermis dirty yellowish-brown or greenish-brown, subshining; pseudocardinals rather strong, ragged, double in the left valve and single in the right, laterals short, heavy, much curved; dorsal cavities compressed; muscle scars well marked; nacre dirty, lurid whitish.

Length 68, height 45, diam. 24 mm.

Type locality, Yadkin River, North Carolina.

Unio strumosus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 158; III, 1873, p. 423; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 57, pl. XIX, fig. 55; Obs., XIII, 1874, p. 61, pl. XIX, fig. 55—SIMPSON, Syn., 1900, p. 729.

Appears to be near to *U. dorsatus*, but is smoother; it scarcely has a double posterior ridge, and its beaks and posterior ridge are not so elevated.

UNIO PURUS Lea.

Shell between subrhomboid and subelliptical, somewhat elongated, convex, inequilateral; beaks not much elevated or inflated, their sculpture not seen; posterior ridge high, rounded, curved up in the middle, ending in a rounded point near the base of the shell; surface with uneven growth lines; epidermis dirty yellowish-green or dirty brownish-green, rather smooth in young shells, becoming dull in old ones; pseudocardinals low, solid, rough, double in both valves; laterals curved, strong, remote; muscle scars round, distinct; nacre purplish, a little thicker in front.

Length 76, height 42, diam. 25 mm.

Type locality, Neuse River, near Raleigh, North Carolina.

Unio purus LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 41; Jl. Ac. N. Sci. Phila., V, 1862, p. 61, pl. IV, fig. 209; Obs., VIII, 1862, p. 65, pl. IV, fig. 209.—SIMPSON, Syn., 1900, p. 729.

Margaron (Unio) purus LEA, Syn., 1870, p. 43.

A rather neat, finely formed species, which does not seem to connect with anything else. The outline is between rhomboid and elliptical, the posterior ridge is rounded and curved up in the middle.

UNIO SUBNIGER (Lea).

Shell subrhomboid, scarcely subsolid, convex, inequilateral; beaks apparently neither full nor high; posterior ridge strong, subangular or narrowly rounded, curved up in the middle, ending behind in a blunt point near the base line; base line incurved a little; surface with decided concentric sculpture; epidermis blackish, scarcely shining; pseudocardinals small.

sharp, ragged; laterals delicate, curved; muscle scars large, shallow; beak cavities shallow; nacre bluish or milky-white.

Length 90, height 52, diam. 28 mm.

Georgia.

Type locality, Flint River, Macon, Ga.

Unio subniger LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 172; Jl. Ac. N. Sci. Phila., IV, 1859, p. 196, pl. XXII, fig. 79; Obs., VII, 1859, p. 14, pl. XXII, fig. 79.—SIMPSON, Syn., 1900, p. 730.

Margaron (Unio) subniger LEA, Syn., 1870, p. 52.

This shell is shaped much like forms of *U. complanatus*, but the posterior ridge curves up in the middle and it is covered with decided concentric sculpture.

UNIO BURKENSIS Lea.

Shell oblong, subelliptical or subrhomboid, thin, subcompressed, inequilateral; beaks neither full nor high, their sculpture not seen; posterior ridge moderately full, double, ending behind in a biangulation at and below the median line; base line nearly straight, anterior end subtruncate above; surface slightly marked with incremental and faint radiating sculpture; epidermis dull dirty green, showing vestiges of rays, subshining; pseudocardinals small, sharp, nearly smooth, compressed, one in the left valve and two in the right; laterals delicate, straight; muscle scars shallow; nacre lurid purplish, iridescent behind.

Length 70, height 34, diam. 17 mm.

North Carolina; south to Georgia.

Type locality, Buckhead Creek, Burke Co., Ga.

Unio burkensis LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 112; Jl. Ac. N. Sci. Phila., IV, 1859, p. 215, pl. XXVII, fig. 95; Obs., VII, 1859, p. 33, pl. XXVII, fig. 95.—SIMPSON, Syn., 1900, p. 730.

Margaron (Unio) burkensis LEA, Syn., 1870, p. 60.

Unio dissimilis LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 161; Jl., Ac. N. Sci. Phila., VIII, 1874, p. 53, pl. XVIII, fig. 52; Obs., XIII, 1874, p. 57, pl. XVIII, fig. 52.

Very close to *U. naviculoides* and probably only a variation of it. It is higher in proportion than that species, the posterior ridge is not so high and it is a little less concentrically sculptured.

UNIO OBLATUS Lea.

Shell subrhomboid, rather solid, convex, inequilateral; beaks apparently not full or high; posterior ridge high, rounded, becoming feebly double below, ending behind in a faint biangulation below the median line; anterior end round; base nearly straight; dorsal slope obliquely subtruncated; surface thrown up into low, concentric ridges at the dark rest marks, otherwise nearly smooth; epidermis dark olive, smooth and shining; left valve with two stumpy pseudocardinals and two club-shaped laterals; right valve with two pseudocardinals, the upper small, with one lateral; anterior scars impressed; posterior scars shallow; nacre dirty flesh-color; nacre thicker in front.

Length 65, height 32, diam. 18 mm.

Type locality, Long Creek, Gaston County, North Carolina.

Unio ablatius LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 193.

Unio oblatius LEA, Jl. Ac. N. Sci. Phila., VI, 1866, p. 13, pl. IV, fig. 10; Obs. XI, 1867, p. 17, pl. IV, fig. 10.—SIMPSON, Syn., 1900, p. 730.

Margaron (Unio) oblatius LEA, Syn., 1870, p. 60.

Another puzzling nondescript. The surface of the only authentic shell I have seen, the type, is thrown up into low, concentric ridges at the rest marks, which are dark and narrowly spaced. The epidermis is dark olive, but shining; the nacre is much thickened in front.

UNIO ERRANS Lea.

Shell elongated, subrhomboid or subelliptical, compressed to convex, inequilateral; subsolid or rather thin; beaks low, not inflated, their sculpture a number of strong ridges, which run nearly parallel with the growth lines and are heavier where they cross the posterior ridge; posterior ridge moderately developed, inclined to be double below, ending behind in a

faint biangulation between the median line and base; surface nearly smooth or with a few uneven growth lines; epidermis greenish-yellow to brownish, often feebly rayed; pseudo-cardinals delicate, subcompressed, double in each valve, the upper in the right valve feeble; laterals delicate, nearly straight; muscle scars scarcely impressed; nacre whitish to pale brownish-purple, iridescent behind.

Length 74, height 35, diam. 22 mm.

Length 72, height 35, diam. 17 mm.

Type locality, Tobesaufke Creek, near Macon, Georgia.

Unio paliatus RAVENEL, letter.—CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 254.

Margarita (Unio) paliatus LEA, Syn., 1836, p. 31; 1838, p. 22.

Margaron (Unio) paliatus LEA, Syn., 1852, p. 33; 1870, p. 53.

Unio palliatus RAVENEL, Cat., 1875, p. 57.

Unio errans LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 262;

Jl. Ac. N. Sci. Phila., IV, 1858, p. 60, pl. IX, fig. 42; Obs.,

VI, 1858, p. 60, pl. IX, fig. 42.—SIMPSON, Syn., 1900, p. 730.

Margaron (Unio) errans, LEA, Syn., 1870, p. 52.

Unio vicinus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 262;

Jl. Ac. N. Sci. Phila., IV, 1858, p. 61, pl. IX, fig. 43; Obs.,

VI, 1858, p. 61, pl. IX, fig. 43.

Margaron (Unio) vicinus LEA, Syn., 1870, p. 52.

A rather delicate, subrhomboid or sometimes subelliptical, compressed to convex, form with no striking characters. It is usually nearly smooth and shining. It is a much less robust shell than *U. tuomeyi*.

Dr. Lea credits *U. paliatus* to Ravenel's letter, (Syn., 1836), and Ravenel, (1875), ascribes it to Lea, but neither ever described it so far as I know.

UNIO SAGITTIFORMIS Lea.

Shell elongated, rhomboid, compressed, subsolid, inequilateral; beaks slightly elevated, but not inflated, their sculpture consisting of strong, longitudinal, somewhat corrugated ridges; posterior ridge well developed, ending in a somewhat produced point near the base of the shell; dorsal slope very obliquely

subtruncated; base line nearly straight; anterior end slopingly cut away below, rounded above; surface having more or less concentric sculpture, the sulcations strong at the anterior end; epidermis greenish-yellow, rayed, subshining; left valve with two subcompressed pseudocardinals and two club-shaped laterals; right valve with two pseudocardinals, the upper small, and one lateral; muscle scars well marked, the posterior elongated; nacre pale lurid brown.

Length 69, height 30, diam. 15 mm.

Type locality, Oconee River, Athens, Georgia. Also Abbeville, South Carolina.

Unio sagittiformis LEA, Tr. Am. Phil. Soc., X, 1852, p. 277, pl. XXII, fig. 35; Obs., V, 1852, p. 33, pl. XXII, fig. 35.—SOWERBY, Conch. Icon., XVI, 1868, pl. XCII, fig. 499.—SIMPSON, Syn., 1900, p. 731.

Margaron (Unio) sagittiformis LEA, Syn., 1852, p. 37; 1870, p. 60.

A peculiar shell, which may be diseased, yet it appears to be normal. The posterior point is much drawn out, the anterior base is decidedly cut away below. The species might be placed in the *fisherianus* group with about as much propriety as in this.

UNIO DISPALANS B. H. Wright.

Shell subrhomboid, rather thin, subcompressed to convex, inequilateral; beaks not inflated or elevated, their sculpture consisting of strong ridges, which run parallel with the growth lines; posterior ridge well developed, narrowly rounded or angled, ending behind near the base in a blunt point or a feeble, narrow biangulation; anterior end a very little narrower, rounded; surface with uneven growth lines; epidermis yellow-green and faintly rayed in young shells, brown, rough and cloth-like in old ones; pseudocardinals small, compressed, double in each valve, the upper in the right valve small; laterals delicate, curved; muscle scars shallow; nacre dirty coppery.

Length 65, height 35, diam. 18 mm.

Type locality, Suwanee River, Florida.

Unio dispalans B. H. WRIGHT, Naut. XIII, 1899, p. 50.—
SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 80, pl. 1, fig. 9;
Syn., 1900, p. 736.

A puzzling form which has no decided characters, yet which does not seem to equal anything else. Since seeing the type shell I have examined other material and rather incline towards placing it in the *complanatus* group.

UNIO ANGUSTATUS Lea.

Shell elongated, subrhomboid or subelliptical, subcompressed to scarcely inflated, the greatest diameter being at the posterior ridge; thin to subsolid, inequilateral; beaks scarcely elevated or inflated, their sculpture being strong ridges running nearly parallel with the growth lines; posterior ridge well developed, angulated, more or less double, ending behind in a slight biangulation at or below the median line; surface with decided concentric sculpture; epidermis olive in young shells, nearly black in old ones, rather dull; pseudocardinals compressed, double in each valve, the upper one in the right valve small; laterals long, somewhat club-shaped; muscle scars shallow; nacre purplish-brown.

Length 98, height 42, diam. 23 mm.

Length 74, height 30, diam. 19 mm.

South Carolina to western Georgia.

Type locality, Cooper River, S. C.

Unio angustatus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 114, pl. XVII, fig. 43; Obs., I, 1834, p. 124, pl. XVII, fig. 43.—CONRAD, Monog., XI, 1838, p. 98, pl. LIV, fig. 2.—HANLEY, Biv. Shells, 1843, p. 204, pl. XXII, fig. 25.—CHENU, Ill. Conch. 1858, pl. XIV, figs. 1, 1a, 1b.—KUSTER, Conch. Cab. Unio, 1861, p. 178, pl. LVI, fig. 4.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXII, fig. 372.—SIMPSON, Syn., 1900, p. 731.

Margarita (Unio) angustatus LEA, Syn., 1836, p. 35; 1838, p. 23.

Margaron (Unio) angustatus LEA, Syn., 1852, p. 36; 1870, p.

Unio extensus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 31; Jl. Ac. N. Sci. Phila., IV, 1858, p. 68, pl. XII, fig. 49; Obs., VI, 1868, p. 67, pl. XII, fig. 49.

Margaron extensus LEA, Syn., 1870, p. 60.

Unio subcylindræus LEA, Pr. Ac. N. Sci. Phila., III, 1873, p. 422; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 58, pl. XX, fig. 57; Obs., XIII, 1874, p. 62, pl. XX, fig. 57.

Much elongated, either subrhomboid or almost elliptical, with dull dark epidermis and decidedly sulcate sculpture.

UNIO PERSTRIATUS Lea.

Shell elongated, subrhomboid, compressed, subsolid, inequilateral; beaks slightly elevated but not full, their sculpture consisting of longitudinal bars; posterior ridge well developed, with a tendency to becoming double below, ending behind near the base in a rounded point or feeble biangulation; dorsal slope obliquely truncated; base line nearly straight; dorsal line curved a little; surface with fine, concentric sculpture; epidermis tawny-greenish, or olive, scarcely rayed, covered with fine, concentric lamellæ, very dull; pseudocardinals subcompressed, rough, single in the right valve and double in the left; laterals straight, delicate; muscle scars large, shallow, the posterior ones long elliptical; nacre bluish-white, dull.

Length 57, height 24, diam. 11 mm.

Length 72, height 29, diam. 12 mm.

North and South Carolina.

Type locality, Abbeville District, S. C.

Unio perstriatus LEA, Tr. Am. Phil. Soc., X, 1852, p. 255, pl. XII, fig. 3; Obs., V, 1852, p. 11, pl. XII, fig. 3.—SOWERBY, Conch. Icon., XVI, 1868, pl. XCII, fig. 500.—SIMPSON, Syn., 1900, p. 731.

Margaron (Unio) perstriatus LEA, Syn., 1852, p. 36; 1870, p. 57.

Unio gracilentus LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 85; Jl. Ac. N. Sci. Phila., V, 1862, p. 58, pl. III, fig. 205; Obs., VIII, 1862, p. 62, pl. III, fig. 205.

Margaron (Unio) gracilentus LEA, Syn., 1870, p. 60.

Unio perlatus LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 193; Jl. Ac. N. Sci. Phila., VI, 1866, p. 15, pl. IV, fig. 13; Obs. XI, 1867, p. 19, pl. IV, fig. 13.

Margaron (Unio) perlatus LEA, Syn., 1870, p. 60.

A delicate, compressed form, whose surface is finely, concentrically striate. *U. gracilentus* is a little darker, but I do not think it is specifically or even varietally different.

UNIO NAVICULOIDES Lea.

Shell much elongated, subrhomboid, thin, convex, inequilateral; anterior end subtruncated above; base line straight or a little incurved in the middle; posterior ridge full, double, the lower ridge the stronger, ending behind in a biangulation below the median line; beaks apparently low and compressed; surface distinctly, though not strongly, marked with concentric sculpture; epidermis dull olive-green, rather dark, scarcely shining; pseudocardinals small, nearly smooth, one in the right valve and two in the left; laterals long, delicate and straight; muscle scars small and shallow; nacre dull purplish, iridescent behind.

Length 75, height 32, diam. 18 mm.

Length 71, height 31, diam. 19 mm.

Length 72, height 33, diam. 21 mm.

Georgia.

Type locality, Buckhead Creek, Burke Co. and Macon, Ga.

Unio naviculoides LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 170;

Jl. Ac. N. Sci. Phila., IV, 1858, p. 94, pl. XX, fig. 74; Obs.,

VI, 1858, p. 94, pl. XX, fig. 74.—SIMPSON, Syn., 1900, p. 732.

Margaron (Unio) naviculoides LEA, Syn., 1870, p. 60.

Darker colored, more elongated, more decidedly sulcate and having a stronger posterior ridge than *U. burkensis*, but doubtfully distinct. I have seen only a limited amount of material of the two forms that I can consider valid.

UNIO SORDIDUS Lea.

Shell subrhomboid, subelliptical or subovate, convex, sub-solid, inequilateral; beaks rather full and elevated above the dorsal line, their sculpture unknown; posterior ridge full, in-

clined to be double below, ending in a faint, wide biangulation at and below the median line; surface with irregular growth lines, sometimes having low, concentric ridges; epidermis dark tawny, shaded with green, sometimes faintly rayed; base line nearly straight; dorsal slope obliquely subtruncated; anterior end rounded, usually a little narrower than the posterior end; left valve with low, rather blurred, double pseudocardinals and two laterals; right valve with somewhat double pseudocardinals and one lateral; muscle scars distinct; nacre dirty white or purplish, thicker in front.

Length 62, height 33, diam. 19 mm.

Length 72, height 38, diam. 24 mm.

Type locality, Abbeville, South Carolina. Also Catawba River, North Carolina.

Unio sordidus LEA, Tr. Am. Phil. Soc., X, 1852, p. 254, pl. XII, fig. 1; Obs., V, 1852, p. 10, pl. XII, fig. 1.—SIMPSON, Syn., 1900, p. 732.

Margaron (Unio) sordidus LEA, Syn., 1852, p. 33; 1870, p. 54.

Unio gibbesianus LEA, Tr. Am. Phil. Soc., X, 1852, p. 254, pl. XII, fig. 2; Obs., V, 1852, p. 10, pl. XII, fig. 2.

Margaron (Unio) gibbesianus LEA, Syn., 1852, p. 33; 1870, p. 54.

A form or species with almost no distinguishing characters, yet I cannot place it with anything else. The type of *U. gibbesianus* has the pseudocardinals divided into several denticles, otherwise it agrees with *sordidus*. The shell varies from subrhomboid to subelliptical, or subovate, has a dirty tawny, half shining, greenish epidermis and is considerably thickened in front.

UNIO SPADICEUS Lea.

Shell rather small, oblong, subrhomboid, subcompressed, inclined to be solid, inequilateral; beaks apparently not elevated or inflated; posterior ridge feebly double, ending behind in a biangulation at and below the median line; dorsal slope obliquely subtruncated; base line faintly emarginate in the middle, swollen behind that point; surface irregularly striate;

epidermis tawny or reddish-brown, with a slight bronzy hue, shining; pseudocardinals stumpy, double in each valve; right valve with one curved lateral; left valve with two; muscle scars distinct; nacre salmon or coppery-tinted, thicker in front.

Length 45, height 23, diam. 14 mm.

Type locality, Mountain stream, North Carolina.

Unio spadiceus LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 86; Jl. Ac. N. Sci. Phila., V, 1862, p. 55, pl. I, fig. 201; Obs., VIII, 1862, p. 12, pl. I, fig. 201.—SIMPSON, Syn., 1900, p. 732.

Margaron (Unio) spadiceus LEA, Syn., 1870, p. 48.

A small form, the type of which seems to be adult. It has a rather solid shell, slightly produced on the base behind the middle, with a half metallic, tawny-brown or reddish-brown, shining epidermis and salmon nacre.

UNIO STRIGOSUS Lea.

Shell elongated, somewhat arcuate, compressed, solid, inequilateral; basal and dorsal lines nearly parallel; anterior end rounded; posterior end feebly subtruncated above, almost evenly rounded below; posterior ridge widely rounded, showing the faintest trace of biangulation; beaks evidently not raised or full; surface with delicate but well-marked growth lines; epidermis greenish and shining on the disk, darker and duller on the border of the shell; pseudocardinals feebly developed, low, two in the left valve and one in the right; laterals remote, not strong; muscle scars well marked; nacre dull purplish-greenish, iridescent behind, thicker in front.

Length 55, height 24, diam. 13 mm.

Type locality, Chattahoochee River, Columbus, Georgia. Also Southeast Alabama?

Unio strigosus LEA, Pr. Am. Phil. Soc., I, 1840, p. 287; Tr. Am. Phil. Soc., VIII, 1843, p. 198, pl. IX, fig. 9; Obs., III, 1842, p. 36, pl. IX, fig. 9.—CHENU, Ill. Conch., 1858, pl. XXX, figs. 6, 6a, 6b.—SIMPSON, Syn., 1900, p. 732.

Margaron (Unio) strigosus LEA, Syn., 1852, p. 36; 1870, p. 57.

A curious form, approaching *U. lazarus*, but more solid and smoother. Its teeth are but imperfectly developed; the

nacre is purplish in front and green iridescent behind. Dr. Lea has placed larger specimens with this from the Little Uchee River, Alabama, that seems to be different.

UNIO SINGULARIS B. H. Wright.

Shell rather elongated, subrhomboid or subelliptical, somewhat inflated, a little narrower and rounded in front; inequilateral; base line straight or slightly incurved in the middle, full behind the middle; posterior ridge full, double, ending behind in a wide, square biangulation; surface rough, with strong growth lines; epidermis olive in young shells, reddish-brown in adult specimens; pseudocardinals stumpy, ragged; laterals straight; anterior scars impressed; posterior scars shallow; nacre coppery or purplish.

Length 66, height 33, diam. 22 mm.

Type locality, Spring Creek, Decatur County, Georgia.

Unio singularis B. H. WRIGHT, Naut., XIII, 1899, p. 75.

The above was accidentally omitted from the Synopsis. It is something like *U. strigosus*, but is much more inflated. I am doubtful as to its validity, but hardly feel like uniting it with anything else.

UNIO LAZARUS Lea.

Shell elongated, decidedly arcuate, compressed, subsolid, inequilateral; beaks slightly elevated, their sculpture consisting of strong ridges, which follow the growth lines; posterior ridge low, rounded or faintly biangulate; dorsal slope obliquely subtruncated; posterior end rounded or feebly biangulate; surface covered with irregular growth lines; epidermis greenish and shining in young shells, dark burnt-brown and rough in old ones; pseudocardinals imperfectly developed; laterals short, remote, not strong; anterior scars rough; posterior scars faint; nacre purplish in young shells, almost chocolate-colored in old specimens.

Length 53, height 22, diam. 11 mm.

Type locality, Abbeville district, South Carolina.

Unio lazarus LEA, Pr. Am. Phil. Soc., V, 1852, p. 251; Tr. Am. Phil. Soc., XI, 1852, p. 259, pl. XIV, fig. 9; Obs., V, 1852, p. 15, pl. XIV, fig. 9.—SIMPSON, Syn., 1900, p. 732.

Margarona (Unio) lazarus LEA, Syn., 1852, p. 39; 1870, p. 62.

A curious form, whose relationships are a little doubtful. It may be only a variety of *U. arctatus*, but it is more arcuate than anything I have seen of that species, is not so biangulate behind, and has less perfect pseudocardinals. It recalls *Margaritana*, but I have found no pits in the nacre of any of the shells I have seen. *Unio strigosus* approaches it in appearance, but is much more solid and is less arcuate.

Group of *Unio downiei*.

Shell subtrapezoidal, inflated, solid, truncate and more or less triangular behind, sometimes swollen in the post-basal region, with a well-developed posterior ridge; beaks full, their sculpture not observed; epidermis smooth and shining in the young shell, becoming duller and roughened when old; hinge moderately strong; pseudocardinals radial, roughened; laterals heavy, somewhat remote, curved; there is a more or less developed secondary lateral in the right valve; dorsal scars few, in a row just behind the pseudocardinals, and fully exhibited on the inner edge of the shallow beak cavity; nacre dull; muscle scars distinct, smooth.

Animal with the marsupium occupying the whole of the outer gills; inner gills free from the abdominal sac a part of their length; palpi rather small; mantle line thick on the border.

UNIO DOWNIEI Lea.

Shell usually obovate, solid, inflated, inequilateral; beaks full and high, no doubt; posterior ridge well developed, angular above, becoming double below and ending at and below the median line; anterior end rounded or truncate; dorsal slope rather high, scarcely truncated; base line curved and produced behind the middle; epidermis laminated; almost cloth-like, dull brownish, sometimes shining a little on the middle of the disk; pseudocardinals strong, ragged, two in the left valve

and one in the right; laterals very heavy, remote, double in the left valve and having a tendency to be double in the right; muscle scars small, deep, the anterior ones rough; beak cavities shallow; nacre flesh-color or purplish, rather dull.

Length 84, height 47, diam. 35 mm.

Southern Georgia; north Florida.

Type locality, Buck Lake, a bay of the Satilla River, Wayne Co., Ga.

Unio downiei LEA, Pr. Ac. Nat. Sci. Phila., II, 1858, p. 166; Jl. Ac. Nat. Sci. Phila., IV, 1859, p. 210, pl. xxv, fig. 91; Obs., VII, 1859, p. 28, pl. xxv, fig. 91.—SOWERBY, Conch., Icon., XVI, 1868, pl. LXVIII, fig. 350.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 413, pl. LV, figs. 1-3; LVI, fig. 5; Syn., 1900, p. 733.

Margaron (Unio) downiei LEA, Syn., 1870, p. 41.

A very solid, obovate, inflated, dull brown shell with strong teeth and deep scars. Its obovate form will distinguish it from the other members of the group.

UNIO GEMINUS Lea.

Shell slightly rhomboid or almost evenly long elliptical, inflated, rather solid, inequilateral; beaks moderately full but not high; posterior ridge elevated, subangular or narrowly rounded, inclined to be double below, ending behind at and below the median line in a slight biangulation; surface with delicate, concentric ridges; epidermis dirty, tawny-greenish to nearly black with a few radiating rows of fine wrinkles, subshining on the disk; left valve with two moderate, stumpy, ragged pseudocardinals and two strong, curved laterals; right valve with one pseudocardinal and a vestigial one above it, with one solid lateral; beak cavities not deep; anterior muscle scars impressed; posterior scars elliptical, shallow; nacre lurid purplish, iridescent behind.

Length 76, height 44, diam. 29 mm.

Georgia.

Type locality, Buckhead Creek, Burke Co., Ga.

Unio geminus LEA, Pr. Ac. Nat. Sci. Phila., VIII, 1856, p. 262; Jl. Nat. Sci. Phila., 1858, p. 63, pl. x, fig. 45; Obs., VI, 1858, p. 63, pl. x, fig. 45.—SIMPSON, Syn., 1900, p. 733.

Margaron (Unio) geminus LEA, Syn., 1870, p. 41.

Unio satillaensis LEA, Pr. Ac. Nat. Sci. Phila., II, 1858, p. 166; Jl. Ac. Nat. Sci. Phila., IV, 1859, p. 216, pl. xxvii, fig. 96; Obs., VII, 1859, p. 34, pl. xxvii, fig. 96.

Margaron (Unio) satillaensis LEA, Syn., 1870, p. 41.

This differs from *U. downiei* in being less solid, in its nearly elliptical instead of obovate form, and in being a smoother shell. To the naked eye it appears as if delicately, radially sculptured on the disk, and under a glass it is seen that there are radiating rows of fine longitudinal folds of the epidermis. I cannot possibly separate *U. satillaensis*, its only difference consisting in a darker epidermis and slightly greater proportionate height.

UNIO LECONTIANUS Lea.

Shell subelliptical or subrhomboid, inflated generally solid, inequilateral; beaks full and apparently somewhat elevated; posterior ridge high, somewhat double below, ending near the base in a scarcely produced biangulation; base line curved or nearly straight; anterior end rounded; dorsal line curved; surface with uneven growth lines; epidermis smooth, tawny and rayed in young shells, brownish and rayless in old ones, dull or subshining, showing occasional radial rows of longitudinal wrinkles; pseudocardinals strong, low, very rough, two in the left valve and one with sometimes a vestigial one above it in the right: left valve with two strong, curved laterals; right valve with one, which is inclined to be double; beak cavities not deep; muscle scars impressed, rather large; nacre dull purplish.

Length of type, a young shell, 70, height 45, diam. 28 mm.

Length 83, height 50, diam. 38 mm.

Georgia.

Type locality, Conochee River, Ga.

Margarita (Unio) lecontianus LEA, Syn., 1836, p. 23; 1838, p. 18.

Unio lecontianus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 40, pl. XII, fig. 35; Obs., II, 1838, p. 40, pl. XII, fig. 35.—HANLEY, Biv. Shells, 1843, p. 188, pl. XXII, figs. 11, 51.—CHENU, Ill. Conch., 1858, pl. XXIV, figs. 6, 6a, 6b.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIII, fig. 173.—SIMPSON, Syn., 1900, p. 733.

Margaron (Unio) lecontianus LEA, Syn., 1852, p. 26; 1870, p. 41.

More solid, higher in proportion, and having lower, rather heavier pseudocardinals and deeper muscle scars than *U. geminus*. It seems to stand as a connecting link between that species and *U. spissus*, in fact all of the species of this group are exceedingly close and variable and, although I have not seen any great amount of material belonging to it, I have found a number of specimens I could not satisfactorily place. I formerly thought that *U. contrarius* Conrad, was a small specimen of this with contrary teeth. Since reaching that conclusion I have seen material which inclines me to think I may have been wrong and I place that species in the genus *Lampsilis* with hesitation.

UNIO SPISSUS Lea.

Shell subrhomboid or subobovate, being somewhat narrowed in front, solid, moderately to greatly inflated, somewhat inequilateral; beaks full and high; posterior ridge high, angled, showing a tendency to become double below, ending at or a little above the base in a blunt point or biangulation; base line more or less curved; dorsal line curved; anterior end somewhat narrowed and rounded; epidermis brownish-green in young shells and sometimes faintly rayed, reddish-brown and rayless in old shells; somewhat concentrically sulcated, rather dull; pseudocardinals small, compressed, not very perfect in adult shells, often strongly cross-striated, double in each valve, the upper one in the right valve small; left valve with

two heavy, curved, granular laterals; right valve with one, which is sometimes almost double; beak cavities often impressed; muscle scars rather deep; nacre lurid purple.

Length of type, a young shell, 78, height 50, diam. 38 mm.
Length 103, height 65, diam. 47 mm.

Georgia.

Type locality, Satilla River, Wayne Co., Ga.

Unio spissus LEA, Pr. Ac. Nat. Sci. Phila., III, 1859, p. 112;
Jl. Ac. Nat. Sci. Phila., IV, 1859, p. 208, pl. xxv, fig. 89;
Obs., VII, 1859, p. 26, pl. xxv, fig. 89.—SOWERBY, Conch.
Icon., XVI, 1868, pl. LXXXVIII, fig. 476.—SIMPSON, Syn.,
1900, p. 734.

Margarona (Unio) spissus LEA, Syn., 1870, p. 41.

The epidermis of this species, if it is a species, is darker than in any of the allied forms. The shell is very solid, the pseudocardinals quite small and for a shell of its solidity remarkably compressed; in old specimens they are solidly cross-striate. The posterior ridge is higher and more angulated than in any of the others. Yet I have seen shells that I cannot say with certainty whether they are this or *U. downici*.

Group of *Unio fisherianus*.

Shell elongated, rather thin, subcompressed, pointed behind and sometimes slightly biangulate; posterior ridge generally well developed; beaks low, the sculpture consisting of a few coarse, slightly irregular ridges, which run nearly parallel with the growth lines, generally heavier where they cross the posterior ridge; epidermis sometimes rayed, shining; pseudocardinals usually compressed; laterals long, straight and lamellar; beak cavities very shallow and containing two or three dorsal scars at some distance behind the beaks; muscle scars well marked, the posterior ones elongated; nacre generally dull. Animal with the gills greatly elongated, inner the larger, more or less free from the abdominal sac; marsupium occupying nearly or quite the whole length of the outer branchiæ; palpi elongated; mantle thin, thicker on the edge.

UNIO LANCEOLATUS Lea.

Shell elongated, subelliptical or subobovate, subcompressed or convex, inequilateral, subsolid; beaks not full or elevated, their sculpture not seen; posterior ridge full, narrowly rounded, ending in a somewhat drawn-out point about on the median line; sometimes the point is turned up a little; surface with light incremental lines; epidermis straw-color, yellow or yellowish-green or brown, often showing the dark rest marks, shining; pseudocardinals subcompressed, double in each valve, the upper one of the right valve small, laterals straight, one in the right valve and two in the left; muscle scars small, shallow; nacre bluish-white, flesh-color or salmon-tinted, thick in front.

Length 58, height 25, diam. 15 mm.

Length 62, height 25, diam. 13 mm.

North Carolina; Virginia.

Type locality, Tar River, Tarboro, N. C.

Unio lanceolatus LEA, Tr. Am. Phil. Soc., 1828, p. 266, pl. III, fig. 2; Obs., I, 1834, p. 8, pl. III, fig. 2.—CONRAD, Monog., III, 1836, p. 32, pl. XIV, fig. 2.—HANLEY, Biv. Shells, 1843, p. 204, pl. XX, fig. 60; XXII, fig. 26.—CHENU, III. Conch., 1858, pl. VIII, fig. 1, *1a*, *1b*.—KUSTER, Conch. Cab. Unio, 1861, p. 204, pl. LXVIII, fig. 4.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLIII, fig. 236.—SIMPSON, Syn., 1900, p. 734.

Margarita (Unio) lanceolatus LEA, Syn., 1836, p. 35; 1838, p. 24.

Margaron (Unio) lanceolatus LEA, Syn., 1852, p. 36; 1870, p. 57.

Unio lanceolata DESHAYES, Enc. Meth., II, 1830, p. 585.

A delicate, light-colored, polished species, which bears about the same relation to *U. fisherianus* and other members of the group that *Lampsilis anodontoides* and *fallaciosa* do to *L. recta*. Indeed it often closely imitates a young delicate *fallaciosa*, but is more elongated and compressed.

UNIO VIRIDULUS Lea.

Shell elongated, subelliptical, a very little wider behind than in front; inequilateral, scarcely subsolid, convex; beaks rather low, not inflated, their sculpture apparently strong, longitu-

dinal ridges; posterior ridge full, subangular, inclined to be double below, ending in a slight biangulation behind at and below the median line; base a little produced behind the middle; surface finely, concentrically sulcate; epidermis bright yellowish-green, with one or two faint rays on the dorsal slope, polished; pseudocardinals subcompressed, double in the left valve and single in the right; laterals long and delicate; muscle scars shallow; nacre bluish.

Length 35, height 14, diam. 8 mm.

Type locality, Neuse River, near Raleigh, North Carolina.

Unio viridulus LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 193;

Jl. Ac. Nat. Sci. Phila., VI, 1866, p. 10, pl. III, fig. 17; Obs.,

XI, 1867, p. 14, pl. III, fig. 17.—SIMPSON, Syn., 1900, p. 734.

Margaron (Unio) viridulus LEA, Syn., 1870, p. 58.

Evidently a young shell and it may be the young of some other elongated species, which has a dark epidermis when adult. I do not think it is a young *lanceolatus*, as it is fuller on the posterior half of the base line than that species and has a somewhat double, broader posterior ending. Besides, it is more decidedly concentrically sulcate than anything I know of that species.

UNIO PRODUCTUS Conrad.

Shell elongated, subcompressed or compressed, subsolid, inequilateral, the dorsal and ventral lines nearly straight and parallel, the anterior end rounded, but often cut away a little below; posterior end drawn out to a point at or a little below the median line; posterior ridge rather low; beaks not elevated or full, their sculpture not seen; surface having fine, uneven, incremental sculpture; epidermis dark reddish-brown or greenish-brown, subshining; pseudocardinals small, stumpy, two in the left valve and one in the right; left valve with two remote laterals; right valve with one, which is often somewhat double; anterior scars impressed; posterior scars shallow; nacre purplish, often salmon-tinted.

Length 67, height 26, diam. 15 mm.

Length 68, height 24, diam. 14 mm.

Type locality, Savannah River at Augusta, Ga. Also, Potomac River, Va.; Emmitsburg, North Carolina, etc.

Unio productus CONRAD, Monog., III, 1836, p. 31, pl. XIV, fig. 1.—HANLEY, Biv. Shells, 1843, p. 205, pl. XXIII, fig. 17.—KUSTER, Conch. Cab. Unio, 1852, p. 66, pl. XVI, fig. 2.—SIMPSON, Syn., 1900, p. 735.

Margarita (Unio) productus LEA, Syn., 1836, p. 37; 1838, p. 24.

Margaron (Unio) productus LEA, Syn., 1852, p. 37; 1870, p. 60.

Elliptio productus ORTMANN, Ann. Car. Mus., VIII, 1912, p. 270.

Unio barrotti KUSTER, Conch. Cab. Unio, 1861, p. 189, pl. LIX, fig. 6.

None of the specimens I have seen exactly agree with Conrad's figure and description in the Monography, being a little less solid and inflated, with dorsal and ventral lines not quite so nearly parallel. Dr. Lea has specimens from Emmitsburg, North Carolina, which he labels *U. productus*, that agree well with our more northern specimens.

UNIO NASUTULUS Lea.

Shell elongated, subrhomboid, subelliptical or slightly obovate, rather compressed, scarcely subsolid, inequilateral; beaks apparently low and not inflated; posterior ridge subangular, ending behind in a drawn-out point just below the median line; surface closely, concentrically striate; epidermis greenish-brown, faintly rayed, dull or subshining; base line curved, full behind the middle; pseudocardinals stumpy; two in the left valve and one in the right; laterals delicate, straight; muscle scars small, the posterior ones faint; nacre dirty pale brownish or purplish, iridescent behind.

Length 45, height 19, diam. 10 mm.

Type locality, Livingston's Creek, Brunswick County, North Carolina.

Unio nasutilus LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 192

Unio nasutulus LEA, Jl. Ac. N. Sci. Phila., VI, 1866, p. 12, pl. III, fig. 9; Obs., XI, 1867, p. 16, pl. III, fig. 9.—SIMPSON, Syn., 1900, p. 735.

Margaron (Unio) nasutulus LEA, Syn., 1870, p. 60.

The name was originally spelled *nasutilus*, a typographical error, no doubt, and was afterwards changed by Dr. Lea to *nasutulus*. His specimens are small, rather shorter in proportion than *productus* or *fisherianus*, and in some cases inclined to be obovate.

UNIO FISHERIANUS Lea.

Shell elongate, compressed or subcompressed, rather thin to subsolid, inequilateral, with low beaks, whose sculpture consists of strong, longitudinal, corrugated ridges; posterior ridge well developed, subangular, generally curved down in the middle, ending behind in a long drawn-out point about at the median line, the point often turned up a little; anterior end rounded, wider than the hinder end; surface with decided concentric striæ; epidermis olive, dirty green, brownish or nearly black, often feebly rayed, scarcely shining; pseudocardinals stumpy, two in the left valve and one, sometimes two, in the right; laterals straight; anterior scars impressed; posterior scars shallow; nacre whitish or purple-tinted, iridescent behind.

Length 75, height 26, diam. 14 mm.

Length 76, height 30, diam. 18 mm.

Length 92, height 35, diam. 18 mm.

Virginia; Maryland; Pennsylvania, in the Atlantic drainage.

Type locality, Headwaters of Chester River, Md.

Unio fisherianus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 8, pl. IV, fig. 8; Obs., II, 1838, p. 8, pl. IV, fig. 8.—HANLEY, Biv. Shells, 1843, p. 206, pl. XXII, fig. 52.—CHENU, Ill. Conch., 1858, pl. XX, figs. 4, 4a, 4b.—KUSTER, Conch. Cab. Unio., 1861, p. 205, pl. LXVIII, fig. 6.—REEVE, Conch. Icon., XVI, 1865, pl. XXIV, fig. 113.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 90, fig. 187.—SIMPSON, Syn., 1900, p. 735.

Margarita (Unio) fisherianus LEA, Syn., 1836, p. 37; 1838, p.

Margaron (Unio) fisherianus LEA, Syn., 1852, p. 37; 1870, p. 60.

Unio nasutus CONRAD (part), Monog., II, 1838, pl. XVIII, fig. 1.

It is difficult to separate this at all times from the northern form of what I believe is *U. productus*. It is generally narrower and more drawn out behind, and the posterior ridge is almost invariably curved down in the middle, which is scarcely ever the case with *productus*.

UNIO EMMONSII Lea.

Shell rather large, elongated, irregularly ovate, convex, subsolid, inequilateral; beaks slightly elevated, compressed, their sculpture consisting of strong, corrugated ridges that nearly follow the growth lines; posterior ridge strong, angled, curved down in the middle, ending behind about at the median line in a sharp, up-curved point; base line almost straight, curved upward towards the posterior end; surface with uneven growth lines, somewhat sulcate; epidermis tawny or yellowish-green and rayed in young shells, becoming brown in old specimens; left valve with two strong, rough pseudocardinals and two laterals; right valve with two pseudocardinals, the upper small, and one lateral; muscle scars impressed; nacre dirty, pale brownish or purplish, iridescent behind.

Length 111, height 45, diam. 25 mm.

North Carolina.

Type locality, Roanoke River, Weldon, N. C.

Unio emmonsii LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 86.

Jl. Ac. N. Sci. Phila., V, 1862, p. 56, pl. II, fig. 203; Obs.,

VIII, 1862, p. 60, pl. II, fig. 203.—SIMPSON, Syn., 1900, p.

735.

Margaron (Unio) emmonsii LEA, Syn., 1870, p. 60.

This is a large edition of *Unio fisherianus*. Its dimensions are greater in every way, it is considerably solider, and somewhat more inflated; the posterior ridge is higher and sharper.

UNIO SUBINFLATUS Conrad.

Shell subrhomboid, higher behind than in front, subsolid, subcompressed, inequilateral; beaks apparently very low and compressed; anterior end rounded; dorsal line straight, mect-

ing the truncation of the dorsal slope at an angle, posterior ridge full, somewhat double below, ending behind in a biangulation at and below the median line; base full behind the middle; epidermis reddish-brown and olivaceous, smooth with unequal green rays; pseudocardinals small; laterals slightly curved; muscle scars distinct; nacre pale purple.

Length 74, height 37, diam. 19 mm.

South Georgia; Florida.

Type locality, Savannah River, Augusta, Ga.

Unio subinflatus CONRAD, Monog., XI, 1838, p. 97, pl. LIV, fig. 1.—SIMPSON, Syn., 1900, p. 736.

Margarona (Unio) subinflatus LEA, Syn., 1870, p. 52.

Shorter and apparently more solid than *U. aheneus*. The posterior truncation in this species is square while in *aheneus* it is oblique, the longer point being below. I have never seen specimens that I can positively refer to this species.

UNIO AHENEUS Lea.

Shell long rhomboid, usually a little higher behind, sub-solid, subcompressed, inequilateral; beaks low, compressed, their sculpture ridges that run parallel with the growth lines; posterior ridge full, inclined to be angled and double, ending behind in a biangulation near the base, the lower angle longer; base line nearly straight, sometimes full behind the middle; surface unevenly, concentrically striate; epidermis yellowish-green and rayed in young shells, dark brown on old specimens, scarcely shining; pseudocardinals small, often strongly cross-striate and imperfect; laterals delicate; muscle scars shallow; nacre purplish or chocolate.

Florida.

Type locality, Black Creek, Fla.

Unio aheneus LEA, Desc. 12 Uniones, 1843 (no paging); Tr. Am. Phil. Soc., IX, 1846, p. 280, pl. XLI, fig. 9; Obs., IV, 1848, p. 38, pl. XLI, fig. 9.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVI, fig. 194.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 431, pl. LXXII, fig. 6; Syn., 1900, p. 736.

Margaron (Unio) aheneus LEA, Syn., 1852, p. 37; 1870, p. 60.

The type is a young shell, but I have seen a quantity of shells from Lake Ashby, Florida, whose young agree well with it.

UNIO WALTONI B. H. Wright.

Shell much elongated, compressed, inequilateral, rather thin, subrhomboid; anterior end angled above, somewhat cut away below; base line nearly straight, full just behind the middle; dorsal line straight or slightly curved, being produced into a low wing; dorsal slope obliquely truncated; posterior ridge angled, inclined to be slightly double below; ending behind near the base of the shell in a feeble biangulation, the lower angle longer; surface concentrically striate; epidermis dark brown, showing vestiges of rays, dull or scarcely shining; pseudocardinals low, small, not perfectly developed, double in both valves; laterals long, straight and delicate; muscle scars shallow; nacre chocolate.

Length 80, height 30, diam. 15 mm.

Length 74, height 30, diam. 16 mm.

Florida.

Type locality, Lake Woodruff, Valusia Co., Fla.

Unio waltoni B. H. WRIGHT, Pr. Ac. N. Sci. Phila., 1888, p. 114, pl. II, fig. 3.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 431, pl. LXXIII, fig. 7; Syn., 1900, p. 736.

I have only seen a few specimens of this shell but I have always suspected that it was only an elongated, rather delicate variety of *U. aheneus*. The shorter shell, whose measurements are given above, seems to hint at a connection, yet from what material I have seen I do not feel justified in uniting the two. *U. waltoni* is more sharply and obliquely pointed behind than *aheneus*. The beaks of all the shells I have seen are so badly eroded that I can make nothing out of them.

UNIO ROSTREFORMIS Lea.

Shell elongated, subelliptical or subovate, compressed or subcompressed, rather thin, inequilateral; beaks scarcely elevated, compressed, their sculpture consisting of slightly broken ridges that run nearly parallel with the growth lines; posterior

ridge moderate, narrowly rounded or subangulate, sometimes inclined to be double below, ending behind in a long point at or below the median line; anterior end rounded or cut away a little below; base line nearly straight or lightly curved; dorsal slope obliquely subtruncated; surface with fine, concentric sculpture; epidermis dirty yellowish-green, profusely but feebly rayed, rather rough and dull; pseudocardinals low, sometimes imperfect, double in each valve; laterals straight; muscle scars shallow; nacre whitish, tinged with dirty purple.

Length 83, height 30, diam. 16 mm.

Georgia.

Type locality, Swift Creek, Macon, Ga.

Unio rostriformis LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 262.—SIMPSON, Syn., 1900, p. 736.

Unio rostriformis LEA, Jl. Ac. N. Sci. Phila., IV, 1858, p. 64, pl. x, fig. 46; Obs., VI, 1858, p. 64, pl. x, fig. 46.

Margaron (Unio) rostriformis LEA, Syn., 1870, p. 60.

Unio maconensis LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 172; Jl. Ac. N. Sci. Phila., IV, 1858, p. 93, pl. xx, fig. 73; Obs., VI, 1858, p. 93, pl. xx, fig. 73.

Margaron (Unio) maconensis LEA, Syn., 1870, p. 60.

Close to *fisherianus* but rougher and having a greener epidermis. The posterior ridge of this species is generally straight, and sometimes curved up a little in the middle; that of *fisherianus* generally is curved down in the middle. *U. rostriformis* is usually a little higher behind than *fisherianus*.

UNIO DUTTONIANUS Lea.

Shell long, subelliptical, the dorsal and ventral lines being nearly parallel, inequilateral, subinflated, solid; beaks apparently not much elevated; posterior ridge moderate, narrowly rounded, becoming almost double below, ending in a feeble biangulation on or a little above the median line; anterior end rounded; base line almost straight; epidermis dark brown, obscurely rayed; pseudocardinals very small, compressed; lat-

erals long, apparently curved down in the middle; anterior muscle scars impressed; posterior scars indistinct; nacre white and iridescent.

Length 70, height 25, diam. 17 mm.

Type locality, Ogeechee Canal, Savannah, Georgia.

Unio duttonianus LEA, Pr. Ac. N. Sci. Phila., II, 1841, p. 31; Jl. Ac. N. Sci. Phila., VIII, 1842, p. 236, pl. XXII, fig. 50; Obs., III, 1842, p. 74, pl. XXII, fig. 50.—CHENU, Ill. Conch., 1858, pl. XXXII, figs. 4, 4a, 4b.—SOWERBY, Conch. Icon., XVI, 1868, pl. XCI, fig. 492.—SIMPSON, Syn., 1900, p. 736. *Margaron (Unio) duttonianus* LEA, Syn., 1852, p. 35; 1870, p. 57.

There seems to be only one specimen of this species known, and it is not in the Lea Collection. It is apparently close to *folliculatus*, but is more cylindrical and has white, shining nacre. As figured by Dr. Lea, the laterals are curved down in the middle.

UNIO FOLLICULATUS Lea.

Shell much elongated, straight or slightly arcuate, the dorsal and ventral lines being nearly parallel, convex or subinflated, subsolid, or rather thin, inequilateral, rounded in front, drawn out to a point or slight biangulation at or just below the median line behind; the region of the base behind the center a little produced; posterior ridge well developed, inclined to be somewhat double below, angled; surface with well marked, uneven, rather fine, concentric sculpture; epidermis tawny-green and faintly rayed in young shells, becoming dark brown or black in old ones, scarcely shining; pseudocardinals subcompressed, double in each valve, the upper one in the right valve small; laterals straight; muscle scars distinct; nacre whitish, tinged with dirty purple.

Length 92, height 32, diam. 19 mm.

Length 80, height 29, diam. 16 mm.

Georgia.

Type locality, Savannah River, Ga.

- Unio folliculatus* LEA, Tr. Am. Phil. Soc., VI, 1858, p. 38, pl. XI, fig. 33; Obs., II, 1838, p. 38, pl. XI, fig. 33.—HANLEY, Biv. Shells, 1843, p. 204, pl. XXII, fig. 55.—CHENU, Ill. Conch., 1858, pl. XXIII, figs. 4, 4a, 4b.—KUSTER, Conch. Cab. Unio, 1861, p. 202, pl. LXVII, fig. 4.—SOWERBY, Conch. Icon., XVI, 1868, pl. XCI, fig. 493.—SIMPSON, Syn., 1900, p. 737.
- Margarita (Unio) folliculatus* LEA, Syn., 1836, p. 34; 1838, p. 23.
- Margaron (Unio) folliculatus* LEA, Syn., 1852, p. 35; 1870, p. 57.
- Unio attenuatus* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 157; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 41, pl. XIV, fig. 38; Obs., XIII, 1874, p. 45, pl. XIV, fig. 38.—SIMPSON, Syn., 1900, p. 736.
- Unio exacutus* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 159; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 45, pl. XV, fig. 43; Obs., XIII, 1874, p. 49, pl. XV, fig. 43.
- Unio rostellum* LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 160; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 44, pl. XV, fig. 41; Obs., XIII, 1874, p. 48, pl. XV, fig. 41.

After bestowing additional study on the puzzling forms of this group, I confess that I can see no valid reason why *Unio attenuatus* should be kept separate from *U. folliculatus*. The type of *U. rostellum* is quite a thin shell, that of *U. attenuatus* is a little more solid, while *U. folliculatus* and *exacutus* are more solid. But there seems to be every variety in the way of intermediates and the general form of all is the same.

UNIO SHEPARDIANUS Lea.

Shell excessively elongated, usually more or less arcuate, rarely straight, generally but not always, higher in front, sub-solid, subcompressed to subinflated, very inequilateral; beaks compressed and but little elevated above the dorsal line, their sculpture apparently strong, slightly doubly-looped ridges; posterior ridge well developed, subangular or narrowly rounded, sometimes double below, ending behind in a point or bifurcation near the base of the shell; surface irregularly, concentrically sculptured; epidermis greenish and often feebly rayed

when young, dark brown or black and rough in old shells; pseudocardinals rough, scarcely compressed, double in both valves; laterals long and straight, inclined to be club-shaped, granulated; anterior muscle scars impressed, separate; posterior scars well-marked, elongated; nacre coppery, chocolate, dull purple or white, dull to brilliant.

Length 190, height 44, diam. 25 mm.

Altamaha River, Georgia.

Type locality, Hopeton, near Darien, Ga.

Unio shepardianus LEA, Tr. Am. Phil. Soc., V, 1834, p. 95, pl. XIII, fig. 38; Obs., I, 1834, p. 207, pl. XIII, fig. 38.—CONRAD, Monog., VIII, 1837, p. 70, pl. XXXIX.—HANLEY, Biv. Shells, 1843, p. 203, pl. XXIII, fig. 25.—KUSTER, Conch. Cab. Unio, 1852, p. 65, pl. XVI, fig. 1.—?CHENU, Man., 1859, II, p. 139, fig. 647.—REEVE, Conch. Icon., XVI, 1865, pl. XIX, fig. 90.—SIMPSON, Syn., 1900, p. 737.

Margarita (Unio) shepardianus LEA, Syn., 1836, p. 34; 1838, p. 23.

Margaron (Unio) shepardianus LEA, Syn., 1852, p. 35; 1870, p. 57.

Unio sheppardianus CATLOW and REEVE, Conch. Nom., 1845, p. 64.

This species is unique and need never be mistaken for any thing else. The specimen measured is one of the largest I have seen; it is somewhat rayed behind and has a white nacre. The shells in a superficial way sometimes resemble some of the Chinese forms, but they are generally more arcuate; they are wider behind than in front and attain a much greater size.

Group of *Unio popeii*.

Shell elongated, narrowed in front, and biangulate behind, with the base slightly sinuate, feebly sulcate; beaks not prominent, sculptured with rather fine, somewhat broken, often faint ridges, which have a tendency to fall into two rounded loops; pseudocardinals compressed, high, sharp, ragged; laterals long, slightly curved; cavity of the beaks shallow; cicatrices not deep. The shell is only a little thickened in front, and that of the female is slightly swollen at the posterior base.

Animal with the marsupium occupying the whole length of the outer gills; ovisacs not separated by a sulcus; gills long, inner a little the larger throughout, generally free their whole length from the abdominal sac; palpi enormous, wide, oval, slightly pointed behind, united two-thirds of their length to the mantle; mantle double on its edge; branchial opening large.

UNIO POPEII Lea.

Shell elongated subtrapezoidal, inequilateral, scarcely sub-solid, rather compressed, narrowed in front and the middle and wider behind, with a low, double posterior ridge, which ends in a wide, rather faint posterior biangulation; posterior slope obliquely subtruncate above; base line generally incurved at the middle, sometimes nearly straight, usually a little full behind the middle; beaks rather low but sharp, their sculpture consisting of a few doubly-looped ridges, the hinder loop heavier; epidermis olive-green, sometimes clouded with tawny, often smoky, slightly rayed on the earlier growth, somewhat imbricated behind; left valve with two small pseudocardinals and two long, curved or nearly straight laterals; right valve with one pseudocardinal, sometimes with a faint second one above; beak cavities shallow, showing the dorsal pits; muscle scars shallow; nacre dull purplish or purplish lead-color. The female shell seems to be a little fuller at the post-base than that of the male.

Length 80, height 35, diam. 22 mm.

Length 57, height 30, diam. 16 mm.

South Texas; northeast Mexico.

Type locality, Devil's River, Texas; Rio Salado, New Leon, Mexico.

Unio popeii LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 102; Jl. Ac. N. Sci. Phila., IV, 1858, p. 372, pl. LXVI, fig. 197; Obs., VIII, 1860, p. 54, pl. LXVI, fig. 197.—SIMPSON, Syn., 1900, p. 738.

Unio popei SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXI, fig. 430.

Margaron (Unio) popeii LEA, Syn., 1870, p. 57.

Lampsilis popei PILSBRY, Pr. Ac. Nat. Sci. Phila., 1909, p. 535.
Elliptio popei ORTMANN, Ann. Car. Mus., VIII, 1912, p. 271.
 ? *Unio vera-pacis* TRISTAM, P. Z. S. Lond. 1863, Pt. 3, p. 414.
 —SIMPSON, Syn., 1900, p. 738.

Unio ravistellus var. *vera-pacis* VON MARTENS, Biol. Cent. Amer., Moll., 1901, p. 516, pl. XXXVIII, figs. 1, 1a.

The greatest diameter of this shell is at or a little behind the center; from this point there is a gradual and nearly straight slope to near the anterior end, from which place it rapidly narrows to the anterior point. I have examined gravid females of this species and the marsupium occupies the entire outer gills. This form differs from *Ū. poeyanus* in being wider behind and darker colored. Its beaks are much more strongly sculptured.

Unio vera-pacis Tristam is probably a synonym.

UNIO POEYANUS Lea.

Shell elongated, inequilateral, scarcely, if at all, narrower in front, convex, subsolid, with a low, rather rounded posterior ridge, which is hardly biangulate; beaks rather low but sharp, their sculpture consisting of very faint ridges; dorsal line nearly straight; basal line straight or slightly incurved at the middle, parallel with the dorsal line; anterior end rounded; posterior end rounded below, obliquely subtruncate above; epidermis straw-colored in young shells, becoming faint brownish-green, often banded with yellowish, in older shells, sometimes feebly rayed and sulcate; left valve with two subcompressed pseudocardinals, the hinder reflexed, and two feeble laterals; right valve with one pseudocardinal and one lateral; beak cavities and muscle scars shallow; nacre whitish.

Length 55, height 23, diam. 15 mm.

Rio de las Balsas, near Coyucan, Mexico.

Unio poeyanus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 85; Obs., VI, 1857, p. 35, pl. XXXII, fig. 30; Jl. Ac. N. Sci. Phila., III, 1858, p. 315, pl. XXXII, fig. 30.—SOWERBY, Conch. Icon., XVI, 1868, pl. xc, fig. 486.—SIMPSON, Syn., 1900, p. 738.

Margaron (Unio) poeyanus LEA, Syn., 1870, p. 57.

This differs from *U. popeii* in several important particulars. It is more nearly cylindrical, its greatest diameter being behind the middle, but it scarcely diminishes in front of that; its nacre is lighter colored and the beaks are much smoother.

Section CANTHYRIA Swainson, 1840.

Canthyria SWAINSON, Treat. Mal., 1840, p. 378.

Shell inflated, suboval, spinose, with a high, rather sharp posterior ridge, above which it is somewhat truncated, the posterior slope being sometimes slightly wrinkled; beaks rather compressed, the sculpture not seen; epidermis smooth and shining, variegated with angular blotches; hinge sharply curved at the center; pseudocardinals rather compressed; laterals short, remote, the hinge plate narrowed; beak cavities rather deep. Animal with the marsupium occupying the whole of the outer gills, forming a smooth pad; branchiæ very large, round below, inner the larger, free nearly their whole length from the abdominal sac; palpi large; mantle double on its edge, sometimes with a few papillæ in front of the branchial opening; branchial opening small; superanal opening colored inside.

Type, *Unio spinosus* Lea.

UNIO SPINOSUS Lea.

Shell subrhomboid or subtriangular, subinflated to inflated, rather solid, inequilateral or almost equilateral; beaks high and full, their sculpture apparently a few short, irregular corrugations; posterior ridge well developed, decidedly angled, ending behind in a point at or just below the median line; anterior end rounded; dorsal line sharply curved at the beaks; dorsal slope obliquely truncated; base line curved; surface with very fine, concentric sculpture; epidermis tawny-yellow, green or brownish, usually with faint and beautiful rays, shining; left valve with two rough, subcompressed pseudocardinals that are nearly opposite each other, with two short, club-shaped, remote laterals; right valve with two opposed pseudocardinals, the upper smaller, with one high lateral; hinge line

rounded and narrowed; muscle scars small, impressed; beak cavities moderately deep; nacre fine rose-color, thicker in front. The surface is ornamented with from one to five spines of various lengths in each valve, varying from one to twenty-five millimeters in length. They are either straight or crooked and though usually arranged in a radial row just in front of the posterior ridge they are sometimes scattered irregularly over this part of the shell.

Length 102, height 60, diam. 33 mm.

Length 95, height 59, diam. 40 mm.

Type locality, Altamaha River, Georgia.

Unio spinosus LEA, Desc. of New Sp. Unio, 1836, colored figs.; Tr. Am. Phil. Soc., VI, 1838, p. 57, pl. XVI, fig. 50; Obs., II, 1838, p. 57, pl. XVI, fig. 50.—JAY, Cat., 1839, p. 113, pl. v, figs. 1, 2.—HANLEY, Biv. Shells, 1843, p. 182, pl. XXIII, fig. 56.—KÜSTER, Conch. Cab. Unio, 1856, p. 167, pl. XLIX, fig. 1.—CHENU, Ill. Conch., 1858, pl. XXII, figs. 6, 6a, 6b.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLIX, fig. 261.—SIMPSON, Syn., 1900, p. 738.

Margarita (Unio) spinosus LEA, Syn., 1836, p. 17, colored plate; 1838, p. 16.

Margaron (Unio) spinosus LEA, Syn., 1852, p. 23; 1870, p. 35.

Canthyria spinosa SWAINSON, Tr. on Mal., 1840, pp. 276, 378.

Unio spinosa GOODRICHT, Ill. Nat. Hist., II, 1859, p. 523, fig.

Elliptio (?) spinosus ORTMANN, Ann. Car. Mus., VIII, 1912, p. 269.

Probably this is the most remarkable member of the family *Unionidae*. Dr. Lea has a magnificent series of 31 specimens ranging from young to old and exhibiting great variation. In one specimen the right valve is destitute of spines; in another there are no spines at all, but as it is somewhat eroded they may have been eaten away. In a young shell a spine is seen in each valve in the process of formation, being merely a short tubular development open at the outer ends and in front. The spines are compressed lengthwise, the growth lines on the upper side of them running across them; on the lower side it is curved sharply downward to a sort of median sulcus. No

doubt the lobe of the mantle fills the hollow spines until it has reached its full height, when it closes up the outer end and in retreating fills the cavity solid or nearly so. One shell in the Lea collection shows a spine broken off at the point where it bifurcates and each part of the spine is hollow. The surface of the shell is bright and usually rayed. One of Lea's shells has beautiful, dark, broad, blotched rays, which become narrower below as if the dark color had been poured on at the beaks and had run down the sides of the shell. It also has a few detached blotches.

Notwithstanding the remarkable character of well-developed spines on the only species of this group, *U. spinosus*, the animal even when gravid does not present any striking peculiarities, and is certainly a *Unio*.

Mr. Charles E. Sykes, of Gardia, Georgia, in a letter written to me, states that he found this species in the Altamaha River about 15 miles above tide water in limited numbers, where they usually burrow in white sand where there is running water from two to four inches deep.

Section UNIOMERUS Conrad, 1853.

Uniomereus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 268.—

ORTMANN, Ann. Car. Mus., VIII, 1912, p. 272.

Shell trapezoid, with a rounded posterior ridge, and pointed or feebly biangulate behind; beaks not prominent, sculptured with 10 to 15 curved, rather strong, concentric ridges, which sweep decidedly upward behind, where they are drawn somewhat closely together; epidermis generally rayless, often cloth-like; pseudocardinals usually compressed; laterals delicate, slightly curved; muscle scars large, shallow; nacre generally lurid.

Animal with the marsupium occupying the whole length of the outer branchiæ, pad-like; gills large, inner the larger, free nearly or quite the length of the abdominal sac; mantle generally rather thick, thicker and double on the edge.

Type, *Unio tetralasmus* Say.

Ortmann, (l. c.), raises this group to generic rank.

UNIO TETRALASMUS Say.

Shell elongated with dorsal and ventral lines nearly parallel, convex to subinflated, rather thin to subsolid, inequilateral, beaks somewhat full and elevated, their sculpture consisting of six or seven moderate concentric ridges, which are evenly and rapidly rounded up behind; posterior ridge widely rounded, ending behind in a point just below the median line; on the dorsal slope there are two radiating furrows, the slope being slightly, obliquely truncate behind; anterior end evenly rounded; surface with feeble, concentric sulcations, and traces of very fine radial sculpture; epidermis yellowish-brown or ashy-brown, banded with lighter color, rather smooth, often subshining; pseudocardinals two in each valve, the upper in the right valve small, all subcompressed; laterals long, two in the left valve and one in the right; beak cavities impressed; dorsal scars immediately under the beaks; muscle scars smooth and shallow; nacre white.

Length of Say's figure 112, height 49, diam. 35 mm.

Length 96, height 48, diam. 30 mm.

Alabama to Texas; north to Southern Missouri and Indian Territory.

Type locality, Bayou St. John, New Orleans, La.

Unio tetralasmus SAY, Am. Conch., III, 1830, pl. XXIII.—HANLEY, Biv. Shells, 1843, p. 198, pl. XXIII, fig. 49.—CHENU, Bib. Conch., 1st. ser., III, 1845, p. 52, pl. X, figs. 1-3.—SIMPSON, Syn., 1900, p. 739.—FRIERSON, Naut., XVII, 1893, p. 49, pl. III, upper fig.

Margarita (Unio) tetralasmus LEA, Syn., 1836, p. 30; 1838, p. 21.

Margaron (Unio) tetralasmus LEA, Syn., 1852, p. 32; 1870, p. 50.

Uniomerus tetralasmus ORTMANN, Ann. Car. Mus., VIII, 1912, p. 272.

Unio excultus CONRAD, Monog., XI, 1838, p. 99, pl. LIV, fig. 1.

Unio parallelus CONRAD, Pr. Ac. N. Sci. Phila., I, 1841, p. 20.

Unio symmetricus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164; Tr. Am. Phil. Soc., X, 1853, p. 73, pl. IV, fig. 11; Obs., IV, 1848, p. 47, pl. IV, fig. 11.

Margaron (Unio) symmetricus LEA, Syn., 1852, p. 32; 1870, p. 52.

Unio porrectus CONRAD, Jl. Ac. N. Sci. Phila., 1854, p. 296, pl. xxvi, fig. 7.

Unio suberocceus CONRAD, Jl. Ac. N. Sci. Phila., VII, 1854, p. 297, pl. xxvii, fig. 1.

Unio jamesianus LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 84; Jl. Ac. N. Sci. Phila., IV, 1858, p. 53, pl. vi, fig. 35; Obs., VI, 1858, p. 52, pl. vi, fig. 35.

Margaron (Unio) jamesianus LEA, Syn., 1870, p. 50.

A widely distributed, very abundant and variable species. There are decided variations enough to make several perfectly valid species in the material I have examined, but they are so completely blended together by connecting forms that it seems to me better to make varieties of them. The specimen figured by Say is much elongated, having the dorsal and ventral lines nearly straight and parallel. It is, according to the colored figure, yellowish-brown with an ashy tint and has near the base, two narrow, concentric, tawny bands. Lea's type of *Unio jamesianus* is a young and considerably distorted shell, being injured and drawn in at the middle of the base, and diseased along the hinge line, so that the hinge is curved upward. He has several fine, healthy shells which he calls *jamesianus* that agree with the type in texture, color and other characters, excepting form, and these are exactly like Say's figure of *tetralasmus*. Generally it is smooth and shining, but I have seen specimens that are slightly dull. In Indian Territory, Southern Missouri and Texas specimens are abundant, which are often a little darker than the type, varying into dark brown. The dorsal and ventral lines of these specimens are sometimes a little curved and in Texas it runs into the variety *manubius*.

Var. *camptodon* Say.

Shell subrhomboid, the base line usually incurved when adult; beaks sharper than in the type; surface dark, subshining or rougish; nacre bluish-white.

Length of Say's figure 95, height 46, diam. 30 mm.

States bordering the Gulf of Mexico.

Type locality, New Orleans, La.

Unio camptodon SAY, Am. Conch., V, 1832, pl. XLII.—HANLEY, Biv. Shells, 1843, p. 198, pl. XXI, fig. 17.—CHENU, Bib. Conch., 1st. ser., III, 1845, p. 53, pl. XIV, figs. 2, 2a, 2b.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXX, fig. 356.

Margarita (Unio) camptodon LEA, Syn., 1836, p. 30; 1838, p. 21.

Margaron (Unio) camptodon LEA, Syn., 1852, p. 32; 1870, p. 50.

Unio tetralasmus var. *camptodon* SIMPSON, Syn., 1900, p. 740.

Unio geometricus LEA, Tr. Am. Phil. Soc., V, 1832, p. 38, pl. IV, fig. 10; Obs., I, 1834, p. 150, pl. IV, fig. 10.

Unio declivis geometricus FRIERSON, Naut., XVII, 1903, p. 49, pl. III, middle fig.

This form is decidedly obliquely truncated on the dorsal slope; the posterior ridge is rather high and rounded and ends at or near the base of the shell in a rounded point. Adult shells have the base line incurved medially and the anterior end is either evenly rounded or angled above. The surface is darker and usually rougher than it is in typical specimens. It is a little difficult to say just what Lea's *U. geometricus* is, as the type does not seem to be in his collection. It is a young shell and is described as dark brown with a wrinkled and sometimes obscurely rayed epidermis. It seems from the figure to stand somewhat between Say's *camptodon* and *declivis*, but I think that the form is nearer the latter, as the base line is almost straight.

Var. *manubius* Gould.

Shell often becoming large; dorsal and ventral lines more or less curved, somewhat rhomboid, the dorsal slope being more or less obliquely truncated; surface yellowish-ashy, dull or feebly shining.

Length 102, height 55, diam. 33 mm.

Length 131, height 68, diam. 41 mm.

Type locality, Chihuahua, sixty miles from Fort Ringgold.

Unio manubius GOULD, Pr. Bost. Soc. Nat. Hist., V, 1856, p. 220.

Margaron (Unio) manubius LEA, Syn., 1870, p. 54.

Unio manubrius PÆTEL, Conch. Sam., III, 1890, p. 158.

Unio tetralasmus var. *manubus* SIMPSON, Syn., 1900, p. 740.

I am not aware that this form has ever been figured, but the Lea collection has a right valve from Chihuahua, Mexico, which was donated by Dr. Gould under the name *Unio manubius*. The form, while slightly rhomboid by reason of the oblique truncation of the posterior slope, becomes more nearly elliptical than the type. The epidermis is sometimes more nearly elliptical than the type. The epidermis is sometimes dark and may either be dull or shining.

Var. *declivis* Say.

Shell of moderate size, subrhomboid, somewhat rounded on the base line; posterior ridge high, narrowly rounded and standing out somewhat distinctly from the rest of the shell; dorsal slope having a wide, shallow, radial furrow just above and reaching to the posterior ridge, decidedly obliquely truncated; surface dark brown, unevenly sulcated and rough; nacre sometimes purple-tinted.

Length of Say's figure 74, height 39, diam. 25 mm.

Lower part of the Gulf States from Alabama to Louisiana.

Type locality, Bayou Teche, La.

Unio declivis SAY, Transylvania Jl. IV, 1831, p. 527; Am. Conch., III, 1832, pl. XXXV.—HANLEY, Biv. Shells, 1843, p. 200, pl. XXIII, fig. 50.—CHENU, Bib. Conch., 1st. ser., III, 1845, p. 46, pl. XIII, figs. 1, 1a, 1b.—KUSTER, Conch. Cab. Unio, 1852, p. 60, pl. XIV, fig. 1.—FRIERSON, Naut., XVII, 1903, p. 49, pl. III, lower fig.

Margarita (Unio) declivis LEA, Syn., 1836, p. 32; 1838, p. 22.

Margaron (Unio) declivis LEA, Syn., 1852, p. 33; 1870, p. 54.

Unio tetralasmus var. *declivis* SIMPSON, Syn., 1900, p. 740.

Quite a distinct form, when typical, and apparently not very abundant. The posterior ridge is elevated, its edges being rather distinctly marked above and below; it is rounded and rather narrow and ends behind above the base in a sort of beak, as noticed by Say. But I have seen specimens much

like *declivis* with the base line almost straight and forms with something of its shape but nearly smooth.

Frierson, (l. c.), considers *declivis* to be specifically distinct from *tetralasmus* with *geometricus* Lea as a synonym.

Var. *sayi* Ward.

Shell rhomboid, with the dorsal and ventral lines very slightly curved; dorsal slope decidedly obliquely truncated; beaks rather full and high, their sculpture strong and distinct; posterior ridge well developed, rounded and ending near the base of the shell in a decided point; surface yellowish or greenish-ash, generally with darker, concentric bands; epidermis sometimes smooth, more commonly delicately, concentrically wrinkled; nacre bluish-white.

Length 82, height 40, diam. 25 mm.

Ohio River system.

Type locality, Walnut Creek and Ohio Canal, Circleville, O. *Unio sayi* WARD (in Tappan), Am. Jl. Sci., XXXV, 1839, p. 268, pl. III, fig. 1.—CONRAD, Monog., XI, 1838?, p. 102, pl. IV, fig. 2.—KUSTER, Conch. Cab. Unio, 1861, p. 246, pl. LXXXIII, fig. 1.

Unio sayanus B. H. WRIGHT, Check List, 1888.

Unio electrinus REEVE, Conch. Icon., XVI, 1865, pl. xxv, fig. 121.

Unio tetralasmus var. *sayi* SIMPSON, Syn., 1900, p. 741.

Sometimes becomes quite dark and elongated and I have a series of intermediates before me, which shows a gradual transition to typical *U. tetralasmus*.

The entire distribution of the species and all its varieties is as follows:

Lower Mississippi drainage north to about latitude 40°: Ohio River system; Alabama River system and southwest through Texas into northern Mexico. Not reported, so far as I know, from the Tennessee and Cumberland rivers.

UNIO COLUMBENSIS Lea.

Shell rather elongated, rhomboid, inequilateral, somewhat solid, convex or subinflated; beaks only moderately full and elevated, their sculpture not observed; posterior ridge full.

rounded, ending behind in a blunt point at or very near the base of the shell; base line incurved a little in the middle; dorsal line nearly parallel with the base line; anterior end rounded; posterior end obliquely subtruncated, the outline being somewhat curved, meeting the dorsal line with a sharper curve; surface finely, concentrically striate; epidermis finely, concentrically wrinkled, becoming cloth-like around the border of the shell, smoother on the disk, greenish-brown to reddish-brown; pseudocardinals stumpy, quite solid, rough, two in the left valve and one in the right; laterals remote, somewhat club-shaped; muscle scars shallow, anterior separate, posterior large; nacre whitish, often tinted with lurid purple.

Length 88, height 44, diam. 28 mm.

Length 70, height 39, diam. 21 mm.

Chattahoochee River, Georgia, west to Little Patsaliga Creek, Alabama.

Type locality, Creeks, Columbus, Ga.

Unio columbensis LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 31;

Jl. Ac. N. Sci. Phila., IV, 1858, p. 75, pl. XIV, fig. 55; Obs.,

VI, 1858, p. 75, pl. XIV, fig. 55.—SIMPSON, Syn., 1900, p. 741.

Margaron (Unio) columbensis LEA, Syn., 1870, p. 50.

Unio columbiensis PÆTEL, Conch. Sam., III, 1890, p. 148.

Exceedingly close to forms of *U. tetralasmus* on the one hand and *U. obesus* on the other. It is generally a solidier shell than either, its teeth are normally considerably heavier and it differs a little from either in texture in an almost indescribable way. Its color is colder, not so warm and soft as that of *tetralasmus* or *obesus*.

UNIO OBESUS Lea.

Shell rhomboid, subinflated or inflated, subsolid, inequilateral; beaks full, high, their sculpture numerous ridges which are strongly curved up behind; posterior ridge high, rounded, ending in a point, rarely a feeble biangulation at or very near the base of the shell; posterior slope with two faint, radial sulci, obliquely truncated; surface with irregular growth lines; epidermis tawny-brown to dark brown, longitudinally wrinkled, often cloth-like; pseudocardinals generally small,

compressed or subcompressed, two in the left valve, one and a vestige of a second in the right; laterals remote, curved; muscle scars large, the posterior ones decidedly so, well marked; nacre lurid purplish.

Length 84, height 50, diam. 33 mm.

Length 108, height 66, diam. 37 mm.

Length 113, height 59, diam. 40 mm.

Southern Virginia probably; South to Georgia.

Type locality, Georgia.

?*Unio carolinensis* BOSCH, Hist. Nat. de coq., 1824, III, p. 139, pl. XXIII, fig. 2.—CHENU, Ill. Conch., 1843, pl. XVIII, fig. 4.

Unio obesus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 96, pl. XIII, fig. 26; Obs., I, 1834, p. 106, pl. XIII, fig. 26.—HANLEY, Biv. Shells, 1843, p. 198, pl. XXII, fig. 34.—CHENU, Ill. Conch., 1858, pl. XVIII, figs. 4, 4a, 4b.—KUSTER, Conch. Cab. Unio, 1861, p. 196, pl. LXIII, fig. 2.—REEVE, Conch. Icon., XVI, 1864, pl. XVIII, fig. 84.—?SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVIII, fig. 212.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 428, pl. LXVIII, fig. 6; LXXIX, figs. 1, 2, 4; LXXI, fig. 3; Syn., 1900, p. 741.

Margarita (Unio) obesus LEA, Syn., 1836, p. 30; 1838, p. 21.

Margaron (Unio) obesus LEA, Syn., 1852, p. 32; 1870, p. 50.

Unio declivis CONRAD, Monog., V, 1836, p. 45, pl. XXIII, fig. 1.

Unio ineptus LEA, Tr. Am. Phil. Soc., X, 1852, p. 261, pl. xv, fig. 12; Obs., V, 1852, p. 17, pl. xv, fig. 12.

Margaron (Unio) ineptus LEA, Syn., 1852, p. 31; 1870, p. 50.

Unio hebes LEA, Tr. Am. Phil. Soc., X, 1852, p. 267, pl. XVIII, fig. 21; Obs., V, 1852, p. 23, pl. XVIII, fig. 21.

Margaron (Unio) hebes LEA, Syn., 1852, p. 26; 1870, p. 51.

Unio ricularis CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 257.

Unio cicur LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 39; Jl. Ac. N. Sci. Phila., V, 1862, p. 93, pl. XIII, fig. 241; Obs., VIII, 1862, p. 97, pl. XIII, fig. 241.

Margaron (Unio) cicur LEA, Syn., 1870, p. 52.

Unio squalidus LEA, (part) Pr. Ac. N. Sci. Phila., XV, 1863, p. 192; Jl. Ac. N. Sci. Phila., VI, 1866, p. 22, pl. VII, fig. 20; Obs., XI, 1867, p. 26, pl. VII, fig. 20.

Margaron (Unio) squalidus LEA, Syn., 1870, p. 51.

Unio jettettii LEA, Pr. Ac. N. Sci. Phila., XI, 1867, p. 81; Jl. Ac. N. Sci. Phila., VI, 1868, p. 276, pl. XXXVII, fig. 89; Obs., XII, 1869, p. 36, pl. XXXVII, fig. 89.

Margaron (Unio) jettettii LEA, Syn., 1870, p. 51.

Unio pawcensis LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 161; Jl. Ac. N. Sci. Phila., VI, 1868, p. 302, pl. XLV, fig. 114; Obs., XII, 1869, p. 62, pl. XLV, fig. 114.

Margaron (Unio) pawcensis LEA, Syn., 1870, p. 51.

A very variable species in size, color and form. Some of the material from South Carolina and Georgia has rather a thin reddish-tinted epidermis. Occasional shells are nearly evenly elliptical, being only slightly rhomboid, from these there is every variation to material that is incurved on the base, decidedly rhomboid and having the posterior point drawn down to a beak. This latter character is the result of maturity or old age and is seen in many other unrelated Uniones.

It may be that the *Unio carolinensis* of Bosc is the same as Lea's *U. obesus*. Dr. Lea thinks it is *Margaritana margaritifera*, but Bosc did not visit any region inhabited by that species, and the figure seems to show lateral teeth. I confess that I am not able to determine what species Bosc refers to and I think it is better to use the name given by Lea.

The figure given by Conrad for *U. declivis* seems to me to be that of a typical *obesus* and not that of any form of *tetralasmus*.

The type locality was originally given as York River, Va., but Lea (Obs., I, p. 118) states that this was a mistake and that the types were collected by Le Conte in Georgia.

Var. *blandingianus* Lea.

Shell dark and rough, often cloth-like, rhomboid, frequently drawn out to a beak at the hinder end. This beak sometimes extends below the rest of the base line.

Florida; extending northward into southern Georgia.

Type locality, St. John's River, Fla.

Unio blandingianus LEA, Tr. Am. Phil. Soc., V, 1834, p. 101, pl. xv, fig. 44; Obs., I, 1834, p. 213, pl. xv, fig. 44.—CONRAD, Monog., V, 1836, p. 46, pl. xxiii, fig. 2.—HANLEY, Biv. Shells, 1843, p. 200, pl. xxii, fig. 1.—KUSTER, Conch. Cab. Unio, 1852, p. 36, pl. vi, fig. 2.—SOWERBY, Conch. Icon., XVI, 1866, pl. xxxv, fig. 187.

Margarita (Unio) blandingianus LEA, Syn., 1836, p. 32; 1838, p. 22.

Margaron (Unio) blandingianus LEA, Syn., 1852, p. 33; 1870, p. 54.

Unio obesus var. *blandingianus* SIMPSON, Syn., 1900, p. 742.

Unio rivicolus CONRAD, Am. Jl. Conch., IV, 1868, p. 280, pl. xviii, fig. 4.

In Florida and Southern Georgia the *obesus* is almost always dark and rough, the epidermis becoming thick, often cloth-like and the form is decidedly rhomboid. There is a gradual change from the type to this form. The *Unio rivicolus* of Conrad belongs here instead of under the type.

Var. *paludicolus* Gould.

Shell small, usually narrower in front, rather thin to sub-solid, greenish-brown to blackish, sometimes biangulate behind and having a double posterior ridge. Nacre bluish-white, dingy purplish or even coppery.

Length 42, height 22, diam. 12 mm.

Florida, various localities.

Type locality, Florida Everglades.

Unio paludicolus GOULD, Pr. Bost. Soc. Nat. Hist., II, 1845, p. 53.

Margaron (Unio) paludicolus LEA, Syn., 1852, p. 33; 1870, p. 54.

Unio obesus var. *paludicolus* SIMPSON, Syn., 1900, p. 743.

Unio paludicolor CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 254.

This form differs from the type merely in degree, not in any real characters. It has never been figured, but the Lea collection contains specimens donated by Dr. Gould from the Everglades, the type locality, and some of these are almost

exact miniatures of the larger *U. obesus*. Occasionally the anterior end is considerably narrowed and the posterior ridge becomes somewhat double. I have found such specimens in Manatee County, Florida.

UNIO BISSELLIANUS Lea.

Shell long rhomboid, subsolid or solid, subinflated, inequilateral; beaks somewhat elevated, moderately full, their sculpture a few strong ridges that curve up decidedly behind; posterior ridge full, rounded, sometimes having above it a couple of low, radiating ridges; dorsal slope decidedly obliquely truncated; base line nearly straight; dorsal line curved a little; anterior end rounded; surface with concentric growth lines; epidermis dull greenish, concentrically wrinkled, usually slightly rayed, having a broad faint ray on the posterior ridge and two narrower ones above it; pseudocardinals subcompressed, two in the left valve and one in the right; laterals curved; muscle scars shallow; nacre having a lurid purplish tint, iridescent behind.

Length 70, height 40, diam. 22 mm.

Type locality, Bissel's Pond, Charlotte, North Carolina.

Unio bissellianus LEA, Pr. Ac. N. Sci. Phila., XI, 1867, p. 81; Jl. Ac. N. Sci. Phila., VI, 1868, p. 277, pl. XXXVII, fig. 90; Obs., XII, 1869, p. 37, pl. XXXVII, fig. 90.—SIMPSON, Syn., 1900, p. 743.

Margaron (Unio) bissellianus LEA, Syn., 1890, p. 50.

Close to forms of *U. obesus*, but the epidermis is colder, not so rough and is rayed behind. I have before me a shell said to come from Lucile, Lauderdale County, Mississippi, received from Mr. Berlin H. Wright, which approaches *U. bissellianus* more nearly than anything, but I do not feel safe in referring it to that.

Section MICRONAIAS Simpson, 1900.

Micronaias SIMPSON, Syn., 1900, p. 743.

Shell small, oval, a little produced near the posterior base, with a moderate posterior ridge and pointed near the base behind; beaks rather prominent, the sculpture being apparently

rather fine, irregularly concentric ridges, having a tendency to fall into two loops; the whole surface strongly and closely concentrically ridged; pseudocardinals compressed, high, slightly curved upward; laterals compressed, curved; beak cavities moderately deep; nacre whitish; anterior muscle scars deep, rough; posterior well marked.

Animal with the marsupium pad-like, occupying all but the extreme posterior part of the outer gills; branchiæ elongated, wider behind, inner the larger throughout, free from the abdominal sac or united to it; palpi large, rounded behind; mantle with thickened border; anal opening crenulate.

Type, *Unio aratus* Lea.

A peculiar group of small species, which conchologically resemble some of the *Plagiolas* of the Central American region. But in the gravid animals the outer gills are filled throughout their entire length with embryos, forming a pad-like marsupium. That of *Plagiola* is very different, consisting of a limited number of ovisacs in the hinder part of the outer gills, which are separated from each other by sulci.

UNIO FALLACIOSUS n. sp.

Shell small, subtriangular, somewhat inflated, rather solid with high beaks, whose sculpture consists of a few moderately coarse ridges, which are corrugated and somewhat doubly looped; from the beaks there is an almost straight oblique truncation to the anterior and posterior points; the base line is evenly rounded; posterior ridge strong; surface everywhere covered with coarse, rather sharp, concentric sculpture, tawny, sometimes greenish-yellow or yellow-green, often having a few faint rays at the beaks; left valve with two rather high, sub-compressed, ragged and, sometimes slightly reflected, pseudocardinals and two laterals; right valve with two pseudocardinals, the upper feeble, and one lateral; beak cavities shallow, showing a few scars; muscle scars moderately impressed; nacre soiled white to salmon.

Length 32, height 23, diam. 17 mm.

Nicaragua.

This form has apparently passed as *Unio aratus* and some time ago I believed it to be the young of *Quadrula spheniopsis*. I am now satisfied that it is neither of these, as it is a solidier, higher, rather more inflated shell than the former, and has coarser, sharper sculpture, while the outline is less quadrate than that of *spheniopsis* at the same age.

UNIO ARATUS Lea.

Shell small, subsolid, suboval to subtriangular, somewhat convex, with a well-defined posterior ridge, which ends behind in a rather sharp point below the median line, anterior end slopingly subtruncate above, rounded below; base rather evenly rounded; epidermis yellowish-tawny, sometimes tinged brownish or greenish and everywhere strongly and irregularly sulcate; left valve with two somewhat compressed, ragged pseudocardinals and two lamellar laterals; right valve with one pseudocardinal, with a vestigial one above it, and one lateral, all the pseudocardinals often slightly recurved; beak cavities shallow, showing a few posterior scars; muscle scars not deep; nacre dirty white or yellowish.

Length 28, height 18, diam. 13 mm.

Length 34, height 20, diam 15 mm.

Central America.

Unio aratus LEA, Disc. 12 Uniones, 1843; Tr. Am. Phil. Soc., IX, 1845, p. 282, pl. XLII, fig. 12; Obs., IV, 1848, p. 40, pl. XLII, fig. 12.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXIV, fig. 320.—SIMPSON, Syn., 1900, p. 744.—VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 499, pl. XXXIX, figs. 1, 1a, 1b, 2, 3, 3a, 3b.

Margaron (Unio) aratus LEA, Syn., 1852, p. 28; 1870, p. 35.

Unio nuculinus PHILIPPI, Zeit. für Mal., V, 1848, p. 176.—SIMPSON, Syn., 1900, p. 607.—VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 509, pl. XXXIX, fig. 6, 6a, 6b.

This species is a variable one and some of the specimens are much more elongated than others and occasional shells are fuller at the posterior base than others and these are probably females. I have examined the gravid animal of what I believe

to be this species and it seems to be a true *Unio*, the marsupium occupying nearly the entire length of the outer gills as a smooth pad. I have not been able to examine the beak sculpture of this species.

I am quite sure that Philippi's *Unio nuculinus* which has been figured for the first time by von Martens in the *Biologia* is a delicate young female *aratus*.

UNIO GRANADENSIS Lea.

Shell rather small, rhombovate, subinflated, somewhat solid, with a well-developed posterior ridge; surface slightly and irregularly concentrically sulcate, covered with a dark brown or blackish epidermis, which sometimes appears slightly silky when fresh; dorsal line strongly curved; basal line less curved or nearly straight ending in a rounded point behind at a level with or just above the base line; anterior end sometimes a little angulate but rounded; left valve with two ragged, sub-compressed pseudocardinals and two short, curved laterals; right valve with one pseudocardinal, sometimes with a vestigial one above, and one lateral, sometimes with a feeble second one below it; beak cavities moderate; muscle scars impressed; nacre whitish or yellowish, soiled.

Length 37, height 24, diam. 18 mm.

Lake Nicaragua.

Unio granadensis LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 95; Jl. Ac. N. Sci. Phila., VI, 1868, p. 293, pl. XLII, fig. 103; Obs., XII, 1869, p. 53, pl. XLII, fig. 103.—SIMPSON, Syn., 1900, p. 744.

Margaron (Unio) granadensis LEA, Syn., 1870, p. 35.

The male and female shells do not appear to differ greatly, the latter is probably a little fuller at the base. This species is larger, solidier and more inflated than *U. aratus* and may be always distinguished from it by having a nearly black epidermis, while that of *aratus* is much lighter colored. Yet the resemblance is sometimes rather close and Dr. Lea placed several young *granadensis* in the tray containing his *aratus*. I am inclined to believe that von Martens has figured one or two specimens of this species for *aratus*.

Species INCERTÆ SEDIS.

UNIO PAJAKOMBOENSIS Bullen.

"Shell solid, ovate, inflated, slightly gaping at both ends; epidermis shining, yellow-brownish-green; valves subrotund, sloping posteriorly, concentrically substriate; unbones close together, eroded; cardinal tooth of the right valve long, erect, sloping, almost smooth, sometimes with a small, auxillary parallel tooth situated near the external margin; lateral tooth elongate; lateral teeth of the left valve elongate and of equal length; cardinal tooth nearly obsolete; anterior cicatrix deep, posterior less impressed.

Length 77, height 51.5, diam. 37 mm." (Bullen).

Type locality, Pajakombo, Sumatra.

Unio pajakomboensis BULLEN, Pr. Mal. Soc. London, VII, 1906, p. 15, pl. II, figs. 9-11.

Schizocleithrum pajakomboense HAAS, Conch. Cab. Unio, 1912, pl. XXII, figs. 5, 6.

Haas has recently, (Nachr. Deutsch. Mal. Ges., 1913, p. 36), made this species the type of a new genus, *Schizocleithrum*.

UNIO TAUMILAPANUS Conrad.

"Oblong, somewhat compressed; substance of shell thick anteriorly and over the umbo; disks flattened; ligament margin nearly parallel with basal margin; umbo decorticated; within pure white.

Allied to *U. niger* Raf., but more regularly oblong and very white inside." (Conrad).

Type locality, San Juan River, Taumilapas.

Unio taumilapanus CONRAD, Pr. Ac. N. Sci. Phila., XII, 1855, p. 256.—LEA, Syn., 1870, p. 65.—VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 521.

Unio taumilapasensis, FISCHER and CROSSE, Miss. Scient. Mex., Moll., II, 1894, p. 621.

This species, which was accidentally omitted from the Synopsis, I have not been able to identify. Both Fischer and Crosse and von Martens have been equally unsuccessful. Conrad identifies *niger* Raf. with *crassidens* Lam. and *incrassatus* Lea.

UNIO BRIARTI Dautzenberg.

"Shell solid, transversely oval, narrowed in front, expanded posteriorly. Beaks at the anterior third of the length. Anterior extremity short, rounded and compressed; posterior end expanded, inflated and very obliquely truncate. Surface with irregular striæ and lines of growth. An obtuse ridge extends from the beaks to the base of the posterior truncation, and the posterior slope is ornamented with numerous, oblique folds, curved and more or less chevroned near the margin. Some similar, but less pronounced, folds appear on the anterior region, near the beaks. Interior of the valves nacreous, very finely shagreened. Cicatrices of the anterior muscles round, deep and with a small scar at the base of and behind the principal one. Cicatrices of the posterior adductors subtrigonal, superficial. Hinge not very thick, with two, short cardinals in the right valve, slightly roughened, separated by a narrow groove, and a long, curved, lamellar lateral; two cardinals in the left valve, the anterior short, compressed, roughened and erect, the posterior obsolete, and two lamellar laterals, curved and quite close together, the upper more prominent. Color uniform olive-yellow, more or less tinged with black; nacre bluish-white. Ligament deep yellowish-brown, quite prominent.

Length 54, height 74, diam. 32 mm." (Dautzenberg)

Type locality, La Lufoi, Congo Free State.

Unio briarti DAUTZENBERG, Ann. Soc. Mal. Belgique, XXXVI, 1901, p. 6, pl. 1, figs. 3, 4.

UNIO MALGACHENSIS Germain.

"General form of the shell an elongate-siliquiform; valves strongly twisted in the infero-posterior region; anterior end very short, obliquely rounded at the base; posterior portion a little more than three times as long as the anterior, subrectilinear-elongate, rounded at the end; beaks very large, very prominent, incurved anteriorly; ligament not large, but slightly projecting; dorsal margin nearly straight; basal margin straight, slightly sinuous in the middle curving upwards towards the posterior end; dorsal and basal margins practically

parallel hinge and muscular impressions unknown. Epidermis of a clear yellowish-chestnut, almost gray towards the beaks and dark brown posteriorly; striæ not strong, very irregular.

Length 11.5, height 4.75, diam. 3.5 mm." (Germain).

Type locality, Madagascar.

Unio malgachensis GERMAIN, Bull. Mus. Hist. Nat., 1911, p. 138, pl. 1, figs. 3, 4, 5.

"The unique example collected by M. Geay is a young shell found alive. The necessity of keeping it intact for the collection of the Museum d'histoire naturelle has prevented me from studying the hinge and muscular impressions. Consequently it is impossible for me to decide definitely as to what subgenus the species should be referred. I have thought it necessary to describe and figure this *Unio*, which will certainly be found again some time and which shows that the island of Madagascar has a more varied fauna of fresh-water pelecypods than has heretofore been believed."

UNIO STOLATUS von Martens.

"Shell elongate, compressed, concentrically striate; epidermis brown, opaque; anterior extremity shortly rounded-truncate; posterior elongate, rostrate; wing slightly elevated; an obtuse ridge extends backwards and downwards from the beaks, behind which the posterior slope is sculptured with small, oblique, decurrent folds; upper posterior margin very oblique, lower posterior margin somewhat rounded; ventral margin moderately curved in front, straight in the middle, slightly ascending posteriorly; cardinal teeth thin, compressed, parallel with the dorsal margin, obliquely sulcate above; nacre bluish, pale yellowish towards the umbones. Beaks at one-fourth of the length.

Long. 72, alt. vert. 32, alæ 39, diam. 17.5 mm." (von Martens).

Type locality, Lake Danau Baru, Sumatra.

Unio stolatus VON MARTENS, Nachtr. Deutsch. Mal. Ges., 1900, p. 15.

"Only a single example, rather thin-shelled, beaks only slightly eroded."

UNIO SZECHENYII Neumayr.

"Shell thick, very inequilateral, oval wedge-shaped, rounded in front, very much smaller behind, pointed, very much truncated, gaping; inflated anteriorly; beaks not prominent, placed very far forward, much eroded. Hinge moderately strong; in the right valve a single, triangular, jagged cardinal tooth; in the left a small lamelliform anterior cardinal and a triangular posterior one, which meet above at an obtuse angle. The lateral teeth in both valves are long. Muscular impressions confluent, equally large, the anterior deep, the posterior shallow. Nacre white. Epidermis blackish-brown.

Length 96, height 45, diam. 31 mm." (Neumayr).

Type locality, Pojang Lake, Kiu-kiang, Kiang-si Province, China.

Unio szechenyii NEUMAYR, Ergebnisse d. Reise Szecheny Ostasien, II, 1898, p. 642, pl. II, fig. 1.

"Among the described species, *Unio corderii* Heude is the nearest, but this species is very easily distinguished by the very pronounced gaping of the shell, greater size, more pointed form and darker epidermis.

Unio pasi Lea differs by its distinctly keeled and much less obliquely truncate posterior end, lamelliform cardinal teeth and very different color of the epidermis, moreover the description does not say that the shell gapes posteriorly."

UNIO FLEXICOSUS Neumayr.

"Shell thick, inequivalve, very inequilateral, long oval, twisted, rounded in front, slightly keeled, pointed, obliquely truncate behind. Beaks not prominent, well anterior, much eroded. Hinge, in the left valve, which alone is known, with two very high, much compressed, jagged cardinal teeth, which unite and form a continuous ridge in a straight line, lateral tooth very long and strong. Anterior muscular impressions deep; posterior confluent, larger, very shallow. Nacre white. Epidermis blackish-brown.

Length 95.5, height 43 mm." (Neumayr).

Type locality, Pojang Lake, Kiu-kiang, Kiang-si Providence, China.

Unio flexicosus NEUMAYR, Ergebnisse d. Reise Szecheny Ostasien, II, 1898, p. 642, pl. II, fig. 2.

"*Unio flexicosus*, it is true, is known only by a single left valve, but this has such a remarkable character and so interesting a form that it is entitled to be made the type of a new species. In the small group of twisted unios, *U. picinalis* Heude is the nearest, but differs at first glance by its much stronger twist. Other species, such as *U. contortus* Heude and *triformis* Heude differ still more."

UNIO SUPERSTES Neumayr.

"Shell oval, thick, inequilateral, somewhat inflated, slightly angulate posteriorly and very little truncated. Beaks situated at the first third of the length, not prominent, somewhat eroded. In the left valve one moderate, triangular cardinal tooth and in front of it a very feeble lamelliform one, in the cavity between them is an elevated ridge, which shows that the cardinal tooth of the right valve is bifid. Lateral tooth long and strong. Anterior muscular impression distinct, deep, posterior slightly larger and much weaker. Epidermis olive-brown. Nacre white. The size can not be accurately stated, as the specimen is imperfect." (Neumayr).

Type locality, Tali-fu, Province of Yunnan, South China.

Unio superstes NEUMAYR, Ergebnisse d. Reise Szecheny Ostasien, II, 1898, p. 643, pl. I, fig. 3.

"Of this species I have only a single, somewhat damaged valve. I would not have described a new species from such a poor specimen, if it were not that, on account of its very close relationship to the European Pliocene types, it is important to the interesting study of the Chinese fresh-water fauna. It stands so exceedingly close to *Unio nicolaianus* Brus. from the middle Paludina-beds, the ancestral form, from which a whole race of other species has been evolved, that one, watching for the greatest difference, would find it very difficult to find any variation between them, the beaks in the first species

(*nicolaianus*) are very slightly further forward, the anterior end is somewhat less rounded and the cavity between the cardinal teeth of the left valve a very little smaller and without the elevated ridge. These insignificant differences are immaterial and there can be no error in referring to the intimate relationship between a *Unio* of the European Tertiary and a living form from the Chinese or American area."

UNIO PANTOENSIS Neumayr.

"Shell thin, rather small, inequilateral, quadrate, slightly inflated, rounded in front, truncate behind, with a slight appearance of being winged; dorsal margin slightly curved; ventral margin straight. Surface with irregular growth lines, angularly wrinkled at the beaks. Beaks not prominent, situated in the first third of the length. Hinge with moderately long, strong laterals: in the right valve a single, rather feeble, forward projecting, lamelliform cardinal tooth; in the left valve two similar ones, of which one begins under the beak and reaches far outward, while the other is direct. Muscular impressions very faint. Nacre bluish. Epidermis olive-brown.

Length 34, height 21, diam. 12 mm." (Neumayr).

Type locality, Panto, Yunnan.

Unio pantoensis NEUMAYR, Ergebnisse d. Reise Szecheny Ostasien, II, 1898, p. 644, pl. 1, fig. 5.

UNIO HERES Neumayr.

"Shell oval, thick, slightly inflated, inequilateral, narrower in front, beaks situated in the front third of the shell, not prominent, the greatest breadth being behind the beaks. Shell very indistinctly keeled posteriorly and somewhat truncated. Beaks somewhat eroded. Hinge of the right valve with a moderately stout cardinal tooth, striate on the upper side and a long, strong lateral. Left valve unknown. Anterior muscular impression small and deep, posterior somewhat larger, but very faint. Epidermis olive-brown. Nacre white." (Neumayr).

Type locality, Lake near Tali-fu, Yunnan.

Unio heres NEUMAYR, Ergebnisse d. Reise Szecheny Ostasien, II, 1898, p. 644, pl. 1, fig. 6.

"*Unio heres* is at first glance extraordinarily like *Unio superstes*, but, on careful consideration, it can easily be distinguished by its form, smaller in front and truncate behind, the greatest width being behind the beaks and the less prominent beaks. The hinge of the two species must also be different, since from the condition of the left valve in *U. superstes* the cardinal tooth in the right valve must be a little stronger, lower and split in the middle.

This interesting species is like the preceding (*superstes*), very closely related to the Slavonic *Unio nicolaianus*. Only a single right valve is before me."

UNIO KOBELTI Neumayr.

"Shell thin, long egg-shaped, inequilateral, slightly inflated; beaks situated in the first fourth of the length, not prominent, greatly eroded; somewhat truncated in front; dorsal margin curved, higher behind the beaks, where is the greatest height. Ventral margin nearly straight; posterior end small, rostrate. Cardinal teeth striate, lamelliform, very thin; laterals long, striate, lamelliform, very feeble. Muscular impressions very faint. Epidermis blackish-brown. Nacre white." (Neumayr).

Type locality, Kiu-kiang, Province of Kiang-si, China.

Unio kobelti NEUMAYR, Ergebnisse d. Reise Szecheny Ostasien, II, 1898, p. 645, pl. III, fig. 1.

"*Unio kobelti* stands rather alone; *Unio pfisteri* Heude is like it in a general way, but in that the beaks are somewhat more posterior, the posterior part is keeled, the basal margin rounded, but especially it differs in the hinge as the characteristic lamelliform cardinal teeth are wanting. *Monocondylus nankingensis* Heude resembles it only in the external surface. *Pseudodon secundus* Heude is like it only in the external contour; the hinge is entirely different."

UNIO ZAMBESIENSIS Preston.

"Shell subtrapezoidal, deep rich brown, sculptured, especially above, with wavy zigzag ridges and below with coarse,

irregular, concentric lines of growth; anterior side obliquely rounded; posterior side somewhat squarely rounded.

Alt. 22.5, length 35 mm." (Preston).

Type locality, just above Victoria Falls, Zambesi River.

Unio zambesiensis PRESTON, Pr. Mal. Soc. London, VI, 1905, p. 301, text-fig. 1.

UNIO ANGONIENSIS Preston.

"Shell ovate, slightly angled posteriorly, covered with a blackish-brown, laminiferous periostracum; sculptured with closely set, irregular, concentric growth-lines, and posteriorly with curved, transverse, interrupted, slightly nodulous riblets; umbones much eroded, rather large, moderately prominent; dorsal margin somewhat ascending, scarcely arched; ventral margin nearly straight; anterior side abruptly rounded; posterior side sloping above, then angled and descending sharply below; lateral teeth elongate curved; cardinal tooth in right valve elongate, erect and jagged anteriorly, partially cleft posteriorly; cardinal tooth in left valve somewhat triangular, broad, tuberculous in the middle, erect and jagged at the sides; anterior adductor scars deeply impressed, ovate; posterior adductor scars light; interior of shell nacreous, pink anteriorly, livid bluish posteriorly.

Length 26, lat. 39 mm." (Preston).

Type locality, Angoniland, British Central Africa, to the south of Lake Nyassa.

Unio angoniensis PRESTON, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 59, pl. IV, fig. 5.

UNIO CHARON Preston.

"Shell elongately ovate, slightly gaping at both sides, covered with a black periostracum, corrugately sculptured towards the umbonal region and marked below with irregular, concentric ridges; umbones eroded, moderately large, not prominent; dorsal margin curved; ventral margin slightly constricted in the middle, otherwise straight; anterior side rather produced, angularly rounded; posterior side elongately produced, sharply rounded; lateral teeth in both valves elongate, curved; cardinal

tooth in right valve elongate, rather fine, rising considerably in the middle; cardinal tooth in the left almost obsolete, serrated anteriorly; anterior adductor scars deep, somewhat square in shape; posterior adductor scars scarcely impressed.

Length 52, height 26.5 mm." (Preston).

Type locality, Silongwe, British Central Africa.

Unio charon PRESTON, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 60, pl. IV, fig. 6.

UNIO SILONGWEENSIS Preston.

"Shell differing from *U. charon* by its narrower form and somewhat more acuminate posterior side, lighter texture, much smoother, concentric sculpture, and paler color, the periostracum being of a pale yellowish-brown color; the muscular scars are much larger and, in the case of the anterior adductor, more deeply impressed.

Long. 26.5, lat. 52 mm." (Preston).

Type locality, Silongwe, British Central Africa.

Unio vicinus PRESTON, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 60, pl. IV, fig. 7.

Unio silongweensis PRESTON, Naut., XXVI, 1912, p. 35.

"*Vicinus*" having already been used for a *Unio* by Lea in 1856, Mr. Preston has proposed another name for his species.

UNIO CHOZIENSIS Preston.

"Shell small, squarely ovate, moderately convex, covered with a blackish-brown periostracum, sculptured with fine, concentric striæ and rather coarse, transverse, corrugate ridges, which become finer posteriorly; umbones not prominent; dorsal margin sloping in an anterior direction; ventral margin slightly rounded; anterior side descending somewhat abruptly; posterior side rather acuminately rounded; lateral teeth elongate, straight; cardinal teeth in right valve weak, jagged, erect anteriorly, bifurcate posteriorly; cardinal teeth in left valve elongate, finely jagged, cleft anteriorly; muscular scars deeply impressed anteriorly, scarcely apparent posteriorly; interior of shell iridescent, bluish-white.

Long. 16.25; lat. 25 mm." (Preston).

Type locality, Chozi River, a tributary of the Chambzi, flowing into Lake Bangweolo from the east.

Unio choziensis PRESTON, Ann. Mag. Nat. Hist., (S), VI, 1910, p. 60, pl. IV, fig. 8.

UNIO GERETI Preston.

"Shell ovate, somewhat tumid, covered with a dark brown, silky periostracum and sculptured with fine, rather closely set, concentric lines of growth; umbones slightly eroded, prominent; dorsal margin nearly straight; ventral margin scarcely rounded; anterior side angled above, obtusely rounded below; posterior side sloping obliquely, sharply rounded below; lateral teeth short anteriorly, elongately curved posteriorly; anterior cardinal tooth in right valve short, rather square, erect, jagged, incised on the outer side; median cardinal tooth very small; posterior cardinal rather small, projecting; anterior cardinal in left valve bluntly triangular, incised posteriorly; posterior cardinal bifurcate, thus presenting the appearance of a double tooth; anterior adductor scars ovate, well impressed; posterior adductor scars moderately impressed; interior of shell pale bluish-white, somewhat iridescent.

Length 36.5, lat. 61 mm." (Preston).

Type locality, Lake Tanganyika.

Unio gereti PRESTON, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 61, pl. IV, fig. 9.

UNIO SIHIRENSIS Preston.

"Shell ovate, moderately tumid, covered with a pale, reddish-brown, rather thin periostracum, which becomes thicker, foliaceous, and darker in color posteriorly, both valves sculptured with coarse, concentric growth-lines; umbones much eroded, very small; dorsal margin somewhat arched; ventral margin slightly rounded; anterior side rounded above, sloping below; posterior side bluntly rostrate; anterior lateral teeth very short; posterior laterals long and straight, slightly serrated; cardinal teeth curved, massive, jagged, especially in the left valve; anterior adductor scar deeply excavated, squarish; posterior adductor scar irregularly triangular, not deeply impressed; in-

terior of shell iridescent, pale pinkish, shading to bluish-white towards the ventral, anterior and posterior margins.

Long. 21; lat. 37 mm." (Preston).

Type locality, Shiré River, at a point from 3 to 4 kilometres to the south of Lake Nyassa.

Unio shirensis PRESTON, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 61, pl. IV, fig. 11.

UNIO SWINHOEI "Reeve" Sowerby.

"Shell broad, oblong, inflated, thin, bluish-white within, smooth without, obscurely blackish-olive, anterior side rather rounded, ventral margin inflated, posterior side wide, dorsal margin elevated, dorso-lateral margin rather straight, umbones depressed." (Sowerby).

Type locality, Formosa.

Unio swinhoei REEVE MS., SOWERBY, Conch. Icon., XVI, pl.

XLII, fig. 232, May, 1866.—H. ADAMS, P. Z. S., 1866, p. 319.

—PILSBRY, Pr. Ac. Nat. Sci. Phila., 1905, p. 750.

Margaron (Unio) swinhoei LEA, Syn., 1870, p. 45.

Cristaria swinhoei (part), SIMPSON, Syn., 1900, p. 586.

"This species was published independently by Sowerby and Henry Adams. The later author presented his paper to the Zoological Society at the meeting of May 22, 1866; and since a colored plate had to be prepared, it could not well have been published for some months later. The descriptions, so far as they go, agree. Sowerby's figure measures, length 65, alt. 40 mm.; and Adams gives the size as, length 60, alt. 39, diam. 22 mm. Sowerby gives the false locality "Camboja"—a region where Swinhoe never collected; but then the monograph of *Unio* in the *Iconica* is famous for false localities.

Mr. Simpson, in his *Synopsis of the Naiades*, 1900, p. 586, has quoted this species in the synonymy of "*Cristaria swinhoei* H. Ad.," which is a totally different species. It may belong to Simpson's genus *Lamellidens*." (Pilsbry).

UNIO PURPURIATUS Say.

"Transversely oval, slightly oblong, in some specimens with a little tendency towards ovate: dirty yellowish or fuscous, obscurely radiate with blackish-green; beaks in front of the

middle, hardly raised; posterior edge rounded or rather composed of two nearly rectilinear lines; anterior margin rounded; hinge margin regularly rounded; cavity of the hinge membranes (in front of the beaks) narrow, but very obvious; basal margin arquated, a little compressed in the middle, and sometimes almost contracted in that part; within purple, margin livid, posterior submargin iridescent; primary teeth nearly direct, rather thick, striated; lateral teeth hardly extending beyond the sinus of the hinge margin.

Var. a. Within white.

Var. b. Within dull yellowish.

Length 3.1, height 1.6, diam. over .9 inches." (Say, emended).

Type locality, a stream a few leagues from Vera Cruz, Mexico.

Unio purpuratus SAY, New Harm. Diss., 1831.—CONRAD, Pr. Ac. Nat. Sci. Phila., VI, 1853, p. 255.

? *Unio medellinus* FISCHER and CROSSE, Miss. Sci. Mex., Moll. II, 1894, p. 603.—VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 517.—SIMPSON, Syn., 1900, p. 592.

Unio (Lampsilis?) purpuratus FRIERSON, Naut., XXVI, 1912, p. 22, pl. III, figs. 4, 5.

"It resembles *U. purpureus*, nob., but differs in having the teeth more direct; in the lateral teeth being shorter, with respect to the sinus of the hinge margin; in having the greatest width at the middle of the posterior margin, etc. In the young and middle-aged specimens the radii are very distinct, but are obsolete in old specimens. The umbones are widely decorticated in age, but seldom are they so deeply eroded as to disclose the waxen-colored stratum. It may be considered as the Mexican analogue of the *purpureus*." (Say).

This species has never been satisfactorily identified. Say did not figure it and his types seem to have disappeared. Conrad was the first to identify it with the *medellinus* of Lea. In this he has been followed more or less dubiously by later writers and by myself in the Synopsis. Von Martens (l. c., p. 503), states that there are in the Berlin Museum two specimens from

the Dunker collection labeled "*Unio purpuriatas* Say, Mexico, Anthony," which agree very well with smaller, scarcely sinuated specimens of *Unio aztecorum*. He also expresses the opinion that "Say's description . . . basal margin a little compressed in the middle and sometimes almost contracted in that part," agrees better with *U. aztecorum* than with *U. medellinus*; but as the American conchologists refer Say's name to the latter, I dare not contradict them."

Mr. Frierson has recently (l. c.) identified with Say's species a series of specimens collected by Hinkley in the Valles River, near Mecos, Mexico and identified by Dr. Pilsbry as *Lampsilis strebeli* Lea.

In this connection I am permitted to quote from a note by Dr. Pilsbry:

"I considered the question of *U. purpuriatas* Say when working on Hinkley's species and then decided that the description fits *medellinus* better than anything else, though I agree with Simpson that the case is too uncertain to use Say's name. Of course, it is quite possible that some other species exists, which we do not know, but I have a specimen of *medellinus*, which is very close in measurements, and of the right color, etc. Hinkley's shells do not have the rays and none are deep purple. I consider them *strebeli*. *U. strebeli* is certainly distinct from *medellinus*."

It may be added that Fischer and Crosse consider *strebeli* a valid species, while von Martens refers it to *aztecorum* as a variety.

In view of this conflict of opinion, the only thing to do, in my opinion, is to still leave the form among the "*Species inquirenda*."

UNIO MWERUENSIS E. A. Smith.

"Shell small, inequilateral, rather thin, narrowly gaping at both ends; rounded in front; narrower and produced behind; epidermis brownish-olive, with a few, radiating, green lines on the posterior portion, smooth, but sculptured with growth

lines and towards the umbones more or less corrugated; umbones eroded, placed well in front; nacre white, iridescent; cardinal teeth rugose; laterals thin, elongate; anterior cicatrices not deep; posterior light, scarcely impressed.

Length 26, height 15, diam. 10.5 mm." (Smith).

Type locality, Lake Mweru, Central Africa.

Unio mweruensis E. A. SMITH, Pr. Mal. Soc. London, VIII, 1908, p. 13, text figures.

The following species are of Rafinesque, and I am utterly unable to make anything out of them:

Unio dilatata, elliptica, fasciata, fragilis, levigata, nervosa, viridis, zonata, all in Monograph, 1820; *Unio bicolor, calendis, castaneus, chloris, diaphanus, fontinalis, fulvus, lasmabrachys, montanus, pallens, platiolus, rivularis, rimosus, tenellus, venus*, all in Continuation of Monograph, 1831.

Other indeterminate *Unionidæ* of Rafinesque are: *Amblema antrosa, costata, gibbosa, olivaria, rubra, torulosa*; *Lasmonos fragilis*; *Obovaria obovalis, pachostea*; *Obliquaria triangularis, attenuata, atroviolacea, bullata, cliffordiana, cuprea, cyphia, ellipsaria, fasciolaris, flava, flexuosa, lateralis, lincolata, nodulata, obliquata, pusilla, quadrula, sintoxia, sinuata, subrotunda*, all in Monograph, 1820. *Bariosta diploderma, ponderosus, vitatis*; *Epilobasma biloba*; *Toxolasma cinerescens, cyclips, flexus*, in Continuation of Monograph, 1831.

The following are also indeterminate and spurious Unios: *Unio tahetianus* CATLOW and REEVE, Conch. Nom., 1845, p.

64. Is probably *U. taitianus* Lea.

Unio radula SAY, N. Harm. Diss., 1829, p. 323.

Unio plumbarius VILLA, Disp. Conch. Terr. Fluv., 1841, p. 62.

Unio pequotianus LINSLEY, Am. Jl. Sci., 1845, p. 277.

Unio iridescens CONRAD, Cov. of Monog., No. 11.

Unio angusta LAMARCK, An. sans Vert., VI, 1819, p. 80.

Unio conus SPENGLER, Skriv. Nat. Selsk., 1793, p. 60.

Unio delphinus SPENGLER, Skriv. Nat. Selsk., 1793, p. 63.

- Unio doumeti* LETOURNEUX and BOURGUIGNAT, Prod. Mal. Tunis, p. 163.
- Unio distortus* BEAN, Ann. and Mag., 1836, p. 376, fig. 53.
- Unio uber* CONRAD, Am. Jl. Conch., II, p. 279.
- Mya obovata* SOLANDER, Portland Cat., p. 100.
- Unio specialis* KOBELT, Icon., new ed., XIX, 1912, p. 8, pl. DXV, fig. 2694.
- Unio hyperamblius* KOBELT, Icon., new ed., XIX, 1912, p. 14, pl. DXIX, fig. 2701.
- Unio diarbekerianus* KOBELT, Icon., new ed., XIX, 1912, p. 15, pl. DXIX, fig. 2702.
- Unio calliopsis* KOBELT, Icon., new ed., XIX, 1912, p. 15, pl. DXIX, fig. 2703.
- Unio deschampsi* KOBELT, Icon., new ed., XIX, 1912, p. 28, pl. DXXIV, fig. 2721.
- Unio raymondopsis* KOBELT, Icon., new ed., XIX, 1912, p. 30, pl. DXXV, fig. 2724.
- Unio kurweikensis* KOBALT, Icon., new ed., XIX, 1912, p. 31, pl. DXXV, fig. 2725.
- Unio ancyrensis* KOBELT, Icon., new ed., XIX, 1912, p. 32, pl. DXXVI, fig. 2727.
- Unio ancyrensis* var. *louisici* KOBELT, Icon., new ed., XIX, 1912, p. 32, pl. DXXVI, fig. 2726.
- Unio bitlisensis* KOBELT, Icon., new ed., XIX, 1912, p. 35, pl. DXXVIII, fig. 2731.
- Unio raymondi* LOCARD, Moll. Lacs Tiberiade, p. 208.—KOBELT, Icon., new ed., XIX, 1912, p. 40, pl. DXXXI, fig. 2738.

Genus PLEUROBEMA (Rafinesque, 1820) Agassiz.

Pleurobema RAFINESQUE, Ann. Gen. Sci. Phys., Brux, 1820, p. 313.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 261.

Shell solid, triangular to rhomboid, usually with a prominent umbonal region; beaks at or near the anterior end of the shell, incurved and pointed forward over a small but well-developed

lunule: beak sculpture coarse, consisting of a few irregular, often broken ridges, which curve upward posteriorly; posterior ridge present, but low and rounded; epidermis showing the rest periods plainly, tawny to olive, often ornamented with rays, which show a tendency to break into square spots; hinge rather strong, the plate generally narrow; pseudocardinals triangular, ragged; laterals reaching nearly or quite to the pseudocardinals, double in both valves, in the right valve the inner being smaller; muscle scars deep, the posterior rounded; cavity of the beaks shallow; nacre silvery; male and female shells essentially alike.

Animal having the inner gills much the larger, rounded below, free from the abdominal sac for a part or all of their length; marsupium occupying the entire outer gills, the ovisacs in some cases seeming to be arranged in pairs; animal generally yellowish to salmon-red, sometimes more or less brown or blackish.

Type, *Unio clava* Lamarck.

The species which I have placed under the generic name *Pleurobema* seem to stand between *Quadrula* and *Unio*. The heavy inflated forms of the *clava*, *showalterii* and *trosceliana* groups approach *Quadrula* in some cases so closely that it is difficult to separate them from it. But all have shallow beak cavities, while those of *Quadrula* are almost invariably deep, and I have no doubt that all carry the young in the outer gills alone, instead of in all four as the *Quadrulas* do. On the other hand many species of the *argentea* group and a few in the *clava* and other groups approach *Unio* so closely that I have been at a loss to know where to place them. Most of the shells of the genus, though not all, have a tawny-colored epidermis often marked with broken, bright green rays that is different from the species of either *Unio* or *Quadrula* and nearly all of them are confined to the Ohio, Tennessee and Alabama River systems. Two or three forms whose relations are a little doubtful belong in the Atlantic drainage.

KEY TO SPECIES OF PLEUROBEMA.

Shell with a subvertical median row of nodules.

Epidermis smooth, shining. *asopus.*

Epidermis cloth-like or silky, dull. *compertum, cicatricosum.*

Shell not nodulous.

Epidermis dark greenish-brown or blackish.

Shell more or less rhomboid.

Somewhat elongated, blackish. *brimleyi.*

Short, brownish. *striatulum, modicellum, gibberum.*

Generally ovate,

Rather thin, not inflated. *patsaligense, simulans.*

Rather solid, subinflated. *bulbosum, ravenelianum,*
hagleri, harperi, reclusum, nux, brumbyanum,
perovatium, pinkstoni.

Elliptical, solid, much inflated.

Subsolid, black. *strodeanum.*

Solid, brown. *rubellum, avellana, furvum.*

Subtriangular.

Inflated, solid. *curtum, showalterii.*

Somewhat compressed, nacre purplish. *lenticulare.*

Nacre white. *argenteum, fassinans.*

Epidermis yellowish, tawny or light brown.

Rayless or feebly rayed.

Beaks terminal or subterminal. *decisum,*
chattanoogaense.

Beaks not terminal.

Oval or elliptical. *hanleyanum, interventum, flav-*
idulum, swordianum, litum, georgianum,
murrayanum.

Rhomboid.

Short. *instructum, meredithii, breve, striatum.*

Longer. *argenteum, conasaugæense, pyriforme,*
amabile, estabrookianum.

Triangular. *altum, instructum, troschelianum,*
stabile, cor, verum, hartmanianum, crudum.

Generally rayed.

Rays broken.

Compressed.

planus, favosum.

Inflated.

ornatum, acuens, cuneolus, appressum, clinchense, lesleyi.

Rays entire, or nearly so.

Compressed.

bigbyanum, pudicum, oviforme.

Subinflated to inflated.

validum, barnesianum.

Group of *Pleurobema clava*.

Shell solid, triangular; beaks high, generally anterior; beak sculpture consisting of three or four broken, coarse, irregular ridges; epidermis yellowish or tawny, marked with broken green rays, which show a tendency to form square spots; pseudocardinals often somewhat lengthened and more or less parallel with the laterals.

Animal having the inner gills the larger except at the extreme posterior end, free nearly or quite their whole length from the abdominal sac; marsupium occupying the entire outer gills; branchial opening rather large, with small papillæ; anal opening with minute papillæ or crenulations. Animal dirty whitish to salmon.

PLEUROBEMA CLAVA (Lamarck).

Shell decidedly triangular, more or less inflated, solid; beaks excessively high, full, placed almost at or even in front of the anterior end, turned forward over a decided lunule that extends under and behind them, their sculpture consisting of a few strong, irregular, often broken, ridges that turn up behind; anterior end generally truncate, often with a slope downward and backward; sometimes the truncation is square, at other times this end is evenly rounded and projects a little in front of the beaks; base line nearly straight or somewhat curved; dorsal line curved, the curve being sharper at or a little behind the middle and meeting the base line at a point on or a very little above the base; posterior ridge rather low, but well defined, narrowly rounded, curved up in the middle.

running close to the dorsal line; near the anterior end there is a wide, radial inflation extending from the beaks and fading out below and the greatest diameter of the shell is at this inflation; growth lines rude and uneven; epidermis yellowish-green, greenish-yellow, tawny, or brownish, usually more or less decorated with bright green rays; the rays often coalesce and are broken until they appear as square blotches, sometimes they are narrow and broken, smooth and shining to rough and dull; pseudocardinals variable; there are generally two in the left valve, the posterior stronger, often united above, solid, rough, radial or the upper running nearly parallel with the dorsal line; right valve with a strong pseudocardinal, there is often one above it and another in front of it; laterals two in the left valve and a double one in the right, heavy and granular; beak cavities shallow; muscle scars small, deep; nacre silvery white, thicker in front.

Length 80, height 50, diam. 35 mm.

Length 87, height 47, diam. 37 mm.

Length 58, height 39, diam. 33 mm.

Ohio, Cumberland, and Tennessee River systems, Maumee Basin, Western New York, Ottawa, Canada (Call). Reported from Iowa City, Iowa; St. Peter's River, Minnesota, and from Nebraska.

Type locality, Lake Erie.

Unio clava LAMARCK, An. sans Vert., VI, 1819, p. 74.—CONRAD, Monog., I, 1835, p. 5, pl. III, fig. 1.—KUSTER, Conch. Cab. Unio, 1852, p. 39, pl. VII, fig. 2.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXIX, fig. 354.

Pleurobema clava AGASSIZ, Arch. für Naturg., I, 1852, p. 49.—SIMPSON, Syn., 1900, p. 745.—ORTMANN, Ann. Car. Mus. VIII, 1912, p. 264, figs. 9-9a.

Unio clavus REEVE, Conch. Syst., I, 1841, p. 117, pl. LXXXVIII, fig. 3.—HANLEY, Biv. Shells, 1843, p. 187, pl. XX, fig. 52.—

CALL, Tr. Acad. Sci. St. Louis, VII, 1895, No. 1, p. 9, pl. I. *Margarita (Unio) clavus* LEA, Syn., 1836, p. 22; 1838, p. 18. *Margaron (Unio) clavus* LEA, Syn., 1852, p. 26; 1870, p. 40.

? *Unio patulus* LEA, Tr. Am. Phil. Soc., III, 1829, p. 44. pl. XII, fig. 20; Obs., I, 1834, p. 55, pl. XII, fig. 20.—CONRAD, Monog., X, 1838, p. 92, pl. I, fig. 2.—HANLEY, Biv. shells, 1843, p. 187, pl. XXII, fig. 27.—CHENU, Ill. Conch., 1858, pl. XVI, figs. 6, 6a, 6b.—KUSTER, Conch. Cab. Unio, 1861, p. 259, pl. LXXXVII, fig. 5.

Margarita (Unio) patulus LEA, Syn., 1836, p. 22; 1838, p. 18.

Margaron (Unio) patulus LEA, Syn., 1852, p. 26; 1870, p. 40.

Unio cuneatus SAY, Am. Conch., VI, 1834.

One of the most striking of North American Uniones. The species is excessively variable in form and it is remarkable that these variations have not oftener received specific names at the hands of students. In some cases the very high beaks project considerably ahead of any other part of the shell, the anterior end below them being cut away with a strong, straight, oblique truncation. At other times the beaks do not reach quite to the anterior end, this end may be rounded or squarely truncated; the truncation even slopes backward at the top in some cases. Specimens so shaped approach the form I have taken for *Unio maculatus* of Conrad. There is a hitch of some kind about Lea's *Unio patulus*, which I cannot untangle. Dr. Lea states that it came from T. G. Lea, from Ohio and he figures a shell that is shaped almost exactly like that of his *U. lesleyi*, which is from Kentucky and Tennessee. I have never seen such a shell from Ohio and I am inclined to think that the figure was made from a rather brightly rayed *lesleyi*. All Lea's specimens marked *patulus* are quite different from the figure and are evidently *clava*.

PLEUROBEMA MACULATUM (Conrad).

Shell subtriangular, compressed to subinflated, rather solid; beaks prominent and inflated, their sculpture apparently a few, not very strong, irregular ridges; lunule small; anterior end nearly evenly rounded, projecting a little in front of the beaks; base line nearly straight; posterior and post-dorsal outline subtruncated, slightly curved, raised almost into a low angle near the hinder end of the ligament; posterior ridge well developed, subangular above, narrowly rounded below, ending behind near

the base in a blunt point; surface nearly smooth in young shells but having irregular, concentric growth in the old ones; epidermis tawny-greenish to tawny-brown, beautifully marked with narrow and wide interrupted dark green rays, scarcely shining; left valve with two moderate sized, somewhat stumpy pseudocardinals and two curved laterals; right valve with two pseudocardinals, the upper small and a double lateral; beak cavities impressed; muscle scars very small and very deep; nacre silvery white, brilliant, iridescent behind.

Length 65, height 50, diam. 30 mm.

Elk, Flint and Duck rivers, Tennessee.

Type locality, Elk and Flint rivers, Ala.

Unio maculatus CONRAD, New F. W. Shells, 1834, p. 30, pl. IV, fig. 4.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 17, pl. III, fig. 7.—KUSTER, Conch. Cab. Unio, 1861, p. 216, pl. LXXII, fig. 2.

Margarita (Unio) maculatus LEA, Syn., 1836, p. 34; 1838, p. 23.

Margaron (Unio) maculatus LEA, Syn., 1852, p. 24; 1870, p. 38.

Pleurobema maculata SIMPSON, Syn., 1900, p. 747.

I cannot be positive as to what Conrad's species is as his figure is rather poor. I have specimens before me from Duck River, Tennessee, collected by Jas. H. Ferriss, that agree well in form with Conrad's figure and description, but are a little brighter and more distinctly painted with green than his figure shows. Although specimens of *clava* somewhat approach this in form and painting I consider the two perfectly distinct. This shell is shorter, and the pseudocardinals are different, being short and radial and not in any case parallel with the dorsal line.

Dr. Lea is inclined to believe (Syn., 1870, p. 38), that Conrad's *Unio maculatus* is the same as his own *ravenelianus*, and if this were the case Lea's name should have precedence. From an examination of specimens in the Philadelphia Academy of Natural Sciences and Conrad's figure and description, I am forced to differ from Dr. Lea, as I consider the species close to Lamarck's *clava*.

PLEUROBEMA HOLSTONENSE (Lea).

Shell of moderate size, subtriangular, inflated, decidedly inequilateral, solid; beaks very high and full, sometimes in old shells extending a very little in advance of the rest of the anterior end; anterior end either truncate or rounded; base line somewhat rounded; dorsal and posterior outline curved, almost angular just at the hinder part of the ligament; lunule small but well developed; posterior ridge of moderate elevation, narrowly rounded, ending behind in a blunt, rounded point near the base of the shell; surface with irregular growth lines; epidermis yellowish, greenish-yellow or tawny, marked with wide and narrow, interrupted rays; pseudocardinals rather small, stumpy, subradial and rough, two in the left valve and usually three in the right, the front and hinder one of the right valve vestigial; laterals two in the left valve and a double one in the right; beak cavities impressed; muscle scars small, deep; nacre whitish.

Length 50, height 38, diam. 28 mm.

Length 52, height 37, diam. 29 mm.

Length 50, height 35, diam. 25 mm.

Tennessee River system.

Type locality, Tuscumbia, Ala.

Unio holstonensis LEA, Pr. Am. Phil. Soc., I, 1840, p. 288; Tr. Am. Phil. Soc., VIII, 1842, p. 212, pl. xv, fig. 27; Obs., III, 1842, p. 50, pl. xv, fig. 27.—CHENU, Ill. Conch., 1858, pl. xxxii, figs. 1, 1a, 1b.—KUSTER, Conch. Cab. Unio, 1862, p. 287, pl. xcvi, fig. 4.

Margaron (Unio) holstonensis LEA, Syn., 1852, p. 25; 1870, p. 38.

Pleurobema holstonensis SIMPSON, Syn., 1900, p. 746.

Unio mundus LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 83; Jl. Ac. N. Sci. Phila., VI, 1866, p. 40, pl. xiv, fig. 38; Obs., XI, 1867, p. 44, pl. xiv, fig. 38.—REEVE, Conch. Icon., XVI, 1864, pl. xvi, fig. 72.

Margaron (Unio) mundus LEA, Syn., 1870, p. 40.

Unio larwi LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 189; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 8, pl. II, fig. 4; Obs., XIII, 1874, p. 12, pl. II, fig. 4.

Unio pattinoides LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 193; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 16, pl. IV, fig. 12; Obs., XIII, 1874, p. 20, pl. IV, fig. 12.

Unio bellulus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 161; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 50, pl. XVII, fig. 48; Obs., XIII, 1874, p. 54, pl. XVII, fig. 48.

I have united under one name a number of nominal species which, though they have some slight differences, do not seem to me to be worthy of specific or even varietal rank. In general this form is smaller than that, which I believe to be *maculatum*, it is more inflated and its base line is more rounded. It is not so much lengthened as *clava* nor are its beaks placed so far forward as a rule. The type of *Unio holstonensis* is quite a young, brightly rayed shell and very different from several larger, rough, rayless specimens that Dr. Lea has placed with it under that name, which I think, are his *Unio pilaris*. The group typified by *Unio clava* is one of the most puzzling in North America and I confess that in some cases I have not been able to satisfactorily untangle its intricacies.

PLEUROBEMA BOURNIANUM (Lea).

Shell triangular, short, subinflated or inflated, solid; beaks very high, rather sharp, full, turned forward over a lunule, placed nearest to the anterior end, their sculpture a few broken ridges; anterior end somewhat obliquely truncated, posterior outline curved from the beaks to the base; base line curved in front, nearly straight behind; posterior ridge low, narrowly rounded, placed almost at the posterior outline, ending below in a point at the base of the shell; in front of the middle of the shell there is a wide, high, radial swelling and here the diameter is much the greatest; between this and the posterior ridge there is a wide radial depression; surface with irregular growth lines; epidermis greenish-yellow or pale tawny, with conspicuous, narrow and wide, interrupted green rays, sub-

shining; pseudocardinals low, irregular, rough, two in the left valve and three in the right; laterals curved, left valve with two, right valve with a double one; beak cavities shallow, muscle scars small, deep; nacre white.

Length 30, height 32, diam. 19 mm.

Length 38, height 40, diam. 26 mm.

Type locality, Scioto River, near Chillicothe, Ohio.

Unio bournianus LEA, Pr. Am. Phil. Sci., I, 1840, p. 288; Tr. Am. Phil. Soc., VIII, 1842, p. 213, pl. xv, fig. 28; Obs., III, p. 51, pl. xv, fig. 28.—CHENU, Ill. Conch., 1858, pl. XXVIII, figs. 2, 2a, 2b.

Margaron (Unio) bournianus LEA, Syn., 1852, p. 25; 1870, p. 39.

Pleurobema bournianus SIMPSON, Syn., 1900, p. 747.

Lea has three shells, to which he gives this name. The larger one is considerably deformed, and the medium one, the type, is probably not exactly normal. I am doubtful whether the third, a young shell, is the same as the others. The species is close to *edgarianum* and may possibly be merely a slight malformation of that. It is higher than long and the beaks are more pointed than they are in that species.

PLEUROBEMA EDGARIANUM (Lea).

Shell subtriangular, subinflated to inflated, solid, inequilateral; beaks full and high, turned forward a little over a lunule; their sculpture a few strong, broken, subnodulous ridges; anterior end obliquely truncated above, rounded below; posterior end curved from the beaks to the base, often subangular just behind the ligament; base line nearly straight behind, curved up in front; posterior ridge well developed, curved so that it runs nearly parallel with the posterior outline, but placed some distance in front of it, narrowly rounded or angular, sometimes slightly double below, ending in a point or biangulation at the base line; in front of the middle there is a wide radial swelling and here the diameter of the shell is greatest; surface with uneven growth lines; epidermis greenish-yellow, yellow-green or brownish, in young shells generally having wide and

narrow broken rays, and shining, often dull and feebly rayed in old shells; pseudocardinals irregular, rough, two in the left valve and three in the right, the anterior and posterior teeth in the right feeble; two laterals in the left valve and a somewhat double one in the right; beak cavities compressed, deep for a *Pleurobema*; nacre white; muscle scars deep, small.

Length 45, height 45, diam. 35 mm.

Length 53, height 48, diam. 31 mm.

Length 45, height 40, diam. 31 mm.

Tennessee River system.

Type locality, Holston River, Tenn., and Tennessee River, Florence, Ala.

Unio edgarianus LEA, Pr. Am. Phil. Soc., I, 1840, p. 288; Tr. Am. Phil. Soc., VIII, 1842, p. 214, pl. xv, fig. 30; Obs., III, 1842, p. 52, pl. xv, fig. 30.—CHENU, Ill. Conch., 1858, pl. xxix, figs. 5, 5a, 5b.—KUSTER, Conch. Cab., 1861, p. 213, pl. lxx, fig. 5.—MUSGRAVE, Phot. Conch., 1863, pl. II, fig. 6.—REEVE, Conch. Icon., XVI, 1864, pl. xv, fig. 65.

Margarona (Unio) edgarianus LEA, Syn., 1852, p. 25; 1870, p. 39.

Pleurobema edgarianus SIMPSON, Syn., 1900, p. 747.

Unio obuncus LEA, Pr. Ac. N. Sci., Phila., I, 1871, p. 192; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 9, pl. II, fig. 5; Obs., XIII, 1874, p. 13, pl. II, fig. 5.

Unio andersonensis LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 155; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 36, pl. XII, fig. 33; Obs., XIII, 1874, p. 40, pl. XII, fig. 33.

The specimens placed by Dr. Lea under *Unio edgarianus* show a wide degree of variation in form and color. I have placed in the synonymy his *Unio obuncus* and *andersonensis*, which differ less from *edgarianus* than specimens of that species do among themselves. The young shells are mostly bright and rayed, they usually become dull and feebly rayed when old and at this stage they may be brown or tawny colored. The beaks are fuller and less sharply elevated than in *bournianum*, the beak cavities are deeper, in fact they are unusually deep for a *Pleurobema*; the posterior ridge is not so low nor is it placed so near the posterior line as it is in *bournianum*.

PLEUROBEMA CUNEOLUS (Lea).

Shell subtriangular or subrhomboid, convex to subinflated, inequilateral, solid; beaks high, moderately full; anterior end usually obliquely truncated above, rounded below, sometimes rounded throughout; basal line nearly straight; post-dorsal line curved, rising in the middle almost or quite to an angle; posterior ridge subangular, ending below in a point at the base, not so high as the radial swelling in front of it; epidermis greenish-yellow or yellow-green, with wide or narrow, broken rays, rather dull; pseudocardinals rough and uneven, double in each valve, laterals curved, that of the right valve partly double; muscle scars small, impressed; nacre white.

Length 50, height 38, diam. 23 mm.

Length 45, height 36, diam. 19 mm.

Tennessee River system.

Type locality, Holston River, Tenn.

Unio cuneolus LEA, Pr. Am. Phil. Soc., I, 1840, p. 286; Tr. Am. Phil. Soc., VIII, 1842, p. 193, pl. VII, fig. 3; Obs., III, 1842, p. 31, pl. VII, fig. 3.—CHENU, Ill. Conch., 1858, pl. XXX, figs. 2, 2a, 2b.—KUSTER, Conch. Cab. Unio, 1861, p. 182, pl. LXVII, fig. 4.—REEVE, Conch. Icon., XVI, 1865, pl. XXXI, fig. 107.

Margaron (Unio) cuneolus LEA, Syn., 1852, p. 24; 1870, p. 38.

Pleurobema cuneolus SIMPSON, Syn., 1900, p. 748.

A rather compressed species when compared with those that precede it. The post-dorsal line is quite high behind the ligament, so that the shell becomes in some cases subrhomboid. The beak cavities are not so deep as those of *edgarianum*, the muscle scars are comparatively shallow. I cannot separate Lea's *Unio cuneolus* and *clinchensis* by any characters of value.

PLEUROBEMA CLINCENSE (Lea).

Shell subtriangular, inequilateral, scarcely inflated, solid; beaks high but not very full; anterior end rounded; base nearly straight; post-dorsal line curved, elevated into a low angle medially; posterior ridge rounded, ending near the posterior

base of the shell; surface with irregular growth lines, greenish-yellow with two or more broken, narrow or wide rays; pseudocardinals solid, radial, two in the left valve and three in the right; left valve with two laterals, that of the right partly double; muscle scars small, impressed; beak cavities shallow; nacre whitish or straw-color, thinner and iridescent behind.

Length 45, height 36, diam. 20 mm.

Clinch River, Tennessee.

Type locality, Clinch, French Broad and Holston Rivers, Tenn.

Unio clinchensis LEA, Pr. Ac. N. Sci. Phila., XI, 1867, p. 81;

Jl. Ac. N. Sci. Phila., VI, 1868, p. 278, pl. XXXVII, fig. 91;

Obs., XII, 1869, p. 38, pl. XXXVII, fig. 91.

Margaron (Unio) clinchensis LEA, Syn., 1870, p. 38.

Pleurobema cuneolus (part), SIMPSON, Syn., 1900, p. 748.

In the Synopsis I placed this species in the synonymy of *Unio cuneolus* Lea. Lea's figured type of the latter is a young shell and is more rhomboid and is straighter on the base than is the type of his *clinchensis*. In his collection there is a large shell from the Clinch River, which he has labeled *Unio cuneolus*, which approaches his *clinchensis* so closely that I am not sure which species it should be referred to. In general *cuneolus* is a little more rhomboid than *clinchensis* and has a straighter base line, it being sometimes slightly incurved, while that of *clinchensis* is very faintly curved.

PLEUROBEMA LESLEYI (Lea).

Shell somewhat drawn out, subtriangular, subrhomboid or nearly evenly ovate, inequilateral, subsolid to moderately solid, subcompressed to scarcely subinflated; anterior end rounded or very slightly subtruncate above; base line lightly curved to straight; post-dorsal line curved, often elevated nearly to an angle in the middle; beaks only moderately high, not very full; surface with rather rude growth lines; epidermis dull greenish, tawny or yellowish, with a few broken, green rays, not shining; pseudocardinals two in the left valve and one in the right, with occasionally vestigial teeth in the right valve; lat-

erals two in the left valve and a somewhat double one in the right; beak cavities not deep; muscle scars well impressed; nacre white, thicker in front.

Length 61, height 40, diam. 24 mm.

Length 58, height 35, diam. 18 mm.

Type locality, Kentucky; Tennessee.

Unio lesleyi LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 306; Jl.

Ac. N. Sci. Phila., IV, 1860, p. 352, pl. LVIII, fig. 177; Obs.,

VIII, 1860, p. 34, pl. LVIII, fig. 177.

Margaron (Unio) lesleyi LEA, Syn., 1870, p. 40.

Pleurobema lesleyi SIMPSON, Syn., 1900, p. 748.

Approaches *cuneolus*, but is more elongated, rather more nearly elliptical and has perhaps more regular pseudocardinals. I have heretofore remarked that the figure of *Unio patulus* seems nearer to this than anything else.

PLEUROBEMA OVIFORME (Conrad).

Shell irregularly ovate or subrhomboid, scarcely subinflated, rather solid; beaks high, not very full, turned forward over a well-developed lunule, their sculpture a number of broken, sub-nodulous ridges: posterior ridge moderate, narrowly rounded, ending just below the median line in a point; outline of the dorsal slope curved, much elevated and subangular near the middle; base line rounded; anterior end rounded; epidermis with fine, concentric folds, nearly smooth on the earlier growth, tawny, greenish-yellow or yellow-green, with narrow and broad broken rays; pseudocardinals uneven, two in the left valve, one with vestiges of two others in the right; laterals two in the left valve, a double one in the right; beak cavities rather shallow; muscle scars deep, small; nacre silvery-white.

Length 46, height 33, diam. 20 mm.

Type locality, Tennessee.

Unio oviformis CONRAD, New F. W. Shells, 1834, p. 46, pl. III,

fig. 6.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 22, pl.

II, fig. 7.

Margaron (Unio) oviformis LEA, Syn., 1852, p. 26; 1870, p. 40

Pleurobema oviformis SIMPSON, Syn., 1900, p. 748.

A beautiful species, which is more brightly painted than *cuneolus*, and is more compressed behind laterally than that shell. It is brighter and less elongated than *P. lesleyi*.

PLEUROBEMA ACUENS (Lea).

Shell irregularly ovate or subrhomboid, subinflated, solid, inequilateral; beaks high and full, with a lunule in front of them; anterior end rounded or very slightly subtruncate above; base line evenly curved; outline of dorsal slope curved, high and almost angled behind the ligament; posterior ridge rounded, ending behind above the base of the shell in a rounded point; surface with uneven growth lines; epidermis pale tawny, with a few broken, green rays, scarcely shining; pseudocardinals small, triangular, two in the left valve and one in the right; two laterals in the left valve and a double one in the right; beak cavities shallow; muscle scars small, deep; nacre beautiful silvery, richly iridescent and thinner behind.

Length 33, height 25, diam. 16 mm.

Tennessee River system.

Type locality, Holston River, Concord, Tenn.

Unio acuens LEA, Pr. Ac. Nat. Sci. Phila., I, 1871, p. 190; JI.

Ac. Nat. Sci. Phila., VIII, 1874, p. 27, pl. VIII, fig. 24; Obs.,

XIII, 1874, p. 31, pl. VIII, fig. 24.

Pleurobema acuens SIMPSON, Syn., 1900, p. 479.

Apparently this is a rare shell and all the specimens I have seen are small, though they have the appearance of being adult. It is a neat species, the posterior ridge being widely rounded, the greatest degree of inflation being above it. The nacre is beautifully soft and rich, and it has the faintest hint of red. The hinder part is richly iridescent and almost coppery and it is much thinner than the rest of it.

PLEUROBEMA ORNATUM (Lea).

Shell subrhomboid, subcompressed, solid, inequilateral; beaks high, only moderately full, their sculpture apparently a few coarse ridges; lunule small; posterior ridge rounded, ending behind in a rounded point near the base of the shell; base

line slightly curved; anterior end rounded; outline of the dorsal slope curved, raised almost to an angle in the middle; surface nearly smooth; epidermis greenish-tawny with a few conspicuous, widely interrupted rays, the whole rather bright; left valve with two ragged pseudocardinals, the anterior small, and two nearly straight laterals; right valve with three pseudocardinals, the median one large, the others small, and a slightly double lateral; muscle scars small, impressed; beak cavities shallow, compressed; nacre silvery, thick in front, thin, copery, iridescent and almost transparent behind.

Length 27, height 22, diam. 12 mm.

Type locality, Alabama.

Unio ornatus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 4; Jl. Ac. N. Sci. Phila., V, 1862, p. 85, pl. XI, fig. 234; Obs., VIII, 1862, p. 89, pl. XI, fig. 234.

Margaron (Unio) ornatus LEA, Syn., 1870, p. 57.

Pleurobema ornata SIMPSON, Syn., 1900, p. 749.

I have no doubt that the only specimen I have seen of this, the type, is a young shell, though Dr. Lea believed it to be nearly adult. It is one of those puzzling forms, which have no very decided characters, yet do not seem to belong to any other species. It is more rhomboid than *oviforme*, not so much drawn out behind to a point. It is much less inflated than *tesserula*, is smaller and less triangular than *bigbyense*, to which Dr. Lea compares it.

PLEUROBEMA APPRESSUM (Lea).

Shell subrhomboid, very inequilateral, the beaks being placed almost at the extreme anterior end, solid, subcompressed or scarcely inflated, with a well-developed, rounded, curved posterior ridge. In front of this ridge the shell is somewhat flattened, the compressed area extending to a sort of rounded, radiating, wide ridge near the anterior end; beaks high, full, turned forward over a well-developed lunule, their sculpture not observed; surface with irregular growth lines; epidermis somewhat wrinkled, greenish-yellow in the young state, dark tawny-brown in the adult shell, with faint indications of broken

rays; left valve with two strong pseudocardinals, which are slightly roughened, the posterior slightly divided, with two curved laterals, the lower the stronger; right valve with one strong pseudocardinal, with a vestigial one in front of it and sometimes one or more imperfect denticles behind it and one lateral; hinge plate wide and flat; cavity of the beaks not deep, but compressed; muscle scars small, impressed; pallial line crossed by short radiating ridges; nacre dirty or lurid white, blotched in the type.

Length 60, height 47, diam. (near anterior end) 28, near posterior end 24 mm.

Clinch and Holston rivers.

Type locality, Tuscumbia, Ala.; Tennessee River and Holston River, Tenn.

Unio appressus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 189; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 12, pl. III, fig. 8; Obs., XIII, 1874, pl. III, fig. 8.

Pleurobema appressa SIMPSON, Syn., 1900, p. 749.

Unio argenteus SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVII, fig. 204.

This species is dangerously near two or three others. The fact is an almost unbroken chain seems to exist connecting this with *Unio tuscumbiensis*, *flavidus*, *tumescens*, *radiosus*, *dollabelloides*, *thorntonii*, *mooresianus*, *recurvatus*, *circumactus* and some other forms. Most specimens of *appressum* are a little more compressed than most of these and are tawny-brown and rayless, though the type is rayed and more inflated than the average. I confess that with the types of all these so-called species and an abundance of other material, I am unable to make any arrangement that is satisfactory.

PLEUROBEMA TUSCUMBIENSE (Lea).

Shell subtriangular or subrhomboid, subinflated to inflated, solid, inequilateral; beaks high, full, long, their sculpture apparently a few broken, nodulous ridges; lunule well developed; anterior end somewhat obliquely truncate above, rounded below; base line curved or straight; outline of the dorsal slope curved, elevated almost to an angle behind the ligament; pos-

terior ridge well defined, narrowly rounded, curved, it is not so high as the wide radial swelling near the anterior end; between the two the surface is flattened; surface with irregular growth lines; epidermis greenish-yellow to tawny, usually marked with narrow and wide, broken, green rays; pseudo-cardinals irregular, ragged, left valve with two, right valve with three, the lateral ones small; laterals two in the left valve and a double one in the right; beak cavities shallow, compressed; muscle scars deep, small; nacre bluish to yellowish-white.

Length 38, height 34, diam. 22 mm.

Length 43, height 37, diam. 24 mm.

Tennessee River system.

Type locality, Tuscumbia, Ala.; Holston River, Tenn.

Unio tuscumbiensis LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 191; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 11, pl. III, fig. 7; Obs., XIII, 1874, p. 15, pl. III, fig. 7.

Unio flavidus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 156; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 28, pl. IX, fig. 25; Obs., XIII, 1874, p. 32, pl. IX, fig. 25.

Pleurobema appressa (part), SIMPSON, Syn., 1900, p. 749.

Although there are specimens, which may be about as easily referred to *P. appressum* as to this, it may be best to separate the two. Generally this form seems to be smaller than *appressum*, a little more inequilateral, and a little more inflated. Lea's *Unio flavidus* seems to me to be absolutely identical with his *tuscumbiensis*.

PLEUROBEMA TESSERULÆ (Lea).

Shell small, much inflated, subrhomboid, solid, inequilateral; beaks high, full, but not much elongated, their sculpture apparently a few coarse ridges, which curve up behind; lunule small; anterior end narrowly rounded and gaping; base line nearly straight; dorsal line behind the beaks straight, meeting the oblique truncation of the dorsal slope at an angle; posterior ridge full, narrowly rounded, ending behind in a rounded point at the base of the shell; surface finely but unevenly, concentrically striate; epidermis yellowish-green, marked with a few

green rays that break up into squarish blotches, scarcely shining; pseudocardinals small, stumpy, two in the left valve, three in the right; laterals two in the left valve and a somewhat double one in the right; beak cavities shallow; muscle scars small, deep; nacre bluish-white, thin and iridescent behind.

Length 28, height 21, diam. 18 mm.

Type locality, Nolachucky River, Tennessee.

Unio tesserula LEA, Pr. Ac. N. Sci. Phila., VI, 1861, p. 392; Jl. Ac. N. Sci. Phila., VI, 1866, p. 40, pl. xv, fig. 39; Obs., XI, 1867, p. 44, pl. xv, fig. 39.

Margaron (Unio) tesserula LEA, Syn., 1870, p. 36.

Pleurobema tesserula SIMPSON, Syn., 1900, p. 749.

A well-characterized little species, which seems to be quite rare, as I have only seen two or three authentic specimens. It is much inflated, is decidedly rhomboid; it gapes rather widely at the anterior base and the hinder part of the nacre is thin, and iridescent, almost translucent and has a purplish tint. It seems to be a healthy, normal species.

PLEUROBEMA VALIDUM (Lea).

Shell subtriangular, scarcely inflated, solid, inequilateral; beaks high, rather full; lunule narrow; anterior end very slightly, obliquely truncated above, widely rounded below; base line curved; outline of the dorsal slope curved, raised almost to an angle at the hinder part of the ligament; posterior ridge narrowly rounded, straight, ending below in a blunt point near the base of the shell; surface with uneven, concentric sculpture; epidermis tawny-greenish, with numerous, rather faint, scarcely broken rays; pseudocardinals rough, radial, two in the left valve and three in the right, the middle one in the right valve strong; left valve with two laterals; right valve with a somewhat double one; beak cavities shallow; muscle scars small, deep; nacre silvery, slightly iridescent behind, thicker in front.

Length 55, height 45, diam. 26 mm.

Tennessee.

Type locality, Duck River, Tenn.

Unio validus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 189; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 6, pl. 1, fig. 2; Obs., XIII, 1874, p. 10, pl. 1, fig. 2.

Pleurobema valida SIMPSON, Syn., 1900, p. 749.

This shell is more distinctly triangular than its allies; the rays are rather narrow on the only examples I have seen, and are scarcely broken.

PLEUROBEMA TUMESCENS (Lea).

Shell nearly triangular, inflated, solid, inequilateral; beaks long, very high and full; lunule large; anterior end decidedly, obliquely truncated above, rounded below; base line nearly straight; outline of the dorsal slope slightly curved; posterior ridge well developed, rounded, the shell being only a little fuller in front of it; surface with uneven growth lines; epidermis greenish-yellow to tawny, faintly rayed; pseudocardinals irregular, two in the left valve and three in the right; laterals curved, two in the left valve and a double in the right; beak cavities shallow; muscle scars small, moderately deep; nacre white or yellowish.

Length 43, height 40, diam. 27 mm.

Tennessee. The localities, Alexandria, Louisiana, of Lea, of the type, and Ouachita River, given by Call, are open to doubt.

Unio tumescens LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164; Tr. Am. Phil. Soc., X, 1848, p. 71, pl. III, fig. 7; Obs., IV, 1848, p. 45, pl. III, fig. 7.

Margaron (Unio) tumescens LEA, Syn., 1852, p. 25; 1870, p. 38.

Pleurobema tumescens SIMPSON, Syn., 1900, p. 750.

Unio radiosus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 192; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 13, pl. III, fig. 9; Obs., XIII, 1874, p. 17, pl. III, fig. 9.

Close to *dolabelloides* but more strictly triangular and smaller. The beaks are not quite so high nor so much curved forward as in that species. I cannot see that *radiosus* differs in any character from *tumescens*.

PLEUROBEMA DOLABELLOIDES (Lea).

Shell subtriangular, inflated, very solid, with high, full beaks, which with the umbonal region curve forward, and are placed near the anterior end, inequilateral; anterior end obliquely truncate above, rounded into the base below; base curved; outline of the dorsal slope strongly curved; posterior ridge narrowly rounded, not elevated so much as the radial swelling in front of it, strongly curved throughout; surface irregularly concentrically sculptured; epidermis tawny to brownish with a few broken rays; pseudocardinals uneven, two in the left valve and three in the right; laterals curved, two in the left valve and a double one in the right; beak cavities shallow, compressed; muscle scars small, deep; nacre white, straw-color or somewhat lurid.

Length 51, height 55, diam. 36 mm.

Length 48, height 52, diam. 32 mm.

Tennessee River drainage.

Type locality, Holston River, Tenn.

Unio dolabelloides LEA, Pr. Am. Phil. Soc., I, 1840, p. 288; Tr. Am. Phil. Soc., VIII, 1842, p. 215, pl. xv, fig. 31; Obs., III, 1842, p. 53, pl. xv, fig. 31.—CHENU, Ill. Conch., 1858, pl. XXIX, figs. 4, 4a, 4b.—KUSTER, Conch. Cab., 1861, p. 214, pl. LXXI, fig. 3.—SOWEBRY, Conch. Icon., XVI, 1866, pl. XXXVII, fig. 205.

Margaron (Unio) dolabelloides LEA, Syn., 1852, p. 35; 1870, p. 56.

Pleurobema dolabelloides SIMPSON, Syn., 1900, p. 750.

Unio thorntonii LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 83; Jl. Ac. N. Sci. Phila., VI, 1866, p. 38, pl. XIV, fig. 36; Obs., XI, 1867, p. 42, pl. XIV, fig. 36.

Margaron (Unio) thorntonii LEA, Syn., 1870, p. 56.

Unio mooresianus LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 83; Jl. Ac. N. Sci. Phila., VI, 1866, p. 39, pl. XIV, fig. 37; Obs., XI, 1867, p. 43, pl. XIV, fig. 37.

Margaron (Unio) mooresianus LEA, Syn., 1870, p. 39.

Unio mooreianus PÆTEL, Conch. Sam., III, 1890, p. 159.

Unio recurvatus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 192; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 10, pl. II, fig. 6; Obs., XIII, 1874, p. 14, pl. II, fig. 6.

Unio circumactus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 192; Jl. Ac. N. Sci. Phila., VIII, 1874, pl. IV, fig. 11; Obs., XIII, 1874, p. 19, pl. IV, fig. 11.

Unio subglobatus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 191; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 7, pl. I, fig. 3; Obs., XIII, 1874, p. 11, pl. I, fig. 3.

Pleurobema subglobata SIMPSON, Syn., 1900, p. 751.

I have united under the oldest name a number of nominal species, some of which seem to be slightly identical and others are apparently the merest variations. I placed *Unio subglobatus* by itself as a species in the Synopsis and it has slightly higher beaks than the average *dolabelloides*. But there is a complete connection through *thorntonii* to *dolabelloides* and to *circumactus*, which has slightly lower beaks and is a little less inflated than the rest.

PLEUROBEMA CRUDUM (Lea).

Shell subtriangular, subinflated, solid, inequilateral, with full high beaks; posterior ridge well developed, rounded, curved; anterior end rounded or very slightly, obliquely truncated above; base line nearly straight; post-dorsal outline evenly curved from the beaks to the rounded posterior point near the base of the shell; surface with irregular growth lines; epidermis cloth-like, brownish or greenish-brown, nearly rayless; hinge plate wide; pseudocardinals irregular, torn, two in the left valve and three in the right; laterals two in the left valve and a double one in the right; beak cavities shallow; muscle scars very small, deep; nacre white, thicker in front.

Length 46, height 39, diam. 22 mm.

Type locality, French Broad, and Holston rivers, Tennessee; Swamp Creek, Murray County, Georgia. Also Cumberland River, Tenn.

Unio crudus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 190; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 14, pl. IV, fig. 10; Obs., XIII, 1874, p. 18, pl. IV, fig. 10.

Pleurobema cruda SIMPSON, Syn., 1900, p. 757.

Something like *P. appressum*, but not so compressed on the disk. It seems close to *dolabelloides*, but the beaks are hardly so high and the color and texture of the epidermis differs a little from that of either of them. I have only seen one shell that I am sure is valid, the type. Another that Dr. Lea has placed with that is his *Unio pudicus*, I think.

PLEUROBEMA BARNESIANUM (Lea).

Shell nearly elliptical, rather solid, convex or subinflated, inequilateral; beaks rather high and full; posterior ridge strong, subangular or narrowly rounded, ending below the median line in a point; anterior end nearly evenly rounded; base line curved; dorsal line lightly curved, meeting the outline of the subtruncated dorsal slope at an angle; surface with fine, uneven growth lines; epidermis tawny to dirty greenish-brown, faintly rayed, subshining; pseudocardinals small, radial, two in the left valve and three in the right; laterals two in the left valve and a somewhat double one in the right; beak cavities shallow; muscle scars small, impressed; nacre white, tinted purple.

Length 44, height 34, diam. 20 mm.

Length 37, height 27, diam. 15 mm.

Cumberland and Tennessee River systems.

Type locality, Cumberland River, Tenn.

Unio barnesianus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 31, pl. x, fig. 26; Obs., II, 1838, p. 31, pl. x, fig. 26.—HANLEY, Biv. Shells, 1843, p. 185, pl. XXIII, fig. 14.—CHENU, Ill. Conch., 1858, pl. XIX, figs. 2, 2a, 2b.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIV, fig. 180.

Margarita (Unio) barnesianus LEA, Syn., 1836, p. 20; 1838, p. 17.

Margaron (Unio) barnesianus LEA, Syn., 1852, p. 24; 1870, p. 38.

Pleurobema barnesiana SIMPSON, Syn., 1900, p. 751.

Unio ravenclianus REEVE, Conch. Icon., XVI, 1864, pl. XVI, fig. 70.

Unio tellicoensis LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 155; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 31, pl. x, fig. 28; Obs., XIII, 1874, p. 35, pl. x, fig. 28.

I have given first the measurements of the type of Lea's *Unio tellicoensis* and then those of his *barnesianus*. The latter is a younger shell and naturally not quite so inflated as the older one. I can see no other difference worthy of mention between the two. The form is quite elliptical for a *Pleurobema* of this group, but it has the characteristic texture and epidermis and I believe that it should be placed there.

PLEUROBEMA PUDICUM (Lea).

Shell subrhomboid or subelliptical, subinflated, inequilateral, rather solid; beaks full and high; posterior ridge strong, narrowly rounded, sometimes feebly and narrowly biangulate below, ending in a slight biangulation near the base of the shell; anterior end nearly evenly rounded; base line curved; post-dorsal outline curved, raised in the middle almost to an angle; surface with fine, uneven growth lines; epidermis yellowish-green to tawny-brown, more or less rayed, scarcely shining; pseudocardinals small, uneven, rough, two in the left valve and three in the right; laterals curved, two in the left valve and a double one in the right; beak cavities not deep; muscle scars small, impressed; nacre silvery, white tinted purple.

Tennessee River system.

Type locality, Florence and Northern Alabama.

Unio pudicus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 92; Jl. Ac. N. Sci. Phila., IV, 1860, p. 346, pl. LVI, fig. 171; Obs., VIII, 1860, p. 28, pl. LVI, fig. 171.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXI, fig. 427.

Margaron (Unio) pudicus LEA, Syn., 1870, p. 37.

Pleurobema pudica SIMPSON, Syn., 1900, p. 751.

Unio subrotundus SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVII, fig. 201.

Unio Iyonii LEA, Pr. Ac. N. Sci. Phila., IX, 1865, p. 89; Jl. Ac. N. Sci. Phila., VI, 1869, p. 259, XXXII, fig. 74; Obs., XII, 1869, p. 19, pl. XXXII, fig. 74.

Margaron (Unio) Iyonii LEA, Syn., 1870, p. 56.

Pleurobema Iyonii SIMPSON, Syn., 1900, p. 751.

The type of *Unio pudicus* is a young shell and is brighter and more compressed than that of *Unio lyonii*, which is an adult shell. Since writing the Synopsis I have had an opportunity of examining a number of shells of the *U. pudicus* and it seems to me to be identical with *lyonii*. The form is less triangular than *bigbyense* and a little more inflated.

PLEUROBEMA BIGBYENSE (Lea).

Shell subcompressed, subtriangular or subrhomboid, inequilateral, subsolid; beaks high and moderately full, their sculpture a few strong, uneven, subnodulous ridges that curve up behind; anterior end rounded; base line lightly curved; outline of the dorsal slope curved, raised to an angle behind the ligament; posterior ridge rounded or imperfectly double, ending in a blunt point near the base of the shell; surface nearly smooth; epidermis greenish-yellow with numerous green, entire or broken rays, sometimes with broken bands of green; the whole bright and glossy; pseudocardinals radial, two in the left valve and three in the right; laterals two in the left valve and a somewhat double one in the right; muscle scars rather small, impressed; beak cavities shallow; nacre white.

Length 52, height 39, diam. 18 mm.

Tennessee River drainage; Indian Territory? Texas? The two last localities very doubtful.

Type locality, Big Bigby Creek, Maury Co., Tenn.

Unio bigbyensis LEA, Pr. Am. Phil. Soc., II, 1841, p. 30; Tr. Am. Phil. Soc., VIII, 1843, p. 237, pl. XXII, fig. 51; Obs., III, 1842, p. 75, pl. XXII, fig. 51.—CHENU, Ill. Conch., 1858, pl. XXII, figs. 5, 5a, 5b.—KUSTER, Conch. Cab. Unio, 1862, p. 279, pl. XCIV, fig. 3.—SOWERBY, Conch. Icon., XVI, 1866, pl. XII, fig. 227.

Margaron (Unio) bigbyensis LEA, Syn., 1852, p. 24; 1870, p. 38.

Pleurobema bigbyensis SIMPSON, Syn., 1900, p. 751.

This species seems allied by its form to the *argenteum* group, but the color pattern is that of the *clava* group. Its form is much like that of *P. argenteum*, but that species is dull and rarely exhibits even traces of rays.

Group of *Pleurobema swordianum*.

Shell oval, convex; beaks only moderately elevated, epidermis nearly or quite rayless; teeth strong; laterals reaching well forward; muscle scars large, deep; nacre lurid.

PLEUROBEMA SWORDIANUM (S. H. Wright).

Shell large, irregularly ovate, not inflated, quite inequilateral; beaks moderately elevated and full, placed well forward; lunule narrow; ligament long; posterior ridge widely rounded; outline of dorsal slope almost evenly curved; posterior end rounded; base line slightly curved; anterior end rounded; surface widely, concentrically striate; epidermis tawny-brownish, nearly or quite rayless; left valve with two strong, rough, radial pseudocardinals and two strong, curved laterals; right valve with three radial pseudocardinals and a somewhat double lateral; laterals reaching forward to the pseudocardinals; beak cavities shallow; muscle scars large, deep; pallial line crenate, remote from the border; nacre lurid, greenish-yellow.

Length 95, height 71, diam. 38 mm.

Type locality, Powell's Creek, Lee Co., Va.

Unio swordianus S. H. WRIGHT, Naut., XI., 1897, p. 4.

Pleurobema swordiana SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 81, pl. IV, fig. 4; Syn., 1900, p. 750.

A peculiar and puzzling form, which has characters of several groups. It has something of the form of *Quadrula kirtlandiana*, and it resembles *Q. bursa-pastoris*, but it has shallow beak cavities. It has some of the characters of *P. appressum*, but is larger, has large muscle scars, remote pallial line, and it has remarkably elongated laterals, which reach forward to near the front part of the pseudocardinals. I have placed it for these reasons in a separate group.

Group of *Pleurobema decisum*.

Shell solid, inflated, ovate to elliptical, very inequilateral, somewhat truncated in front and rounded or bluntly pointed behind, wedge-shaped when looked at from above; base slight-

ly angled in front, then nearly straight for two-thirds of its length, from whence it curves to the posterior point; beaks high, curved inward and forward; beak sculpture consisting of a few coarse, irregularly concentric ridges, which curve slightly upward behind; epidermis tawny to brownish, rayless, the rest periods very distinctly marked by dark bands; pseudo-cardinals stumpy, ragged, often showing a tendency to elongation in the direction of the axis of the shell.

Animal having the branchiæ rather small, inner the larger, free nearly or quite the entire length of the abdominal sac, marsupium occupying all but the extreme posterior end of the outer gills; branchiæ and anal openings papillose.

PLEUROBEMA DECISUM (Lea).

Shell somewhat elongated, subtriangular, solid, inflated; beaks high and full, placed close to the anterior end in young shells, and projecting well in advance in the old ones; lunule extending under the beaks; anterior end sometimes rounded in young shells, sharply cut away below in old ones; base line rounded; outline of the dorsal slope slightly curved or even straight in old shells; posterior ridge not greatly elevated, rounded or subangular, ending in a rounded point about at the median line. In front of the posterior ridge there is a wide, radial swelling that is much fuller than it is; epidermis tawny to greenish-brown or brown, nearly or quite rayless, often showing the dark rest marks very plainly, there are frequently one or two broad, dark, dimly outlined rays at the posterior part of the shell; pseudocardinals irregular, radial, two in the left valve and three in the right; left valve with two laterals; right valve with a double one; muscle scars small, the anterior deep, the posterior round and impressed; beak cavities shallow; nacre silvery, thicker along the anterior base.

Length 80, height 40, diam. 34 mm.

Alabama and Tombigbee River systems.

Type locality, Alabama River.

Unio decisus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 92, pl. XII, fig. 23; Obs., I, 1834, p. 102, pl. XII, fig. 23.—CONRAD, Monog., I, 1835, p. 6, pl. III, fig. 2.—HANLEY, Biv. Shells, 1843, p. 187, pl. XXII, fig. 21.—KUSTER, Conch. Cab. Unio, 1852, p. 41, pl. VII, fig. 3.—CHENU, Ill. Conch., 1858, pl. XVIII, figs. 3, 3a, 3b.—REEVE, Conch. Icon., XVI, 1864, pl. XVI, fig. 71.

Margarita (Unio) decisus LEA, Syn., 1836, p. 21; 1838, p. 18.

Margaron (Unio) decisus LEA, Syn., 1852, p. 26; 1870, p. 40.

Pleurobema decisa SIMPSON, Syn., 1900, p. 752.

Unio scalenius SAY, Am. Conch., VI, 1834.

Unio anaticulus LEA, Pr. Ac. N. Sci. Phila., I, 1861, p. 40;

Jl. Ac. N. Sci. Phila., V, 1862, p. 92, pl. XIII, fig. 240; Obs.,

VIII, 1862, p. 96, pl. XIII, fig. 240.—SOWERBY, Conch. Icon.,

XVI, 1866, pl. XXXVII, fig. 199.

Margaron (Unio) anaticulus LEA, Syn., 1870, p. 40.

Unio consanguineus LEA, Pr. Ac. N. Sci. Phila., VI, 1861, p.

60; Jl. Ac. N. Sci. Phila., V, 1862, p. 67, pl. VII, fig. 217;

Obs., VIII, 1862, p. 71, pl. VII, fig. 217.—SOWERBY, Conch.

Icon., XVI, 1868, pl. LXXVIII, fig. 409.

Margaron (Unio) consanguineus LEA, Syn., 1870, p. 40.

Unio crebricittatus LEA, Pr. Ac. N. Sci. Phila., VI, 1861, p.

60; Jl. Ac. N. Sci. Phila., VI, 1866, p. 43, pl. XV, fig. 41;

Obs., XI, 1867, p. 47, pl. XV, fig. 41.

Margaron (Unio) crebricittatus LEA, Syn., 1870, p. 40.

?*Unio medius* REEVE, Conch. Icon., XVI, 1864, pl. XVII, fig. 77

I have united a number of nominal species under the oldest name. There is considerable variation in the form, the anterior end being often rounded in young or almost adult shells, while in old ones it is obliquely and strongly cut away below, leaving the beaks to project well in advance of the rest of the shell. The posterior end is generally bluntly pointed, but is sometimes widely rounded, young shells or those almost adult often have broad, dark green rest marks; they are rarely rayed, but often have one or two irregular blotched rays on the hinder part of each valve.

PLEUROBEMA CHATTANOOGAENSE (Lea).

Shell subelliptical, subinflated or inflated, solid, very inequilateral; beaks full and high; lunule distinct; posterior ridge low, often scarcely marked; anterior end feebly truncate or evenly rounded; base line curved; outline of dorsal slope generally more nearly straight than that of the base; posterior end rounded, sometimes bluntly pointed or slightly biangulate; outline of shell when viewed from above wedge-shaped; epidermis tawny-brown, sometimes shaded green, usually having the rest-marks very distinct; these and one or two ill-defined rays on the posterior end are often dark green; pseudocardinals irregular, radial, two in the left valve and three in the right; laterals two in the left valve and a double one in the right; beak cavities shallow; nacre white, iridescent behind.

Length 56, height 33, diam. 25 mm.

Alabama River system.

Type locality, Chattanooga, Tenn.; Etowah, Oostanaula and Coosawattee Rivers, Ga.

Unio chattanoogaensis LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 166; Jl. Ac. N. Sci. Phila., IV, 1859, p. 209, pl. xxv, fig. 90; Obs., VII, 1859, p. 27, pl. xxv, fig. 90.—REEVE, Conch. Icon., XVI, 1864, pl. xvi, fig. 69.

Margaron (Unio) chattanoogaensis LEA, Syn., 1870, p. 40.

Pleurobema chattanoogaensis SIMPSON, Syn., 1900, p. 753.

Although this approaches *P. decisum* so closely in some cases that it is difficult to separate the two, I am inclined to believe them distinct. This is a more distinctly elliptical shell at all ages than *decisum*, the beaks are not placed so far forward, the anterior end, though sometimes truncate, is cut away little if any below, the posterior end is not usually pointed but round, and the growth marks are stronger and greener than in that species. I am doubtful whether this form is found at Chattanooga, Tennessee, as Dr. Lea was informed. It is probably confined to the drainage of the Alabama River system. According to T. H. Aldrich the animal of this and allied species is a brilliant scarlet.

PLEUROBEMA INTERVENTUM (Lea).

Shell irregularly oval or elliptical, subinflated, solid, inequilateral; beaks full and high; posterior ridge low; dorsal and ventral outlines curved; region behind the ligament sometimes elevated into a low angle; anterior end rounded or slightly, almost squarely truncated; posterior end rounded or feebly biangulate; epidermis tawny or tawny-brownish, often with dark rest marks, sometimes with a few faint broken rays or small dark spots; pseudocardinals small, triangular, two in the left valve and one to three in the right; left valve with two laterals; right valve with a double one; beak cavities shallow; nacre white, iridescent and thinner behind.

Length 36, height 25, diam. 16 mm.

Length 37, height 26, diam. 19 mm.

Type locality, Cahawba River, Alabama.

Unio interventus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 60;

Jl. Ac. N. Sci. Phila., V, 1862, p. 84, pl. XI, fig. 233; Obs.,

VIII, 1862, p. 88, pl. XI, fig. 233.

Margaron (Unio) interventus LEA, Syn., 1879, p. 40.

Pleurobema interventus SIMPSON, Syn., 1900, p. 753.

Unio pallidofulvus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 60;

Jl. Ac. N. Sci. Phila., V, 1862, p. 83, pl. XI, fig. 232; Obs.,

VIII, 1862, p. 87, pl. XI, fig. 232.

Margaron (Unio) pallidofulvus LEA, Syn., 1870, p. 40.

I cannot possibly separate this from the *Unio pallidofulvus* and I do not know why Dr. Lea did so, as both were described at the same time. The species is smaller than *chattanoogaense*, it is shorter than that and not quite so inequilateral and it is generally lighter colored.

PLEUROBEMA MURRAYENSE (Lea).

Shell oval, elliptical or subtriangular, solid, inflated, inequilateral; beaks full and high, the greatest diameter of the shell being just below them; posterior ridge low, narrowly rounded; anterior end nearly squarely subtruncated or rounded; dorsal and basal outlines curved, the latter usually more strongly so; posterior end narrowly rounded; epidermis dull, ashy or greenish-brown, with strong, sometimes greenish, rest marks;

pseudocardinals small, triangular, two in the left valve, three in the right; laterals two in the left valve and a double one in the right; muscle scars small, impressed; beak cavities shallow; nacre white.

Length 37, height 29, diam. 22 mm. (type)

Length 45, height 30, diam. 23 mm.

Coosa River system; Columbus, Georgia?

Type locality, Connasauga Creek, Whitfield Co., and Etowah River, Ga.

Unio murrayensis LEA, Pr. Ac. N. Sci. Phila., II, 1868, p. 143;

Jl. Ac. N. Sci. Phila., VI, 1869, p. 303, pl. XLVI, fig. 115;

Obs., XII, 1869, p. 62, pl. XLVI, fig. 115.

Margaron (Unio) murrayensis LEA, Syn., 1870, p. 40.

Pleurobema murrayensis SIMPSON, Syn., 1900, p. 753.

The type, whose dimensions I have given above, is not as elongated as most specimens of this species are. The shell is shorter than *chattanoogaense*, it is solid and more inflated than *interzertum* and is duller colored than either. It is close to the *troschelianum* group.

Group of *Pleurobema curtum*.

Shell elongate, triangular, truncated in front, rounded on the base, where it is quite full behind the middle, with a low posterior ridge, the space between the middle of the disk and the ridge flattened or sometimes slightly excavated, rather sharply pointed behind; umbonal region very prominent; beaks well forward; beak sculpture not observed; epidermis rather smooth, brownish-olive; pseudocardinals distinct, triangular, radiate; laterals heavy, slightly curved; cicatrices small and deep; nacre iridescent posteriorly. Animal with the gills large, semicircular, the outer slightly larger than the inner, which are free nearly their whole length from the abdominal sac; marsupium occupying the entire length of the outer gills.

PLEUROBEMA CURTUM (Lea).

Shell subtriangular, solid, inflated, the beaks high and full, placed nearly or quite at the anterior end, which below them is squarely truncated; outline of dorsal slope nearly straight;

base rounded in front, obliquely truncate behind; posterior ridge low, ending behind in a point about on the median line; in front of the center of the shell there is a wide, radial swelling; epidermis dark greenish-brown, greenish in the young shell, often showing faint rest marks; pseudocardinals triangular, radial, three in the right valve and two in the left; laterals two in the left valve and a double one in the right; beak cavities shallow; muscle scars small, impressed; nacre bluish-white, thin and iridescent behind.

Length 47, height 34, diam. 24 mm.

Type locality, Tombigbee River, Columbus, Mississippi.

Unio curtus LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 112; Jl. Ac. N. Sci. Phila., V, 1862, p. 103, pl. xvii, fig. 253; Obs., VIII, 1862, p. 107, pl. xvii, fig. 253.

Margaron (Unio) curtus LEA, Syn., 1870, p. 40.

Pleurobema curta SIMPSON, Syn., 1900, p. 754.

The radial swelling at and in front of the middle of the shell is strong and wide. Behind it the shell is compressed and the base line is straight or even a little incurved. The anterior truncation is square. The form and the dark epidermis will distinguish it from all other species.

Group of *Pleurobema troschelianum*.

Shell rather small, solid, rounded-triangular, inflated, somewhat inequilateral, slightly pointed near the posterior base, and rounded angular at the hinder end of the ligament; base of the shell almost evenly rounded; posterior ridge low; beaks high and slightly curved inward and forward over a well-defined lunule; epidermis dull tawny, showing the rest periods and occasionally marked with a radiating row of dark green, squarish spots in front of the posterior ridge; hinge plate wide and flat; pseudocardinals small, triangular, rough; laterals short, curved; muscle scars small, rather deep. Animal with semicircular gills, the inner the larger and free from the abdominal sac half to nearly their whole length; ovisacs of outer gills apparently in pairs.

PLEUROBEMA TAITIANUM (Lea).

Shell obliquely triangular, solid, inflated; beaks very full and high, placed at or in advance of the anterior end of the shell; anterior end obliquely truncated, sometimes showing an almost double lunule, rounded below; base line straight; post-dorsal line only slightly curved; posterior ridge low, ending in a rounded point near the base of the shell; in front of the posterior ridge there is a wide, radial swelling; surface with uneven, concentric ridges; epidermis tawny or tawny-brown, scarcely shining; pseudocardinals broken up, solid, ragged, two in the left valve and one, with often one or more small ones, in the right; laterals irregular, two in the left and a double one in the right; muscle scars small, deep; beak cavities shallow; nacre white or pink, thin and iridescent behind.

Length of type 40, height 40, from beak to post-basal point 45, diam. 26 mm.

Length 52, height 48, diam. 24 mm.

Type locality, Alabama River.

Unio taitianus LEA, Tr. Am. Phil. Soc., V, 1834, p. 39, pl. IV, fig. 11; Obs., I, 1834, p. 151, pl. IV, fig. 11.—HANLEY, Biv.

Shells, 1843, p. 186, pl. XXIII, fig. 26.

Margarita (Unio) taitianus LEA, Syn., 1836, p. 21; 1838, p. 18.

Margaron (Unio) taitianus LEA, Syn., 1852, p. 25; 1870, p. 38.

Pleurobema taitiana SIMPSON, Syn., 1900, p. 754.

This shell bears a most striking superficial resemblance in shape to *Quadrula pyramidata*, but the epidermis is very differently colored and the beak cavities are unusually shallow, while in *Q. pyramidata* they are deep and compressed. A specimen from Claiborne, Alabama, in the Lea collection has rich pink nacre.

PLEUROBEMA TOMBIGEANUM Frierson.

"Shell short, triangular, thick, solid and heavy; truncated in front, roundly pointed behind at the post-base. Beaks high and incurved, their sculpture not seen. Post-ridge rounded and close to post-margin. The sides are slightly flattened just in front of the post-ridge and an inflated, raised area extends

from the beaks to the anterior base. This area is to a considerable degree concentrically sulcated, the sulci becoming obsolete behind, where it becomes striated; epidermis rayless, dark reddish-brown or having faint, greenish rays near the beaks. Lunule triangular and membranaceous. The shell is remarkably flattened in front, half way from beaks to base, showing a sort of so-called "secondary lunule." Nacre white, to rose-color and iridescent. Muscle scars well impressed and separate. Beak cavities shallow. In the left valve there are two low, thick, curved laterals, somewhat striate, and a stout, upright, bifid, striate, acuminate cardinal. In the right valve, a single low, stout, curved lateral upon a very wide, heavy plate or shelf and a wedge-shaped cardinal arising from a pit surrounded by a semicircular, low ridge. Cardinal plate thick, on the inner surface of which may be noted the dorsal muscle scars.

Length 48, alt. 40, diam. 32.3 mm.

Length 41, alt. 39, diam. 27.5 mm." (Frierson).

Type locality, Tombigbee River, Demopolis, Marengo Co., Ala. Also found at Columbus, Miss., and in the Alabama River.

Pleurobema tombigbeanum FRIERSON, Naut., XXII, 1908, p. 27, pl. III, figs. 3, 4.

"The shell may be mistaken by the casual observer for a small *Quadrula pyramidata* Lea, but may be easily distinguished by its smaller size and especially its shallower beak cavities, lower beaks and less pronounced sulcus from beak to post-base. It seems to be a rather rare shell in the Tombigbee and Alabama rivers. Compared with *P. taitianum* Lea ours is less convex, with a more or less distinct sulcus back of the convexity."

PLEUROBEMA COR (Conrad).

Shell obliquely subtriangular. solid, inflated, inequilateral; beaks very high, full and rounded; anterior end slightly truncated above, sometimes almost angled in the middle, base line decidedly rounded; outline of the dorsal slope curved: pos-

terior ridge rounded, ending behind near the base in a rounded point; surface irregularly, concentrically striate; epidermis tawny or tawny-brown; pseudocardinals triangular, two in the left valve and three in the right; laterals two in the left valve and a double one in the right; beak cavities shallow; muscle scars small and impressed; nacre silvery-white, iridescent behind.

Length 35, height vertically from the beaks 38, from beaks to post-basal point 43 mm.

Alabama River system; Flint River, Georgia.

Type locality, Elk and Flint Rivers, Ala.

Unio mytilloides CONRAD, Am. Jl. Sci., XXV, 1834, p. 343, pl. 1, fig. 7.

Unio cor CONRAD, New F. W. Shells, 1834, p. 28, pl. III, fig. 3.

—CHENU, Bib. Conch., 1st ser., III, 1845, p. 16, pl. III, fig. 2.

Margarita (Unio) cor LEA, Syn., 1836, p. 21; 1838, p. 18.

Margaron (Unio) cor LEA, Syn., 1852, p. 26; 1870, p. 39.

Pleurobema cor SIMPSON, Syn., 1900, p. 754.

Unio crapulus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 39; Jl.

Ac. N. Sci. Phila., VI, 1866, p. 42, pl. xv, fig. 40; Obs., XI, 1867, p. 46, pl. xv, fig. 40.

Margaron (Unio) crapulus LEA, Syn., 1870, p. 41.

Unio lewisii LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 40; Jl. Ac.

N. Sci. Phila., V, 1862, p. 71, pl. VIII, fig. 220; Obs., VIII, 1862, p. 75, pl. VIII, fig. 220.

Margaron (Unio) lewisii LEA, Syn., 1870, p. 56.

Conrad's shell is evidently fully adult or old; Lea's *U. lewisii* and *crapulus* are young or barely adult specimens of what seem to me to be the same. The species is less angular than *P. taitanum*, and the disk is evenly swollen, there being no compression in front of the posterior ridge.

Conrad says this is between *Unio ellipsis* Lea and *mytiloides* Rafinesque, but that he has no doubt that it is the latter. It is certainly very different from the shell Rafinesque figures and describes as *Pleurobema mytiloides*. (Am. Gen. Sci. Phys. Brux., XIII, 1820, p. 313, pl. LXXXII, figs. 8-10.) Con-

rad's *Unio cor* was published in May, 1834, and his *mytilloides* in January of the same year, so that the latter has priority, but as Rafinesque's name was placed under the genus *Pleurobema*, and as I place Conrad's species, which is an entirely different thing, in the same genus, the name *mytilloides* can not be used for it, and it must therefore take the next name proposed, which is Conrad's *cor*.

Dr. Lea admits Rafinesque's *mytilloides* with doubt, and in his collection places under that name specimens which I regard as a rather elongated *Quadrula pyramidata*. Rafinesque's figure represents an elongated shell, almost absolutely straight on the dorsal line, and with the beaks carried far in front of the rest of the shell. I have never seen anything which at all agrees with it.

PLEUROBEMA PEROVATUM (Conrad).

Shell irregularly oval, inflated, rather thick, inequilateral; beaks full, high and rounded, undulated, placed not very near the anterior end; anterior end rounded, slightly cut away below; base line curved; post-dorsal line raised into a decided angle at some distance behind the ligament; below this angle the posterior end is obliquely truncate; posterior ridge narrowly rounded; epidermis olive; pseudocardinals erect and prominent, not very thick; laterals straight, compressed; anterior muscle scars deep; posterior scars impressed; nacre white, much thinner behind.

Length of Conrad's figure 44, height 30 mm.

Type locality, Prairie Creek, (tributary of the Tombigbee), Marengo County, Alabama. Also small streams, Greene Co., Ala.

Unio perovatus CONRAD, Am. Jl. of Sci., XXV, 1834, p. 338, pl. I, fig. 3; ?New F. W. Shells, 1834, p. 47, pl. II, fig. 3.—

CHENU, Bib. Conch., 1st. ser., III, 1845, p. 22, pl. I, fig. 3.

Margarita (Unio) perovatus LEA, Syn., 1836, p. 23; 1838, p. 19.

Margaron (Unio) perovatus LEA, Syn., 1852, p. 27; 1870, p. 42.

Pleurobema perovata SIMPSON, Syn., 1900, p. 755.

I have never seen what I felt certain was a specimen of this species and am at a loss to know just where to place it. Conrad states that "the young shell is broader behind, approaching to an oval figure, and is prettily ornamented with green rays on an olive-yellow ground." His figure in the *New Fresh Water Shells* is considerably different from the one in the *American Journal of Science*, but the former may be from a younger shell. The high broadly rounded, mammillar beaks, placed at some distance from the anterior end and the rather decided angle behind the ligament are distinguishing characters.

PLEUROBEMA NUCLEOPSIS (Conrad).

Shell short elliptical, subinflated, solid, inequilateral; beaks moderately full and high; posterior ridge scarcely developed, widely rounded; anterior end almost evenly rounded; base and dorsum curved; posterior end rounded; surface nearly smooth; the rest marks a little depressed; epidermis tawny or tawny-brown with a row of small green spots on the posterior ridge in the young shell, dirty brown in the old state; pseudocardinals triangular; laterals short, stout, that of the right valve partly double; muscle scars small; beak cavities shallow; nacre bluish-white.

Length 30, height 24.5; diam. 15 mm.

Length 46, height 39.5, diam. 24 mm.

Coosa River system.

Type locality, Etowah River, Ga.

Unio nucleopsis CONRAD, *Ann. and Mag. Nat. Hist.*, IV, 1849, p. 301; *Jl. Ac. N. Sci. Phila.*, I, 1850, p. 276, pl. xxxvii, fig. 81.—KÜSTER, *Conch. Cab. Unio*, 1861, p. 217, pl. lxxiii, fig. 3.—REEVE, *Conch. Icon.*, XVI, 1864, pl. xvi, fig. 68.

Margaron (Unio) nucleopsis LEA, *Syn.*, 1852, p. 35; 1870, p. 56.

Pleurobema nucleopsis SIMPSON, *Syn.*, 1900, p. 755.

Conrad's figure is evidently taken from a young shell and shows it to be almost evenly short elliptical. A specimen in the Lea collection about the size of Conrad's figure, bearing the name *Unio nucleopsis* Conrad, agrees very well with the figure of that species but is somewhat broken behind. Lea

has several older shells with the same name, but most of them are perhaps something else. The species is more evenly elliptical than *P. irrasum*, but I am doubtful whether it is distinct.

PLEUROBEMA STABILE (Lea).

Shell subovate, subelliptical or subtriangular, solid, inflated, somewhat inequilateral; beaks high, full and rounded; lunule narrow; anterior end evenly rounded; base line curved; outline of the dorsal slope curved, sometimes raised behind the ligament into a low angle; posterior ridge rather low, slightly double below, ending at and below the median line in a faint biangulation; surface with irregular, concentric striæ; epidermis tawny or tawny-brownish, rarely with a broken row of squarish green blotches; pseudocardinals ragged, triangular, two in the left valve and one to three in the right; laterals two in the left valve and a double one in the right; beak cavities shallow; muscle scars small, impressed; nacre whitish, slightly iridescent behind.

Length 36, height 27, diam. 22 mm.

Length 43, height 33, diam. 27 mm.

Type locality, Coosa River, Alabama.

Unio stabilis LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 59; Jl. Ac. N. Sci. Phila., V, 1862, p. 71, pl. VIII, fig. 221; Obs. VIII, 1862, p. 75, pl. VIII, fig. 221.

Margaron (Unio) stabilis LEA, Syn., 1870, p. 38.

Pleurobema stabilis SIMPSON, Syn., 1900, p. 755.

Unio medius LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 40; Jl. Ac. N. Sci. Phila., V, 1861, p. 78, pl. x, fig. 227; Obs., VIII, 1862, p. 82, pl. x, fig. 227.—SOWERBY, Conch. Icon., XVI, 1868, pl. IXXIII, fig. 375.

Margaron (Unio) medius LEA, Syn., 1870, p. 40.

A species with no very striking characters. Lea's *Unio medius* seems to me to be only the younger shell of his *stabilis*, which appears to be adult. The high, full, rounded beaks placed at some distance back from the anterior end sometimes give the shell a somewhat triangular outline. The double posterior ridge and faint biangulation where it ends behind are constant characters in all the specimens I have seen.

PLEUROBEMA TROSCHELIANUM (Lea).

Shell irregularly elliptical, subtriangular or subovate, somewhat inflated, rather solid; beaks full, rather high and rounded, placed near the anterior end; anterior end rounded or slightly obliquely truncate above; base and dorsal outlines rounded, the latter sometimes raised almost to an angle behind the ligament; posterior ridge well developed, narrowly rounded, slightly double below, ending near the base in a faint biangulation; epidermis tawny to dirty greenish-brown, sometimes with a single, broken ray near the posterior ridge; pseudocardinals small, stumpy; two in the left valve and one to three in the right; laterals two in the left valve and a double one in the right; beak cavities shallow; muscle scars small, impressed; nacre whitish, thinner and iridescent behind.

Length 40, height 28, diam. 21 mm.

Alabama River system.

Type locality, Coosawattee River, Murray Co., Ga.

Unio troschelianus LEA, Tr. Am. Phil. Soc., X, 1852, p. 280, pl. XXIII, fig. 39; Obs., V, 1852, p. 36, pl. XXIII, fig. 39.

Margaron (Unio) troschelianus LEA, Syn., 1852, p. 26; 1870, p. 40.

Pleurobema troscheliana SIMPSON, Syn., 1900, p. 756.

Close to *stabile*, but less inflated, less solid, having a stronger posterior ridge and a darker epidermis with a tint of dirty green. It is more elongated than *irrasum* or *altum*.

PLEUROBEMA IRRASUM (Lea).

Shell subtriangular, short, rather inflated, solid, slightly inequilateral; beaks full, high, rounded; anterior end rounded, slightly obliquely truncate above; base line rounded; outline of dorsal slope somewhat curved, elevated into a low angle behind the ligament; posterior ridge well developed, narrowly rounded, ending in a rounded point below the median line; epidermis dirty greenish-brown, rarely with vestiges of rays; pseudocardinals subtriangular, two in the left valve, one to three in the right; laterals short, two in the left valve and a

double one in the right; muscle scars small, impressed; beak cavities shallow; nacre white, thinner and iridescent behind.

Length 35, height 28, diam. 20 mm.

Length 44, height 35, diam. 29 mm.

Coosa River system.

Type locality, Etowah River, Ga.

Unio irrasus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 38; Jl.

Ac. N. Sci. Phila., V, 1862, p. 91, pl. XIII, fig. 239; Obs.,

VIII, 1862, p. 95, pl. XIII, fig. 239.

Margaron (Unio) irrasus LEA, Syn., 1870, p. 38.

Pleurobema irrasa SIMPSON, Syn., 1900, p. 756.

Close to *troschelianum*, but it is not so elongated, it is more nearly triangular and the beaks are nearer the center of the shell. It is quite likely that the two forms may run together.

PLEUROBEMA ALTUM (Conrad).

Shell suborbicular or somewhat subtriangular, inflated, solid, subequilateral; beaks high, full and rounded; anterior end nearly evenly rounded, sometimes very faintly subtruncate above; base line much rounded; outline of dorsal slope slightly curved, raised into a slight angle behind the ligament; posterior ridge strong, narrowly rounded, generally narrowly double below, ending below the median line in a narrow biangulation; surface with irregular growth lines; epidermis dirty tawny or tawny-brown, sometimes having a few faint, squarish, green spots; pseudocardinals subtriangular, two in the left valve, one to three in the right; laterals very short and heavy; two in the left valve and a double one in the right; beak cavities shallow; muscle scars small, deep; nacre white, thinner and iridescent behind.

Length 35, height 33, diam. 21 mm.

Alabama River system.

Type locality, Tennessee.?

Unio altus CONRAD, Jl. Ac. N. Sci. Phila., II, 1854, p. 298, pl.

XXVII, fig. 5.

Margaron (Unio) altus LEA, Syn., 1870, p. 42.

Pleurobema alta SIMPSON, Syn., 1900, p. 756.

Unio fibuloides LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 154; Jl. Ac. N. Sci. Phila., IV, 1859, p. 219, pl. XXVIII, fig. 100; Obs., VII, 1859, p. 37, pl. XXVIII, fig. 100.—SOWERBY, Conch. Icon., XVI, 1866, pl. XII, fig. 223.

Margaron (Unio) fibuloides LEA, Syn., 1870, p. 56.

Very close to *irrasum*, but shorter, rather more nearly round, solider and having a more tawny epidermis. Conrad's *Unio altus* is apparently a light-colored young shell, having a ray on each valve broken into squarish spots.

PLEUROBEMA HARTMANIANUM (Lea).

Shell almost triangular, inequilateral, inflated, solid; beaks full and high, turned a little forward; anterior end generally obliquely truncate above, rounded below; base line slightly curved; outline of dorsal slope curved, elevated to a low angle behind the ligament; posterior ridge well developed, angled above, somewhat double below, ending near the base in a bifurcation; surface rudely and unevenly concentrically sculptured, epidermis tawny to tawny-brown; pseudocardinals ragged, two in the left valve, three in the right; laterals strong, two in the left valve and a double one in the right; beak cavities shallow, compressed; muscle scars small, deep; nacre white, thinner and iridescent behind.

Length 50, height 51, diam. 35 mm.

Coosa River, Alabama.

Type locality, Coosa River, Wetumpka, Ala.

Unio hartmanianus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 307; Jl. Ac. N. Sci. Phila., V, 1862, p. 73, pl. VIII, fig. 222; Obs., VIII, 1862, p. 77, pl. VIII, fig. 222.

Margaron (Unio) hartmanianus LEA, Syn., 1870, p. 38.

Pleurobema hartmaniana SIMPSON, Syn., 1900, p. 756.

Close to *taitianum*, but not so high, the outline being near to an equilateral triangle while that of *taitianum* is an inequilateral triangle. There are, however, intermediates, which hint strongly at a connection of the two. The two forms differ pretty constantly from *P. cor* in having a decided posterior ridge, in front of which the disk is flattened. In *cor* the pos-

terior ridge is feebly developed and the disk in front of it is full.

Dr. Lea has shells in his collection from the Clinch River, which he places with this species, which I am certain belong to the *clava* group.

PLEUROBEMA INSTRUCTUM (Lea).

Shell subtriangular, convex to subinflated, inequilateral, sub-solid: beaks high, rather full, their sculpture a few strong, irregular ridges that curve up decidedly behind; anterior end evenly rounded; base line slightly curved; outline of dorsal slope curved, raised into an angle behind the ligament; posterior ridge high, somewhat narrowly double, ending in a bifurcation near the base: surface unevenly, concentrically striate, epidermis pale greenish-tawny; pseudocardinals small, two in the left valve, one to three in the right; laterals two in the left valve and one in the right, the latter somewhat double; beak cavities shallow; muscle scars small, not deep; nacre white or bluish-white, silvery or iridescent behind.

Length 38, height 30, diam. 17 mm.

Length 35, height 28, diam. 19 mm.

Type locality, Cahawba River, Alabama.

Unio instructus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 59;

Jl. Ac. N. Sci. Phila., V, 1862, p. 82, pl. x, fig. 230; Obs.,

VIII, 1862, p. 86, pl. x, fig. 230.

Margaron (Unio) instructus LEA, Syn., 1870, p. 38.

Pleurobema instructa SIMPSON, Syn., 1900, p. 756.

Thinner and less inflated than any of the nearly related species. In fresh specimens the epidermis is often somewhat cloth-like.

Group of *Pleurobema shorvalterii*.

Shell small, rounded triangular, inflated, slightly truncated anteriorly, posterior end arched and ending in a bluntly rounded point at the post-base, posterior ridge well defined; umbonal region full; beaks rather prominent, the sculpture not observed; epidermis brown, not rayed; hinge plate rather wide:

pseudocardinals small, triangular, radial, roughened; laterals short, heavy; nacre white, brilliantly iridescent posteriorly.

Animal apparently having ovisacs in pairs, which are slightly wavy and lirate at the base; gills rather large, semicircular, inner much the larger, partly free from the abdominal sac; mantle thin, thickened at edge, and bordered with a dark line.

PLEUROBEMA SHOWALTERII (Lea).

Shell subtriangular to suborbicular, inflated, very solid, inequilateral, or equilateral; beaks high and full; posterior ridge generally well developed, narrowly rounded, usually ending in a blunt point below the median line; anterior end rounded or slightly subtruncate above, base more or less rounded; posterior outline curved; surface with irregular growth lines; epidermis tawny to dark greenish-brown, sometimes feebly rayed; pseudocardinals subtriangular, two in the left valve and one to three in the right; left valve with two short laterals; right valve with a double one; beak cavities very shallow; muscle scars small, deep; nacre whitish, sometimes tinted with purple, thicker in front.

Length 32, height 30, diam. 20 mm.

Length 31, height 33, diam. 24 mm.

Coosa River, Alabama.

Type locality, Coosa River, Wetumpka, Ala.

Unio showalterii LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 307;

Jl. Ac. N. Sci. Phila., V, 1862, p. 73, pl. VIII, fig. 223; Obs.,

VIII, 1862, p. 77, pl. VIII, fig. 223.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXI, fig. 426.

Margaron (Unio) showalterii LEA, Syn., 1870, p. 55.

Pleurobema showalterii SIMPSON, Syn., 1900, p. 757.

This species varies from subtriangular to almost orbicular and considerably in the degree of inflation. It is generally dark greenish-brown, though occasional specimens show a flush of tawny-color. Some shells appear almost exactly on a casual view like young *Quadrula solida* or *pyramidata*, but the almost total want of beak cavities will at once distinguish them and the shell is solidier than the young of either of them.

Group of *Pleurobema nur*.

Shell oval, inflated, moderately solid, with a low posterior ridge, swollen at the post-basal part; posterior end pointed at the termination of the posterior ridge; beaks full, rather high, considerably removed from the anterior end; epidermis pale to dark brown, rest lines very distinct; pseudocardinals small, stumpy, radiate, rough; laterals straight; nacre brilliantly iridescent posteriorly; front part of shell heavy, suddenly becoming thinner behind.

Animal unknown.

PLEUROBEMA VERUM (Lea).

Shell subovate or subtriangular, subinflated, subsolid, inequilateral; beaks elevated, moderately full; anterior end rounded or slightly truncated above; base line curved; outline of dorsal slope curved, subangulate just behind the ligament; posterior ridge well developed, narrowly rounded, ending in a blunt point above the base; surface with uneven growth lines; epidermis dull tawny-brown to greenish-brown, generally showing the rest marks; pseudocardinals small, two in the left valve and one to three in the right; two laterals in the left valve and a double one in the right; muscle scars impressed; beak cavities rather shallow; nacre whitish.

Length 50, height 40, diam. 23 mm.

Black Warrior and Cahawba rivers, Alabama.

Type locality, Cahawba River, Perry Co., Ala.

Unio verus LEA, Pr. Ac. N. Sci. Phila., V, 1860, p. 140; Jl. Ac. N. Sci. Phila., V, 1862, p. 83, pl. XI, fig. 231; Obs., VIII, 1862, p. 87, pl. XI, fig. 231.

Margaron (Unio) verus LEA, Syn., 1870, p. 38.

Pleurobema vera SIMPSON, Syn., 1900, p. 757.

The type is a young shell, and seems to stand between the *troschelianum* and *nur* groups, and to show some relation to that of *Pleurobema argenteum*. The shell is only moderately solid and inflated.

PLEUROBEMA HAGLERI Frierson.

Shell subelliptical, subinflated, inequilateral; beaks only moderately full and high; posterior ridge well developed, slightly double below, ending at and below the median line in a feeble biangulation; anterior end almost evenly rounded; base line curved, quite full just behind the middle; outline of dorsal slope curved, a little more prominent just behind the ligament than elsewhere; surface with irregular growth lines; epidermis pale to rather dark reddish-brown, often very faintly rayed, scarcely shining; pseudocardinals triangular, two in the left valve, one to three in the right; two laterals in the left valve and a scarcely double one in the right; beak cavities shallow; muscle scars of moderate size, impressed; nacre whitish, purplish or salmon-red, thinner and iridescent behind.

Length 47, height 34, diam. 20 mm.

North and Black Warrior Rivers, Alabama.

Type locality, North River, Tyner, Ala.

Unio (Pleurobema) hagleri FRIERSON, *Naut.*, XIII, 1900, p. 109, pl. II.

Pleurobema hagleri SIMPSON, *Syn.*, 1900, p. 757.

This species has no strong characters, yet it does not seem to be referable to anything else. It is larger, less solid and inflated than what I take to be Conrad's *Unio rubellus*; it is lighter colored than that species. It is much lighter colored apparently than his *U. furvus* and does not have the minute, crowded wrinkles he mentions as belonging to the latter species. It may be a mere variety of *furvus*. The swelling just behind the middle of the base differentiates it from the *Unio fassinans* of Lea, to which it bears some resemblance.

PLEUROBEMA RUBELLUM (Conrad).

Shell rather small, inflated, solid, somewhat triangular or irregularly elliptical, slightly inequilateral; beaks full, high; anterior end usually obliquely subtruncate above, slightly cut away below, narrowly rounded in the middle; base line strongly curved, unusually full in most cases at the middle; outline of the dorsal slope curved; posterior ridge well devel-

oped, narrowly rounded, ending in a blunt point below the median line; epidermis scarcely smooth, reddish-brown; pseudocardinals triangular, two in the left and one to three in the right valve; beak cavities shallow; muscle scars rather small, impressed; nacre whitish, thinner behind.

Length 33, height 27, diam. 22 mm.

Length 32, height 24, diam. 17.5 mm.

Black Warrior and Cahawba Rivers, Alabama.

Type locality, Black Warrior River, near its source.

Unio rubellus CONRAD, New F. W. Shells, 1834, p. 38, pl. VI, fig. 2.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 20, pl. II, fig. 2.

Margarita (Unio) rubellus LEA, Syn., 1836, p. 33; 1838, p. 28.

Margaron (Unio) rubellus LEA, Syn., 1852, p. 34; 1870, p. 55.

Pleurobema rubella SIMPSON, Syn., 1900, p. 757.

Unio rudis CONRAD, Monog., No. 9, 1837, p. 76, pl. XLIII, fig. 1.

Unio pulvinulus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164; Tr. Am. Phil. Soc., X, 1848, p. 81, pl. VIII, fig. 24; Obs., IV, 1848, p. 55, pl. VIII, fig. 24.

Margaron (Unio) pulvinulus LEA, Syn., 1852, p. 26; 1870, p. 41.

I have before me a large number of shells from the above two rivers that agree in all essential characters with Conrad's *Unio rubellus*. It is a small, very solid, inflated form with a reddish-brown, rayless, almost rough epidermis, and with white nacre in all the examples I have seen.

PLEUROBEMA FURVUM (Conrad).

Shell somewhat obovate, solid, subinflated or inflated, inequilateral; beaks rather full and high; anterior end a little narrowed and rounded; base line curved, fullest just behind the middle; outline of dorsal slope rounded, sometimes raised almost to an angle at the hinder end of the ligament; posterior ridge rounded, ending in a point at or below the median line; surface with uneven, concentric sculpture; epidermis reddish-brown, dark brown or nearly black with very fine, crowded, concentric wrinkles, dull to subshining; pseudocardinals tri-

angular, two in the left valve and one to three in the right; laterals two in the left valve and a somewhat double one in the right; beak cavities shallow; muscle scars rather small, impressed; nacre white or reddish, thinner and iridescent behind.

Length 59, height 40, diam. 30 mm.

Length 59, height 39, diam. 26 mm.

Type locality, Black Warrior River, Alabama.

Unio furvus CONRAD, New F. W. Shells, 1834, p. 39, pl. VI, fig. 3.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 20, pl. II, fig. 4.

Pleurobema furva SIMPSON, Syn., 1900, p. 758.

I cannot be positive that the shells, which I call *Pleurobema furvum*, are Conrad's *Unio furvus*, but I think they are. They agree well in shape; some of them are quite dark and they have the epidermis beautifully and minutely concentrically wrinkled, a character he notes in his description. He gives no dimensions, but if the shells I have are that, his figure is taken from a young specimen, as it is 32 millimeters long and 18 high.

PLEUROBEMA AVELLANA Simpson.

Shell small, solid, inflated, inequilateral, nearly elliptical; beaks full, slightly elevated; posterior ridge well developed, narrowly rounded, ending below the median line; anterior end evenly rounded; base line curved, a little fuller in the middle; outline of dorsal slope almost evenly curved, the posterior end narrowly rounded; surface lightly concentrically striate, greenish-brown, slightly clouded but scarcely rayed; pseudocardinals, two in the left valve and one in the right; laterals, two in the left valve and one in the right, which is somewhat double; muscle scars deep; nacre bluish, iridescent behind.

Length 30, height 20, diam. 15 mm.

Type locality, Cahawba River, Alabama.

Pleurobema avellana SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 81, pl. II, figs. 6, 7; Syn., 1900, p. 758.

A small, compact, solid, inflated species, which is more nearly elliptical than *P. rubellum* and differently colored.

PLEUROBEMA NUX Lea.

Shell small, solid, inflated, inequilateral, irregularly elliptical or ovate; beaks high and full, with two or three strong, irregular ridges; anterior end evenly rounded; base line curved, fullest just behind the middle; outline of dorsal slope evenly curved or raised almost to an angle behind the ligament; posterior ridge low but well marked, subangular or narrowly rounded, ending in a point at the median line; in front of it the shell is much swollen; epidermis greenish-brown to reddish-brown, often showing the dark rest marks, almost cloth-like in fresh shells; pseudocardinals triangular, two in the left valve and one to three in the right; two laterals in the left valve and a somewhat double one in the right; beak cavities small; muscle scars impressed; nacre bluish-white, thinner and iridescent behind.

Length 42, height 29, diam. 21 mm.

Alabama River system.

Type locality, Alabama River.

Unio nux LEA, Tr. Am. Phil. Soc., X, 1852, p. 283, pl. XXIV, fig. 43; Obs., V, 1852, p. 39, pl. XXIV, fig. 43.

Margaron (Unio) nux LEA, Syn., 1852, p. 31; 1870, p. 49.

Pleurobema nux SIMPSON, Syn., 1900, p. 758.

Unio cinnamomicus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 39; Jl. Ac. N. Sci. Phila., V, 1862, p. 100, pl. XVI, fig. 248; Obs., VIII, 1862, p. 104, pl. XVI, fig. 248.

Margaron (Unio) cinnamominus, LEA, Syn., 1870, p. 49.

Unio cinnamominus SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIII, fig. 436.

I cannot see that *cinnamomicus* differs in any way except in having a reddish-brown epidermis. Between this and typical *nux* there is a complete blending in the matter of color. This differs from *avellana* in having a decided point on the median line behind.

PLEUROBEMA JOHANNIS (Lea).

Shell irregularly, elliptical, subrhomboid or subovate, sub-inflated or inflated, inequilateral, solid; beaks full and high; posterior ridge much less inflated than the disk in front of it.

subangular or narrowly rounded, ending at or below the median line in a blunt point; anterior end evenly rounded; base line curved, fuller behind the middle; outline of dorsal slope curved, raised to an angle behind the ligament; surface nearly smooth; epidermis greenish-yellow, clouded or irregularly marked with broad bands of rich green and these are broken by faint, light rays; rest marks often distinct; pseudocardinals two in the left valve and three in the right; laterals two in the left valve and a somewhat double one in the right; muscle scars small; beak cavities shallow; nacre bluish-white, thinner and iridescent behind.

.Length 37, height 23, diam. 18 mm.

Alabama River system.

Type locality, Connasauga and Etowah Rivers, Ga.

Unio johannis LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 171; Jl. Ac. N. Sci. Phila., IV, 1860, p. 340, pl. LV, fig. 168; Obs., VIII, 1860, p. 25, pl. LV, fig. 168.

Margaron (Unio) johannis LEA, Syn., 1870, p. 41.

Pleurobema johannis SIMPSON, Syn., 1900, p. 759.

Shorter and solidier than *P. flavidulum* and having a very different color pattern from it or *P. hanleyanum*. The largest specimen I have seen is covered all over with what appears like low blisters of the epidermis; but this character is not present in other shells I have seen.

PLEUROBEMA HANLEYANUM (Lea).

Shell irregularly elliptical, subinflated to inflated, inequilateral, rather solid; beaks full and high; posterior ridge low, narrowly rounded, ending in a blunt point about at the median line; in front of the ridge the disk is decidedly inflated; anterior end rounded; base curved, full behind the middle; outline of the dorsal slope curved, most elevated behind the ligament; epidermis brownish or greenish-brown, somewhat cloth-like, showing the dark rest marks plainly; pseudocardinals triangular, two in the left valve and one to three in the right; two short laterals in the left valve and a more or less double one

in the right; beak cavities shallow; muscle scars small; nacre white or bluish, thin and iridescent behind.

Length 37, height 24, diam. 20 mm.

Length 38, height 22, diam. 17 mm.

Coosa River drainage, Georgia and Alabama.

Type locality, Coosawattee River, Murray Co., Ga.

Unio hanleyanus LEA, Tr. Am. Phil. Soc., X, 1852, p. 279, pl. XXIII, fig. 37; Obs., V, 1852, p. 35, pl. XXIII, fig. 37.—REEVE, Conch. Icon., XVI, 1864, pl. XVII, fig. 76.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLVI, fig. 249.

Margaron (Unio) hanleyanus LEA, Syn., 1852, p. 26; 1870, p. 40.

Pleurobema hanleyana SIMPSON, Syn., 1900, p. 759.

This species is close to *P. johannis* but the latter seems to constantly differ in the texture and color of the epidermis. *P. hanleyanum* is never clouded nor marked with green, it is more cloth-like and has the dark rest marks in all cases. It is a solidier, darker colored species than *flavidulum*.

PLEUROBEMA FLAVIDULUM (Lea).

Shell subelliptical, convex or subinflated, inequilateral, rather thin to subsolid; beaks moderately full and elevated; posterior ridge well developed, narrowly rounded, ending in a point at the median line; epidermis dirty yellow, tawny or dirty greenish, sometimes with one or two rays on the posterior slope; pseudocardinals subcompressed, two in the left valve, and one to three in the right; two delicate laterals in the left valve and one in the right; beak cavities shallow; muscle scars scarcely impressed; nacre whitish or purplish, a little thinner and iridescent behind.

Length 37, height 21, diam. 15 mm.

Type locality, Columbus, Mississippi.

Unio flavidulus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 39; Jl. Ac. N. Sci. Phila., V, 1862, p. 97, pl. xv, fig. 245; Obs., VIII, 1862, p. 101, pl. xv, fig. 245.

Margaron (Unio) flavidulus LEA, Syn., 1870, p. 40.

Pleurobema flavidulus SIMPSON, Syn., 1900, p. 759.

More delicate, thinner and less compressed than either *johannis* or *hanleyanum*. It is sometimes flushed a little with green.

Group of *Pleurobema bulbosum*.

Shell elongate oval, solid, inflated, with a high posterior ridge, ending in a point behind, above which it is feebly wrinkled; beaks full, sculpture not seen; epidermis smooth, dark, rayless; hinge strong; pseudocardinals heavy, torn, sometimes a small third one in the left valve; laterals heavy, club-shaped, granulate, two in the left valve and one and a small secondary lateral in the right. Animal unknown.

PLEUROBEMA BULBOSUM (Lea).

Shell irregularly ovate or subelliptical, inequilateral, moderately solid; beaks high and full; posterior ridge high, subangular above, narrowly rounded below, ending in a point on the median line; dorsal slope somewhat truncated and wrinkled; surface with irregular growth lines; epidermis black, subshining; pseudocardinals small, rough, two in the left valve and one to three in the right; laterals two in the left valve and a decidedly double one in the right; beak cavities shallow; muscle scars small; nacre whitish, purplish or salmon-colored.

Length 47, height, 31, diam. 20 mm.

Length 45, height 29, diam. 20 mm.

Ocmulgee and Flint rivers, Georgia.

Type locality, Flint River, Macon, Ga.

Unio bulbosus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 172; Jl. Ac. N. Sci. Phila., IV, 1859, p. 191, pl. XXI, fig. 75; Obs., VII, 1859, p. 9, pl. XXI, fig. 75.

Margaron (Unio) bulbosus LEA, Syn., 1870, p. 40.

Pleurobema bulbosa SIMPSON, Syn., 1900, p. 759.

This group is quite different from any other of the genus *Pleurobema* and I am not positive as to its relationships, though the general form, small muscle scars and double lateral of the right valve incline me to place it here. The truncation of the post-dorsal slope, and its wrinkles, together with the black epidermis are peculiar characters.

PLEUROBEMA HARPERI (B. H. WRIGHT).

Shell oval, subinflated, subsolid, inequilateral; beaks full and high; posterior ridge angled above, double below, ending in a biangulation at and below the median line; anterior end some-

what squarely truncated; base line slightly curved, outline of dorsal slope curved; surface irregularly, concentrically striate; epidermis black, strongly, concentrically wrinkled around the border of the shell, nearly smooth and shining below the umbonal region; pseudocardinals two in the left valve and three in the right; laterals straight, two in the left valve and one in the right; beak cavities shallow; muscle scars small; nacre reddish flesh-color.

Length 50, height 30, diam. 20 mm.

Type locality, Altamaha and Flint rivers, Georgia; Suwanee River, Florida.

Unio harperi B. H. WRIGHT, Naut., XIII, 1899, p. 6.

Pleurobema harperi SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 81, pl. I, fig. 10; Syn. 1900, p. 759.

I strongly suspect that this is a mere form of *P. bulbosum*, but I have only seen a very limited amount of material and cannot be certain. This differs from that species, so far as the material I have seen indicates, in being squarely truncate in front, in being more wedge-shaped when viewed from above, in having the lateral of the left valve single, and the epidermis around the border of the shell more rough. But specimens of *bulbosum* differ so much that these characters may be only individual.

PLEUROBEMA RECLUSUM (B. H. Wright).

Shell irregularly ovate, inequilateral, subinflated, rather solid; beaks moderately full and high; their sculpture apparently a few strong, irregular ridges that curve up behind; posterior ridge strong, subangular, ending below the median line in a point; base line rounded; anterior end subtruncated; outline of the dorsal slope curved; surface nearly smooth; dorsal area with a few plications; epidermis greenish-brown, smooth and shining; left valve with two ragged pseudocardinals and two laterals; right valve with one pseudocardinal and a double lateral; beak cavities shallow; muscle scars small, impressed; nacre brilliant silvery, bluish-tinted, iridescent and thinner behind.

Length 40, height 25, diam. 17 mm.

Type locality, Ochlocknee River, Leon County, Florida.

Unio reclusus B. H. WRIGHT, Naut., XI, 1898, p. 3.

Pleurobema reclusa SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 82, pl. I, fig. 2; Syn., 1900, p. 760.

Close to *bulbosum*. It is not so inflated as that species, its beaks are not so full, the dorsal slope is more plicate, the epidermis is greener, and the nacre is different.

Group of *Pleurobema brumbyanum*.

Shell oval, inflated, moderately solid, faintly swollen at post-basal region; beaks rather prominent, somewhat distant from the anterior end; beak sculpture not seen; disks irregularly, concentrically sculptured; epidermis dark olive to blackish, striate; pseudocardinals subradiate, slightly compressed; lateral of the right valve nearly or quite single; beak cavities shallow; nacre iridescent posteriorly, somewhat thickened in front.

PLEUROBEMA BRUMBYANUM (Lea).

Shell almost evenly elliptical, subinflated to inflated, sub-solid, inequilateral; beaks somewhat elevated and inflated; posterior ridge well developed, narrowly rounded or subangular, ending behind in a blunt point at the median line; anterior end rounded; base line curved, sometimes a little fuller just behind the middle; outline of dorsal slope curved, elevated at the hinder end of the ligament almost into an angle; surface unevenly and somewhat feebly concentrically sculptured, the sculpture strongest on the dorsal slope; epidermis greenish-brown to blackish, rather smooth, subshining; pseudocardinals slightly subcompressed, two in the left valve and one in the right; two delicate laterals in the left valve and one in the right; muscle scars rather shallow; beak cavities not deep; nacre whitish, a little thicker in front.

Length 52, height 34, diam. 22 mm.

Length 47, height 30, diam. 22 mm.

Alabama River system.

Type locality, Warrior River, Tuscaloosa, Ala.

Unio brumleyanus LEA, Proc. Am. Phil. Soc., II, 1841, p. 82.

Unio brumbyanus LEA, Tr. Am. Phil. Soc., VIII, 1842, p. 245, pl. XXVI, fig. 62; Obs., III, 1842, p. 83, pl. XXVI, fig. 62.

Margaron (Unio) brumbyanus LEA, Syn., 1852, p. 31; 1870, p. 49.

Pleurobema brumbyana SIMPSON, Syn., 1900, p. 760.

Unio concolor LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 40; Jl. Ac. N. Sci. Phila., V, 1862, p. 89, pl. XII, fig. 237; Obs., VIII, 1862, p. 93, pl. XII, fig. 237.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIII, fig. 440.

Margaron (Unio) concolor LEA, Syn., 1870, p. 49.

Less inflated, thinner, smoother and more strongly concentrically sculptured than *P. pinkstoni*. I have given above the measurements of the types of Lea's *Unio concolor* and *brumbyanus*. The latter is a little smaller, a little more inflated and a trifle darker than *concolor*, but I believe they are both one species.

PLEUROBEMA PINKSTONI (S. H. Wright).

Shell almost regularly oval, inflated, subsolid, somewhat inequilateral; beaks full, only moderately elevated; posterior ridge rather low, rounded, the disk in front being much more inflated; surface with irregular growth lines; epidermis dark brownish or blackish, irregularly, concentrically wrinkled, often showing the rest marks, dull; left valve with two triangular, radial pseudocardinals and two delicate, slightly curved laterals; right valve with one pseudocardinal, sometimes with vestigial ones, and one lateral; muscle scars impressed; beak cavities not deep; nacre bluish-white, thicker in front, iridescent behind.

Length 58, height 35, diam. 30 mm.

Alabama River system.

Type locality, Tallapoosa River (not Tuscaloosa), Macon Co., Ala.

Unio pinkstoni S. H. WRIGHT, Nautilus, X, 1897, p. 136.

Pleurobema pinkstoni SIMPSON, Pr. Ac. N. Sci. Phila., p. 81, pl. I, fig. 8; Syn., 1900, p. 758.

Since writing the Synopsis I have seen additional material of this species and am inclined to place it near *P. brumbyanum* rather than in the *troscelianum* group. In fact it is close to

that species, but has a duller, more brownish epidermis, which sometimes shows the rest periods quite plainly. It is also more inflated and a little solidier than that shell.

Group of *Pleurobema argenteum*.

Shell solid, oval to rhomboid, generally compressed, with high but not inflated beaks, well removed from the anterior end, which have strong, irregular sculpture, curved up and swollen behind where the bars are slightly looped; epidermis brownish to straw-color, sometimes having a few broken, blotched rays; teeth strong; cicatrices deep and distinct. Animal unknown.

PLEUROBEMA SIMULANS (Lea).

Shell somewhat rhomboid, subcompressed, inequilateral, sub-solid; beaks moderately full and high; posterior ridge well developed, narrowly rounded, ending in a blunt point near the base of the shell; anterior end rounded; base line lightly curved; outline of the dorsal slope curved and raised into an angle behind the ligament, surface rather smooth; epidermis brownish-green or greenish-brown, sometimes faintly rayed or clouded with yellow; left valve with two triangular pseudo-cardinals and two curved laterals; right valve with one pseudo-cardinal and vestiges of one or two others, with one double lateral; beak cavities not deep; muscle scars small; nacre bluish-white, thinner and very iridescent behind.

Length 40, height 25, diam. 15 mm.

Black Warrior and Cahawba rivers, Alabama; Pine Barren Creek, Escambia County, Florida.

Type locality, Cahawba River, Shelby Co., Ala.

Unio simulans LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 190; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 18, pl. v, fig. 15; Obs., XIII, 1874, p. 22, pl. v, fig. 15.

Pleurobema simulans SIMPSON, Syn., 1900, p. 760.

This species is close to *P. patsaligense*, but is more elongated, is darker colored and has a rather higher posterior ridge. Some specimens appear almost black. It is much shorter than *P. strodeanum*, and is not black like that species.

PLEUROBEMA UTRICULUM (Lea).

Shell almost elliptical, subinflated or convex, inequilateral, rather solid; beaks full and high; anterior end narrowed and rounded; base line curved; posterior end obliquely subtruncated; posterior ridge full, rounded, ending near the base in a feeble biangulation; epidermis greenish-brown, showing faint, dark rest marks; pseudocardinals small, triangular, two in the left valve and one in the right; laterals two in the left valve and one in the right; beak cavities shallow; nacre bluish-white, thinner and iridescent behind.

Length 43, height 30, diam. 19 mm.

Type locality, North Carolina.

Unio utriculus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164; Tr. Am. Phil. Soc., X, 1848, p. 69, pl. 1, fig. 3; Obs., IV, 1848, p. 43, pl. 1, fig. 3.

Margaron (Unio) utriculus LEA, Syn., 1870, p. 46.

Quadrula utriculus SIMPSON, Syn., 1900, p. 785.

In the Synopsis I placed this species in *Quadrula* with a question. I am inclined on giving it additional study to place it in *Pleurobema* near *simulans*. Its beak cavities are shallow; the pseudocardinals are small and not split up. Lea has two shells placed with the type of *utriculus*, said to come from Arkansas, which do not seem to me to be that at all, but are probably undescribed. They are so badly worn that I do not think it advisable to give diagnosis of them.

PLEUROBEMA STRODEANUM (B. H. Wright).

Shell irregularly short elliptical, subcompressed, scarcely subsolid, slightly inequilateral; beaks moderately full and high; posterior ridge well developed, subangulate, ending in a point below the median line; anterior end round; base line rounded; outline of dorsal slope almost evenly curved; epidermis closely, concentrically striate, cloth-like on the border, shining at the umbonal region, nearly jet black; left valve with two pseudocardinals and two nearly straight laterals; right valve with one pseudocardinal and a double lateral; beak cavities not deep

muscle scars small, shallow; nacre bluish-white, thinner and iridescent behind.

Length 37, height 28, diam. 16 mm.

Type locality, Escambia River, Florida. Also, Flint River, Rhoadsville, Georgia.

Unio strodeanus B. H. WRIGHT, Naut., XII, 1898, p. 5.

Pleurobema strodeana SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 81, pl. I, fig. 3; Syn., 1900, p. 761.

The type, whose dimensions are given above, may be a young shell. Its short, nearly elliptical form and black epidermis together with the almost blue nacre distinguish it from allied species.

PLEUROBEMA PATSALIGENSE Simpson.

Shell nearly elliptical or subrhomboid, convex or subinflated, scarcely subsolid, inequilateral; beaks moderately full and high; posterior ridge subangular or narrowly rounded, ending in a point or slight biangulation below the median line; surface finely and unevenly concentrically sculptured; epidermis tawny-green flushed with brown at the umbonal region and generally faintly rayed, rather dull and cloth-like, sometimes slightly blistered; pseudocardinals two in the left valve and one to three in the right; left valve with two laterals; right valve with one; beak cavities not deep; muscle scars small; nacre dirty whitish, sometimes tinted purple and blotched.

Length 45, height 33, diam. 18 mm.

Length 43, height 25, diam. 17 mm.

Type locality, Little Patsaliga Creek, Crenshaw Co., Alabama.

Pleurobema patsaligensis SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 82, pl. II, fig. 1; Syn., 1900, p. 761.

Thinner and generally shorter than *P. simulans*, usually lighter colored and having duller nacre.

PLEUROBEMA STRIATULUM (Lea).

Shell short, subrhomboid, subsolid or solid, convex or subinflated, slightly inequilateral; base somewhat rounded; beaks full and high, their sculpture consisting of ridges which are

curved up behind; posterior ridge high, angled, ending behind in a point near the base; dorsal slope obliquely truncated, meeting the dorsal line at an angle; epidermis greenish-brown; left valve with two low, rough, rather solid pseudocardinals and two short, straight laterals; right valve with one pseudocardinal and one lateral, the latter inclined to be double; muscle scars small, shallow; beak cavities compressed; nacre whitish, iridescent behind.

Length 40, height 28, diam. 17 mm.

Type locality, Roanoke River, Weldon; also Salem, North Carolina.

Unio striatulus LEA, Pr. Acad. N. Sci. Phila., I, 1857, p. 86; Jl. Acad. N. Sci. Phila., V, 1862, p. 55, pl. II, fig. 202; Obs., VIII, 1862, p. 59, pl. II, fig. 202.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXII, fig. 367.—SIMPSON, Syn., 1900, p. 719.
Margaron (Unio) striatulus LEA, Syn., 1870, p. 37.

Conchologically this and a few other apparently related species seem closely allied to the *Unio argenteus* of Lea, and I am now inclined to place them in that assemblage notwithstanding the fact that they are found in the Atlantic drainage. The beak sculpture of these forms, so far as I can ascertain, is rather strong ridges which turn up sharply behind and this style of sculpture is more characteristic of *Pleurobema* than of *Unio*. Their peculiar distribution is no more remarkable than that of *Lampsilis constricta*, which is found in both the Atlantic and Tennessee areas.

PLEUROBEMA FAVOSUM (Lea).

Shell subrhomboid, subcompressed or convex, subsolid, inequilateral; beaks rather full and high, their sculpture a few irregular corrugations; posterior ridge narrowly rounded, ending in a blunt point near the base of the shell; anterior end rounded; base evenly curved; dorsal line nearly straight, meeting the obliquely truncated posterior slope with an angle; surface delicately, concentrically striate; epidermis yellowish-green or brownish, generally with a broad, ill-defined, broken ray in front of the posterior ridge; pseudocardinals two in the

left valve and one in the right; left valve with two laterals; right valve with a somewhat double one; beak cavities not deep; muscle scars small, shallow; nacre whitish, thinner and iridescent behind.

Length 50, height 33, diam. 18 mm.

Alabama River system.

Type locality, Othcalooga Creek, Gordon Co., Ga.

Unio favosus LEA, Proc. Ac. N. Sci. Phila., VIII, 1856, p. 262; Jl. Ac. N. Sci. Phila., IV, 1858, p. 58, pl. VIII, fig. 40; Obs., VI, p. 58, pl. VIII, fig. 40.—SOWERBY, Conch. Icon., XVI, 1868, pl. xc, fig. 488.

Margaron (Unio) favosus LEA, Syn., 1870, p. 38.

Pleurobema favosa SIMPSON, Syn., 1900, p. 761.

The shell approaches that of several species, *simulans*, *argenteum*, *amabile* and *patsaligense*, etc. It is larger and lighter colored than *simulans*, smaller, brighter colored and more curved on the base than *argenteum*, larger, more compressed, and greener than *amabile*, thinner and more rounded below than *pyriforme*, more elongated than *patsaligense* and does not have fine rays. It must be confessed that many of the forms I have placed in this group are close and puzzling, that a good many specimens are found that cannot be referred with certainty to anything. The types of all these species are distinct enough and I have not felt that the material I have seen would justify me in uniting them. The base is sometimes swollen just behind the middle.

PLEUROBEMA LENTICULARE (Lea).

Shell between subtriangular and subrhomboid, subcompressed, rather solid, somewhat inequilateral; beaks apparently not very full or high; posterior ridge rather low, slightly double, ending below the median line in a biangulation; anterior end faintly and obliquely truncate above, rounded below; base line lightly curved; outline of dorsal slope curved; epidermis closely, concentrically wrinkled, brownish, showing feeble rest marks; left valve with two triangular pseudocardinals and two curved laterals; right valve with three pseudocardinals,

the anterior and posterior ones feeble, and a double lateral; beak cavities shallow; muscle scars small, impressed; nacre lurid purple; iridescent and thinner behind.

Length 44, height 33, diam. 16 mm.

Type locality, Tellico River, Monroe County, Tennessee. Also, East Tennessee.

Unio lenticularis LEA, Pr. Acad. N. Sci. Phila., II, 1872, p. 155; Jl. Acad. N. Sci. Phila., VIII, 1874, p. 30, pl. IX, fig. 27; Obs., XIII, 1874, p. 34, pl. IX, fig. 27.—SIMPSON, Syn., 1900, p. 761.

A very rare species. A small shell, which Lea has placed with this, is, I think, a *P. barnesianum*, and another is possibly a *P. meredithii* in bad condition. The species is close to the latter and may merge into it. The type is rather dark brown, and the nacre is a peculiar lurid purple tint.

PLEUROBEMA MEREDITHII (Lea).

Shell subovate or subrhomboid, lenticular, subsolid, inequilateral; beaks little elevated or inflated; posterior ridge well developed, inclined to be narrowly double, ending below the median line in a feeble biangulation; anterior end round; base line curved; outline of dorsal slope curved, elevated just behind the ligament; surface with irregular, concentric sculpture; epidermis finely, concentrically wrinkled, greenish-yellow or brownish, dull; left valve with two pseudocardinals and two curved laterals; right valve with one to three pseudocardinals and a double lateral; beak cavities not deep; muscle scars small, impressed; nacre silvery white or flesh-colored.

Length 45, height 36, diam. 18 mm.

Tennessee River system; Black Warrior River, Alabama.

Type locality, Tennessee River, Tuscumbia, Ala.

Unio meredithii LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 40; Jl. Ac. N. Sci. Phila., V, 1862, p. 65, pl. VI, fig. 214; Obs., VIII, 1862, p. 69, pl. VI, fig. 214.

Margaron (Unio) meredithii LEA, Syn., 1870, p. 35.

Pleurobema meredithii SIMPSON, Syn., 1900, p. 761.

The shell is lighter colored than *P. lenticulare*, it is wider and more rounded anteriorly and is much lighter colored within and without, but it is quite likely only a variety of that species.

PLEUROBEMA LITUM (Lea).

Shell subrhomboid, convex, subsolid, somewhat inequilateral; beaks only moderately developed; posterior ridge rather strong, narrowly rounded, ending in a blunt point near the base of the shell; anterior end rounded; base curved; posterior end obliquely truncated; surface with irregular growth lines; epidermis straw-color to tawny, finely, concentrically wrinkled, shining, showing the dark rest marks; pseudocardinals two in the left valve and one and an anterior rudimentary one in the right; two laterals in the left valve and one in the right; beak cavities shallow; muscle scars small, not deep; nacre brilliant salmon or reddish, iridescent and thinner behind.

Length 41, height 26, diam. 15 mm.

Cahawba and Black Warrior rivers, Alabama.

Type locality, Cahawba River, Shelby Co., Ala.

Unio litus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 189; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 17, pl. v, fig. 13; Obs., XIII, 1874, p. 21, pl. v, fig. 13.

Pleurobema lita SIMPSON, Syn., 1900, p. 761.

I am not positive as to where this form should be placed. There are only two shells in the Lea collection, the larger, of which I have given measurements, may be adult, the other is a young shell. The rich, bright epidermis with its dark rest marks and the brilliant nacre are good characters.

PLEUROBEMA GEORGIANUM (Lea).

Shell subrhomboid, slightly obovate, being narrower at the anterior end, convex, subsolid, somewhat inequilateral; beaks apparently not very full or high; posterior ridge narrowly rounded, ending below the median line in a blunt point; anterior end rounded; base line curved; posterior end obliquely subtruncate, joining the dorsal line with an angle; epidermis

dull, dirty tawny with a tint of green, showing faint rest marks; pseudocardinals triangular, nearly smooth, two in the left valve and one in the right; laterals two in the left valve and a double one in the right; muscle scars shallow; beak cavities not impressed; nacre pale dirty violet, thinner behind.

Length 40, height 28, diam. 16 mm.

Type locality, Stump Creek, northwest Georgia.

Unio georgianus LEA, Pr. Am. Phil. Soc., II, 1841, p. 31; Tr. Am. Phil. Soc., VIII, 1842, p. 235 pl. XXI, fig. 49; Obs., III, 1842, p. 73, pl. XXI, fig. 49.—CHENU, Ill. Conch., 1858, pl. XXXII, figs. 3, 3a, 3b.

Margaron (Unio) georgianus LEA, Syn., 1852, p. 27; 1870, p. 42.

Pleurobema georgiana SIMPSON, Syn., 1900, p. 761.

I am uncertain as to the position of this species. I have seen only the type, which is broken and in rather bad condition. It is a remarkably lenticular form, with a dull, dirty brownish or greenish-tawny epidermis.

PLEUROBEMA PYRIFORME (Lea).

Shell subelliptical or subrhomboid, subcompressed, solid, inequilateral; beaks apparently neither full nor high; posterior ridge narrowly double, ending above the base line in a bifurcation; anterior end rounded; basal and dorsal outlines curved, the former least so; the outline of the dorsal slope is sometimes elevated almost into an angle at or behind the ligament; surface finely, concentrically striate; epidermis tawny or tawny-brown, often shaded or clouded with green; more or less shining, polished at the umbonal region; hinge rather strong; pseudocardinals two in the left valve and one to three in the right; laterals two in the left valve and one in the right; beak cavities shallow; muscle scars small, not deep; nacre salmon, thinner behind.

Length 54, height 33, diam. 17 mm.

Length 52, height 29, diam. 16 mm.

Type locality, near Columbus, Georgia.

Unio pyriformis LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 31; Jl. Ac. N. Sci. Phila., IV, 1858, p. 69, pl. XII, fig. 50; Obs., VI, p. 69, pl. XII, fig. 50.

Margaron (Unio) pyriformis LEA, Syn., 1870, p. 40.

Pleurobema pyriformis SIMPSON, Syn., 1900, p. 762.

Close to *P. argenteum*, but smaller, more nearly elliptical, with a brighter epidermis and salmon nacre.

PLEUROBEMA AMABILE (Lea).

Shell rather small, subovate, convex, solid, inequilateral; anterior end rounded, base curved; posterior slope obliquely subtruncate; posterior ridge high, narrowly rounded, ending behind in a point just below the median line; beaks high and full, their sculpture a series of strong ridges, running nearly parallel with the growth lines, but heavier and suddenly turned up behind; epidermis almost smooth, tawny or tawny-brownish, subshining, sometimes very feebly rayed; left valve with two solid, subcompressed, rough pseudocardinals and two short laterals; right valve with one pseudocardinal and a vestigial tooth in front of and behind it, and one somewhat double lateral; beak cavities shallow but compressed; muscle scars small; nacre whitish or straw-colored, iridescent and thinner behind.

Length 37, height 25, diam. 16 mm.

Type locality, Butler, Taylor County, Georgia.

Unio amabilis LEA, Pr. Ac. N. Sci. Phila., IX, 1865, p. 89; Jl. Ac. N. Sci. Phila., VI, 1869, p. 257, pl. XXXI, fig. 72; Obs., XII, 1869, p. 17, pl. XXXI, fig. 72.—SIMPSON, Syn., 1900, p. 720.

Margaron (Unio) amabilis LEA, Syn., 1870, p. 37.

Apparently close to the *Unio pyriformis* of Lea and it may connect with that species. Judging from the type, it is shorter, smoother and lighter colored than that species and has a somewhat higher posterior ridge.

PLEUROBEMA MODICUM (Lea).

Shell small, subrhomboid, inequilateral, convex to subinflated, subsolid; beaks full and high, sculptured with a few strong ridges; posterior ridge rather full, but not distinctly biangulate.

ending in a blunt point at the base of the shell; anterior end rounded; base line nearly straight; outline of posterior slope obliquely truncated; surface nearly smooth; epidermis brownish-green when young, dirty reddish-brown when old, dull colored; left valve with two pseudocardinals and two curved laterals; right with one pseudocardinal and one, usually double, lateral; muscle scars shallow; beak cavities not deep; nacre flesh-colored or purplish, thicker in front.

Length 38, height 22, diam. 17 mm.

Chattahoochee River, Georgia.

Type locality, Columbus, Ga.

Unio modicus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 171; Jl. Ac. N. Sci. Phila., IV, 1859, p. 204, pl. XXIV, fig. 86; Obs., VII, 1860, p. 22, pl. XXIV, fig. 86.

Margaron (Unio) modicus LEA, Syn., 1870, p. 40.

Pleurobema modica SIMPSON, Syn., 1900, p. 762.

Smaller than *P. gibberum*, more inflated and having a less distinctly biangulate posterior ridge. It is duller colored within and without.

PLEUROBEMA STRIATUM (Lea).

Shell small, subrhomboid, subcompressed or compressed, scarcely subsolid, inequilateral; beaks only moderately full and high, their sculpture a few strong irregular ridges; posterior ridge rounded or feebly biangulate, ending below the median line; anterior end rounded; base line curved; outline of dorsal slope curved, sometimes angular behind the ligament; epidermis decidedly, concentrically wrinkled, dirty greenish or brownish, somewhat cloth-like; left valve with two pseudocardinals and two laterals; right valve with one pseudocardinal and a double lateral; beak cavities and muscle scars shallow; nacre dirty purplish, iridescent behind.

Length 36, height 23, diam. 13 mm.

Chattahoochee River, Georgia.

Type locality, Columbus, Ga.

Unio striatus LEA, Pr. Am. Phil. Soc., I, 1840, p. 287; Tr. Am. Phil. Soc., VIII, 1843, p. 203, pl. XII, fig. 16; Obs., III, 1842, p. 41, pl. XII, fig. 16.—CHENU, Ill. Conch., 1858, pl. XXIX, figs. 1, 1a, 1b.

Margaron (Unio) striatus LEA, Syn., 1852, p. 26; 1870, p. 40.
Pleurobema striata SIMPSON, Syn., 1900, p. 762.

A small, rather thin, compressed species, having the dull epidermis decidedly, concentrically wrinkled, so that the un-rubbed shell is cloth-like. There is a good deal of variation in the development of the posterior ridge.

PLEUROBEMA GIBBERUM (Lea).

Shell subrhomboid, convex, rather solid, inequilateral; beaks moderately elevated and full; posterior ridge double, ending at the base of the shell; anterior end a little narrowed, rounded; base line nearly or quite straight; outline of dorsal slope lightly curved; surface with delicate, uneven, concentric sculpture; epidermis reddish-brown, subshining; left valve with two pseudocardinals and two laterals; right valve with three pseudocardinals and one lateral; muscle scars not deep; beak cavities shallow; nacre bronzy or coppery-purple, thin and iridescent behind.

Length 45, height 26, diam. 14 mm.

Type locality, Caney Fork River, Tennessee.

Unio gibber LEA, Tr. Am. Phil. Soc., VI, 1838, p. 34, pl. x, fig. 30; Obs., II, 1838, p. 35, pl. x, fig. 30.—HANLEY, Biv. Shells, 1843, p. 185, pl. XXI, fig. 46.—CHENU, Ill. Conch., 1858, pl. XXIII, figs. 2, 2a, 2b.—SOWERBY, Conch. Icon., XVI, 1866, pl. XL, fig. 219.

Margarita (Unio) gibber LEA, Syn., 1836, p. 20; 1838, p. 17.

Margaron (Unio) gibber LEA, Syn., 1852, p. 24; 1870, p. 37.

Pleurobema gibber SIMPSON, Syn., 1900, p. 762.

Close to *pyriforme* and *modicum*. Smaller and more triangular in outline than the former; larger, less inflated and having a more distinctly biangulate posterior ridge than the latter.

PLEUROBEMA RAVENELIANUM (Lea).

Shell subovate or subrhomboid, subinflated, inequilateral, solid; anterior end rounded; base lightly curved or straight; post-dorsal line curved or obliquely subtruncated; beaks full, moderately high; posterior ridge well developed, rounded,

rarely slightly biangulate, ending near the base of the shell in a blunt point or feeble biangulation; epidermis concentrically wrinkled, dull, greenish-brown, or yellowish-brown, rayless or with faint, broken rays; pseudocardinals low, stumpy, two in the left valve and one with vestiges of two others in the right; laterals two in the left valve and a somewhat double one in the right; beak cavities shallow; muscle scars small, deep; nacre white or lurid whitish.

Length of type 37, height 24, diam. 16 mm.

Length 52, height 35, diam. 21 mm.

Length 50, height 36, diam. 25 mm.

Kentucky; Tennessee; western North Carolina.

Type locality, French Broad River, Asheville, N. C.

Unio ravenelianus LEA, Tr. Am. Phil. Soc., V, 1834, p. 32, pl. III, fig. 5; Obs., I, 1834, p. 144, pl. III, fig. 5.—HANLEY, Biv. Shells, 1843, p. 187, pl. XX, fig. 59.—KUSTER, Conch. Cab. Unio, 1862, p. 269, pl. XCI, fig. 1.—REEVE, Conch. Icon., XVI, 1864, pl. XVI, fig. 70.

Margarita (Unio) ravenelianus LEA, Syn., 1836, p. 22; 1838, p. 18.

Margaron (Unio) ravenelianus LEA, Syn., 1852, p. 26; 1870, p. 40.

Pleurobema raveneliana SIMPSON, Syn., 1900, p. 748.

Unio decisus KUSTER, (part) Conch. Cab. Unio, 1852, p. 41, pl. VIII, fig. 1.

I placed this in the group of *Pleurobema clava* in the Synopsis with considerable doubt. It is an aberrant form having some of the characters of the *argenteum* group, but is quite solid and inflated for that assemblage. I now place it near *P. modica* with some hesitation. It is larger and rather more inflated than that species and is considerably solidier and much more inflated than *P. pyriforme*.

PLEUROBEMA FASSINANS (Lea).

Shell subelliptical or subrhomboid, convex, rather solid, inequilateral; beaks high but not full; posterior ridge well developed, inclined to be double, ending in a feeble biangulation below the median line; anterior end rounded; base line well

curved; outline of dorsal slope curved, elevated to a low angle behind the ligament; surface rudely, concentrically striate; epidermis concentrically wrinkled, reddish-brown, not shining; left valve with two pseudocardinals and two laterals; right valve with two pseudocardinals and a double lateral; muscle scars impressed; beak cavities not deep; nacre lurid flesh-color, shining, thinner behind.

Length 60, height 40, diam. 22 mm.

Upper Tennessee River drainage.

Type locality, Headwaters of the Holston River, Washington Co., Va.

Unio fassinans LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 143; Jl. Ac. N. Sci. Phila., VI, 1869, p. 305, pl. XLVII, fig. 118; Obs., XII, p. 65, pl. XLVII, fig. 118.

Margaron (Unio) fassinans LEA, Syn., 1870, p. 42.

Pleurobema fassinans SIMPSON, Syn., 1900, p. 762.

Close to several forms of this puzzling group. It is more evenly elliptical than *argenteum* and has a darker epidermis.

Var. *rhomboideum* Simpson.

Shell considerably more rhomboid than the type.

Type locality, Upper waters of the Clinch River, Virginia.

Pleurobema fassinans var. *rhomboidea* SIMPSON, Syn., 1900, p. 762.

A form occurs in this region, which has most of the characters of *fassinans*, but is more rhomboid. It may be a distinct species but I do not feel like adding another specific name to this terribly difficult group without the very best of reasons.

PLEUROBEMA ARGENTEUM (Lea).

Shell subrhomboid or subovate, compressed or subcompressed, rather solid, inequilateral; beaks not very full or high; posterior ridge single or double, ending in a point or biangulation near the base line; anterior end rounded; base line curved; outline of dorsal slope raised to an angle behind the ligament, the posterior end being obliquely truncated; surface with fine, uneven, concentric sculpture; epidermis dull green-

ish, dull brownish or somewhat tawny, often showing rest marks, not shining; pseudocardinals low, ragged, two in the left valve and one to three in the right; laterals two in the left valve and one in the right; muscle scars impressed; beak cavities not deep; nacre whitish, often silvery, thinner and iridescent behind.

Length 63, height 39, diam. 20 mm.

Upper Tennessee River drainage.

Type locality, Holston River, Tenn.

Unio argenteus LEA, Pr. Am. Phil. Soc., II, 1841, p. 82; Tr. Am. Phil. Soc., VIII, 1843, p. 242, pl. xxv, fig. 57; Obs., III, 1842, p. 80, pl. xxv, fig. 57.—CHENU, III, Conch., 1858, pl. xxxiii, figs. 2, 2a, 2b.—KUSTER, Conch. Cab. Unio, 1861, p. 188, pl. lix, fig. 4; 1861, p. 225, pl. lxxvi, fig. 3.—SOWERBY, Conch. Icon., XVI, 1868, pl. xxxvii, fig. 204.

Margaron (Unio) argenteus LEA, Syn., 1852, p. 26; 1870, p. 40.

Pleurobema argentea SIMPSON, Syn., 1900, p. 763.

The type differs somewhat from any shells I have seen, being more ovate in outline and having a smoother, greener epidermis than other shells, which Dr. Lea refers to the species. The shell is larger than *pyriforme* and lacks the almost coppery luster of that form. It is not so rhomboid as *planius* or *estabrookianum* and lacks the strong, concentric sulcations that characterize them. It is near to *breve* and I am not sure but what some of the material referred to *argenteum* should be placed in that species. The former has a higher posterior ridge and is more distinctly rhomboid.

Var. *pannosum* Simpson.

Shell more rude and solid than the type, the surface being roughly concentrically sculptured; epidermis coarse, brownish or tawny-brown, dull colored; nacre thick in front, suddenly becoming thinner.

Length 75, height 47, diam. 26 mm.

Type locality, Hot Springs, Arkansas.

Pleurobema argentea pannosa SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 82; Syn., 1900, p. 763.

This may be a distinct species, but I do not feel like separating it on the limited amount of material I have seen. The surface is quite dull and rude; the anterior basal part of the nacre is quite solid, becoming suddenly thinner at the cavity of the shell.

PLEUROBEMA CONASAUGÆNSE (Lea).

Shell long rhomboid, solid, subinflated, inequilateral; beaks moderately full and high; posterior ridge well developed, somewhat double, ending behind in a biangulation near the base of the shell; anterior end rounded; base line nearly straight; posterior end obliquely truncated above; the truncation joining the slightly curved dorsal line at an angle; surface with irregular growth lines; epidermis dark tawny or brownish, concentrically wrinkled, almost cloth-like; left valve with two triangular pseudocardinals and two short, curved laterals; right valve with one pseudocardinal and two rudimentary ones, with a double lateral; beak cavities not deep; muscle scars well impressed; nacre soiled whitish.

Length 65, height 40, diam. 26 mm.

Upper Tennessee River drainage.

Type locality, Conasauga Creek, Monroe Co., Tenn.

Unio conasaugænsis LEA, Pr. Ac. N. Sci. Phila., II, 1872, p.

155; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 33, pl. x, fig. 30;

Obs., XIII, 1874, p. 37, pl. x, fig. 30.

Pleurobema conasaugænsis SIMPSON, Syn., 1900, p. 763.

A subinflated, rather solid species, which is close to *P. breve*. It is a little more inflated, heavier and more elongated than that species. The form from Hardy, Arkansas, which I called variety *subelliptica* of *breve* might as well be considered a variety of *conasaugænsis* as specimens seem to almost connect the two.

PLEUROBEMA BREVE (Lea).

Shell rhomboid or somewhat subtriangular, compressed or subcompressed, rather solid, somewhat inequilateral; beaks apparently only moderately full or high; posterior ridge strong, narrowly and feebly double, ending in a biangulation at the

base of the shell; anterior end somewhat slopingly truncate above, rounded below; dorsal slope obliquely truncate, angled at the hinder end of the ligament; base line nearly straight; epidermis tawny, sometimes showing rest marks, concentrically wrinkled and dull, rarely faintly rayed; pseudocardinals two in the left valve, one to three in the right; left valve with two laterals; right valve with a somewhat double one; beak cavities not deep; muscle scars small, slightly impressed; nacre whitish or purplish tinted, thinner behind.

Length 50, height 35, diam. 18 mm.

Tennessee River system.

Type locality, Conasauga Creek, Monroe Co., Tenn.

Unio brevis LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 157; JI. Ac. N. Sci. Phila., VIII, 1874, p. 35, pl. XII, fig. 32; Obs., XIII, 1874, p. 39, pl. XII, fig. 32.

Pleurobema brevis SIMPSON, Syn., 1900, p. 763.

This has a higher posterior ridge than *P. argenteum*, and the shell is usually most inflated along that line, being often wedge-shaped in front, when viewed from above. But there are intermediates that cannot be placed with certainty in either species.

Var. *subellipticum* Simpson.

Shell larger and more elongated and inflated than the type; posterior ridge decidedly double.

Type locality, Hardy, Arkansas.

Pleurobema brevis subelliptica SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 80.

Pleurobema brevis var. *subilliptica* SIMPSON, Syn., 1900, p. 763.

This may be a valid species, but there are specimens, which seem to be intermediate between the two. By a typographical error this name was spelled *subilliptica* in the Synopsis.

PLEUROBEMA MISSOURIENSE Marsh.

"Shell smooth, obliquely triangular, rounded before, subtriangular behind, moderately thick, very much thicker anteriorly, sides somewhat flattened; beaks wide, solid, incurved;

ligament long, light brown; epidermis light brown, without rays; growth lines numerous, not raised; umbonal slope wide and rather flat; posterior slope wide, flattened, with two dark, inconspicuous lines running from beaks to posterior margin; beak sculpture unknown; cardinal teeth rather long and solid, depressed, disposed to be double in both valves, corrugate; lateral teeth straight, oblique, corrugate; anterior cicatrices distinct, deep; posterior cicatrices distinct and well impressed; shell cavity wide and deep; nacre white." (Marsh).

(Dimensions not given.)

Type locality, Black River, Poplar Bluff, Butler Co., Mo.

Pleurobema missouriensis MARSH, Naut., XV, 1901, p. 74.

"I know of no described species, which this closely resembles; in outline it is perhaps nearest to *U. bigbyensis* Lea, but differs in every other respect. Specimens of *bigbyensis* from Flint River, Ala., attain twice the size of this shell. *Bigbyensis* is nearly always covered with green rays. This shell is rayless. It also has higher and more massive beaks, is more equilateral and differs entirely in the color of epidermis, teeth, etc. The color of the epidermis and the character of the beaks is more like *U. hartmanianus* Lea, but that shell has very much higher beaks, more swollen and pointed, and is in every respect a more solid shell."

PLEUROBEMA PLANIUS (Lea).

Shell decidedly rhomboid, subcompressed, subsolid, inequilateral; beaks apparently not very full or high; posterior ridge double, ending below in a rather wide biangulation at the base of the shell; above the posterior ridge there is a shallow, radial depression; anterior end rounded; base line straight; posterior end obliquely truncated; surface feebly concentrically sculptured; epidermis greenish-yellow, tawny behind, with a few broken green rays, scarcely shining, showing rest marks; left valve with two small pseudocardinals and two laterals; right valve with one pseudocardinal, a rudimentary one in front, and a somewhat double lateral; muscle scars rather shallow; beak

cavities not deep; nacre whitish, purple tinted and iridescent behind.

Length 58, height 38, diam. 19 mm.

Upper Tennessee River drainage.

Type locality, Tennessee; Holston River, Washington Co., Va.

Unio planior LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 145;

Jl. Ac. N. Sci. Phila., VI, 1869, p. 316, pl. L, fig. 129; Obs.,

XII, 1869, p. 76, pl. L, fig. 129.

Margaron (Unio) planior LEA, Syn., 1870, p. 35.

Pleurobema planior SIMPSON, Syn., 1900, p. 763.

The only shell I have seen, which I am certain is this, is the type, which is probably young. Compared with specimens of *estabrookianum* of equal size it is more elongated, straighter on the base, less sulcate and has broken rays. It is less solid and more compressed than *P. breve* or its variety.

PLEUROBEMA ESTABROOKIANUM (Lea).

Shell rather large, subrhomboid, compressed, solid, somewhat inequilateral; beaks compressed but considerably elevated, slightly turned forward over a narrow lunule, their sculpture a few strong, irregular ridges; posterior ridge more or less double, curved, ending near the base in a feeble biangulation; above them there is a light, radial depression; anterior end rounded; base line more or less curved; outline of dorsal slope almost evenly curved in old shells, angular at the middle in young ones; surface strongly, concentrically sculptured; epidermis straw-colored in young shells, tawny or greenish-brown in old ones, showing rest marks; pseudocardinals strong, two in the left valve, two or three in the right; left valve with two laterals; right valve with one, which is sometimes double; muscle scars well impressed; beak cavities shallow; nacre silvery white and thinner behind, thicker and duller colored in front.

Length 78, height 57, diam. 24 mm.

Upper Tennessee River drainage.

Type locality, Clinch River; Second Creek (Knoxville?), Tenn.

Unio estabrookianus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164;
Tr. Am. Phil. Soc., X, 1853, p. 77, pl. VI, fig. 17; Obs., IV,
1848, p. 51, pl. VI, fig. 17.

Margaron (Unio) estabrookianus LEA, Syn., 1852, p. 24; 1870,
p. 35.

Unio estabrookianus PÆTEL, Conch. Sam., III, 1890, p. 152.

Pleurobema estabrookiana SIMPSON, Syn., 1900, p. 763.

Unio striatissimus ANTHONY, Am. Jl. Conch., I, 1865, p. 156,
pl. XII, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl.
LXXXVI, fig. 460.

Strongly concentrically sculptured and not very inequilateral.
The hinge plate is wide and flat; the muscle scars are deeper
than in any of the allied forms.

PLEUROBEMA SUBPLANUM (Conrad).

Shell decidedly rhomboid, compressed or subcompressed,
somewhat inequilateral, rounded in front and slightly cut away
below; base line almost straight; dorsal slope subtruncate;
posterior ridge full, rounded but disposed to be double below,
ending in a narrow, feeble biangulation at the base of the shell;
beaks high, only moderately full, their sculpture a few strong
ridges, which are heavier and turned up decidedly behind;
surface with irregular incremental striæ; epidermis dirty
greenish, sometimes feebly rayed; left valve with two strong,
ragged pseudocardinals and two short, straight laterals; right
valve with one pseudocardinal and one double lateral; beak
cavities not deep, compressed; nacre whitish, thinner and
slightly iridescent behind.

Length 45, height 30, diam. 16 mm.

North Carolina and Virginia.

Type locality, Branch of James River, Lexington, Rock-
bridge Co., Va.

Unio subplanus CONRAD, Monog., IX, 1837, p. 73, pl. XLI, fig.
1.—HANLEY, Biv. Shells Supp., 1856, p. 383, pl. XXI, fig. 16.
—KUSTER, Conch. Cab. Unio, 1862, p. 272, pl. XCI, fig. 5.—
SIMPSON, Syn., 1900, p. 720.

Margaron (Unio) subplanus LEA, Syn., 1852, p. 33; 1870, p.
54.

Unio subplanum SOWERBY, Conch. Icon., XVI, 1866, pl. XLVII, fig. 252.

More rhomboid and compressed than *striatulum*, lighter colored and less decidedly rhomboid than *brimleyi*.

PLEUROBEMA BRIMLEYI (S. H. Wright).

Shell decidedly rhomboid, convex or subinflated, somewhat inequilateral; anterior end rounded but a trifle cut away below; base line straight; dorsal slope obliquely truncate; dorsal line curved a little; beaks rather full, somewhat elevated, their sculpture not seen; posterior ridge full, narrowly rounded; above it, separated by a shallow furrow, is a second slight ridge; epidermis almost cloth-like, rather dull, dark dirty greenish; left valve with two ragged pseudocardinals and two straight laterals; right valve with one pseudocardinal, and a faint tooth above it, with one lateral disposed to be double; beak cavities compressed; muscle scars shallow, small; nacre bluish and bluish-white, much thinner and iridescent behind.

Length 58, height 36, diam. 21 mm.

Type locality, Neuse River. Also Irwin's Creek, North Carolina.

Unio brimleyi S. H. WRIGHT, Naut., X, 1897, p. 138.—SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 80, pl. iv, fig. 6; Syn., 1900, p. 720.

I have seen only the type of this species, which appears to be perfectly distinct. It is a little more elongated than *subplanum*, to which it seems most nearly related, is more decidedly rhomboid, is darker and less compressed.

Section PLETHOBASUS Simpson, 1900.

Plethobasus SIMPSON, Syn., 1900, p. 764.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 259.

Shell large, irregularly oval, inflated, solid, somewhat suddenly swollen at the posterior base; posterior ridge low and rounded; beaks rather high, near the anterior end, having a few strong ridges, which are curved upward behind; a row of low, irregular tubercles extends from near the beaks to the

post-basal part of the valves; epidermis tawny-brown in the younger shell, becoming darker with age; hinge plate solid, not flattened; pseudocardinals triangular, rough; cavity of the beaks not deep; front part of the shell very heavy; hinder part much thinner.

Animal having the mantle somewhat toothed posteriorly; branchial and anal openings large, the latter smooth or with very faint papillæ; inner gills the larger, rounded below, free nearly or quite their whole length from the abdominal sac; marsupium occupying the entire outer gills.

Type, *Unio æsopus* Green.

Ortmann, (l. c.), raises this group to generic rank.

PLEUROBEMA ÆSOPUS (Green).

Shell irregularly oval, inflated, solid, inequilateral; beaks full and high, turned slightly forward over a lunule; their sculpture a few irregular ridges; anterior end rounded; front half of base rounded; at about the middle of the shell a row of irregular knobs runs from the beaks to the base; behind this row of knobs the base line is straight or incurved; outline of the dorsal slope curved; posterior ridge low, rounded, ending in a blunt point about on the median line; surface with uneven, concentric sculpture; epidermis straw-color and shining in young shells, becoming brown and roughened in old shells; left valve with two strong, triangular pseudocardinals and two stout laterals; right valve with one to three pseudocardinals and a more or less double lateral; muscle scars nearly round, impressed; beak cavities rather shallow; nacre white, thicker in front.

Length 120, height 80, diam. 55 mm.

Ohio, Cumberland and Tennessee river systems; west to Missouri and Minnesota; Alabama River, according to Call.

Type locality, Pittsburgh, Pa.

Unio æsopus GREEN, Cont. Mac. Lyceum, I, No. 2, 1827, p. 46,

fig. 3.—HANLEY, Biv. Shells, 1843, p. 181, pl. XXIV, fig. 7.

—CALL, Jl. Cin. Soc. N. H., XVIII, 1896, p. 157, pl. VI.

Margarita (Unio) æsopus LEA, Syn., 1836, p. 17; 1838, p. 16.

- Margaron (Unio) asopus* LEA, Syn., 1852, p. 23; 1870, p. 34.
Pleurobema asopus SIMPSON, Syn., 1900, p. 764.
Plethobasus asopus ORTMANN, Ann. Car. Mus., VIII, 1912,
 p. 260, fig. 8.
Unio cyphia CONRAD, New F. W. Shells, 1834, p. 68.
Unio cyphius SAY, Am. Conch., VI, 1834.—REEVE, Conch.
 Icon., XVI, 1864, pl. VIII, fig. 28.
Unio cyphias var. *asopus* PÆTEL, Conch. Sam., III, 1890, p.
 150.
Unio scyphius KUSTER, Conch. Cab. Unio, 1861, p. 181, pl.
 LVII, fig. 2.

I am not positive as to the generic position of this and the following species, but I am inclined to place them in *Pleurobema*. No other living species of this genus has any development of tubercles, but a great number of fossil forms from the Tertiary of eastern Europe, which seem to be most like *Pleurobema*, are decidedly pustulous. The heavy, inflated, high beaks and the comparatively shallow beak cavities are characters found in nearly all the species of this genus. In the single gravid specimen I examined (one out of a large number from different localities) the outer gills were not filled very full of ova, though they were found throughout their extent, while the most careful search did not disclose any in the inner gills.

In some specimens the radial ridge of nodules is strongly developed, so that the knobs become large, often compound humps. In this case there is a sort of wide radial depression behind the ridge and in front of the low posterior ridge. In other shells this ridge of nodules is feeble and there is no appreciable depression behind it. The species differs from *cicatricosum* in being more angular at the base of the nodulous ridge, and in having a harder, smoother epidermis.

PLEUROBEMA CICATRICOSUM (Say).

Shell subtriangular or subquadrate, somewhat inflated, solid, inequilateral; beaks very high and full, turned slightly forward over a well-developed lunule; in the middle of the disk there is a curved, radial row of low, irregular nodules, reaching

to the base; posterior ridge low, narrowly rounded, ending in a blunt point at or below the median line; anterior end rounded or slightly truncated; base line rounded and quite full at the termination of the row of nodules, from this to the posterior point it is straight or slightly incurved; outline of dorsal slope curved; surface generally sculptured with low, uneven, concentric ridges; epidermis tawny to brown, lighter colored on the dorsal slope, silky; left valve with two rather small, triangular pseudocardinals and two laterals; right valve with one to three pseudocardinals and a double lateral; beak cavities rather shallow; muscle scars small, impressed; nacre white, thicker in front.

Length 70, height 66, diam. 38 mm.

Ohio River; Tennessee; Claiborne, Alabama. The last locality I consider doubtful. Lea gives St. Paul, Minnesota, as a habitat, but I do not think it possibly can be.

Type locality, Wabash River.

Unio varicosus LEA, Tr. Am. Phil. Soc., IV, 1829, p. 90, pl. XI, fig. 20; Obs., I, 1834, p. 100, pl. XI, fig. 20.—HANLEY, Biv. Shells, 1843, p. 181, pl. XXI, fig. 14.—CHENU, Ill. Conch., 1858, pl. XI, figs. 6, 6a, 6b.

Margarita (Unio) varicosus LEA, Syn., 1836, p. 17; 1838, p. 16.

Margaron (Unio) varicosus LEA, Syn., 1852, p. 23; 1870, p. 34.

Unio cicatricosus SAY, N. Harm. Diss., II, No. 19, 1829, p. 292.—KUSTER, Conch. Cab. Unio, 1861, p. 185, pl. LVIII, fig. 2.—REEVE, Conch. Icon., XVI, 1864, pls. VIII, fig. 31; XIII, fig. 50.

Unio cicatricosus var. *varicosus* PÆTEL, Conch. Sam., III, 1890, p. 148.

Pleurobema cicatricosa SIMPSON, Syn., 1900, p. 765.

Unio detectus FRIERSON, Naut., XXV, 1911, p. 52, pl. II, lower; pl. III, upper figures.

Unio cicatricoides FRIERSON, Naut., XXV, 1911, p. 53, pl. II, upper figure.

Not so inflated nor so large as *P. asopus*. The base is more widely rounded at the end of the row of nodules and the shell is higher in proportion than it is in that species. The texture

of the epidermis is soft and silky while in *osopus* it is hard and shining.

I change Lea's name because Lamarck previously applied the name *Unio varicosa* to what is no doubt, *Alasmidonta marginata*. Mr. T. G. Lea, of Cincinnati, took many specimens of this species, the shells of which he sent to Dr. Lea, and in several of them he has written in pencil "not charged" or "ovaries charged," with the date, but neither of them seems to have described the animal. I am somewhat at a loss to know where to place this curious form. The young are much like those of *Quadrula solida*, and do not show the swellings until the third or fourth year, and occasionally the adult shell is nearly smooth.

PLEUROBEMA COMPERTUM (Frierson).

"Shell medium in size. Apparently dimorphic, the females (?) being broader behind than the males and more rounded, the males (?) being somewhat triangular and pointed behind, beaks high and well forward (their sculpture not seen). Epidermis dirty yellow, darker before (as in *circulus*). Basal outline rounded and, in the females, expanded in the middle; shell not very much inflated. The posterior ridge is rounded and becomes more and more inflated with age. The posterior area is narrow, with several more or less well-defined lines from beak to margin. Down the centre of the disk runs a row of pustules, larger in the females, as well as more numerous. Inside, the nacre is white, quite thick in front, as far back as the centre, or row of pustules, from thence it becomes remarkably thin in comparison, producing a trough-like excavation from beak to posterior base. Teeth erect and fairly stout; two cardinals and two laterals in the left valve and one each in the right.

Length 2.3, height 2.1, diam. 1.3 inches." (Frierson)

Habitat: Clinch and Holston rivers.

Type locality not specified.

Unio compertus FRIERSON, Naut., XXV, 1911, p. 53, pl. III, middle and lower figures.

"This shell is remotely, if at all, related to the other shells above mentioned (*cicatricosus* Say and *varicosus* Lea). There is apparently a slight relationship to *Unio propinquus* in its general facies, but the species is in reality quite distinct."

Doubtful and indeterminate species.

PLEUROBEMA ABACUS (Haldeman).

"General form of *U. subplanus* Conrad. Substance of the shell thick; umbones approximate, depressed, anterior end without interior cavity; posterior slope regularly arched; muscular and pallial impressions very well marked; epidermis brown, rough.

Length 3.8, height 2.0, thickness 1.0 inch.

Hab. Holston River, Tennessee." (Haldeman).

Unio abacus HALDEMAN, Jl. Ac. N. Sci. Phila., VIII, 1842, p. 202.

Margaron (Unio) abacus LEA, Syn., 1852, p. 24; 1870, p. 38.

Pleurobema abacus SIMPSON, Syn., 1900, p. 749.

I am wholly unable to say what this is as it never has been figured and I have never seen the type. Shells that are in the Lea collection and others that I have seen labeled *Unio abacus* Haldeman are much like *Pleurobema appressum* and cannot be the genuine *abacus* of Haldeman, which according to his measurements is a longer, larger, form.

The following species are described by Rafinesque, but I am unable to make them out.

Pleurobema mytiloides RAFINESQUE, Ann. Gen. Sci. Brux., V, 1820, p. 313. pl. LXXXII, figs. 8-10.

Pleurobema cuneata RAFINESQUE, Ann. Gen. Sci. Brux., V, 1820, p. 313.

TETRAGENEÆ.

Male and female shells alike, solid; beak sculpture consisting of coarse, subparallel ridges; beak cavities deep; marsupium filling all four gills, smooth, pad-like.

Genus QUADRULA (Rafinesque, 1820) Agassiz.

Quadrula RAFINESQUE, Ann. Gen. Sci. Phys. Brux., 1820, p. 305.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 250.

Rotundaria AGASSIZ, Arch. für Naturg., 1852, p. 48.

Orthonymus AGASSIZ, Arch. für Naturg., 1852, p. 48.

Shell triangular, quadrate or rhomboid, solid, inflated, with rather prominent beaks, which are generally sculptured with a few coarse, irregular, subparallel ridges that are inflated where they cross the posterior ridge; posterior ridge ordinarily well developed; base often incurved in old specimens; disks sculptured or smooth; epidermis usually dull colored, dark and rayless, or feebly rayed; hinge plate heavy, wide, flattened; pseudocardinals solid, direct, ragged; laterals double in the left and single in the right valve, often with a small secondary lateral below the large one in the right valve; cavity of the beaks deep and compressed; dorsal scars under the hinge plate; male and female shells alike.

Animal having the inner gills the larger, generally free from the abdominal sac the greater part or all of their length; marsupium occupying all four of the gills throughout, the whole smooth and pad-like.

Type, *Quadrula metanevra* Rafinesque.

The forms, which I have placed in the genus *Quadrula*, seem to me to be perfectly well characterized by differences of the animal and the shell, so much so that I have placed them, together with a few Asiatic species, in a group of higher than generic value. In almost all cases the shells of *Quadrula* are short and solid, they are quite commonly, though not always, inflated, and with scarcely an exception *the beak cavities are deep*. This last character separates them almost invariably from the species of *Pleurobema*, in which the beak cavities are uniformly shallow.

With but few exceptions the epidermis is dark, rough and rayless. The exception occurs in the section *Quadrula*, in which the epidermis is sometimes painted and bright. Two anomalous forms occur in the United States, the *Unio cylindri-*

cus of Say and *Unio trapezoides* of Lea. The former is nearly cylindrical, and looks like an elongated *metanevra*. This fact and the deep beak cavities led me to place it in *Quadrula* though I know nothing of the character of the marsupia. Subsequently Mr. L. E. Daniels of La Porte, Indiana, who has rendered great assistance in furnishing anatomical material, sent me a lot of gravid specimens of both species. In the *metanevra* all four of the gills were filled with young, the whole being a rich purple and I was delighted to find that the marsupia of *cylindrica* were exactly like those of *metanevra* in texture, in color and in occupying all four of the gills, like pads, differing only in being more elongated.

It has been believed by most students that the *Unio trapezoides* of Lea was closely related to his *Unio sloatianus*, both being shaped somewhat alike and having obliquely, plicate sculpture. This view I held until I carefully examined the shell. Those of *trapezoides* have much deeper beak cavities than the shells of *sloatianus* and for this reason I placed the former in *Quadrula*, in the section *Crenodonta*, near *plicata*, and the latter in *Unio*. Recently Mr. Lorraine S. Frierson, who has been making a study of the anatomy of the Naiades of Louisiana and Texas, has repeatedly found the *trapezoides* gravid, and in each case the marsupia are pad-like, occupying all four leaves of the branchiæ.

If I am right in supposing that the earliest and lowest forms of the *Unionidæ* had radial beak sculpture, that the marsupia of such forms occupied only the inner gills, that the higher and more modern forms have concentric beak sculpture and carry the young in the outer gills only, then the *Quadrulas* and the few other forms I have placed with them would be a sort of transition group. It is quite reasonable, if this supposition is correct, that occasionally female specimens placed in the subfamily *Hyrianaæ* (*Endobranchiæ*) may have more or less young in the outer as well as the inner gills and that some gravid females of the *Unioninaæ* (*Exobranchiæ*) may have the young in all four of the gills, the inner as well as the outer. Suter is authority for the statement that the gravid females of

Diplodon menziesi of New Zealand occasionally have some embryos in the outer gills. One or more examples of the *Anodontoides ferussacianus*, which the writer examined, had more or less young in the inner gills. And in the *Quadrulas* all four gills are filled, though the outer are usually thicker and more pad-like. Now, if these are transition forms, it would also be reasonable to expect that the beak sculpture would sometimes be neither radial or strictly concentric. In most of the *Quadrulas* the beak sculpture seems to be a sort of compromise between the two patterns, consisting of parallel bars arranged in zigzags or chevrons. In many of the species of this genus and of allied groups there are a few strictly radial, delicate ridges either before or behind the main sculpture.

In Volume XV, page 53, of the *Nautilus*, Dr. H. von Ihering has applied the name *Quadrulinae* to the *Quadrulas* and allied forms. My reason for not giving them the rank of a subfamily is that in the character of the shells, their beak sculpture and in the anatomy they seem much more nearly allied to the *Unioninae* than to the *Hyrianae*.

Section CRENODONTA Schlüter.

Crenodonta SCHLÜTER, Virz. meiner Conch., 1836, p. 33.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 245.

Shell more or less alate; beaks prominent; the surface of the valves usually sculptured with oblique folds; posterior slope generally having smaller radial plications, which curve upward behind; epidermis brownish or blackish; anterior muscle scars large, distinct, very shallow, the anterior edge smooth, the rest apparently filled with roughened shelly matter; posterior scars large, shallow, indistinct; escutcheon large and dark.

Animal with the gills generally large, rounded below; inner the larger, usually free nearly or quite the entire length of the abdominal sac, the two pairs united to the mantle nearly, but not quite, to the posterior end, having a small portion free; marsupium occupying all the four branchiæ, forming very heavy, thick pads; labial palpi usually large.

Type, *Unio plicatus* Say.

Schlüter applied the name *Crenodonta* to a group of Unionidæ, the first species of which was the *Unio plicatus* of Say, but he gave no description of his group and did not designate a type. In 1853 Mörch (Yoldi catalogue, p. 45) used this name without a description or a type, and it has been applied to the plicate uniones by von Martens (Biologia Centrali-Americana, Mollusca, 1900, p. 479).

ORTMANN, (l. c.), raises this group to generic rank.

Dr. Lea found in *Quadrula heros* the inner gills generally nearly or entirely free, but in certain specimens they were wholly united. My own experience in examining the animals of this species exactly coincides with his, thus showing that the character of the union of the inner gills with the abdominal sac, or their separation from it, is not a generic character, as Agassiz believed, nor is it even of specific value.

Group of *Quadrula plicata*.

Shell rounded to subrhomboid; plications usually strong, oblique, though in occasional specimens the surface may be perfectly plain or slightly concentrically sculptured.

QUADRULA PLICATA (Say).

Shell subquadrate or subrhomboid, inflated, solid, inequilateral; beaks full and high, turned forward over a well-marked lunule, their sculpture consisting of a few coarse, irregular, somewhat corrugated ridges; anterior end generally narrowed a little, rounded and often cut away somewhat below; base line rounded or nearly straight: dorsal slope often carried up into a low wing, obliquely truncated behind; posterior ridge rounded; above it there is often a wide, shallow, radial depression; surface with uneven, concentric sculpture and having usually several very strong, irregular ridges below the posterior ridge running nearly parallel with it; posterior slope with or without radial ridges: epidermis yellow-green, brownish or blackish, generally coarse and rough; left valve with two strong, radial pseudocardinals, which are often split into a number of radial denticles, with two strong laterals; right

valve with three pseudocardinals, the middle one large and frequently much split, with one lateral, which is sometimes partly double; beak cavities deep, compressed; muscle scars shallow, the anterior very rough; nacre white, much thinner and iridescent behind; pallial line strongly crenate.

Length 119, height 83, diam. 54 mm.

Length 120, height 90, diam. 46 mm.

Length 90, height 62, diam. 52 mm.

Upper Mississippi drainage area south to the Tennessee and Arkansas rivers; Red River of the North; Saskatchewan River; Lake Winnipeg; western Michigan.

Type locality, Lake Erie.

Unio plicata SAY, Nich. Encyc., II, 1817.

Unio (Theliderma) plicata SWAINSON, Tr. on Mal., 1840, p. 271, fig. 54e.

Mya plicata EATON, Zool. Text-Book, 1826, p. 219.

Quadrula plicata BAKER, Moll. Chicago, Pt. 1, 1898, pl. xxv, fig. 1.—SIMPSON, Syn., 1900, p. 767.

Unio plicatus HANLEY, Biv. Shells, 1843, p. 175, pl. XXI, fig. 21.—KUSTER, Conch. Cab. Unio, 1856, p. 137, pl. XL, fig. 3.—REEVE, Conch. Icon., XVI, 1864, pl. II, fig. 5.

Margarita (Unio) plicatus LEA, Syn., 1836, p. 12; 1838, p. 14.

Margaron (Unio) plicatus LEA, Syn., 1852, p. 20; 1870, p. 30.

Plectomerus plicatus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 261.

Unio peruviana LAMARCK, An. sans Vert., VI, 1819, p. 71.—DESHAYES, Encyc. Meth., 1827, pl. 248, fig. 7; pl. 249, fig. 1.

Unio crassus BARNES, Am. Jl. Sci., VI, 1823, p. 118.

Unio variplicata DESHAYES, Enc. Mth., II, 1830, p. 578.

Unio gigantéus LEA, Obs., II, 1838, p. 35.

Unio heros KUSTER, Conch. Cab. Unio, 1856, p. 136, pl. XL, figs. 1, 2.

An exceedingly variable species in general form, degree of inflation, development of beaks, etc. As in most of the species of this group there are occasional specimens that are wholly destitute of plications. Normally it is perfectly distinct from its near ally *Quadrula undulata*, being more inflated, solidier

in proportion, shorter and having much fuller, higher beaks but there are intermediates, which can hardly be placed. The beaks of *plicata* are generally a little nearer the anterior end than those of *undulata*.

Say says: "It was found by Mr. Lesueur in Lake Erie, and was communicated by him under the above name." As there is no evidence that Lesueur described the species, and as Say was the one to first properly characterize it, I believe that he must be credited with it.

Var. *hippopæa* (Lea).

Smaller and more delicate than the type; epidermis greenish, greenish-brown or reddish-brown.

Length 60, height 42, diam. 27 mm.

Type locality, Lake Erie. Also, Eastern Michigan.

Unio hippopæus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 163; Tr. Am. Phil. Soc., X, 1848, p. 67, pl. 1, fig. 1; Obs., IV, 1848, p. 41, pl. 1, fig. 1.—KUSTER, Conch. Cab., 1861, p. 251, pl. LXXXIV, fig. 3.—REEVE, Conch. Icon., XVI, 1864, pl. XI, fig. 40.

Margaron (Unio) hippopæus LEA, Syn., 1852, p. 21; 1870, p. 31.

Quadrula plicata var. *hippopæa* SIMPSON, Syn., 1900, p. 767.

Crenodonta plicata ORTMANN, Ann. Car. Mus., VIII, 1912, p. 246.

Very variable in form and size. Some adult shells are very much smaller than the measurements given above. A form of *plicata* left in the St. Lawrence drainage at the close of the Glacial Epoch, no doubt, and developed by its environment.

Ortmann, (l. c.), says, "this species has been misunderstood hitherto. The type locality of *plicata* is Lake Erie, and thus the only known *Crenodonta* from Lake Erie should bear this name, but this is the form called *hippopæa* by Lea. The *plicata* of authors should be *Cr. peruviana* (Lamarck)."

He also says that "this is undoubtedly only a local race of *undulata*." If this is correct, *plicata* Say would take precedence over *undulata* Bar. as the specific name for that species.

QUADRULA PERPLICATA (Conrad).

Shell subrhomboid, inflated, solid, inequilateral; beaks full and high, turned forward over a well-marked lunule, their sculpture a few strong, irregular bars; anterior end rounded, a little narrower than the posterior end, often cut away a little below; base line curved; post-dorsal slope usually developed into a slight wing, the hinder part obliquely truncate; surface with light, irregular, concentric ridges, and with very strong, oblique ridges on the hinder half of the disk that run well on to or cross the posterior ridge; epidermis dark brown or nearly black, often subshining; pseudocardinals strong, radial, much split, two in the left valve and three in the right; two laterals in the left valve and one in the right; muscle scars shallow, the anterior ones rough; beak cavities deep, compressed; nacre white, generally purple-tinted and iridescent behind.

Length 145, height 110, diam. 60 mm.

Length 87, height 67, diam. 55 mm.

Alabama River drainage and streams flowing into the Gulf of Mexico west to central Texas, north to southern Kansas.

Type locality, Jackson, La.

Unio perplicatus CONRAD, Pr. Ac. N. Sci. Phila., I, 1841, p.

19; Jl. Ac. N. Sci. Phila., I, 1850, p. 276, pl. XXXVIII, fig. 2.

—REEVE, Conch. Icon., XVI, 1864, pl. IX, fig. 35.

Margaron (Unio) perplicatus LEA, Syn., 1852, p. 20; 1870, p. 29.

Plectomerus perplicatus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 261.

Quadrula perplicata SIMPSON, Syn., 1900, p. 767.

Crenodonta perplicata ORTMANN, Ann. Car. Mus., VIII, 1912, p. 247.

Unio atrocostatus LEA, Tr. Am. Phil. Soc., X, 1848, p. 70, pl.

II, fig. 5; Obs., IV, 1848, p. 44, pl. II, fig. 5.

Margaron (Unio) atrocostatus LEA, Syn., 1852, p. 20; 1870, p. 29.

Unio pearlensis CONRAD, Tr. Am. Phil. Soc., VII, 1855, p. 256.

—REEVE, Conch. Icon., XVI, 1864, pl. XI, fig. 42.

Unio perlensis PÆTEL, Conch. Sam., III, 1890, p. 163.

Unio brazosensis LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 144;
Jl. Ac. N. Sci. Phila., VI, 1869, p. 309, pl. XLVIII, fig. 122;
Obs., XII, 1869, p. 69, pl. XLVIII, fig. 122.

Margaron (Unio) brazosensis LEA, Syn., 1870, p. 31.

Unio lincecumii LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 144;
Jl. Ac. N. Sci. Phila., VI, 1869, p. 312, pl. XLIX, fig. 125;
Obs., XII, 1869, p. 72, pl. XLIX, fig. 125.

Margaron (Unio) lincecumii LEA, Syn., 1870, p. 31.

Unio lincecurii PÆTEL, Conch. Sam., III, 1890, p. 157.

Unio pauciplicatus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 156;
Jl. Ac. N. Sci. Phila., VIII, 1874, p. 29, pl. IX, fig. 26;
Obs., XIII, 1874, p. 33, pl. IX, fig. 26.

This has about an equal degree of inflation as *Q. plicata*, but as a rule its beaks are not so high, its outline is less rhomboid, the ridges are stronger and cover more of the shell. They sometimes extend behind the posterior ridge and curve up to the hinder end of the dorsal slope. Generally it is a smoother, more shining shell than *plicata* and the nacre is more often tinted with purple. The *Unio atrocostatus* of Lea is a little shorter than the ordinary manifestation of the species, seeming to stand between it and *elliottii*, but it hardly seems to me to be worth a varietal name. *U. brazosensis*, *pauciplicatus* and *lincecumii* are merely forms more or less destitute of plications.

Var. *quintardii* (Cragin).

Shell with light brown, glossy epidermis; surface with a series of V-shaped ridges on the disk.

Kansas.

Type locality, Salt Creek, Sac and Fox Reservation, Oklahoma.

Unio quintardii CRAGIN, Bull. Wash. College, II, 1887, p. 6.—
PILSBRY, Pr. Ac. N. Sci. Phila., 1892, p. 131, pl. VII, figs. 1-3.
Quadrula perplicata var. *quintardii* SIMPSON, Syn., 1900, p. 768.

I do not think this form worthy of a specific name. It often happens that shells of other related species show decided traces of V-shaped sculpture.

QUADRULA ELLIOTTII (Lea).

Shell subquadrate or subtrapezoidal, inflated, solid, inequilateral; beaks only slightly elevated or inflated, their sculpture a few strong, somewhat corrugated ridges that curve up strongly behind; anterior end somewhat narrowed and rounded; base line lightly curved; dorsal line straight or nearly so; posterior end almost squarely truncate; posterior ridge scarcely developed; surface sculptured with uneven concentric ridges and with 6 to 8 very strong, oblique folds; these fade out before reaching the anterior end and trend in the direction of the posterior base; dorsal slope strongly plicate; epidermis often bright green in young shells, brownish to blackish in old shells; pseudocardinals low and rather small, ragged and somewhat split up, two in the left valve and two to three in the right; left valve with two short laterals; right valve with one; beak cavities deep, compressed, muscle scars shallow, the anterior partly filled with roughened nacre; pallial line deep, remote from the border; nacre white, iridescent behind.

Length 130, height 112, diam. 67 mm.

Southern Georgia; west to Texas.

Type locality, Othcalooga Creek, Gordon Co., Ga.

Unio elliotii LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 262; Jl. Ac. N. Sci. Phila., IV, 1858, p. 54, pl. VII, fig. 37; Obs., VI, 1858, p. 54, pl. VII, fig. 37.—REEVE, Conch. Icon., XVI, 1864, pl. v, fig. 20.

Margaron (Unio) elliotii LEA, Syn., 1870, p. 29.

Quadrula elliotii SIMPSON, Syn., 1900, p. 768.

I am strongly inclined to believe that this is only a variety of *perplicata*. It is more decidedly quadrate than that species, the anterior end is narrowed and the pseudocardinals are smaller and less elevated. The *Unio atrocostatus* of Lea seems to be to a certain extent a connecting form.

QUADRULA UNDULATA (Barnes).

Shell somewhat elongated, irregularly rhomboid, subcompressed to subinflated, solid, inequilateral; beaks only moderately elevated and inflated, their sculpture a few strong ridges, which are swollen where they cross the posterior ridge; pos-

terior ridge low and rounded; anterior end rounded; basal and dorsal lines curved; posterior end obliquely truncated above, pointed or rounded below; surface concentrically sculptured and having uneven, oblique folds on the hinder half of the disk, which run nearly parallel with the posterior ridge and are sometimes broken into corrugations or pustules; dorsal slope usually having radial plications; epidermis greenish or yellow-green and sometimes rayed in young shells, becoming brown or blackish with age; pseudocardinals strong and ragged, two in the left valve and two or three in the right; left valve with two laterals; right valve with one; beak cavities deep, compressed; muscle scars shallow, the anterior partly filled with rough nacre; pallial line deep, remote; nacre whitish, iridescent and thinner behind.

Length 165, height 108, diam. 60 mm.

Length 140, height 97, diam. 60 mm.

Length 136, height 93, diam. 42 mm.

Mississippi basin generally; St. Lawrence drainage; Red River of the North; Lake Winnipeg; Alabama River system. Type locality, Ohio River.

Unio undulatus BARNES, Am. Jl. Sci., VI, 1823, p. 120, pl. II.—HANLEY, Riv. Shells, 1843, p. 175, pl. XX, fig. 26.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 24, pl. V, figs. 1, 1a; Manual, 1850, II, p. 143, fig. 704.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVI, fig. 399.

Margarita (Unio) undulatus LEA, Syn., 1836, p. 12; 1838, p. 14.

Margaron (Unio) undulatus LEA, Syn., 1852, p. 20; 1870, p. 29.

Mya undulata EATON, Zool. Text-Book, 1826, p. 219.

Unio undulato VALENCIENNES, Rec. Obs. Zool. Anat., II, 1833, p. 229, pl. LIV, figs. 3, 3a, 3b.—DESHAYES, Tr. Elem. Conch., 1839, p. 19, pl. XXX, figs. 8, 9.

Quadrula undulata BAKER, Moll. Chicago, Pt. I, 1898, p. 82, pl. XXII, figs. 1, 2; XII, fig. 1.—SIMPSON, Syn., 1900, p. 769.

Crenodonta undulata ORTMANN, Ann. Car. Mus., VIII, 1912, p. 246.

Unio costatus CONRAD, Monog., II, 1836, p. 17, pl. VII.—KUSTER, Conch. Cab., 1852, p. 54, pl. XI, fig. 4.—REEVE, Conch. Icon., XVI, 1864, pl. IV, fig. 16.

Plectomerus costatus CONRAD, Pr. Acad. N. Sci. Phila., VI 1853, p. 260.

Unio plicatus KUSTER, Conch. Cab., 1856, p. 137, pl. XL, fig. 3.—CHENU, Manual, 1859, II, p. 143, fig. 706.

Unio atrocostatus SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVII, fig. 404.

Var. *latecostata* (Lea).

This is possibly worthy of a varietal designation. It is generally not quite so solid as the typical form and the oblique folds are finer and more numerous.

Length 135, height 85, diam. 50 mm.

Type locality, Tuscaloosa, Alabama. Also, Illinois; Missouri: south to Texas.

Unio latecostatus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 163; Tr. Am. Phil. Soc., X, 1848, p. 68, pl. I, fig. 2; Obs., IV, 1848, p. 42, pl. I, fig. 2.—KUSTER, Conch. Cab., 1861, p. 251, pl. LXXXIV, fig. 4.

Margaron (Unio) laticostatus LEA, Syn., 1852, p. 21.

Margaron (Unio) laticostatus LEA, Syn., 1870, p. 31.

Unio laticostatus H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 497.

Quadrula undulata var. *latecostata* SIMPSON, Syn., 1900, p. 769.

More delicate in every way than the type, but connecting with it.

Var. *pilsbryi* (Marsh).

Shell subrhomboid, slightly inflated and thickened before, compressed and thin behind; epidermis dark reddish-brown; plications small, seminodulous.

Kansas.

Type locality, Little Red River, Arkansas.

Unio pilsbryi MARSH, Nautilus, V, 1891, p. 1.—PILSBRY, Pr. Ac. N. Sci. Phila. 1892, p. 131, pl. VIII, figs. 7, 8; Nautilus, VII, 1893, pl. 1, figs. 7, 8.

Quadrula undulata var. *pilsbryi* SIMPSON, Syn., 1900, p. 769.

I do not think this is more than a variety of *undulata*. It is more wedge-shaped when viewed from above, has a browner epidermis than the ordinary manifestation of that species, and the plications are somewhat broken into nodules, a character often found in *undulata*.

On the one hand this species closely approaches *Q. plicata* and on the other it almost connects with forms of *Q. heros*. Ordinarily it is much more compressed, is shorter and has lower and less inflated beaks than the former, but there is a great deal of intermediate material. Frequently the strong, oblique folds become broken up by cross folds until the sculpture so closely resembles that of *heros* that the two forms can scarcely be separated. The *Unio pilsbryi* of Marsh shows something of this style of sculpture.

A peculiar shell belonging to Mr. J. H. Ferriss, of Joliet, Illinois, from Lake Winnipeg, has been examined by the writer. It has unusually strong growth lines and is quite full in the ventral region, and has only the very faintest vestiges of plications below the lower part of the posterior ridge. I regard it as a smooth form of *Q. undulata*, and if any considerable number of such specimens were found it might be worthy of a varietal name.

QUADRULA DIGITATA (Morelet).

Shell large, very solid, subcompressed, irregularly elliptical or subrhomboid; beaks moderately developed; dorsal line nearly straight; anterior end rounded and cut away somewhat below; base line nearly straight; posterior end rounded, somewhat pointed about on the median line, angular above; surface strongly, concentrically striate, and nearly covered with strong folds, which radiate from behind the beaks to a point somewhat lower on the disk and extend to the border of the shell; anterior end having low, rather regularly arranged pustules;

epidermis dark brown or blackish; pseudocardinals somewhat split up radially; laterals lamellar; muscle scars large, shallow, the anterior partly filled with roughened nacre; nacre white.

Length 125, height 92, diam. 46 mm.

Rio Usumacinta, Guatemala.

Unio digitatus MORELET, Test. Noviss., Pt. 2, 1851, p. 24.—

FISCHER and CROSSE, Miss. Sci., II, 1894, p. 563, pl. LX, fig. 1.

Quadrula digitata SIMPSON, Syn., 1900, p. 770.

The prominent and distinguishing characters are the radiating ribs, about 15 in number that start from behind the beak and along to a point lower down the disk and extend backward and outward to the extreme edge of the shell from the middle of the ligament to the base, and the small, regularly arranged pustules on the anterior end.

QUADRULA TRIUMPHANS (B. H. Wright).

Shell short, irregularly obovate, scarcely subinflated, inequilateral, solid; beaks low and compressed; anterior end narrowed and rounded; base line lightly curved; dorsal outline nearly straight, elevated into a wing; posterior end somewhat obliquely truncated above, widely rounded below; surface covered with concentric growth marks and narrowly spaced rest marks, having a series of folds, which radiate backward and outward from below the region of the beaks, these folds are strongest below and are somewhat corrugated, broken and divaricate; along the anterior end and anterior base there are numerous uneven tubercles; epidermis blackish; pseudocardinals rather small, radial and radially striate; laterals granulate; beak cavities deep and compressed; anterior scars small, slightly roughened; nacre whitish or flesh-color, thinner, purplish and iridescent behind.

Length 105, height 94, diam. 40 mm.

Type locality, Coosa River, St. Clair County, Alabama.

Unio triumphans B. H. WRIGHT, Naut., XI, 1898, p. 101.

Quadrula triumphans SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 83, pl. III, fig. 3; Syn., 1900, p. 770.

In some characters this species is close to *Q. boykiniana*. The general sculpture is much as it is in that species, but in the type, the only absolutely authentic specimen I have seen, there is no indication of chevron shaped patterns. I have seen material, which hints strongly at a connection of the two species and would not be surprised if it would eventually be found necessary to unite them, different as they are typically.

QUADRULA BOYKINIANA (Lea).

Shell trapezoid or subrhomboid, subinflated to inflated, solid, inequilateral; beaks full and elevated, their sculpture consisting of coarse, sometimes doubly looped or zigzagged, nodulous ridges; anterior end narrowed and rounded, often full and subangular above and slightly cut away below; base line straight or nearly so; post-dorsal part produced into a rather high wing; posterior end almost squarely or obliquely truncate, rounded or pointed below the median line; posterior ridge moderate to full, rounded; surface with strong, irregular concentric sculpture and covered with oblique, corrugated or subnodulous plications. These folds are generally strongest along the posterior portion, where they are often divaricate and they frequently are formed into irregular, chevron-shaped patterns on the anterior half of the shell; epidermis dark brown or blackish; pseudocardinals radially striate, often uneven and broken up; laterals granular; beak cavities deep, compressed; posterior scars indistinct; anterior scars nearly filled with rough nacre; nacre white, often dull purplish in the cavities, much thinner and iridescent behind.

Length 162, height 100, diam. 63 mm.

Length 112, height 86, diam. 43 mm.

Chattahoochee River system; Claiborne, Alabama; Pine Barren Creek, Escambia County, Florida.

Type locality, Chattahoochee River, Columbus, Ga.

Unio boykinianus LEA, Pr. Am. Phil. Soc., I, 1840, p. 288; Tr. Am. Phil. Soc., VIII, 1842, p. 208, pl. XIII, fig. 22; Obs., III, 1842, p. 46, pl. XIII, fig. 22.—CHENU, Ill. Conch., 1858, pl. XXVII, figs. 2, *2a*, *2b*.—KUSTER, Conch. Cab., 1861, p. 181, pl. LVII, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl. 1, fig. 1.

Margaron (Unio) boykinianus LEA, Syn., 1852, p. 19; 1870, p. 28.

Plectomerus boykinianus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 260.

Quadrula boykiniana SIMPSON, Syn., 1900, p. 770.

Unio baykinianus PÆTEL, Conch. Sam., III, 1890, p. 145.

Differs from *Q. triumphans* in being longer in proportion to its height, in being less rounded and in having chevron-shaped sculpture. But it is quite probable that the two will be found to run together, when a sufficient amount of material is examined.

QUADRULA HEROS (Say).

Shell long rhomboid or long quadrate, subinflated to inflated, solid, inequilateral; posterior ridge usually full, rounded; beaks rather full and high, their sculpture strong, doubly looped or zigzag ridges; dorsal line straight or lightly curved; anterior end rounded, generally angled above; base line straight or a little curved; posterior end almost squarely or somewhat obliquely truncate and angled above where it joins the low dorsal wing, rounded below; surface with uneven, concentric sculpture, all, except the anterior basal part, more or less covered with oblique folds and nodules. The earlier growth is usually densely covered with subradial or chevron-shaped, nodulous plications; frequently the sculpture in front is decidedly nodulous; epidermis brownish or blackish; pseudo-cardinals elevated, radial, radially striate; laterals straight or slightly curved; muscle scars large, the anterior ones with rough nacreous matter; beak cavities deep, compressed; nacre whitish, often blotched with lurid color, much thinner and iridescent behind; pallial line remote.

Length 210, height 133, diam. 70 mm.

Length 133, height 91, diam. 60 mm.

Length 112, height 82, diam. 55 mm.

Mississippi River system generally; Red River of the North; Tombigbee River, Alabama; southwest to New Leon, Mexico.

Type locality, Fox River, tributary of the Wabash.

- Unio heros* SAY, New Harm. Diss., II, No. 19, 1829, p. 291.—
CONRAD, Monog., XII, 1840, p. 107, pl. LIX.—HANLEY, Biv.
Shells, 1843, p. 175, pl. XXII, fig. 28.
- Quadrula heros* SIMPSON, Syn., 1900, p. 770.
- Crenodonta heros* ORTMANN, Ann. Car. Mus., VIII, 1912, p.
248.
- Unio heros* var. *multiplicatus* PÆTEL, Conch. Sam., III, 1890,
p. 155.
- Unio undulatus* SAY, Am. Conch., I, 1831, pl. XVI (April).
- Unio multiplicatus* LEA, Tr. Am. Phil. Soc., IV, 1831, p. 70,
pl. IV, fig. 2 (latter part of the year); Obs. I, 1834, p. 80, pl.
IV, fig. 2.—POTIEZ and MICHAUD, Gall. Moll., 1844, p. 155,
pl. LIX, fig. I.—CHENU, Ill. Conch., 1858, pl. IX, figs. 2, 2a,
2b; Manual, 1859, II, p. 143, fig. 703.
- Margarita (Unio) multiplicatus* LEA, Syn., 1836, p. 12; 1838,
p. 14.
- Margaron (Unio) multiplicatus* LEA, Syn., 1852, p. 20; 1870,
p. 29.
- Unio eightsii* LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 306;
Jl. Ac. N. Sci. Phila., IV, 1860, p. 367, pl. LXIV, fig. 192;
Obs., VIII, 1860, p. 49, pl. LXIV, fig. 192.
- Margaron (Unio) eightsii* LEA, Syn., 1870, p. 29.
- Unio eightsii* PÆTEL, Conch. Sam., III, 1890, p. 151.
- Unio atrocostatus* REEVE, Conch. Icon., XVI, 1864, pl. IV, fig.
13. (Changed in Errata to *Unio heros*.)

This is one of the largest known North American Uniones. Specimens have been reported exceeding the largest dimensions given above, which are those of a specimen taken from the Little Miami River, near Cincinnati, Ohio, and is in the Lea collection. Lea's shell is 8 inches long and weighs 2 lbs. 9.5 oz. Dr. W. S. Strode in the Nautilus, Vol. IX, p. 116, reports a specimen of this species from the Spoon River, Illinois, 8.5 inches in length, *Symphynota complanata* the same length and *Lampsilis alata* 9 inches long. I can see no reason for separating *Unio eightsii* from *heros* even varietally. The species apparently extends through Mississippi, Louisiana and Texas well into Mexico.

There has been some dispute as to what name should be applied to this species. In 1829 Say fully described in the New Harmony Disseminator a species, which he called *Unio heros*, but did not figure. Later in the American Conchology he placed it in the synonymy of *Unio undulatus* Barnes, though the figure, which he gives as *undulatus* in that work and to which his description refers, is plainly not Barnes's species, but the *heros* described in the Disseminator. In 1831 Dr. Lea described Say's species as *Unio multiplicatus*. Notwithstanding the fact that Say placed his own species in the synonymy, it is perfectly distinct and was properly characterized in his description, and his name will have to take the place of the better known one of Dr. Lea.

QUADRULA NICKLINIANA (Lea).

Shell short trapezoid, compressed, solid, inequilateral, beaks rather elevated, subcompressed, or slightly inflated, their sculpture strong, somewhat zigzagged, ridges; anterior end narrowed and rounded; base line somewhat curved; dorsal outline produced into a wing, which is somewhat obliquely truncated behind; posterior ridge nearly wanting, feebly and very widely double, the lower ridge often being developed into a wide lump or swelling about the middle; the whole ending below in a very wide, faint biangulation at and below the median line; surface rudely, concentrically sculptured. The posterior end has a few, more or less strongly developed, radial folds and besides these there is a set of fine, radial wrinkles reaching to the front of the posterior ridge. In front of this the umbonal region is sculptured with broken corrugations, which change into irregular, radial wrinkles and pustules below; epidermis greenish-brown; pseudocardinals rough, radial; laterals short, remote; beak cavities very deep and compressed; muscle scars large, shallow, the anterior filled with roughened nacre; pallial line remote; nacre white, very thick on anterior base, suddenly becoming thin behind.

Length 145, height over all 125, diam. 47 mm.

Mexico; Guatemala.

Unio nicklinianus LEA, Tr. Am. Phil. Soc., V, 1834, p. 28, pl. 1, fig. 1; Obs., I, 1834, p. 140, pl. 1, fig. 1.—HANLEY, Biv. Shells, 1843, p. 175, pl. XXI, fig. 52.—SOWERBY, Conch. Icon., XVI, 1866, pl. LIII, fig. 276.

Margarita (Unio) nicklinianus LEA, Syn., 1836, p. 12; 1838, p. 14.

Margaron (Unio) nicklinianus LEA, Syn., 1852, p. 19; 1870, p. 28.

Plectomerus nicklinianus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 261.

Quadrula nickliniana SIMPSON, Syn., 1900, p. 771.

Unio nicklianus KUSTER, Conch. Cab., 1861, p. 218, pl. LXXIII, fig. 3.

Shorter than *Q. stolli*, having a more elaborate pattern of sculpture and usually a sort of hump on the middle of the lower posterior ridge. I am able to separate Lea's shells, which he calls *Unio nicklinianus*, into two lots, one agreeing with his type, the other longer and answering very well to the description and figure of *Unio stolli* von Martens.

QUADRULA STOLLI (VON Martens).

Shell subtrapezoid, compressed, solid, quite inequilateral; beaks compressed and rather low; dorsal line nearly straight, produced into a gradually expanding wing behind; posterior slope with a long oblique truncation, angled above, rounded below; base line nearly straight; anterior end somewhat narrowed and rounded, angled a little below the beaks; surface covered with low, radiating, somewhat corrugated or broken folds, whose radius is below the beaks and which spread out behind in light curves; there is also moderate concentric sculpture; pseudocardinals strong, radial, rough, two in the left valve and three in the right; laterals heavy, remote, two in the left valve and one in the right; beak cavities deep, compressed; muscle scars large, the anterior nearly filled with roughened matter; nacre white, much thicker in front; pallial line remote.

Length 160, height over all 120, diam. 40 mm.

Rio de las Salinas, Guatemala; Moctezuma River, Central America?

Unio stollii VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 492, pl. XXIX, fig. 2.

Quadrula stollii SIMPSON, Syn., 1900, p. 771.

I am inclined to believe that this is a valid species. It seems to be uniformly more elongated than *Q. nickliniana*, the nacre is not so suddenly or greatly thickened in front and it lacks a swelling just back of the middle of the shell generally seen in that species. The sculpture near the beaks is considerably corrugated and broken. von Martens believes that Kuster's *Unio nicklinianus* (Conch. Cab. Unio, p. 217, pl. LXXIII, fig. 3) is not the *nicklinianus* of Lea, but his species. I cannot agree with him in this.

QUADRULA NEISLERII (Lea).

Shell subquadrate, inflated, solid, inequilateral; beaks moderately full and high; posterior ridge high, narrowly rounded, sometimes slightly double, ending at the base in a feeble angulation or a blunt point; anterior end narrower and rounded; base line nearly or quite straight; post-dorsal slope scarcely winged above, almost squarely truncated behind; surface with the usual concentric sculpture of the group and having, often, throughout all the shell, except the extreme anterior end, a series of nearly horizontal, moderate folds, these sometimes descend a very little in front and behind and on the dorsal slope they curve slightly upward; in the umbonal region the sculpture is corrugated somewhat as in *Q. heros*; epidermis brownish to blackish; pseudocardinals radially striate, often radially split up; laterals short; beak cavities moderately deep, compressed; anterior scars partly filled with rough nacre; nacre whitish or purplish, iridescent and slightly thicker behind.

Length 80, height 65, diam. 43 mm.

Type locality, Flint River, Lamar Co., and Macon, Georgia.

Unio neislerii LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 165; Jl.

Ac. N. Sci. Phila., IV, 1859, p. 212, pl. XXVI, fig. 93; Obs.,

VII, 1859, p. 30, pl. XXVI, fig. 93.

Margaron (Unio) neislerii LEA, Syn., 1870, p. 29.

Quadrula neislerii SIMPSON, Syn., 1900, p. 771.

A rather small member of the *plicata* group, always much inflated, decidedly quadrate and having delicate, almost horizontal folds. The posterior ridge is always full. I have seen a specimen without locality, which I refer to this, in which the folds are almost wanting. A shell of *trapezoides* before me is shaped almost exactly like *neislerii*, but it has only a few short folds in front of the posterior ridge and a deep purple nacre.

Group of *Quadrula trapezoides*.

Shell rhomboid, inflated, with a high posterior ridge; beak sculpture coarse, irregular corrugations swollen to nodules on the posterior ridge; surface sculptured on posterior half with oblique ridges, which are sometimes corrugated, and with strong corrugations on post-slope; beak cavities only moderately deep; nacre purple.

Animal with the gills slightly rounded below, inner the larger throughout, free from the abdominal sac; palpi enormous, long; branchial opening very large, finely papillose; anal opening with fine papillæ or crenulations.

QUADRULA TRAPEZOIDES (Lea).

Shell long rhomboid, subinflated to inflated, solid, inequilateral; beaks only moderately full and high, their sculpture consisting of a few decidedly nodulous corrugations; posterior ridge strong and high, often pinched up into a sharp angle, ending at the base of the shell in a point; anterior end a little narrowed and rounded; base line straight; post-dorsal area somewhat winged; posterior end obliquely truncated with a slightly curved outline; surface with a few oblique folds in front of the posterior ridge and on the posterior end there are curved folds; umbonal region with lengthened nodules arranged in zigzagged patterns; epidermis brownish or blackish; pseudocardinals ragged, radially split; laterals long; muscle scars large, the anterior ones filled with roughened nacre; beak cavities moderately deep; pallial line remote; nacre purple-red.

Length 160, height 100, diam. 65 mm.

Length 108, height 67, diam. 43 mm.

Streams flowing into the Gulf of Mexico, from the Alabama River west to eastern Texas; northward in the Mississippi system to northwest Tennessee.

Type locality, Lake St. Joseph, La.

Unio crassidens var. *a*, LAMARCK, An. sans Vert., VI, 1819, p. 71.

Plectomerus crassidens var. *a*, CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 261.

Unio trapezoides LEA, Tr. Am. Phil. Soc., IV, 1831, p. 69, pl. III, fig. 1; Obs., I, 1834, p. 79, pl. III, fig. 1.—HANLEY, Biv. Shells, 1843, p. 176, pl. XXII, fig. 29.—CHENU, Ill. Conch., 1858, pl. X, figs. 2, 2a, 2b; Manual, 1859, II, p. 142, fig. 699.—KUSTER, Conch. Cab., 1862, p. 274, pl. XCII, fig. 2.—REEVE, Conch. Icon., XVI, 1864, pl. V, fig. 17.

Margarita (Unio) trapezoides LEA, Syn., 1836, p. 12; 1838, p. 14.

Margaron (Unio) trapezoides LEA, Syn., 1852, p. 21; 1870, p. 31.

Quadrula trapezoides SIMPSON, Syn., 1900, p. 772.

Crenodonta trapezoides ORTMANN, Ann. Car. Mus., VIII, 1912, p. 248, figs. 5-5a.

Unio interruptus SAY, Transylvania Journal, IV, 1831, p. 525; Am. Conch., IV, 1832, pl. XXXIII.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 45, pl. XVII, figs. 1-3.

Unio dombeyana VALENCIENNES, Rec. Obs. Zool., II, 1833, p. 227, pl. LIII, figs. 1, 1a, 1b.

Quadrula heros dombeyana VANATTA, Naut., XXIII, 1910, p. 102.

The only number of the section with purple, red or coppery nacre.

Var. *pentagonoides* FRIERSON.

"This shell differs from the type in having its dorsum very much arched or bent midway. The posterior is widely biangulated. The anterior is singularly truncated like *U. coruscus* Gld. The effect being that the outline forms nearly an equilateral pentagon, hence the name. Aside from its form,

it differs in being much smaller and frequently entirely devoid of plication on either its sides or posterior slope. A striking peculiarity is that the posterior end of the ligament is perpendicularly over the centre of the base, whereas in the ordinary *trapezoides* the end is situated about three-fourths of the distance from the anterior to the posterior." (Frierson).

Type locality, Calcasieu River, La.

Quadrula trapezoides var. *pentagonoides* FRIERSON, Naut., XVI, 1902, p. 40.

Section QUADRULA s. s.

Shell rhomboid, surface pustulous, with a high, rounded or sharp posterior ridge; epidermis generally smooth and bright.

Type, *Unio cylindricus* Say.

Group of *Quadrula metanevra*.

Shell quadrate or rhomboid, with a wide, rounded posterior ridge, above which, on the posterior slope, is a decided radial furrow; whole surface except the anterior end generally pustulous, the sculpture of the posterior slope being often wrinkled; umbonal region high; epidermis shining, usually painted with a beautiful pattern of triangular spots, and sometimes chevron-shaped lines; hinge strong, the secondary lateral in right valve rather feeble, but there is often a faint third lateral above; cavity of the beaks deep and compressed.

Animal with the marsupium filling all four leaves of the branchiæ, the ova giving it a purplish tint; inner gills free from the abdominal sac for the greater part of their length; mantle bordered with black; branchial opening opposite the lobe of the shell, extending well on to its base; anal opening without papillæ.

QUADRULA CYLINDRICA (Say).

Shell much elongate, inflated and having parallel dorsal and ventral lines so that it is almost cylindrical, inequilateral, solid; beaks rather full and elevated, turned forward over a deep.

wide lunule, their sculpture a few irregular, strong ridges that are nodulous on the posterior ridge; posterior ridge full, rounded; above it there is usually a wide, radial impression that sometimes ends in a slight sinus behind; anterior end rounded, subangular above; posterior end squarely or obliquely truncate; sometimes there is a point behind below the median line; surface with irregular, concentric sculpture, having a row of knobs extending along the posterior ridge and often more or less covered with lachrymous nodules and plications; epidermis straw-color, tawny, yellowish-green or greenish-yellow, generally overlaid with a pattern of triangular, green blotches, these are sometimes developed into radial stripes as if they had been painted on and had drizzled down; sometimes the green blotches are so close that they are only separated by narrow, greenish-yellow, zigzag lines, the whole smooth and somewhat shining; pseudocardinals radially split up; laterals long and straight; anterior scars impressed; beak cavities deep, compressed; nacre silvery white, rarely purplish, iridescent and much thinner behind.

Length 114, height 50, diam. 46 mm.

Entire Ohio, Cumberland, and Tennessee river systems; west to Nebraska (Aughey, doubtful); south to Arkansas and Indian Territory.

Type locality, Wabash River.

Unio cylindricus SAY, Nich. Encyc., II, 1817, pl. IV, fig. 3.—HILDRETH, Am. Jl. Sci., XIV, 1828, p. 283, figs. 13, 13*b*.—HANLEY, Biv. Shells, 1843, p. 182, pl. XX, fig. 31.—KUSTER, Conch. Cab. Unio, 1861, p. 194, pl. LXII, figs. 1, 2.—SOWERBY, Conch. Icon., XVI, 1867, pl. LX, fig. 300.—CALL, Tr. Acad. Sci., St. Louis, VII, 895, p. 15, pl. XII.

Margarita (Unio) cylindricus LEA, Syn., 1836, p. 17; 1838, p. 16.

Margaron (Unio) cylindricus LEA, Syn., 1852, p. 23; 1870, p. 35.

Orthonymus cylindricus AGASSIZ, Arch. für. Naturg., I, 1852, p. 48.

Mya cylindrica EATON, Zool. Text-Book, 1826, p. 219.

Unio (Theliderma) cylindrica SWAINSON, Treat. on Mal., 1840, p. 271, fig. 54c.

Quadrula cylindrica SIMPSON, Syn., 1900, p. 773.

Unio (Eurynia) solenoides var. *cylindrica* RAFINESQUE, Ann. Gen. Sci. Phys. Brux., V, 1820, p. 298.

Unio naviformis LAMARCK, An. sans Vert., VI, 1819, p. 75.—VALENCIENNES, Rec. Obs. Zool., II, 1833, p. 233, pl. LIII, fig. 4.—REEVE, Conch. Syst., 1841, p. 118, pl. LXXXIX, fig. 7.

Unio rugosus CHENU, Man., 1859, II, p. 138, fig. 668.

This is perhaps the most beautifully painted Naiad in the world. Occasional specimens are uniformly colored, but a great majority have a lovely pattern of green angular markings on a lighter ground. The form is an aberrant one and can never be mistaken for any other.

Mr. B. H. Wright, Nautilus, XII, 1898, p. 6, has made a var. *strigillatus* of a compressed, very rough form of *cylindrica*. There seems to me to be an absolute graduation from cylindrical, nearly smooth specimens to this form.

QUADRULA METANEVRA Rafinesque.

Shell irregularly rhomboid, more or less inflated, solid, inequilateral; beaks rather full and high, turned forward over a narrow lunule, their sculpture a few strong, irregular ridges, which are nodulous on the posterior ridge; posterior ridge elevated, rounded, separated from the rest of the shell in front and behind by a radial depression; anterior end rounded; base line straight or incurved behind the middle; dorsal slope obliquely truncated, the sulcation above the posterior ridge ending in a well-marked sinus; surface more or less covered with lachrymose knobs or tubercles, a row on the posterior ridge usually higher; epidermis yellow-green, tawny or brownish, often marked with small, dark green, triangular patches, subshining to dull and rough; pseudocardinals ragged, two in the left valve and three in the right; laterals short; anterior scars small, impressed; beak cavities deep, compressed; nacre white, rarely pinkish, greatly thickened at the anterior base.

Length 100, height 72, diam. 55 mm.

Mississippi drainage area except its southern portion, extending to the Tennessee and Arkansas rivers.

Type locality, Kentucky River.

Obliquaria (Quadrula) metanevra RAFINESQUE, Ann. Gen. Sci., Brux., V, 1820, p. 305, pl. LXXXI, figs. 15, 16.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 18, pl. II, fig. 15, 16.

Unio (Theliderma) metanevra SWAINSON, Treat. on Mal., 1840, p. 268, figs. 50, 54b.

Quadrula metanevra SIMPSON, Syn., 1900, p. 774.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 255, figs. 6-6a.

Unio metanevra HANLEY, Biv. Shells, 1843, p. 179, pl. XXI, fig. 31.—REEVE, Conch. Icon., XVI, 1864, pl. VII, fig. 25.

Margarita (Unio) metanevra LEA, Syn., 1836, p. 15; 1838, p. 15.

Unio metanevrus CONRAD, Monog., I, 1835, p. 10, pl. V, fig. 2.

—CALL, Tr. Acad. N. Sci. St. Louis, VII, 1895, p. 28, pl. X.

Margaron (Unio) metanevrus LEA, Syn., 1852, p. 22; 1870, p.

33.

Unio metanevrus KUSTER, Conch. Cab. Unio, 1852, p. 50, pl. X,

fig. 4.

? *Unio nodosus* BARNES, Am. Jl. Sci., VI, 1823, p. 124, pl. VI, figs. 7, 7a, 7b.—CHENU, Manual, 1859, II, p. 138, fig. 663.

Mya nodosa EATON, Zool. Text-Book, 1826, p. 216.

A solid, rhomboid form usually covered with tear-like tubercles and having stronger knobs on the rounded posterior ridge. The smaller forms run suspiciously close to *Q. tuberosa*.

Var. *wardii* (Lea).

Shell more compressed, more delicate and less solid than the type, usually smoother, sometimes scarcely tuberculate.

Ohio; west to Iowa.

Type locality, Walhonding River, Ohio; Wassepinicon River, Iowa; Coal River, Logan Co., Va.

Unio wardii LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 392; Jl. Ac. N. Sci. Phila., V, 1862, p. 187, pl. XXIV, fig. 257; Obs.,

IX, 1863, p. 9, pl. XXIV, fig. 257.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXII, fig. 434.

Margaron (Unio) wardii LEA, Syn., 1870, p. 33.

Quadrula metanevra var. *wardii* SIMPSON, Syn., 1900, p. 774.

This form is about as well separated from typical *metanevra* as is *tuberosa*. There are intermediates, which completely connect the variety with the species. The typical *wardii* is a trifle more elongated than the average *metanevra*.

QUADRULA TUBEROSA (Lea).

Shell irregularly subrhomboid, solid, subinflated, inequilateral; beaks high, rather full; lunule small or almost wanting; anterior end rounded; base line rounded, generally emarginate in front of the posterior ridge; dorsal slope truncated obliquely, with a sinus above the posterior ridge and an angle where the truncation joins the dorsal line; posterior ridge elevated, rounded, with a shallow radial depression in front of it and a deeper one behind it; surface, except the anterior end, covered with irregular, elevated tubercles; epidermis tawny, tawny-greenish or brown, often having faint, triangular, green markings, dull colored; pseudocardinals radial, marked with radial striæ; laterals short, that of the right valve double; beak cavities deep, compressed; nacre white, thin and iridescent behind.

Length 60, height 60, diam. 32 mm.

Length 56, height 46, diam. 25 mm.

Cumberland and Tennessee River systems.

Type locality, Caney Fork and Cumberland rivers, Tenn.

Unio tuberosus LEA, Pr. Am. Phil. Soc., I, 1840, p. 286; Tr. Am. Phil. Soc., VIII, 1842, p. 210, pl. XIV, fig. 25; Obs., III, 1842, p. 48, pl. XIV, fig. 25.—CHENU, Ill. Conch., 1858, pl. XXVIII, figs. 7. 7a, 7b.

Margaron (Unio) tuberosus LEA, Syn., 1852, p. 22; 1870, p. 33.

Quadrula tuberosa SIMPSON, Syn., 1900, p. 774.

Generally a little shorter in proportion than *metanevra*, not knobbed on the posterior ridge, smaller, less brightly painted and having a more decided projection of the posterior ridge. The lateral of the right valve is more completely double than it is in *metanevra*.

Var. *sparsa* (Lea).

Shell smaller than *tuberosa*, generally not nodulous.

Length 47, height 38, diam. 22 mm.

Holston and Clinch rivers, Tennessee.

Type locality, Holston river, Tennessee.

Unio sparsus LEA, Pr. Am. Phil. Soc., II, 1841, p. 82; Tr. Am. Phil. Soc., VIII, 1842, p. 242, pl. xxv, fig. 58; Obs., III, 1842, p. 80, pl. xxv, fig. 58.—CHENU, Ill. Conch., 1858, pl. xxvi, figs. 2, 2a, 2b.—REEVE, Conch. Icon., XVI, 1864, pl. iv, fig. 14.

Margaron (Unio) sparsus LEA, Syn., 1852, p. 22; 1870, p. 33.
Quadrula sparsa SIMPSON, Syn., 1900, p. 775.

After critically comparing large series of this and *tuberosa*, it does not seem to me that it can take any higher rank than that of a variety of the latter. It is smaller and generally a little less nodulous, but the coloring, texture, form and general characters are practically the same. I am very strongly inclined to believe that both should be considered mere varieties of *metanevra*.

QUADRULA INTERMEDIA (Conrad).

Shell subelliptical, suborbicular or subquadrate, convex to subinflated; beaks moderately high but not full; posterior ridge scarcely elevated above the outline of the shell, but having above it a deep, wide, radial depression, so that on its upper side it is well defined; the depression ends in a deep, rounded sinus: surface covered, except on the anterior end, with large, elevated warts, which are sometimes double; epidermis greenish-yellow or yellowish-green, variegated with fine, angular green spots or zigzags, sometimes with imperfect rays; pseudocardinals radial, radially striate; lateral of right valve double; beak cavities deep, much compressed; muscle scars small, impressed; nacre white or straw-color, thinner and iridescent behind.

Length 59, height 51, diam. 29 mm.

Tennessee River system.

Type locality, Nolachucky River, Tenn.

Unio intermedius CONRAD, Monog., VII, 1836, p. 63, pl. xxxv, fig. 2.—HANLEY, Biv. Shells, 1856, p. 381, pl. xx, fig. 28.—KUSTER, Conch. Cab. Unio, 1861, p. 213, pl. lxx, fig. 6.—REEVE, Conch. Icon., XVI, 1864, pl. xiii, fig. 48.

Margarona (Unio) intermedius LEA, Syn., 1852, p. 22; 1870, p. 33.

Quadrula intermedia SIMPSON, Syn., 1900, p. 775.

Unio kleinianus KUSTER, Conch. Cab. Unio, 1861, p. 191, pl. lx, fig. 4.

More compressed and lenticular, more nearly round or short elliptical than *tuberosa*, to which it sometimes closely approaches. The posterior radial depression is deeper and more sinuate behind than in any member of the group and the posterior ridge is less elevated or produced below.

QUADRULA STAPES (Lea).

Shell irregularly quadrate, subinflated to inflated, solid, equilateral; beaks high but not very full; posterior ridge high, narrowly rounded or subangular; behind it there is a radial depression and the posterior end of the shell is decidedly truncated: anterior end rounded; base rounded, straight behind, sometimes slightly incurved in front of the posterior ridge; surface covered with warts or lachrymose tubercles; these are sometimes triangular or formed into broken, zigzag ridges; epidermis yellowish-green in the young shells with fine, zigzag or triangular green markings; old shells usually brown; pseudocardinals radial, ragged; laterals short, that of the right valve double; beak cavities deep, compressed; muscle scars small, impressed; nacre silvery white, thinner and iridescent behind.

Length 60, height 53, diam. 27 mm.

Length 49, height 44, diam. 36 mm.

Alabama and Tombigbee rivers.

Type locality, Alabama river.

Unio stapes LEA, Tr. Am. Phil. Soc., IV, 1831, p. 77, pl. vii, fig. 8; Obs., I, 1834, p. 87, pl. vii, fig. 8.—CONRAD, Monog., VII, 1836, p. 62, pl. xxxv, fig. 1.—HANLEY, Biv. Shells, 1843, p. 179, pl. xxii, fig. 38.—CHENU, Ill. Conch., 1858, pl. xv, figs. 5, 5a, 5b; Manual, 1859, II, p. 142, fig. 997.—REEVE, Conch. Icon., XVI, 1864, pl. xiii, fig. 52.

Margarita (Unio) stapes LEA, Syn., 1836, p. 15; 1838, p. 13.

Margaron (Unio) stapes LEA, Syn., 1852, p. 22; 1870, p. 33.

Quadrula stapes SIMPSON, Syn., 1900, p. 775.

Unio retusus SAY, Am. Conch., VI, 1834.

Unio stegarius KUSTER, Conch. Cab. Unio, 1861, p. 211, pl. LXX, fig. 3.

In this species the beaks are placed usually midway between the anterior and posterior ends, sometimes a little in front of the center and occasionally just behind it. The shell is almost as decidedly truncate behind as is that of *Plagiola elegans*. These two characters will distinguish it from all other related forms.

Section THELIDERMA (Swainson, 1840) Simpson.

Theliderma SWAINSON, Treat. Mal., 1840, p. 378.—SIMPSON, Syn., 1900, p. 775.

Shell rounded, quadrate to rhomboid, solid, inflated; beaks rather prominent; beak sculpture consisting of a few rather coarse, subparallel ridges; anterior end rounded or slightly subtruncate above; base often arcuate; posterior end truncate, high, angled behind the ligament; epidermis scarcely rayed, never painted; beak cavities rather deep.

Type, *Unio lachrymosus* Lea.

Group of *Quadrula lachrymosa*.

Shell quadrate or rhomboid, generally with a sharp, well-developed posterior ridge, in front of which is a wide, shallow, radial excavation; base incurved; posterior end sharply truncate, generally slightly biangular below, high and distinctly angled behind the ligament; posterior tubercles often in somewhat radiating rows; earlier beak sculpture consisting of ridges nearly parallel with the growth lines; but later on becoming doubly looped and blending into the general sculpture of the shell; epidermis smooth; pseudocardinals strong; laterals straight; nacre white.

Animal with all four gills used as a marsupium throughout, inner much the larger, free from the abdominal sac nearly or quite their whole length; palpi very large; branchial opening generally having clustered, often branching, papillæ; anal opening smooth; superanal opening closed below.

QUADRULA ASPERA (Lea).

Shell subrhomboid, moderately inflated, subsolid to solid, somewhat inequilateral; beaks high, rather full, their sculpture a number of strong, somewhat double-looped ridges, which gradually blend into the sculpture of the surface; posterior ridge well-developed, distinctly double and angled, ending at the base of the shell in a decided biangulation; in front of it there is a wide radial depression and there is often another behind it, the outline of the shell being incurved where these depressions end; anterior end rounded, slightly, obliquely truncate above; base line incurved in front of the posterior ridge; post-dorsal slope often curved, sometimes raised to an angle behind the ligament; surface more or less covered with coarse and fine pustules, which are often longitudinally compressed, they are frequently stronger in the anterior post-ridge and down the middle of the disk; the depressed area between being smoother; epidermis lurid greenish to brown, scarcely shining; pseudocardinals radial, radially striate and often much split; laterals curved, that in the right valve somewhat double; anterior scars deep, partly filled with rough nacre; beak cavities moderately deep; nacre whitish, iridescent behind.

Length 63, height 50, diam. 30 mm.

Length 70, height 47, diam. 30 mm.

Length 56, height 47, diam. 27 mm.

Streams flowing into the Gulf of Mexico from Alabama west to central Texas, and northward to the Verdigris river, Kansas.

Type locality, Alabama river.

Unio asper LEA, Tr. Am. Phil. Soc., IV, 1831, p. 85, pl. IX, fig. 15; Obs., I, 1834, p. 95, pl. IX, fig. 15.—HANLEY, Biv. Shells, 1843, p. 179, pl. XXII, fig. 37.—CHENU, Ill. Conch., 1858, pl. XV, figs. 4, 4a, 4b: Manual, 1859, II, p. 142, fig. 695.—REEVE, Conch. Icon., XVI, 1864, pl. v, fig. 18.

Margarita (Unio) asper LEA, Syn., 1836, p. 15; 1838, p. 15.

Margaron (Unio) asper LEA, Syn., 1852, p. 22; 1870, p. 33.

Quadrula asper SIMPSON, Syn., 1900, p. 776.

Quadrula aspera ORTMANN, Ann. Car. Mus., VIII, 1912, p. 253.

Unio turgidus REEVE, Conch. Icon., XVI, 1864, pl. III, fig. 10.

Unio apiculatus var. *asper* PÆTEL, Conch. Sam., III, 1890, p. 144.

Variable in size, form, tuberculation and smoothness of epidermis, and very closely related to several other forms. Some specimens are almost smooth with the exception of the rows of strong tubercles on the median and posterior ridges, and approach dangerously close to forms of what I believe are *lachrymosa*. On the other hand certain shells are quite densely tuberculate and approach very near to *apiculata*.

QUADRULA LACHRYMOSA (Lea).

Shell subrhomboid, subinflated, solid, somewhat inequilateral; beaks high and full, their sculpture doubly looped or zigzagged bars, with radial threads behind them; posterior ridge well developed, generally somewhat double, ending at the base of the shell in a feeble biangulation; in front of and behind it there is a wide, radial depression; anterior end rounded; base line incurved in front of the posterior ridge; posterior end squarely or somewhat obliquely truncated, with a sinus in the middle; at the middle of the shell or a little in front of it there is usually a wide radial swelling; surface generally more or less covered with tubercles, excepting in front of this ridge; the sculpture on this and the posterior ridge often stronger than elsewhere; epidermis greenish in young shells, greenish-brown, brown or tawny in old ones, usually somewhat shining, sometimes feebly rayed; pseudocardinals very strong, triangular, ragged; lateral of the right valve somewhat double; anterior scars well impressed; beak cavities moderately deep; nacre white, thinner and iridescent behind; pallial line deep, roughened, remote in front.

Length 143, height 110, diam. 63 mm.

Length 100, height 88, diam 50 mm.

Entire Mississippi river drainage; various localities in the St. Lawrence basin; Red River of the North; southwest into eastern Texas.

Type locality, Ohio.

Unio lachrymosus LEA, Tr. Am. Phil. Soc., III, 1828, p. 272, pl. VI, fig. 8; Obs., I, 1834, p. 14, pl. VI, fig. 8.—HANLEY, Biv. Shells, 1843, p. 177, pl. XX, fig. 38.—KUSTER, Conch. Cab., 1854, p. 70, pl. XVII, fig. 3.—CHENU, Ill. Conch., 1858, pl. XV, figs. 6, 6a, 6b; Manual 1849, II, p. 142, fig. 698.—REEVE, Conch. Icon., XVI, 1864, pl. IX, fig. 33.

Margarita (Unio) lachrymosus LEA, Syn., 1836, p. 14; 1838, p. 15.

Margaron (Unio) lachrymosus LEA, Syn., 1852, p. 21; 1870, p. 32.

Quadrula lachrymosa BAKER, Moll. Chicago, Pt. I, 1898, p. 83, pl. XXV, fig. 1; XII, fig. 2.—SIMPSON, Syn., 1900, p. 776.

Unio asperrimus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 71, pl. V, fig. 3; Obs., I, 1834, p. 81, pl. V, fig. 3.—HANLEY, Biv. Shells, 1843, p. 178, pl. XXI, fig. 12.—POTIEZ and MICHAUD, Gall. Moll., 1844, p. 156, pl. LIX, figs. 2, 3.—CHENU, Ill. Conch., 1858, pl. IX, figs. 1, 1a, 1b.

Margarita (Unio) asperrimus LEA, Syn., 1836, p. 14; 1838, p. 15.

Margaron (Unio) asperrimus LEA, Syn., 1852, p. 21; 1870, p. 33.

Unio quadrulus SAY, Am. Conch., VI, 1834.—KUSTER, Conch. Cab., 1861, p. 184, pl. LVIII, fig. 1.

Unio quadratus REEVE, Conch. Icon., XVI, 1864, pl. VI, fig. 24.

Abundant, widespread and variable. Specimens occur, which are almost without tubercles, others are almost entirely covered with them. Those on the central ridges are often elongated in the direction of the growth lines, while the ones on the posterior ridge are rounded.

QUADRULA COUCHIANA (Lea).

Shell of medium or rather small size, subrhomboid, subinflated, rather solid, slightly inequilateral; beaks full and elevated, their sculpture consisting of strong doubly-looped or

zigzag ridges; posterior ridge moderately developed, generally double, and indistinctly angled, ending at the base of the shell in a biangulation; in front of and behind it there is a slight radial depression; there is usually a more or less developed, median, radial elevation; surface with fine, concentric growth lines, otherwise nearly smooth or covered with scattered pustules; epidermis greenish in the young shell, ashy-brown in the adult; pseudocardinals elevated, ragged and uneven; lateral of the right valve single or slightly double; beak cavities moderately deep; muscle scars impressed; nacre white, often silvery and iridescent behind.

Length 50, height 38, diam. 26 mm.

Length 41, height 30, diam. 20 mm.

Type locality, Rio Salado, New Leon, Mexico. Also southwestern Texas.

Unio couchianus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 305;

Jl. Ac. N. Sci. Phila., IV, 1860, p. 371, pl. LXVI, fig. 196;

Obs., VIII, 1860, p. 53, pl. LXVI, fig. 196.—SOWERBY, Conch.

Icon., XVI, 1868, pl. LXXXI, fig. 429.

Margaron (Unio) couchianus LEA, Syn., 1870, p. 54.

Quadrula couchiana SIMPSON, Syn., 1900, p. 777.

Lea has in his collection two matched pairs of this form, which are almost smooth. Other shells received from Dr. Mearns from the southwestern part of the state are more or less covered with scattered nodules. It is a rather small, somewhat elongated species having an ashy-brown epidermis.

QUADRULA FRAGOSA (Conrad).

Shell short, irregularly quadrate, inequilateral, subinflated, solid; beaks very high, full, turned forward over a well-developed lunule; anterior end rounded; base line incurved in front of the posterior ridge; posterior end almost squarely truncated; posterior ridge single above, double below, with a radial depression in front of and behind it; surface with uneven, concentric growth lines; anterior third of the shell otherwise smooth; remainder of the shell having coarse, scattered, irregular tubercles, which are strongest on the posterior and

median ridges; epidermis brownish, not shining; pseudocardinals elevated, exceedingly ragged and torn; lateral of the right valve usually single; beak cavities deep, compressed; anterior scars small; nacre white, thinner and slightly iridescent behind.

Length 96, height 85, diam. 53 mm

Ohio, Cumberland, and Tennessee river systems; westward probably to Minnesota, Nebraska, and Kansas.

Type locality, Scioto River, Ohio.

Unio fragosus CONRAD, Monog., II, 1836, p. 12, pl. VI, fig. 2.—

KUSTER, Conch. Cab. Unio, 1861, p. 173, pl. LV, fig. 1.—

REEVE, Conch. Icon., XVI, 1864, pl. I, fig. 2; pl. VII, fig. 27.

Margarita (Unio) fragosus LEA, Syn., 1836, p. 14; 1838, p. 15.

Margaron (Unio) fragosus LEA, Syn., 1852, p. 22; 1870, p. 33.

Unio fragosa CATLOW and REEVE, Conch. Nom., 1845, p. 59.

Quadrula fragosa SIMPSON, Syn., 1900, p. 778.

Unio tragosus HANLEY, Biv. Shells, 1843, p. 178, pl. XX, fig. 40.

A robust, rude, short quadrate species with strong tubercles, which sometimes are knob-like on the posterior and median ridges. The epidermis is brown, rayless and dull. It is generally much more quadrate than *lachrymosa* and has stronger sculpture, though there are intermediate specimens that are sometimes difficult to place.

QUADRULA FORSHEYI (Lea).

Shell rather short, subquadrate, subinflated, nearly or quite equilateral, solid; beaks elevated but not inflated, their sculpture sharply doubly-looped ridges; posterior ridge well developed, single above, double below, ending at the base of the shell in a biangulation and having in front of and behind it a radial depression; anterior end round; base line incurved in front of the posterior ridge; posterior end almost squarely truncated, with a sinus just above the termination of the posterior ridge; surface with uneven growth lines, more or less covered throughout with rather small tubercles; epidermis greenish in young shells, brownish or ashy-brown in old ones; pseudocardinals strong, triangular, not greatly torn; lateral

of the right valve somewhat double; beak cavities deep, compressed; muscle scars impressed; nacre whitish, thinner and slightly iridescent behind.

Length 90, height 80, diam. 47 mm.

Alabama to Texas, in streams flowing into the Gulf of Mexico.

Type locality, Fayette Co., Texas.

Unio forsheyi LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 155; JI. Ac. N. Sci. Phila., IV, 1860, p. 357, pl. LX, fig. 182; Obs., VIII, 1860, p. 39, pl. LX, fig. 182.—REEVE, Conch. Icon., XVI, 1864, pl. VI, fig. 21.

Margaron (Unio) forsheyi LEA, Syn., 1870, p. 32.

Quadrula forsheyi SIMPSON, Syn., 1900, p. 778.

This species varies much in the degree of smoothness or roughness of its surface. Young specimens are more tuberculous than old ones. The tubercles usually extend over the whole surface and in this it differs from the ordinary manifestation of *lachrymosa* and *fragosa* where they are usually wanting on the anterior end. I am inclined to think that it may run into *Q. speciosa*.

QUADRULA SPECIOSA (Lea).

Shell long rhomboid or long quadrate, subcompressed, inequilateral, subsolid; beaks rather high but not full, their sculpture sharply doubly-looped ridges; posterior ridge single and angled above, becoming double below, ending in a biangulation at the base of the shell; in front of and behind it there is a faint radial depression; surface densely covered with rather small, uneven pustules, which are arranged on the posterior slope in curved, subradial lines; epidermis greenish; pseudocardinals elevated, two in the left valve and one with two vestigial ones in the right; left valve with two laterals; right valve with one double one; beak cavities rather deep, compressed; anterior scars impressed, rough; nacre bluish-white, silvery.

Length 62, height 45, diam. 20 mm.

Kansas, south to Texas.

Type locality, Colorado River, La Grange and Leon Co., Texas.

Unio speciosus LEA, Pr. Ac. N. Sci. Phila., VI, 1862, p. 168; Jl. Ac. N. Sci. Phila., V, 1862, p. 207, pl. XXXI, fig. 276; Obs., IX, 1863, p. 29, pl. XXXI, fig. 276.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIV, fig. 447.

Margaron (Unio) speciosus LEA, Syn., 1870, p. 33.

Quadrula speciosa SIMPSON, Syn., 1900, p. 778.

Lea has four shells in his collection labeled *Unio speciosus*. I have given above the measurements of the largest one and am doubtful whether any of them are adult. They are very much like young *forshyei*, but are more compressed and elongated.

QUADRULA APICULATA (Say).

Shell subrhomboid, rather short, slightly inequilateral, sub-solid to solid; beaks high, moderately full; posterior ridge well developed, narrowly rounded, angled or showing a tendency to be double, ending in a point or feeble biangulation at the base of the shell; in front of and behind it there are radial depressions; anterior end rounded, sometimes obliquely truncated above; basal line sinused in front of the posterior ridge; outline of dorsal slope raised to an angle behind the ligament, squarely or obliquely truncate below; surface covered with fine, close pustules, which are often laid down in zigzag patterns; epidermis greenish in young shells, ashy-brown in old ones, dull; pseudocardinals radial, somewhat split; lateral of right valve partly double; beak cavities moderately deep; anterior scars well impressed; nacre white, iridescent behind.

Length 72, height 59, diam. 37 mm.

Length 60, height 52, diam. 32 mm.

Louisiana to Texas.

Type locality, New Orleans, La.

Unio apiculatus SAY, New Harm. Diss., II, No. 2, 1829, p. 309; Am. Conch., VI, 1834, pl. LII.—CONRAD, Monog., IX, 1837, p. 78, pl. XLIV, fig. 1.—HANLEY, Biv. Shells, 1843, p. 178, pl. XXIII, fig. 51.—CHENU, Manual, 1859, II, p. 142, fig. 696.—REEVE, Conch. Icon., XVI, 1864, pl. III, fig. 11.

Margarita (Unio) apiculatus LEA, Syn., 1836, p. 15; 1838, p. 15.

Margaron (Unio) apiculatus LEA, Syn., 1852, p. 22; 1870, p. 33.

Quadrula apiculata SIMPSON, Syn., 1900, p. 778.

Unio nobilis CONRAD (part), Jl. Ac. N. Sci. Phila., 1854, p. 297, pl. XXVII, fig. 2.

Close to *aspera*, but, as a rule, not quite as elongated. It is more densely covered with pustules, which are often arranged in partly zigzag patterns, they are finer, and are equally numerous in the radial depression in front of the posterior ridge. Those on the posterior and median ridges are not enlarged and the epidermis in mature specimens is more ashy-colored and less brown than in *aspera*.

QUADRULA RUMPHIANA (Lea).

Shell subquadrate, subinflated, solid, equilateral or having the beaks slightly nearer to the posterior end; beaks high, moderately full; their sculpture consisting of sharply doubly looped bars; posterior ridge full, rounded or showing a slight inclination towards being biangulate, ending at the posterior base of the shell, and having in front of and behind it a decided radial depression; anterior end round; base line incurved in front of the posterior ridge; posterior end almost squarely truncated, sinused above the posterior ridge; surface more or less covered with low tubercles of various sizes, the posterior ridge nearly or quite smooth; post-dorsal slope with radial, nodulous plications; epidermis greenish in the young shell, rich reddish-brown in the adult shell, shining; pseudocardinals subtriangular, rough, but not much split; laterals short, straight, that of the right valve more or less double; beak cavities deep; muscle scars well marked; nacre silvery, thinner and iridescent behind.

Length 90, height 78, diam. 45 mm.

Type locality, Western Georgia. Also Alabama in the Gulf drainage.

Unio rumphiannus LEA, Tr. Am. Phil. Soc., X, 1852, p. 276, pl. XXII, fig. 34; Obs., V, 1852, p. 32, pl. XXII, fig. 34.

Margaron (Unio) rumphiannus LEA, Syn., 1852, p. 21; 1870, p. 33.

Quadrula rumphiana SIMPSON, Syn., 1900, p. 778.

Unio blandianus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 263; Jl. Ac. N. Sci. Phila., IV, 1858, p. 65, pl. XI, fig. 47; Obs., VI, 1858, p. 65, pl. XI, fig. 47.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVIII, fig. 405.

Margaron (Unio) blandianus LEA, Syn., 1870, p. 33.

A very fine species with generally smooth, somewhat rounded posterior ridge and rich shining brown epidermis. The nacre is fine and silvery. I have seen specimens, which I referred to this species with doubt, that have quite strong, rough pustules.

Group of *Quadrula pustulosa*.

Shell round quadrate, truncated behind, full and angled back of the ligament; beaks high; beak sculpture a few coarse ridges, which are swollen at the posterior ridge, which is rounded; surface generally more or less pustulous, but sometimes entirely smooth, and in some cases slightly corrugated; epidermis often having broad, faint, green rays; hinge strong; nacre white or purple.

Animal with the marsupium occupying all four gills throughout; inner gills the larger, free the whole or the greater part of their length from the abdominal sac; branchial opening having clustered, often branching papillæ.

QUADRULA PUSTULOSA (Lea).

Shell subquadrate, subrhomboid, subtriangular or suborbicular, generally inflated, solid, inequilateral; beaks full and high, turned forward over a deep lunule, their sculpture a few coarse corrugations; anterior end rounded; base straight or lightly curved; posterior end squarely or obliquely truncated, usually well-angled behind the ligament; posterior ridge only moderately developed, rounded; there is often a slight radial

depression above it; surface, excepting at the anterior part, usually more or less covered with warty or lachrymose tubercles, sometimes nearly or quite smooth; epidermis tawny or tawny-greenish in young shells, often with a wide, broken, bright green ray, dirty brownish in old shells; pseudocardinals strong, triangular, more or less ragged, two in the left valve and three in the right; lateral of the right valve sometimes partly double; beak cavities deep, compressed; muscle scars impressed; nacre white, thinner and iridescent behind.

Length 105, height 95, diam. 70 mm.

Length 75, height 72, diam. 40 mm.

Length 56, height 51, diam. 35 mm.

Entire Mississippi drainage; Michigan; Lake Erie.

Type locality, Ohio; Alabama river.

Unio pustulosus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 76, pl. VII, fig. 7; Obs., I, 1834, p. 86, pl. VII, fig. 7.—HANLEY, Biv. Shells, 1843, p. 180, pl. XXI, fig. 34.—CHENU, Ill. Conch., 1858, pl. XXIII, figs. 2, 2a, 2b.

Margarita (Unio) pustulosus LEA, Syn., 1836, p. 15; 1838, p. 15.

Margaron (Unio) pustulosus LEA, Syn., 1852, p. 22; 1870, p. 33.

Quadrula pustulosa BAKER, Moll. Chicago, Pt. I, 1898, p. 86, pl. XXV, fig. 2; XXVIII, fig. 13.—SIMPSON, Syn., 1900, p. 779.

Unio verrucosa VALENCIENNES, Rec. Obs. Zool. Anat., II, 1833, p. 231, pl. LIII, fig. 2.

Unio nodulosus SAY, Am. Conch., VI, 1834.

Unio prasinus CONRAD, New F. W. Shells, 1834, p. 44, pl. III, fig. 1; Monog., IX, 1837, p. 79, pl. XLIV, fig. 2.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 22, pl. III, fig. 1.—REEVE, Conch. Icon., XVI, 1864, pl. VII, figs. 26, 26a, 26b.

Unio bullatus var. *prasinus* PÆTEL, Conch. Sam., III, 1890, p. 146.

Unio bullatus CONRAD, New F. W. Shells, 1834, p. 68; Monog., X, 1838, p. 82, pl. XLV, fig. 2.—KUSTER, Conch. Cab. Unio, 1852, p. 47, pl. IX, fig. 3.—REEVE, Conch. Icon., XVI, 1864, pl. XII, fig. 2.

Unio dorfeullianus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 73, pl. XVII, fig. 54; Obs., II, 1838, p. 73, pl. XVII, fig. 54.—HANLEY, Biv. Shells, 1843, p. 179, pl. XXIII, fig. 10.—CHENU, Ill. Conch., 1858, pl. XXV, figs. 5, 5a, 5b.—REEVE, Conch. Icon., XVI, 1864, pl. x, fig. 38.—CALL (part), Tr. Ac. N. Sci., St. Louis, VII, 1895, p. 40, pls. XII; XIII; XIV; XV, figs. 1, 2.

Margarita (Unio) dorfeullianus LEA, Syn., 1838, p. 15.

Margaron (Unio) dorfeullianus LEA, Syn., 1852, p. 22; 1870, p. 33.

Unio uber CONRAD, Am. Jl. Conch., II, 1866, p. 279, pl. xv, fig. 16.

Abundant throughout the most of the Upper Mississippi drainage and very variable. The anterior one-fourth to two-fifths of the surface is usually smooth, the remainder is generally furnished with various sized pustules, though in some cases the whole shell is destitute of tubercles. A large quadrate shell with high beaks from the Wabash was called *Unio dorfeullianus* by Dr. Lea, but it scarcely differs from shells, which he has placed with his *pustulosus*. Two of the specimens he has placed with *dorfeullianus* are from Columbus, Mississippi, and are certainly *Q. mortoni* Conrad.

Var. *schoolcraftensis* (Lea).

More quadrate and compressed than the type, the young usually with a broad, often broken, ray in the middle of the disk with narrow ones on the dorsal slope; surface varying from smooth to pustulous. It is distributed over much the same area as the type.

Length 72, height 64, diam. 35 mm.

Mississippi valley.

Type locality, Fox River of Green Bay.

Unio schoolcraftensis LEA, Tr. Am. Phil. Soc., V, 1834, p. 37, pl. III, fig. 9; Obs., I, 1834, p. 149, pl. III, fig. 9.—SOWERBY, Conch. Icon., XVI, 1868, pl. I, fig. 3; pl. XIII, fig. 47.

Margarita (Unio) schoolcraftensis LEA, Syn., 1836, p. 15; 1838, p. 15.

Margaron (Unio) schoolcraftensis LEA, Syn., 1852, p. 22.

Unio bullatus var. *schoolcraftensis* PÆTEL, Conch. Sam., III, 1890, p. 146.

Margaron (Unio) schoolcraftii LEA, Syn., 1870, p. 33.

Unio schoolcraftii, B. H. WRIGHT, Check List, 1888.

Varies absolutely into the type, but possibly worthy of varietal rank. The type was a young shell and is not in the Lea collection.

Var. *pernodosa* (Lea).

Suborbicular, moderately inflated, pustulous; epidermis yellowish-brown.

Length 50, height 50, diam. 33 mm.

Tennessee and Alabama River systems.

Type locality, North Carolina.

Unio pernodosus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 163; Tr. Am. Phil. Soc., X, 1848, p. 71, pl. III, fig. 8; Obs., IV, 1848, p. 45, pl. III, fig. 8.—REEVE, Conch. Icon., XVI, 1864, pl. XII, fig. 46.

Margaron (Unio) pernodosus LEA, Syn., 1870, p. 34.

Quadrula pustulosa var. *pernodosa* SIMPSON, Syn., 1900, p. 780.

Unio asperatus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 41; Jl. Ac. N. Sci. Phila., V, 1862, p. 68, pl. VII, fig. 218; Obs., VIII, 1862, p. 72, pl. VII, fig. 218.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXV, fig. 450.

Margaron (Unio) asperatus LEA, Syn., 1870, p. 33.

Distinguished from the type by being nearly orbicular in outline. Specimens connecting it with the type are abundant in the Ohio and adjacent rivers.

Var. *kieneriana* (Lea).

Shell suborbicular, smooth or somewhat nodulous; epidermis ashy-brown or greenish-brown.

Length 39, height 39, diam. 22 mm.

Alabama river system.

Type locality, Coosawattee river, Murray Co., Ga.

Unio keinerianus LEA, Pr. Am. Phil. Soc., V, 1852, p. 251; Tr. Am. Phil. Soc., X, 1852, p. 281, pl. XXIII, fig. 40; Obs., V, 1852, p. 37, pl. XXIII, fig. 40.

Margaron (Unio) keinerianus LEA, Syn., 1852, p. 22.

Margaron (Unio) kienerianus LEA, Syn., 1870, p. 34.

Quadrula pustulosa var. *keineriana* SIMPSON, Syn., 1900, p. 780.

Seems to merge into variety *pernodosa*, but it is smaller and the epidermis is differently colored. Some specimens have broken green bands and are feebly rayed.

This form was named by Lea after Kiener, but he inadvertently misspelled the name. It is therefore proper to correct the error.

QUADRULA COOPERIANA (Lea).

Shell subtriangular, rarely suborbicular, subinflated, solid, inequilateral; beaks very high, rather full, turned forward over a deep lunule; posterior ridge low, rounded; anterior end usually obliquely truncated above, rounded below; base line more or less rounded; outline of dorsal slope slightly curved, sometimes raised almost into an angle behind the ligament; surface with irregular growth lines; posterior two-thirds covered with strong, irregular pustules; epidermis reddish-brown; pseudocardinals triangular, not greatly roughened; lateral double in the right valve; beak cavities deep, compressed; muscle scars deep; nacre white or pink, thinner behind where it is often bronzy.

Length 90, height 80, diam. 47 mm.

Length 80, height 84, diam. 43 mm.

Ohio, Cumberland, and Tennessee River systems. Reported by Keyes at Muscatine, Iowa, but this is probably an error.

Type locality, Ohio river.

Unio cooperianus LEA, Tr. Am. Phil. Soc., V, 1834, p. 61, pl. VIII, fig. 21; Obs., I, 1834, p. 173, pl. VIII, fig. 21.—HANLEY, Biv. Shells, 1843, p. 180, pl. XXI, fig. 1.—KUSTER, Conch. Cab. Unio, 1861, p. 183, pl. LVII, fig. 5.

Margarita (Unio) cooperianus LEA, Syn., 1836, p. 16; 1838, p. 15.

Margarona (Unio) cooperianus LEA, Syn., 1852, p. 22; 1870, p. 34.

Quadrula cooperiana SIMPSON, Syn., 1900, p. 781.

Plethobasus cooperianus ORTMANN, Ann. Car. Mus., VIII, 1912, p. 261.

Unio striatus REEVE, Conch. Icon., XVI, 1864, pl. VIII, fig. 30.

Usually somewhat triangular and always having very high beaks. It is occasionally nearly orbicular in outline. The epidermis is reddish-brown, the hinder two-thirds of the shell has very strong, irregular pustules. They are usually strongest and longitudinally compressed from the umbonal region down towards the middle of the base. Very young shells are greenish-brown or brownish-green.

Ortmann, (l. c.), states that "the anatomy of this species is practically identical with that of *P. asophus*, agreeing in all particulars, chiefly so in the peculiar color of the soft parts."

QUADRULA MORTONI (Conrad).

Shell subquadrate, inflated, subsolid, sometimes solid when old, inequilateral; beaks high and full, turned forward over a lunule; posterior ridge well developed, angled or narrowly rounded, rarely somewhat double below, ending at the base of the shell in a blunt point; anterior end rounded, sometimes slightly, obliquely truncate above; base line straight or lightly curved; outline of dorsal slope curved or raised in the middle to an angle; surface varying from almost smooth to densely pustulous, pustules generally covering the whole shell; epidermis ashy-brown or lurid brown, having a greenish tint and sometimes a broad, broken, green ray when young; pseudo-cardinals triangular, not greatly split up; lateral of the right valve scarcely double; beak cavities deep, compressed; muscle scars impressed; nacre whitish with a purplish tint, purple and iridescent behind.

Length 60, height 52, diam. 35 mm.

Lower Mississippi river drainage as far north as western Tennessee and Indian Territory; west into eastern Texas.

Type locality, Bayou Teche, La.

Unio mortoni CONRAD, Monog., II, 1836, p. 11, pl. VI, fig. 1.—
KUSTER, Conch. Cab. Unio, 1852, p. 51, pl. XI, fig. 1.

Quadrula mortoni SIMPSON, Syn., 1900, p. 781.

Unio turgidus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 11, pl. v,
fig. 11; Obs., II, 1838, p. 11, pl. v, fig. 11.—HANLEY, Biv.
Shells, 1843, p. 180, pl. XXI, fig. 51.—CHENU, Ill. Conch.,
1858, pl. XXV, figs. 1, 1a, 1b.

Margarita (Unio) turgidus LEA, Syn., 1836, p. 16; 1838, p. 15.

Margaron (Unio) turgidus LEA, Syn., 1852, p. 22; 1870, p. 34.

Varies greatly in the degree of smoothness. Some shells have scarcely a nodule; in others they are crowded over the whole surface. The pustules are often compressed, sometimes into short ridges and some of them are laid on obliquely to the growth lines.

QUADRULA SPHÆRICA (Lea).

Shell subquadrate or suborbicular, inflated, solid, slightly inequilateral; beaks full and high, turned forward over a lunule; posterior ridge moderately developed, subangular; anterior end rounded or slightly subtruncate above; base rounded; posterior end almost squarely truncated; posterior three-fifths of the surface somewhat nodulous, the nodules generally rather feeble; epidermis reddish-chestnut, subshining; pseudo-cardinals irregular, somewhat torn and ragged; laterals short, that of the right valve single or double; beak cavities deep, compressed; muscle scars deep; nacre brilliant purplish or violet, richly and darkly iridescent behind.

Length 48, height 48, diam. 35 mm.

Streams of Alabama and Mississippi flowing into the Gulf of Mexico.

Type locality, Pearl River, Jackson, Miss.

Unio sphaericus LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 145;
Jl. Ac. N. Sci. Phila., 1869, p. 319, pl. LI, fig. 132; Obs., XII,
1869, p. 79, pl. LI, fig. 132.

Margaron (Unio) sphaericus LEA, Syn., 1870, p. 33.

Quadrula sphaerica SIMPSON, Syn., 1900, p. 781.

A fine richly-colored species, suborbicular in outline. The nacre and epidermis are fine, the former having comparatively few, irregular pustules. It is more inflated, less elongated and has fainter tubercles than *Q. refulgens*.

QUADRULA REFULGENS (Lea).

Shell subelliptical, subcompressed to slightly inflated, somewhat inequilateral; beaks elevated but not inflated, their sculpture a few coarse, nodulous ridges; posterior ridge subangular, ending in a blunt point near the base of the shell; anterior end rounded or very little truncate above; base line curved; outline of dorsal slope curved, often raised to an angle in the middle; on the disk there is a wide band extending from the umbonal region to the base that is covered with large, low, rather even nodules; dorsal slope somewhat nodulously wrinkled; anterior end without nodules; epidermis reddish-chestnut, subshining; pseudocardinals triangular, ragged, two in the left valve and three in the right; lateral in right valve single or double; beak cavities deep, compressed; muscle scars small, impressed; nacre purple or violet, iridescent behind.

Length 48, height 38, diam. 23 mm.

Length 50, height 40, diam. 28 mm.

Mississippi and probably Alabama.

Type locality, Oktibbiha River, Lauderdale Co., Miss.

Unio refulgens LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 145; Jl. Ac. N. Sci. Phila., VI, 1869, p. 317, pl. LI, fig. 130; Obs., XII, 1869, p. 77, pl. LI, fig. 130.

Margaron (Unio) refulgens LEA, Syn., 1870, p. 34.

Quadrula refulgens SIMPSON, Syn., 1900, p. 782.

Unio pustulosus CALL, (part), Tr. Ac. Soc. St. Louis, VII, 1895, p. 42, pl. xv, figs. 3, 4.

Typically quite distinct from *spharica*, but there are examples that almost connect the two. Generally the pustules on this species are large, rather regular and evenly spaced, and they occupy a wide band in front of the posterior ridge, running vertically, while in *spharica* they are smaller and less regularly disposed. The shell is more elliptical and compressed than *spharica*.

QUADRULA PUSTULATA (Lea).

Shell subquadrate, inflated, slightly inequilateral, solid; beaks high and full, turned forward over a lunule, their sculpture a few coarse, irregular corrugations; posterior ridge well developed, narrowly rounded or subangular, sometimes inclined to be double below; anterior end rounded, sometimes feebly angled above; base line slightly curved; posterior end almost squarely truncated, sinused in the middle at the termination of a radial depression above the posterior ridge; surface with a few large warts or pustules, often arranged in two imperfect rows, one on the posterior ridge, the other some distance in front of it; epidermis generally smooth, subshining, ashy-green in young shells, rarely feebly rayed, ashy-brown in old shells; pseudocardinals considerably split up; lateral of the right valve single or double; beak cavities deep, compressed; anterior scars small, deep; nacre white, iridescent behind.

Length 60, height 53, diam. 33 mm.

Ohio, Cumberland, and Tennessee River systems; Mississippi River and tributaries from eastern Iowa south to Louisiana.

Type locality, Ohio; Tennessee.

Unio pustulatus LEA, Tr. Am. Phil. Soc., IV, 1834, p. 79, pl. VII, fig. 9; Obs., I, 1834, p. 89, pl. VII, fig. 9.—HANLEY, Biv. Shells, 1843, p. 178, pl. XXII, fig. 36.—CHENU, Ill. Conch., 1858, pl. XV, figs. 8, 8a, 8b.

Margarita (Unio) pustulatus LEA, Syn., 1836, p. 15; 1838, p. 15.

Margaron (Unio) pustulatus LEA, Syn., 1852, p. 22; 1870, p. 33.

Quadrula pustulata SIMPSON, Syn., 1900, p. 782.

Unio nodulatus SAY, Am. Conch., VI, 1834.—CONRAD, Monog., 1837, p. 80, pl. XLV, fig. 1.—KUSTER, Conch. Cab., 1861, p. 254, pl. LXXXVI, fig. 1.—REEVE, Conch. Icon., XVI, 1864, pl. XIII, fig. 51.

Unio nodulatus RAFINESQUE var. *pustulatus* PETEL, Conch. Sam., III, 1890, p. 161.

This species is associated with *Q. pustulosa* and is often mistaken for it. It has as a rule smoother epidermis, much fewer and larger tubercles, which are inclined to be placed in two radial rows. There are occasional specimens, which are nearly or quite destitute of pustules. Occasionally this species has a few small nodules on the dorsal slope. The truncation of the posterior end is strong and, as in some of the species of this group, the upper part of the truncation often overhangs the lower part.

QUADRULA NODIFERA (Conrad).

Shell subquadrate or subrhomboid, inflated, moderately solid, somewhat inequilateral; beaks full and high; anterior end rounded, usually a little narrowed; base line curved in front, straight behind; posterior end rounded from the beaks to the lower end of the posterior ridge; posterior ridge moderately developed, subangular, ending in front of the extreme posterior end of the shell; surface smooth or having a few scattered nodules; epidermis dull, dirty or grayish-brown; pseudocardinals triangular, much split up into radial denticles; lateral of the right valve double or single; beak cavities rather deep; muscle scars small, impressed; nacre white or lurid, often blotched.

Length 47, height 39, diam. 27 mm.

Length 44, height 34, diam. 27 mm.

Louisiana and eastern Texas.

Type locality, Jackson, La.

Unio nodiferus CONRAD, Pr. Ac. N. Sci. Phila., I, 1841, p. 19;

Jl. Ac. N. Sci. Phila., I, 1850, p. 277, pl. XXXVIII, figs. 4, 8.

Quadrula nodifera SIMPSON, Syn., 1900, p. 782.

A somewhat doubtful species. I have seen no specimens, which exactly agree with the figure of the species as given by Conrad. It is usually a little narrowed in front and the outline of the posterior end sweeps around in an almost regular curve from the beaks to a point on the base considerably in front of the extreme hinder part of the shell. It is rarely raised into a low angle behind the ligament.

There are six shells bearing the name *Unio nodiferus* Conrad in the Philadelphia Academy of Natural Sciences. Part of them are the same as figured in the Journal, and the rest are probably *mortoni*.

QUADRULA CAHABENSIS (Lea).

Shell subquadrate, compressed or subcompressed, slightly inequilateral, moderately solid; beaks elevated and full; anterior end rounded; base nearly straight; posterior end obliquely truncated, the upper part overhanging; posterior ridge low, widely rounded; surface thickly covered, except the upper anterior portion, with strong, wart-like tubercles, which on the posterior slope are sometimes elongated; epidermis tawny to brownish, showing the dark growth lines; pseudocardinals radial, roughened; lateral in right valve single or double; beak cavities deep, compressed; anterior scars small; nacre flesh-color or salmon-tinted, brilliant, thinner and iridescent behind.

Length 46, height 37, diam. 18 mm.

Cahawba River, Alabama.

Type locality, Cahawba River, Shelby Co., Ala.

Unio cahabensis LEA, Pr. Ac. N. Sci. Phila., XXIII, 1871, p. 190; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 17, pl. v, fig. 14; Ob., XIII, 1874, p. 21, pl. v, fig. 14.

Quadrula cahabensis SIMPSON, Syn., 1900, p. 782.

I have seen larger shells than the type (whose measurements I have given) in the collection of T. H. Aldrich of Birmingham, Alabama. Typically it is quite distinct from *Q. vallata*, being more compressed, more quadrate and having brighter epidermis and nacre, but I should not be surprised if an abundance of material would demonstrate that the two run together.

QUADRULA VALLATA (Lea).

Shell subquadrate, convex or subinflated, solid, subequilateral; beaks neither very full nor high; anterior end slopingly truncate above, rounded below; base line nearly or quite straight; posterior end somewhat obliquely truncated, the up-

per end of the truncation slightly angled; posterior ridge full, widely rounded; surface more or less covered with low pustules, taking the form on the dorsal slope of nodular, curved ridges; epidermis lurid or ashy-brownish; pseudocardinals radial, rather smooth, two in the left valve and a single or double one in the right; beak cavities very deep, compressed; muscle scars large and deep; nacre dull, lurid whitish.

Length 60, height 53, diam. 30 mm.

Alabama and Black Warrior Rivers, Alabama.

Type locality, Alabama River.

Unio vallatus LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 45; Jl. Ac. N. Sci. Phila., 1869, p. 315, pl. L, fig. 128; Obs., XII, 1869, p. 75, pl. L, fig. 128.

Margaron (Unio) vallatus LEA, Syn., 1870, p. 34.

Quadrula vallata SIMPSON, Syn., 1900, p. 782.

Not so quadrate of *cahabensis*, more inflated, solid and duller colored throughout. Yet it is quite probable that the two species run together.

QUADRULA HOUSTONENSIS (Lea).

Shell subrhomboid or subquadrate, inflated, solid, nearly or quite equilateral; beaks full and high, turned forward over a lunule; posterior ridge well developed, narrowly rounded or subangular, ending at or near the base in a blunt point; anterior end rounded, sometimes slightly slopingly truncate above; base line curved or nearly straight; posterior end nearly or quite squarely truncated; surface usually free from pustules, rarely having a few feeble ones; epidermis yellowish-green in young shells, sometimes faintly rayed, becoming ashy brown or lurid brown when old; pseudocardinals strong, often split up; left valve with two laterals; right valve with a single or somewhat double one; beak cavities deep; muscle scars large, impressed; nacre silvery white.

Length 66, height 59, diam. 38 mm.

Texas and southern Arkansas. Verdigris River, Kansas?

Type locality, Houston and Rutersville, Texas.

Unio houstonensis LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 155; Jl. Ac. N. Sci. Phila., IV, 1860, p. 358, pl. LX, fig. 183; Obs., VIII, p. 40, pl. LX, fig. 183.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXI, fig. 425.

Margaron (Unio) houstonensis LEA, Syn., 1870, p. 55.

Quadrula houstonensis SIMPSON, Syn., 1900, p. 782.

A solid, inflated form with the beaks near the center. Usually the shell is entirely free from tubercles, but occasionally there are a few weak ones. It is not so smooth as *petrina* and the epidermis is duller colored.

QUADRULA PETRINA (Gould).

Shell subelliptical, subquadrate or subrhomboid, somewhat inflated, slightly inequilateral, solid; beaks moderately full and high, turned forward over a lunule, their sculpture consisting of irregular corrugations, which are almost nodulous on the posterior ridge; posterior ridge widely rounded, sometimes feebly biangulate below; anterior end rounded; base line curved; posterior end obliquely or squarely subtruncate; umbonal region corrugated; posterior slope faintly corrugately wrinkled, the rest of the shell smooth or very feebly corrugated; epidermis rather smooth, somewhat shining, sometimes uniform dirty straw-color, usually yellowish-green with irregular bands or clouds of green; pseudocardinals stumpy, triangular, two in the left valve and three in the right; beak cavities deep, compressed; muscle scars deep, smooth; nacre silvery, iridescent and thinner behind.

Length 70, height 53, diam. 32 mm.

Length 47, height 38, diam. 25 mm.

Texas. Cragin's localities, Verdigris and Neosho Rivers, Kansas, are probably erroneous.

Type locality, Llanos River, Texas.

Unio petrinus GOULD, Pr. Bost. Soc. N. Hist., V, 1855, p. 228.

Margaron (Unio) petrinus LEA, Syn., 1870, p. 55.

Quadrula petrina SIMPSON, Syn., 1900, p. 783.

More inflated, less quadrate or rhomboid than *Q. aurea*; less inflated and not so short as *Q. houstonensis*, and having a differently colored epidermis from either.

QUADRULA AUREA (Lea).

Shell subrhomboid, subcompressed to convex, inequilateral, subsolid; beaks slightly elevated, rather compressed, their sculpture a few coarse, irregular ridges; posterior ridge rounded; anterior end rounded; base straight or lightly curved; posterior end obliquely, rarely squarely, truncate; surface nearly smooth; there are occasionally faint plications on the dorsal slope and a few feeble nodules on the disk; epidermis yellowish-tawny or brownish, rarely greenish or having slight greenish markings, scarcely shining; pseudocardinals radial, somewhat split up; lateral of the right valve single or somewhat double; beak cavities moderately deep, compressed; muscle scars not deep; nacre whitish, often purple-tinted, iridescent behind.

Length 62, height 46, diam. 21 mm.

Length 56, height 39, diam. 23 mm.

Length 50, height 34, diam. 22 mm.

Type locality, Texas.

Unio aureus LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 112; Jl. Ac. N. Sci. Phila., V, 1862, p. 195, pl. XXVI, fig. 264; Obs., IX, 1863, p. 17; pl. XXVI, fig. 264.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIII, fig. 438.

Margaron (Unio) aureus LEA, Syn., 1870, p. 37.

Quadrula aurea SIMPSON, Syn., 1900, p. 783.

Unio bolli CALL, Am. Naturalist, XV, 1881, p. 390.

This species is usually more elongated and more rhomboid than *petrina*, less solid and inflated, smoother, and not so brightly painted. Its beak cavities are generally shallower, and the beaks are more compressed. Yet there are intermediates that are hard to place.

QUADRULA ARCHERI Frierson.

"Shell small, thin, lenticular, somewhat quadrate, smooth. Anterior margin rounded, basal margin slightly curved, dorsal margin somewhat bent midway, posterior margin rounded or bluntly pointed, umbones low and flattened. Sides compressed, raised slightly at the posterior angle, which is nearly

obsolete; posterior slope wide and somewhat elevated; epidermis smooth, light brown, sometimes inclining to orange, two or three concentric bands of green or black mark the earlier lines of growth. Teeth of the left valve double, anterior cardinal high, thin and wedge-shaped, the posterior cardinal triangular, low and small; laterals thin, rather short and nearly straight. In the right valve, the cardinals are divided by a deep cleft, extending nearly to the bottom of the anterior adductor scar, the posterior tooth being much the smaller. The dorsal plate is quite wide for so small a shell. The shell cavity is quite capacious; the beak cavities deep and compressed. Nacre white, with brown splotches and very iridescent. The nacre is probably also salmon-colored in some individuals. The pallial line in the specimens before me is nearly imperceptible in the posterior part of the shell, where the nacre is very thin. One specimen shows in the upper part of the shell cavity, 20 or 30 almost microscopic muscle scars extending from the beak cavities half way to the pallial line.

Long. 34, alt. 28, diam. 14 mm." (Frierson).

Type locality, Tallapoosa River, Tallahassee, Ala.

Quadrula archeri FRIERSON, Naut., XIX, 1905, p. 13, pl. 1, figs. 1, 2.

"This shell is not closely allied to any shell, with which I am acquainted. On the one hand, it resembles some of the Pleurobemas of the group typified by *P. fassinans* Lea and, on the other hand, it bears some resemblance to a young and thin *Q. aurea* Lea. In the concentric coloring of the lines of growth, it reminds one of *O. asperata* Lea. Its deep and compressed beak cavities place it in the genus *Quadrula*, while its resemblance to the latter two species is too slight to cause any error in their direction."

QUADRULA PAUPERCULA (Lea).

Shell subquadrate, a little narrower in front, subinflated, rather solid, slightly inequilateral; beaks probably full and high; posterior ridge full, angled, ending at the hinder base in a blunt point; anterior end round; base curved; posterior end with a somewhat curved, square truncation; surface near-

ly smooth; the posterior slope shows faint plications in some individuals and there are rarely traces of pustules on the disk; epidermis greenish-yellow or yellowish-green, somewhat cloth-like when fresh; pseudocardinals considerably split up; lateral of the right valve single or partly double; beak cavities moderately deep, compressed; muscle scars small; nacre dirty whitish.

Length 30, height 23, diam. 15 mm.

Texas.

Type locality, Columbus, Miss.

Unio pauperculus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 39;

Jl. Ac. N. Sci. Phila., V, 1862, p. 99, pl. xv, fig. 247; Obs.,

VIII, 1862, p. 103, pl. xv, fig. 247.

Margaron (Unio) pauperculus LEA, Syn., 1870, p. 55.

Quadrula paupercula SIMPSON, Syn., 1900, p. 783.

The above measurements are from the type. I have seen a specimen in the collection of Wm. A. Marsh, Sr., which is somewhat larger and has a few faint tubercles on the disk. It is a doubtful species, and all the material I have seen is probably young. Lea's shell and a couple of others I have seen have been scraped until the epidermis has been nearly destroyed. The color and the angular posterior ridge differ from those in any closely allied form, yet it may be the young of some well-known species.

Group of *Quadrula infucata*.

Shell small, rounded rhomboid, with a low, distinct posterior ridge, truncated behind and angled back of the ligament; beaks moderately elevated, subcentral; beak sculpture, four or five coarse, subparallel ridges, which curve upward behind, with fine, radial ridges between them and the ligament; surface blackish, sculptured with zigzag or chevron-shaped corrugations, which often become pustulous below; posterior slope having radial, broken wrinkles; pseudocardinals small, stumpy; secondary lateral of the right valve present; beak cavities moderately deep, slightly compressed; anterior scars small, smooth; nacre rather dull, purplish.

Animal with the marsupium occupying all four leaves of the gills; inner gills the larger, free from the abdominal sac only part of their length; anal opening without papillæ.

I have been puzzled as to the relationship of this group and have been strongly inclined to place it near *chickasawhensis*, but I now believe it is more closely allied to the *pustulosa* group. Its posterior truncation, the prominent angle behind the ligament, and beak sculpture lead me to place it here. The general sculpture of *Q. petrina* approaches that of these species.

QUADRULA INFUCATA (Conrad).

Shell subrhomboid, convex or subinflated, solid, somewhat inequilateral; beaks high, rather full, their sculpture consisting of strong, irregular ridges, which curve up sharply behind, and behind these there are a few radial, subnodulous ridges; anterior end a little narrower and rounded; base line curved; posterior end obliquely subtruncate; posterior ridge full, narrowly rounded, ending in a blunt point on the base line; surface sometimes nearly smooth, but usually sculptured with low, nodulous ridges arranged in zigzag or chevron-shaped patterns; epidermis greenish in young shells, thick, black and subshining in old ones; pseudocardinals considerably split; two laterals in the left valve and one, which is often somewhat double, in the right; beak cavities not very deep, compressed; anterior scars small; nacre purplish, iridescent behind.

Length 38, height 30, diam. 17 mm.

Chattahoochee and Flint Rivers, Georgia.

Type locality, Flint River, Ga.

Unio infucatus CONRAD, New F. W. Shells, 1834, p. 45, pl. III, fig. 2.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 22, pl. II, fig. 6.—KUSTER, Conch. Cab. Unio, 1861, p. 176, pl. LV, fig. 5.—SOWERBY, Conch. Icon., XVI, 1866, pl. XL, fig. 221.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 409, pl. XLIX, figs. 1-3, 6.

Margarita (Unio) infucatus LEA, Syn., 1836, p. 34; 1838, p. 23.

Margaron (Unio) infucatus LEA, Syn., 1852, p. 20; 1870, p. 30.

Unio securiformis CONRAD, Ann. and Mag., IV, 1849, p. 300;

Pr. Ac. Nat. Sci. Phila., I, 1850, p. 275, pl. XXXVII, fig. 1.

Generally a little smaller, solider and smoother than *kleiniana* and having a darker epidermis.

QUADRULA KLEINIANA (Lea).

Shell subquadrate, convex to subinflated, solid, inequilateral; beaks apparently moderately full and high; posterior ridge full, almost subangulate, ending at the base of the shell in a blunt point; anterior end round; base line slightly curved or straight; posterior end obliquely truncated; surface generally covered with chevron-shaped, subnodulous ridges; epidermis brown, scarcely shining; pseudocardinals triangular; lateral in the right valve rarely double; beak cavities not very deep, compressed; anterior scars small; nacre dull purplish.

Length 50, height 36, diam. 24 mm.

Southern Georgia; northern Florida.

Type locality, Suwanee River, Fla.

Unio kleinianus LEA, Pr. Am. Phil. Soc., V, 1852, p. 251; Tr. Am. Phil. Soc., X, 1852, p. 265, pl. XVII, fig. 18; Obs., V, 1852, p. 21, pl. XVII, fig. 18.—REEVE, Conch. Icon., XVI, 1864, pl. II, fig. 6.

Margaron (Unio) kleinianus LEA, Syn., 1852, p. 20; 1870, p. 30.

Quadrula kleiniana SIMPSON, Syn., 1900, p. 784.

Unio sparsus KUSTER, Conch. Cab. Unio, 1861, p. 252, pl. LXXXV, fig. 2.

Generally larger, more elongated, more sculptured and lighter colored than *Q. infucata*. The pseudocardinals do not seem to be so irregular or so much split up. But there are intermediates that might almost as well be placed in one species as the other.

Section FUSCONAIA Simpson, 1900.

Fusconaia SIMPSON, Syn., 1900, p. 784.

Fusconaja ORTMANN, Ann. Car. Mus., VIII, 1912, p. 240.

Shell round, rhomboid, triangular, or short elliptical, with a moderate posterior ridge; beaks high and full, curved inward and forward, sculptured with a few coarse, parallel ridges, which curve upward behind; epidermis dark; surface not sculptured; hinge plate of moderate width; pseudocardinals strong; nacre white, salmon or purple.

Animal having all four gills occupied throughout as a marsupium, filled with pink or purplish ova when gravid; inner gills much the wider in front, free generally from the abdominal sac; outer gills cut away slopingly in front.

Type, *Unio trigonus* Lea.

Ortmann, (l. c.), raises this group to generic rank.

Group of *Quadrula beadleiana*.

Shell moderately solid, somewhat triangularly rounded, bluntly pointed and sometimes slightly triangular at post-base, with a more or less developed posterior ridge, in front of which it is full; beaks not very high; beak sculpture very coarse, concentric ridges; disks irregularly, concentrically striate; epidermis rich, dark chestnut; hinge plate rather narrow; pseudocardinals radial, stumpy; cavity of the beaks only moderately deep.

No gravid specimens have been seen, but those examined do not seem to differ from others of the genus.

QUADRULA CHICKASAWHENSIS (Lea).

Shell subelliptical to subrhomboid, compressed to subinflated, inequilateral, subsolid; beaks only moderately full or high; posterior ridge full, narrowly rounded or subangular, ending near the base in a blunt point; anterior end rounded; base curved; outline of dorsal slope curved, rarely subtruncate; surface with fine growth lines; epidermis dark brown, sometimes tinted with green, often showing dark rest marks; pseudocardinals triangular; laterals curved, sometimes partly double in the right valve; beak cavities only moderately deep; muscle scars impressed; nacre whitish, pink or salmon-tinted.

Length 55, height 41, diam. 25 mm.

Mississippi and Louisiana.

Type locality, Chickasawha River, Miss.

Unio chickasawhensis LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 39; Jl. Ac. N. Sci. Phila., V, 1862, p. 101, pl. XVI, fig. 250; Obs., VIII, 1862, p. 105, pl. XVI, fig. 250.

Margaron (Unio) chickasawhensis LEA, Syn., 1870, p. 55.

Quadrula chickasawhensis SIMPSON, Syn., 1900, p. 785.

The base and dorsal outlines are usually so curved that the shell is almost evenly short elliptical. It is less inflated, less solid and more evenly elliptical than *Q. beadleiana*.

QUADRULA SUCCISSA (Lea).

Shell subrhomboid, convex or subinflated, somewhat inequilateral, subsolid or solid; beaks apparently only moderately full and high; anterior end, obliquely truncate above, rounded below; base line straight or nearly so; outline of posterior end curved from the beaks to the base; posterior ridge well developed, subangular above, inclined to be double below; surface finely and unevenly, concentrically striate; epidermis reddish-brown, sometimes showing faint, dark rest marks, scarcely shining; pseudocardinals triangular, split up or striated; laterals curved, scarcely double in the right valve; beak cavities rather deep, compressed; muscle scars impressed; nacre purplish or violet.

Length 44, height 31, diam. 18 mm.

Type locality, West Florida. Also, southern Alabama.

Unio succissus LEA, Tr. Am. Phil. Soc., X, 1852, p. 275, pl. XXI, fig. 32; Obs., V, 1852, p. 31, pl. XXI, fig. 32.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIII, fig. 174.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 29, pl. LXXI, fig. 5.

Margaron (Unio) succissus LEA, Syn., 1852, p. 24; 1870, p. 38.

Quadrula succissa SIMPSON, Syn., 1900, p. 785.

Unio cacao LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 154; Jl. Ac. N. Sci. Phila., IV, 1860, p. 344, pl. LVI, fig. 169; Obs., VIII, 1860, p. 26, pl. LVI, fig. 169.

Margaron (Unio) cacao LEA, Syn., 1870, p. 54.

The type of this is from West Florida and is a subsolid, scarcely inflated, reddish-brown shell with a purple nacre. It is an older shell than Lea's *cacao*, but I believe that the two are absolutely identical. In Lea's collection there is a shell which he calls *Unio succissus*, from New Orleans, that I believe is *chickasawhensis* and another bearing that name from Alexandria, Louisiana, is, I think, *Quadrula cerina* Conrad.

QUADRULA WRIGHTII n. s.

Shell subrhomboid or subtriangular, convex to inflated, solid, inequilateral; beaks somewhat elevated, not inflated, their sculpture a few coarse, undulating ridges; posterior ridge full, narrowly rounded, ending near the base in a blunt point; anterior end obliquely truncated above, rounded below; base line curved; post-dorsal outline usually rounded from the beaks to the base, sometimes truncated behind; surface irregularly, concentrically sculptured; epidermis dark reddish-brown, somewhat silky; pseudocardinals considerably split up; lateral in right valve sometimes slightly double; beak cavities rather deep, compressed; muscle scars small; nacre violet at the border, lighter colored in the cavity of the shell.

Length 55, height 44, diam. 25 mm.

Length 43, height 37, diam. 25 mm.

Type locality, Pine Barren Creek, Escambia County, Florida.

I formerly thought this was identical with *Q. succissa*, but although the specimens before me show much variation they differ from that species constantly in being solider, shorter and in the pattern of coloring of the nacre. Young shells are shorter and solider than Lea's *cacao*.

QUADRULA PUMILA (Lea).

Shell small, subrhomboid, convex, scarcely subsolid, inequilateral; posterior ridge full, somewhat double below; anterior end rounded, narrowed and slightly truncate above; base line nearly straight; posterior end obliquely subtruncated; epidermis reddish-brown, somewhat cloth-like; pseudocardinals triangular; laterals straight; beak cavities moderately deep; muscle scars small; nacre dirty or lurid purplish.

Length 28, height 19, diam. 13 mm.

Type locality, Black river, North Carolina.

Unio pumilus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 23, pl. VII, fig. 17; Obs., II, 1838, p. 23, pl. VII, fig. 17.—HANLEY, Biv. Shells, 1843, p. 185, pl. XXIII, fig. 13.—CHENU, Ill. Conch., 1858, pl. XIX, figs. 1, 1a, 1b.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVI, fig. 198.

Margarita (Unio) pumilus LEA, Syn., 1836, p. 20; 1838, p. 17.

Margaron (Unio) pumilus LEA, Syn., 1852, p. 24; 1870, p. 37.

Quadrula pumila SIMPSON, Syn., 1900, p. 785.

The type, the only shell I have seen, is a small specimen, so badly eroded that nothing whatever of the beak characters can be made out. I cannot be sure where it should go, but am inclined to place it in this group.

QUADRULA BEADLEIANA (Lea).

Shell subrhomboid or subtriangular, inflated, solid; beaks full and high, placed almost centrally; posterior ridge well developed, subangular; anterior end rounded, sometimes slightly truncate above; base line well curved; posterior end obliquely subtruncated; surface with strong, irregular, concentric growth lines; epidermis rich reddish-brown, scarcely shining; pseudocardinals triangular; laterals curved, that of the right valve partly double; muscle scars deep; beak cavities not very deep; nacre whitish, purple-tinted or salmon.

Length 54, height 45, diam. 34 mm.

Mississippi to eastern Texas.

Type locality, Pearl River, Jackson, Miss.

Unio beadleianus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 39;

Jl. Ac. N. Sci. Phila., V, 1862, p. 94, pl. XIV, fig. 242; Obs.,

VIII, 1862, pl. 98, pl. XIV, fig. 242.

Margaron (Unio) beadleianus LEA, Syn., 1870, p. 55.

Quadrula beadleiana SIMPSON, Syn., 1900, p. 786.

Elliptio beadleianus ORTMANN, Ann. Car. Mus., VIII, 1912, p. 268.

Much more solid and inflated than *chickasawhensis* and rather more truncate behind.

Ortmann. (l. c.), states that only the outer gills are marsupial.

QUADRULA ASKEWI (Marsh).

Shell somewhat rhomboid, inflated, almost or quite equilateral, rather solid; beaks full and high; posterior ridge full, generally angled above, sometimes biangulate below; anterior end rounded, obliquely truncate above; base line generally a

little sinuate in front of the posterior ridge; outline of dorsal slope generally curved, sometimes raised into an angle behind the ligament; surface somewhat concentrically sculptured; epidermis dark reddish-brown, dull; pseudocardinals triangular, ragged; laterals curved; beak cavities moderately deep; muscle scars small; nacre whitish or pinkish.

Length 54, height 40, diam. 29 mm.

Length 70, height 47, diam. 32 mm.

Length 47, height 41, diam. 34 mm.

Western Louisiana; eastern Texas.

Type locality, Village Creek, Hardin Co., and Sabine River, Texas.

Unio askewi MARSH, Nautilus, X, 1896, p. 91; X, 1897, pl. 1, figs. 3, 4.

Quadrula askewi SIMPSON, Syn., 1900, p. 786.

Exceedingly variable. It has a higher, sharper posterior ridge than *beadleiana* and is generally more distinctly rhomboid.

QUADRULA LANANENSIS Frierson.

"Shell quadrate to triangular, nearly equilateral, anterior margin rounded. Base round in front, nearly straight behind. Posterior oblique, biangular, slightly emarginate. Dorsum curved; smooth, nearly polished above, striate below and upon posterior slope. Lines of growth distinct and ill-defined. Dark reddish-brown, sometimes a little olive, obscurely radiate. Beaks eroded, umbos low, somewhat inflated. Anterior umbonal slope rounded. Lateral slope flattened. Posterior ridge angular near the beaks, becoming obsolete near the base. Ligament brown, smooth, medium sized. Shell of medium thickness, thinner behind. Teeth double in left valve, single in right. Laterals rather thin, nearly straight. Cardinals stumpy. Muscle scars well marked, generally separate, sometimes confluent. Pallial line distinct in front, less so behind. Cavity of shell dish-like; of the beaks deep and full. Sometimes the dorsal muscle scars are situated in the extreme end of the beak cavity, but generally upon the base of cardinal and dorsal

plate. Nacre rose-color, with blotches of yellow surrounded by brown. Cavity nearly always studded with numerous pearly excrescences.

Flesh of the animal whitish or salmon-colored exteriorly, but shows scarlet when cut. Eggs carried in all four gills, very red, and the gravid animal thus presents a striking appearance.

Length 3.2, height 2.3, diam. 1.5 inches." (Frierson).

Type locality, Lanana Creek, also Banita Creek, near Nacogdoches, Texas.

Quadrula lananensis FRIERSON, Naut., XV, 1901, p. 75, pl. IV.
Fusconaja lananensis ORTMANN, Ann. Car. Mus., VIII, 1912, p. 244.

"*Q. lananensis* is closely allied to *Q. askevi* Marsh, both by its conchological and anatomical characteristics. It may be differentiated from that shell by being longer, more compressed, more oblique, and its shell is never so inflated and thickened in front as *askevi* and not so acutely angled on the posterior ridge. Internally, *lananensis* is rose-colored nearly invariably and the color is uniformly spread over its surface. *Askevi* is mostly white, and, when colored (pink) the color is almost always confined exterior to the pallial line. Finally, *Q. askevi* never possess those peculiar pearly excrescences, which seem to belong to *lananensis*."

Group of *Quadrula undata*.

Shell triangular, generally inflated, with high, full beaks, which are incurved and turned forward over a well-developed lunule; anterior end obliquely truncate above, often with a curved, shallow depression in each valve, running from the beaks to midway down the anterior end, and forming a sort of secondary lunule; posterior base, usually incurved; the posterior ridge ending in a rather sharp point; beak sculpture, a few coarse, concentric ridges turned upward behind, and often swollen on the posterior ridge, sometimes becoming finer and broken or irregular on the upper disk; hinge solid but not very wide; pseudocardinals triangular and radial, torn; there is a

secondary lateral in the right valve; cavity of the beaks generally deep and compressed; muscle scars small, deep.

Animal with the marsupium occupying the whole of all four branchiæ, inner gills generally free from the abdominal sac, much wider than the outer in front; outer nearly or quite equaling them in width behind; anal opening distinctly crenulate or papillose.

QUADRULA RUBIGINOSA (Lea).

Shell rhomboid, compressed to slightly inflated, subsolid to solid, equilateral or inequilateral; beaks high, generally full, turned forward over a lunule, their sculpture a few corrugations that curve up strongly behind; anterior end rounded, often slopingly truncate above; base line sometimes slightly curved; usually straight or feebly sinused in front of the posterior ridge; dorsal slope angled in the middle, obliquely truncate below; posterior ridge high, subangular or narrowly rounded, ending in a point at the base of the shell; surface with more or less irregular, concentric sculpture; epidermis brown or greenish-brown, sometimes feebly rayed, cloth-like when fresh; pseudocardinals triangular, more or less ragged; lateral in the right valve single or double; beak cavities rather deep; muscle scars impressed; nacre bluish-white to salmon-tinted, thinner and iridescent behind.

Length 110, height 80, diam. 45 mm.

Length 71, height 52, diam. 29 mm.

Length 68, height 51, diam. 23 mm.

Length 80, height 68, diam. 42 mm.

Entire Mississippi drainage; eastern Texas; St. Lawrence River system; Nelson River and its tributaries.

Type locality, Ohio.

Unio rubiginosus LEA, Tr. Am. Phil. Soc., III, 1829, p. 427, pl. VIII, fig. 10; Obs., I, 1834, p. 41, pl. VIII, fig. 10.—HANLEY, Biv. Shells, 1843, p. 185, pl. XXI, fig. 43.—CHENU, Ill. Conch., 1858, pl. XIII, figs. 4, 4a, 4b.—REEVE, Conch. Icon., XVI, 1865, pl. XXVII, fig. 136.—WALTON, Moll. Monroe Co., 1802, p. 16, pl. VIII, fig. 1.

- Margarita (Unio) rubiginosus* LEA, Syn., 1836, p. 20; 1838, p. 17.
- Margaron (Unio) rubiginosus* LEA, Syn., 1852, p. 24; 1870, p. 37.
- Unio rubiginosa* DESHAYES, An. sans Vert., 3d ed., II, 1839, p. 672.
- Quadrula rubiginosa* BAKER, Moll. Chicaco, Pt. 1, 1898, p. 77, pl. XIX, fig. 2; XX, fig. 1.—SIMPSON, Syn., 1900, p. 786.
- Fusconaja rubiginosa* ORTMANN, Ann. Car. Mus., VIII, 1912, p. 241, figs. 4-4a.
- Unio flavus* CONRAD, Monog., IX, 1837, p. 74, pl. XLI, fig. 2.—KUSTER, Conch. Cab., 1852, p. 61, pl. XIV, fig. 2; p. 265, pl. LXXXIX, fig. 5.
- Unio flavus* var. *rubiginosus* PÆTEL, Conch. Sam., III, 1890, p. 152.
- Unio trigonus* SOWERBY, Conch. Icon., XVI, 1868, pl. LXIV, p. 322.

This is a very abundant, widespread and variable species. Some specimens are compressed and long rhomboid, of rather light structure. Others are subtriangular, inflated, solid and approach so close to *undata* that it is a question to which species they should be assigned. It is also close to *cerina*, so much so that Dr. Lea believed the latter to be synonymous. It is less strongly sculptured than *rubida* and does not have the peculiar reddish tint commonly found in that species. It is more rude than *cerina*, it is not so richly or darkly colored and it lacks the rest marks often found in that species.

QUADRULA CERINA (Conrad).

Shell rhomboid, convex to subinflated, subsolid, inequilateral; beaks somewhat full and high; posterior ridge well developed, subangular, often slightly double below, ending in a feeble biangulation at the base of the shell; anterior end rounded; base line straight or lightly curved; outline of dorsal slope raised to an angle in the middle, obliquely truncate below; surface with faint, uneven, concentric sculpture; epidermis brownish to reddish-brown, generally showing feeble

rest marks, rather cloth-like when fresh; pseudocardinals triangular, rough; laterals curved, that of the right valve usually single; muscle scars impressed; beak cavities moderately deep; nacre whitish, pinkish, purplish or red.

Length 78, height 56, diam. 32 mm.

Louisiana; eastern Texas; Mississippi; Alabama; north to Arkansas.

Type locality, New Orleans, La.

Unio cerinus CONRAD, Monog., XI, 1838, p. 95, pl. LII.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVII, fig. 468.

Quadrula cerina SIMPSON, Syn., 1900, p. 787.

Fusconaja cerina ORTMANN, Ann. Car. Mus., VIII, 1912, p. 243.

I have before me a shell from Lanana Creek, Nacogdoches County, Texas, which agrees well with Conrad's figure of *Unio cerinus*. Other shells before me probably belong to the same species, but are not so typical. The waxen spots on the nacre, for which he bestowed the name *cerinus*, are present in the specimen before me from Texas and are probably pathologic. In this shell they are bronzy-yellowish.

QUADRULA HEBETATA (Conrad).

Shell quadrate, rather inflated, solid, slightly inequilateral; beaks moderately full and high; posterior ridge full, curved, angled throughout its length, ending in a point at the base of the shell; anterior end rounded; base line nearly or quite straight; posterior end truncated, the upper part overhanging, the truncation slightly curved; surface rough, somewhat concentrically sculptured; epidermis dull, shaggy, ashy-brown or blackish; pseudocardinals triangular, somewhat ragged; lateral in right valve somewhat double; muscle scars deep; beak cavities deep and compressed; nacre white.

Length 67, height 54, diam. 35 mm.

Type locality, Missouri. Also, Tallapoosa River, Alabama.

Unio hebetatus CONRAD, Jl. Ac. N. Sci. Phila., II, 1854, p. 296, pl. XXVI, fig. 5.

Margaron (Unio) hebetatus LEA, Syn., 1870, p. 38.

Quadrula hebetata SIMPSON, Syn., 1900, p. 787.

A peculiarly quadrate form, the posterior end being truncated and slightly rounded, the upper portion overhanging. The posterior ridge is curved and sharp throughout and the surface is rough. It seems to be rather rare. I have seen specimens larger than the one whose measurements are given above. It is more quadrate and less inflated than *chunii*.

QUADRULA RUBIDA (Lea).

Shell long rhomboid, convex to inflated, rather solid, inequilateral; beaks high, more or less inflated, their sculpture consisting of numerous corrugations that curve up behind; posterior ridge full, sharp above, narrowly biangulate below, ending at the shell's base in a point or double angle; anterior end rounded, sometimes obliquely truncate above; base line straight or incurved in front of the posterior ridge; outline of dorsal slope curved or raised to a decided angle behind the ligament; surface covered with strong, concentric ridges; epidermis greenish to reddish-brown, sometimes feebly rayed in the young shell; pseudocardinals triangular, rough; lateral of right valve single or partly double; beak cavities moderately deep, compressed; muscle scars impressed; nacre white or flesh-color.

Length 82, height 60, diam. 40 mm.

Length 73, height 55, diam. 34 mm.

Length 70, height 48, diam. 24 mm.

Streams flowing into the Gulf of Mexico from Alabama to Louisiana.

Type locality, Tombigbee River, Miss.; Coosa River and Big Prairie Creek, Ala.

Unio rubidus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 40; Jl.

Ac. N. Sci. Phila., V, 1862, p. 95, pl. XIV, fig. 244; Obs., VIII, 1862, p. 99, pl. XIV, fig. 244.

Margaron (Unio) rubidus LEA, Syn., 1870, p. 35.

Quadrula rubida SIMPSON, Syn., 1900, p. 787.

Unio negatus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 59; Jl.

Ac. N. Sci. Phila., V, 1862, p. 76, pl. IX, fig. 225; Obs., VIII, 1862, p. 80, pl. IX, fig. 225.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXII, fig. 165.

Margaron (Unio) negatus LEA, Syn., 1870, p. 35.

I hardly see why Dr. Lea made two species out of this form which is reasonably constant in its characters. It is shaped something like *Q. cerina* but is strongly, concentrically ridged. It is more evenly quadrate and more strongly sculptured than *rubiginosa*.

The shell reported under the name *Unio negatus*, from Kansas, is probably a somewhat sulcate *rubiginosa*.

QUADRULA RUBIDULA Frierson.

"Shell small, heavy, somewhat triangular; base emarginate; dorsum arched; posterior angle biangulate; ligament elevated, light red. Beaks not very high; umbones inflated; sides flattened; epidermis brown, rough, obsoletely rayed and showing traces of a greenish tint. Cardinals stout, short, rough, inclined to be double in both valves; laterals rather short, heavy, rough and slightly curved; cavity of shell very irregular, excavated from beak to posterior margin; beak cavity deep and compressed; nacre white, sometimes pinkish, not very iridescent.

Length 36, height 32, diam. 22 mm." (Frierson).

Type locality, Mulberry River; Black Warrior River and North River, Ala.

Quadrula rubidula FRIERSON, Naut., XIX, 1905, p. 14, pl. 1, figs. 3, 4.

"The shell is close to *Q. rubida* Lea and some forms resemble some of the depauperate specimens of *Q. trigona* Lea. From either of these species it may be differentiated by its small size and by the biangulated posterior angle."

QUADRULA CHUNII (Lea).

Shell subtriangular or subrhomboid, rather solid, inflated, somewhat inequilateral; beaks high and full with strong, irregular corrugations, and a few radial linæ behind them; anterior end rounded, somewhat obliquely truncate above; base straight; dorsal slope with an angle behind the ligament, obliquely truncate below; surface feebly, concentrically sculptured; epidermis brownish or greenish-brown, often faintly

rayed, cloth-like; pseudocardinals ragged, the anterior one in the left valve compressed and joined to the posterior one; laterals curved, that of the right valve partly double; muscle scars impressed, the posterior ones round; nacre bluish-white, thinner behind; beak cavities deep, compressed.

Length 57, height 48, diam. 33 mm.

Mississippi; west to central Texas north to Arkansas.

Type locality, Dallas, Texas.

Unio chunii LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 392; Jl.

Ac. N. Sci. Phila., V, 1862, p. 196, pl. XXVII, p. 265; Obs.,

IX, 1863, p. 18, pl. XXVII, fig. 265.

Margaron (Unio) chunii LEA, Syn., 1870, p. 38.

Quadrulo chunii SIMPSON, Syn., 1900, p. 787.

Close to *undata* and certain specimens can scarcely be separated from that species. It is generally less triangular, the beaks are not so full and high, the posterior ridge is not so pronounced and it has a smoother, less rude shell than that species.

Var. *nasuta* n. v.

More elongated, more drawn to a point at the posterior base than the type, less solid, with a higher posterior ridge.

Length 55, height 39, diam. 30 mm.

I formerly thought this was a variety of *cerina* but since seeing what I believe are valid specimens of that I am inclined to make it a variety of *chunii*. Typically it is quite different, but material before me seems to connect the two.

QUADRULA CASTANEA n. s.

Shell irregularly ovate, inflated, solid, inequilateral; beaks full and elevated; posterior ridge fairly well developed, single or imperfectly double, narrowly rounded, angular or slightly biangulate; anterior end rounded or subtruncate above, sometimes having an angle at the front end of the compressed lunule; base line lightly curved to straight; outline of dorsal slope lightly curved from the beaks to near the base, sometimes raised into a low angle behind the ligament; surface rather

rough, irregularly, concentrically striate; epidermis reddish-brown, wrinkled, rarely feebly rayed; pseudocardinals ragged, the anterior of the left valve often compressed and joined to the posterior one; muscle scars small and deep; beak cavities moderately deep, compressed; nacre whitish to salmon, dull, much thicker in front, sometimes obliquely ribbed.

Length 64, height 44, diam. 27 mm.

Length 50, height 38, diam. 26 mm.

Type locality, Tombigbee River, Moscow, Alabama.

This species has something of the form of a *Pleurobema*, but it has a higher and different posterior ridge and the beak cavities are deeper than in any *Pleurobema* I know of. There are four shells before me, which vary considerably, but they agree in essential characters. They are about as much elongated as the form I have called *chunii* var. *nasuta*, but are more nearly oval, they have no such beak behind, the posterior ridge is lower and the epidermis has a reddish tint.

QUADRULA RIDDELLII (Lea).

Shell short, subquadrate, inflated, solid, equilateral or nearly so; beaks high and full, turned forward over a lunule, their sculpture consisting of numerous corrugated ridges that are strongly curved up behind; posterior ridge elevated, carinated throughout, ending in a point near the base of the shell; anterior end almost evenly rounded, having a slight oblique truncation above; base line rounded; posterior end almost squarely truncated, the upper part sometimes overhanging a little, with an angle behind the ligament; surface unevenly, concentrically striate; epidermis greenish-brown; pseudocardinals rough, irregular; laterals short, that in the right valve somewhat double; muscle scars small, deep; beak cavities moderately deep, compressed; nacre bluish-white, thinner and iridescent behind.

Length 35, height 34, diam. 23 mm.

Length 36, height 34, diam. 20 mm.

Eastern Texas; western Louisiana?

Type locality, Dallas, Texas.

Unio riddellii LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 392; Jl. Ac. N. Sci. Phila., V, 1862, p. 198, pl. XXVII, fig. 267; Obs., IX, 1863, p. 20, pl. XXVII, fig. 267.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIII, fig. 442.

Margaron (Unio) riddellii LEA, Syn., 1870, p. 38.

Quadrula riddellii SIMPSON, Syn., 1900, p. 787.

Pleurobcma riddellii ORTMANN, Ann. Car. Mus., VIII, 1912, p. 262.

This seems to be a rare species and I have never seen more than four or five specimens that I could refer to it with any certainty. The overhanging of the posterior truncation and the rounded base will distinguish it from *Q. friersoni*. It is more inflated in the middle of the disk than that species or *chunii*. Yet some intermediate material that I have seen hints at a connection with the latter.

QUADRULA FRIERSONI (B. H. Wright).

Shell triangular, inflated, solid, nearly or quite equilateral; beaks very high and full, their sculpture apparently consisting of numerous oblique corrugations; posterior ridge high, angled, ending near the base of the shell; anterior end obliquely subtruncated above, rounded below; base line in adult shells nearly straight; outline of dorsal slope curved, often elevated into a low angle behind the ligament; surface irregularly, concentrically striate; epidermis varying from ashy-brown to reddish-brown; pseudocardinals triangular rough; lateral of right valve partly double; beak cavities moderately deep, compressed; muscle scars small, impressed; nacre whitish to purple.

Length 56, height 49, diam. 35 mm.

Length 43, height 37, diam. 27 mm.

Louisiana; eastern Texas.

Type locality, Bayou Pierre, De Sota Parish, La.

Unio friersoni B. H. WRIGHT, Nautilus, IX, 1896, p. 134, pl. III.

Quadrula friersoni SIMPSON, Syn., 1900, p. 787.

The beak sculpture of this form seems to be different from that of any allied species. I have never seen it perfect, but it is apparently oblique or zigzagged. It is longer in proportion to its height than *riddellii*. is more distinctly triangular than it or *chunii*.

QUADRULA UNDATA (Barnes).

Shell triangular, inflated, solid, slightly inequilateral; beaks very high and full, turned forward over a lunule, their sculpture a few irregular ridges, which turn up behind and occasionally two or three rayed liræ behind them; anterior end usually obliquely truncate above and angular in front of the lunule, though rarely evenly rounded; base line straight or lightly sinused in front of the posterior ridge; outline of dorsal slope often curved, raised into a low angle behind the ligament; posterior ridge well developed, angled or narrowly rounded, ending in a blunt point at the base line; in front of the posterior ridge there is generally a wide, radial depression and in front of this is the greatest diameter; surface with uneven growth lines; epidermis brownish-green and faintly rayed in the young state, greenish-brown, brownish or blackish in the old shell, rather dull; pseudocardinals strong, torn; lateral of the right valve often partly double; muscle scars very deep; beak cavities moderately deep; nacre white, salmon or rose-tinted, thinner behind.

Length 87, height 70, diam. 52 mm.

Length 85, height 74, diam. 52 mm.

Length 50, height 50, diam. 38 mm.

Entire Mississippi drainage; Coosa River, Alabama; Michigan and the Upper St. Lawrence drainage.

Type locality, Wisconsin and Fox Rivers.

Unio undatus BARNES, Am. Il. Sci., VI, 1823, p. 121, pl. iv, fig.

4.

Mya undata EATON, Zool. Text book, 1826, p. 219.

Quadrula undata WALKER, Naut., XXIV, 1910, p. 24, pl. 1, figs. 1-3; pl. II, figs. 1-2.

Fusconaja undata ORTMANN, Ann. Car. Mus., VIII, 1912, p. 241.

Unio trigonus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 110, pl. XVI, fig. 40; Obs., I, 1834, p. 120, pl. XVI, fig. 40.—HANLEY, Biv. Shells, 1843, p. 185, pl. XXI, fig. 6.—CHENU, Ill. Conch., 1858, pl. XVI, figs. 7, 7a, 7b.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVI, fig. 459.

Margarita (Unio) trigonus LEA, Syn., 1836, p. 18; 1838, p. 17.

Margaron (Unio) trigonus LEA, Syn., 1852, p. 25; 1870, p. 38.

Quadrula trigona BAKER, Moll. Chicago, Pt. 1, 1898, p. 76, pl. XV, fig. 5.—SIMPSON, Syn., 1900, p. 787.

Unio triangularis KUSTER, Conch. Cab. Unio, 1852, p. 56, pl. XII, fig. 3.

Unio pitaris REEVE, Conch. Icon., XVI, 1865, pl. XXVII, fig. 138.

Quadrula obliqua (part), SIMPSON, Syn., 1900, p. 788.

This abundant species approaches closely to several others but in all cases that I have seen there is a wide, shallow radial groove in front of the rather sharp, well-defined posterior ridge and in front of this depression the disk is swollen, so that along this swelling the shell has a much greater diameter than at the posterior ridge. There is usually a large, wide lunule, and often below this there is an illy-defined, flattened area, which almost forms a second lunule. In *chunii* and *friersoni* there is no such lunule-like depression and scarcely anything of the radial depression on the disk. *Q. rubiginosa* is generally considerably less inflated than *undata* and lacks the second lunule and radial depression, but there are intermediate shells that may be referred to one species as well as to the other.

QUADRULA OBLIQUA (Lamarck).

Shell subtriangular, inflated, solid, somewhat inequilateral; beaks very high and full, turned inward and forward over a decided lunule, their sculpture a few, coarse, irregular ridges that are turned up behind, and nodulous on the posterior ridge; anterior end usually obliquely truncate above, rounded below; base line usually lightly sinused in front of the posterior ridge; outline or dorsal slope generally almost evenly curved from the beaks to the base; posterior ridge rather low but well developed, narrowly rounded, placed near the edge of the shell and curved throughout; in front of the middle of the shell is a high.

wide, curved, radial swelling; between this and the much lower posterior ridge is a wide, curved, radial depression; surface having irregular, concentric striæ; epidermis tawny-brown and rayed in the young, dark reddish-brown in the old shells, dull; pseudocardinals ragged; lateral of right valve partly double; muscle scars and beak cavities deep; nacre white, thinner and somewhat iridescent behind.

Length 115, height 95, diam. 57 mm.

Length 95, height 78, diam. 50 mm.

Length 77, height 69, diam. 40 mm.

Ohio, Cumberland, and Tennessee River systems; west in Illinois to the Mississippi; Claiborne, Alabama.

Type locality, Ohio River.

Unio obliqua LAMARCK, An. sans Vert., VI, 1819, p. 72.

Margarita (Unio) obliqua LEA, Syn., 1836, p. 20.

Quadrula obliqua SIMPSON, Syn., 1900, p. 788.

Unio obliquus HANLEY, Biv. Shells, 1843, p. 186, pl. xx, fig.

24.—KUSTER, Conch. Cab. *Unio*, 1852, p. 63, pl. xv, fig. 1.—

CALL, Tr. Ac. Sci. St. Louis, VII, 1895, p. 31, pl. iv.

Margarita (Unio) obliquus LEA, Syn., 1838, p. 17.

Margaron (Unio) obliquus LEA, Syn., 1852, p. 25; 1870, p. 38.

Pleurobema obliquum ORTMANN, Ann. Car. Mus., VIII, 1912, p. 264.

Unio mytiloides SHORT and EATON, Transylvania Jl., 1831, p. 74.

Unio cordatus CONRAD, Monog., V, 1836, p. 48, pl. xxv.—

KUSTER, Conch. Cab., 1852, p. 57, pl. xiii, fig. 1.—SOWERBY,

Conch. Icon., XVI, 1868, pl. lxxiii, 376.

The posterior ridge and outline of the dorsal slope are curved. In *undata* the posterior ridge is straight, and the post-dorsal outline is raised to an angle in the middle. *Q. obliqua* approaches more nearly to an equilateral triangle than either *pyramidata* or *solida*. It is less inflated and longer than *plena*.

Ortmann, (l. c.), states that only the outer gills are marsupial. But Lefevre and Curtis, (Bull. Bur. Fish., XXX, 1912, p. 120), find that all four gills are used for that purpose.

Ortmann also remarks that this species, in his opinion, is not specifically different from *coccineum*."

QUADRULA COCCINEA (Conrad).

Shell subtriangular, convex to moderately inflated, inequilateral, solid; beaks high, moderately full, turned forward over a lunule, their sculpture a few corrugations which curve up behind; anterior end generally obliquely truncated above, rounded below; base line straight or curved; outline of dorsal slope curved, usually subangulate behind the ligament; posterior ridge narrowly rounded above, widely rounded below, ending near the base in a blunt point or faint biangulation; the shell has its greatest diameter in front of the middle but there is no radial depression behind it; surface with irregular growth lines; epidermis brownish or reddish-brown, somewhat cloth-like when not rubbed; tawny or yellowish-green and rayed when young; pseudocardinals triangular; lateral of left valve more or less double; beak cavities moderately deep, compressed; muscle scars impressed; nacre rich pink, salmon-tinted, flesh-colored or white, thinner and iridescent behind.

Length 100, height 76, diam. 43 mm.

Length 90, height 74, diam. 41 mm.

Entire Upper Mississippi drainage; St. Lawrence basin in various localities.

Type locality, Mahoning River, near Pittsburgh.

Unio coccineus CONRAD, Monog., III, 1836, p. 29, pl. XIII, fig. 1.—LEA, Tr. Am. Phil. Soc., VI, 1838, p. 12, pl. v, fig. 12; Obs., II, 1838, p. 12, pl. v, fig. 12.—HANLEY, Biv. Shells, 1843, p. 203, pl. XXII, fig. 54.—KUSTER, Conch. Cab., 1852, p. 49, pl. x, fig. 2.—CHENU, Ill. Conch., 1858, pl. xxv, figs. 4, 4a, 4b.—SOWERBY, Conch. Icon., XVI, 1868, pl. xciv, fig. 512.

Margarita (Unio) coccineus LEA, Syn., 1836, p. 34; 1838, p. 23.

Margaron (Unio) coccineus LEA, Syn., 1852, p. 35; 1870, p. 56.

Quadrula coccinea BAKER, Moll. Chicago, Pt. I, 1898, p. 79, pl. XIV, fig. 1; pl. XIX, fig. 3.—SIMPSON, Syn., 1900, p. 788.

Pleurobema coccineum ORTMANN, Ann. Car. Mus., VIII, 1912, p. 263.

Unio rubens MENKE, Syn., Meth. Moll., 1828, p. 90.

Unio catillus CONRAD, Monog., III, 1836, p. 30, pl. XIII, fig. 2.

—KUSTER, Conch. Cab., 1852, p. 64, pl. XV, fig. 2.

Unio catillus B. H. WRIGHT, Check List, 1888.

Unio gouldianus WARD, Jay's Catalogue, 3d ed., 1839, p. 24.

Unio cuneus CALL, Tr. Ac. Sci. St. Louis, VII, p. 14.

In the Transactions of the American Philosophical Society, VI, 1838, p. 12, pl. v, fig. 12, Lea described this species, and stated that about eighteen months previous Dr. Hildreth had sent him a single specimen under the name *Unio coccineus*; but there is nothing to show that Hildreth had described it. In the Monography in 1836, III, p. 29, pl. XIII, fig. 1, Conrad describes this species under the same name, and also credits it to Hildreth, stating that it was in the collection of the Philadelphia Academy of Natural Sciences under that name. The species must be credited to Conrad, who first described it, though Lea read his description in 1834.

This is an exceedingly variable species and difficult to diagnose. It is more compressed than *solida*, the beaks are not quite so high, there is no such full, median, radial swelling, and it does not have a radial depression in front of the posterior ridge. Yet there are intermediates that I do not believe any one can satisfactorily name. This species occasionally shows dark rest marks.

Ortmann, (l. c.), states that in this species only the outer gills are marsupial.

Var. *magnalacustris* n. n.

Shell much smaller than the typical form, subinflated to inflated, subsolid; epidermis light reddish-brown, with darker, impressed rest marks, subshining.

Length 49, height 39, diam. 23 mm.

Length 44, height 30, diam. 24 mm.

Type locality, St. Lawrence basin at and near Niagara Falls.

Quadrula coccinea var. *paupercula* SIMPSON, Syn., 1900, p. 789.

In this form the epidermis is almost shining, a light reddish-brown and the darker rest marks are decidedly impressed.

Some of the specimens are distorted and have the upper part of the anterior end decidedly angled. But all are of light, delicate structure. The name *paupercula* having already been used by Lea for a species of *Quadrula*, I am obliged to change the name of this form.

QUADRULA SOLIDA (Lea).

Shell having almost the form of a right-angled triangle, generally inflated, solid, inequilateral; beaks high and full, turned forward over a wide lunule, their sculpture a few strong, irregular ridges that curve up behind; anterior end squarely or somewhat obliquely truncated above, rounded below; base line nearly or quite straight; outline of dorsal slope lightly curved; posterior ridge not greatly elevated, rounded, ending in a rounded point at the base of the shell; there is a wide inflation running from the beaks down to a little in front of the middle base; between this and the posterior ridge there is scarcely any depression; surface with irregular growth lines; epidermis greenish-brown to reddish-brown, somewhat silky when fresh, slightly rayed in young shells; pseudocardinals strong, ragged; lateral of the right valve usually somewhat double; muscle scars deep; beak cavities moderately deep; nacre white, yellowish, salmon-tinted or pink.

Length 115, height 75, diam. 43 mm.

Length 110, height 67, diam. 44 mm.

Length 70, height 68, diam. 41 mm.

Length 72, height 65, diam. 42 mm.

Ohio, Cumberland, and Tennessee River systems; south to Louisiana; west to Arkansas and Kansas; north to Minnesota; east, through Wisconsin, Illinois, and Indiana, to Ohio.

Type locality, Ohio River, Cincinnati; Mahoning River, Ohio.

Unio solidus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 13, pl. v, fig. 13; Obs., II, 1838, p. 13, pl. v, fig. 13.—HANLEY, Biv. Shells, 1843, p. 186, pl. XXIII, fig. 15.—CHENU, Ill. Conch., 1858, pl. XXV, figs. 2, 2a, 2b.—KUSTER, Conch. Cab., 1861, p. 258, pl. LXXXVII, fig. 4.—REEVE, Conch. Icon., XVI, 1865, pl. XXVII, fig. 133.

Margarita (Unio) solidus LEA, Syn., 1836, p. 20; 1838, p. 17.

Margaron (Unio) solidus LEA, Syn., 1852, p. 25; 1870, p. 38.

Quadrula solida SIMPSON, Syn., 1900, p. 789.

?*Unio cardiacea* DESHAYES, Tr. Elem. de Conch., 1839, p. 19, pl. XXXI, figs. 1, 2.

Unio fulgidus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164; Tr.

Am. Phil. Soc., X, 1848, p. 73, pl. IV, fig. 10; Obs., IV, 1848, p. 47, pl. IV, fig. 10.

Margaron (Unio) fulgidus LEA, Syn., 1852, p. 25; 1870, p. 38.

Unio obovatis CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 253.

It is almost impossible to draw up a description that will characterize all the variations of this protean species and separate it from the other closely allied forms. Generally its outline approaches that of a right-angled triangle, the beaks being full, high and placed far forward. The anterior end is ordinarily truncated, sometimes squarely, occasionally falling back a little above. The base line is nearly straight; the post-dorsal outline is lightly curved; the posterior ridge is low and nearly straight. Although the shell has its greatest diameter in front of the middle there is scarcely any depression between this inflation and the posterior ridge as there is in *plena*, *undata*, *obliqua* and many specimens of *pyramidata*.

I have seen numerous old shells, which are much lengthened at the posterior base, with high beaks placed far forward that I have been unable to satisfactorily name. One of these is in the Lea collection and Dr. Lea calls it *Unio solidus*. I cannot be sure whether he is right or wrong.

QUADRULA PLENA (Lea).

Shell short and high, subtriangular, inflated, inequilateral, solid; beaks very full and high, turned forward over a deep, ragged lunule, sculptured with a few irregular nodulous ridges; anterior end strongly and obliquely truncated, the truncation often developed into a second lunule; base line short, straight or lightly sinused in front of the posterior ridge; outline of dorsal slope curved; posterior ridge narrowly rounded, curved, ending at the base in a blunt point; median radial ridge full

and wide; between it and the posterior ridge there is generally a radial depression; surface with irregular growth lines; epidermis cloth-like, reddish-brown, dull and rather rough; pseudocardinals radial, somewhat split up; lateral of the right valve more or less double; beak cavities deep, compressed; muscle scars small, deep; nacre white, thinner and iridescent at the posterior base.

Length 54, height 60, diam. 38 mm.

Length 50, height 53, diam. 33 mm.

Ohio, Cumberland, and Tennessee River systems; southwest to Kansas and Arkansas.

Type locality, Ohio River, Cincinnati, Ohio.

Unio plenus LEA, Pr. Am. Phil. Soc. I, 1840, p. 286; Tr. Am. Phil. Soc., VIII, 1843, p. 211, pl. XIV, fig. 26; Obs., III, 1842, p. 49, pl. XIV, fig. 26.—KUSTER, Conch. Cab., 1861, p. 264, pl. LXXXIX, fig. 3.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXI, fig. 305.

Margarona (Unio) plenus LEA, Syn., 1852, p. 25; 1870, p. 39.

Quadrula plena SIMPSON, Syn., 1900, p. 790.

Close to several species, yet probably as distinct as any member of the group. It is usually a little higher than wide and in this character it differs from *obliqua* and *solida*. The epidermis is rougher and more cloth-like than in any allied species. The post-basal point is short and never drawn out as it is in *solida* or *pyramidata*.

QUADRULA FLEXUOSA Simpson.

Shell subtriangular, solid, inflated with a feebly double posterior ridge, which ends in a blunt point or slight biangulation at the base of the shell, inequilateral; beaks high and rather full, badly eroded in the only shell seen; anterior end rounded; base line nearly straight, slightly sinused at the lower end of a wide, radiating depression in front of the posterior ridge; outline of dorsal slope almost evenly curved; epidermis roughly, concentrically striate, tawny to brownish, showing the rest marks; hinge plate wide and flat; pseudocardinals low, diverging, ragged; laterals straight, short, that of the right valve

double; anterior muscle scars deep; posterior scars distinct; nacre lurid whitish, dull.

Length 65, height 55, diam. 33 mm.

Type locality, Holston River, Tennessee.

Quadrula flexuosa SIMPSON, Proc. Ac. N. Sci. Phila., 1900, p. 83, pl. II, fig. 8; Syn., 1900, p. 790.

The above form shows relationship to several others, yet although I have only seen a single shell, which is in the collection of Mr. L. S. Frierson, I cannot connect it with anything else. It is less inflated and more elongated than *Q. plena*, it is less triangular than *Q. obliqua* and the light-colored epidermis with the distinct rest marks differs from that of any related species.

QUADRULA PYRAMIDATA (Lea).

Shell generally, when adult, having the outline of a scalene or right-angled triangle, the beaks being placed at the extreme anterior point and often projecting in advance of the rest of the shell, subinflated or inflated, solid; beaks high and full, turned forward over a wide, deep lunule that passes forward under them; anterior end truncated squarely or with a slope below and usually having a large, faint second lunule; base line nearly or quite straight; outline of dorsal slope lightly curved; posterior ridge, low, rounded, ending in a rounded point at the base of the shell; median ridge very high, rounded, curved, usually separated from the posterior ridge by a radial, concave depression; surface with irregular growth lines; epidermis brown to blackish, brownish-green and rayed in young shells, scarcely subshining; pseudocardinals radial, often oblique, torn; lateral of right valve more or less double; muscle scars small, deep; beak cavities deep, compressed; nacre rose-colored or white, rarely yellowish or salmon, thinner and iridescent behind.

Length along base 75, from beaks to post-base 84, height 63, diam. 41 mm.

Length over all 110; height 60, diam. 47 mm.

Length on base 105, over all 115, height 90, diam. 58 mm.

Ohio, Cumberland, and Tennessee River systems; southwest to Arkansas; west to Nebraska?; north in the Mississippi to Prairie du Chien, Wisconsin.

Type locality, Ohio.

Unio pyramidatus LEA, Tr. Am. Phil. Soc., IV, 1834, p. 109, pl. XVI, fig. 39; Obs., I, 1834, p. 119, pl. XVI, fig. 39.—HANLEY, Biv. Shells, 1843, p. 186, pl. XX, fig. 45.—DESHAYES, Traite Elem. de Conch., II, 1850?, p. 216, pl. XXXI, figs. 1, 2.—CHENU, Ill. Conch., 1858, pl. XVI, figs. 5, 5a, 5b.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXIV, fig. 323.

Margarita (Unio) pyramidatus LEA, Syn., 1836, p. 21; 1838, p. 17.

Margaron (Unio) pyramidatus LEA, Syn., 1852, p. 25; 1870, p. 39.

Quadrula pyramidata SIMPSON, Syn., 1900, p. 790.

Pleurobema pyramidatum ORTMANN, Ann. Car. Mus., VIII, 1912, p. 264.

Unio mytiloides DESHAYES, Enc. Meth., II, 1830, p. 586, pl. CCXLIX, fig. 4.—CONRAD, Monog., IV, 1836, p. 41, pl. XX.—SWAINSON, Treatise on Mal., 1840, p. 267, figs. 52-53.—KUSTER, Conch. Cab., 1852, p. 59, pl. XIII, fig. 3; 1861, p. 265, pl. LXXXIX, fig. 4.

Margarita (Unio) mytiloides LEA, Syn., 1836, p. 21; 1838, p. 17.

Margaron (Unio) mytiloides LEA, Syn., 1852, p. 25; 1870, p. 39.

Unio mytiloides Rafinesque var. *pyramidatus* PÆTEL, Conch. Sam., III, 1890, p. 160.

Unio cardiacea GUERIN, Icon. Regne Animal, 1828?, II, pl. XXVIII, fig. 7.

Unio ruber CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 257.

Unio obliqua WOOD, Ind. Test. Rev., 1856, p. 200, pl. 1, fig. 8.

Differs from allied forms in its great obliquity and in usually having rose-colored nacre. The young shells are not nearly so oblique.

Ortmann, (l. c.), states that only the outer gills are marsupial and says that "this is only an extreme form of *P. obliquum*."

Group of *Quadrula subrotunda*.

Shell solid, rounded, elliptical or ovate, with high beaks curved inward and forward over a distinct lunule; beak sculpture a few coarse ridges curved up behind; posterior ridge feebly developed; epidermis brownish or blackish and often painted with a few faint rays on the earlier shell, which are disposed to break into squarish spots; hinge and teeth strong; secondary lateral in right valve well developed; beak cavities deep, compressed; muscle scars deep. Animal with all four gills used as a marsupium throughout, filled with pink ova; gills large, inner only slightly the larger, free the greater part of their length; anal opening crenulate or papillose.

QUADRULA BURSA-PASTORIS (B. H. Wright).

Shell irregularly ovate or subrhomboid, subcompressed to convex, solid, inequilateral; beaks apparently not very full or greatly elevated; posterior ridge rather low, usually widely and faintly double; ending near the base of the shell in a bifurcation; anterior end rounded, sometimes truncated above; base line curved or straight in young or adult shells, often slightly sinused in front of the posterior ridge in old specimens; outline of dorsal slope curved, sometimes subangular behind the ligament; surface rough, having strong, irregular, growth lines; epidermis brownish, wrinkled, dull; pseudocardinals radially striate; laterals heavy, that of the right valve somewhat double; muscle scars large, impressed; beak cavities deep, compressed; nacre dirty white to lead-colored, generally with large, greenish-yellow blotches, thinner behind.

Length 110, height 77, diam. 42 mm.

Length 92, height 67, diam. 33 mm.

Clinch and Powell Rivers; Virginia and Tennessee.

Type locality, Powell River, Va.

Unio bursa-pastoris B. H. WRIGHT, Naut., 1896, p. 133, pl. III.

Quadrula bursa-pastoris SIMPSON, Syn., 1900, p. 791.

Close to *Q. kirtlandiana*, but generally more elongated and having more lurid nacre. The pallial line is nearer the edge of the shell than it is in *kirtlandiana* and the epidermis is more inclined to be tawny-brown.

QUADRULA KIRTLANDIANA (Lea).

Shell large, subrhomboid or subelliptical, subcompressed or convex, inequilateral, solid; beaks moderately full and high; posterior ridge varying from low to somewhat elevated, often widely double, ending near the base of the shell in a wide, feeble biangulation; anterior end rounded, often slightly truncate above; base line usually curved; outline of dorsal slope usually having the angle behind the ligament; surface irregularly, concentrically sculptured; epidermis yellowish-green with broken rays when young, becoming greenish-brown, brown or blackish and rarely rayed when adult; pseudocardinals radially striate; lateral of right valve partly double; beak cavities deep, compressed; muscle scars well marked; pallial line remote in front; nacre white, rarely lurid, porcellaneous, thinner behind.

Length 120, height 88, diam. 45 mm.

Length 126, height 88, diam. 42 mm.

Ohio, Cumberland, and Tennessee River systems; southwest to Arkansas; north to Wisconsin?; east through southern Michigan.

Type locality, Mahoning River, O.

Unio kirtlandianus LEA, Tr. Am. Phil. Soc. V, 1834, p. 98, pl. XIV, fig. 41; Obs., I, 1834, p. 210, pl. XIV, fig. 41.—HANLEY, Biv. Shells, 1843, p. 203, pl. XXIII, fig. 27.—KUSTER, Conch. Cab., 1856, p. 168, pl. XLIX, figs. 2, 3; 1861, p. 214, pl. LXXI, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVII, fig. 402.

Margarita (Unio) kirtlandianus LEA, Syn., 1836, p. 34; 1838, p. 23.

Margaron (Unio) kirtlandianus LEA, Syn., 1852, p. 35; 1870, p. 56.

Quadrula kirtlandiana SIMPSON, Syn., 1900, p. 791.

Fusconaja kirtlandiana ORTMANN, Ann. Car. Mus., VIII, 1912, p. 245.

Unio kirklandianus HANLEY, Test. Moll., 1842, p. 203.

The young shell is very different from that of *bursapastoris*, being short, and quadrate or elliptical, smooth and rayed, while that of the latter is long oval, and scarcely rayed. *Q. kirtlandiana* is not as elongated as *bursapastoris* and is usually curved on the base line.

Var. *minor* Simpson.

Shell smaller and more delicate in every way than the type, not very solid, usually greenish-yellow or greenish-brown, the young with broken rays.

Length 63, height 48, diam. 22 mm.

Length 49, height 37, diam. 20 mm.

Type locality, Various localities in the Tennessee River drainage.

Quadrula kirtlandiana var. *minor* SIMPSON, Syn., 1900, p. 791.

It was the opinion of the late Prof. A. G. Wetherby that this is a form of Lea's *Unio subrotundus*. It seems to me to be too much compressed for that species, which is generally quite inflated. Dr. Sterki believes that *Q. subrotunda* and *kirtlandiana* should be united. While they approach closely and there may be intermediates that can scarcely be named, it seems to me they are as distinct as most of the closely related species of this and other allied groups.

QUADRULA SUBROTUNDA (Lea).

Shell irregularly elliptical or subquadrate in outline, subinflated to inflated, solid, inequilateral; beaks high, full, turned forward over a lunule, their sculpture a few subnodular ridges or wrinkles; anterior end obliquely truncate above, rounded below; base line curved throughout, sometimes quite full behind the middle of the shell; outline of dorsal slope curved, raised almost to an angle behind the ligament; surface generally sculptured with low, wide, concentric ridges; epidermis greenish-brown, somewhat cloth-like, usually with wide and narrow green, broken rays in the young, which often remain on the umbonal region in the adult shell; pseudocardinals triangular, rough; lateral in the right valve disposed to be double;

muscle scars impressed; beak cavities rather deep, compressed; nacre white, porcellaneous, thinner and slightly iridescent behind.

Length 89, height 65, diam. 44 mm.

Length 74, height 65, diam. 38 m.

Length 68, height 46, diam. 30 mm.

Ohio, Cumberland, and Tennessee River systems. Reported from Michigan and the Grand River, Ontario, but it is probable that the material from these localities is not *subrotunda*.

Type locality, Ohio.

Unio subrotundus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 117, pl. XVIII, fig. 45; Obs., 1, 1834, p. 127, pl. XVIII, fig. 45.—HANLEY, Biv. Shells, 1843, p. 203, pl. XX, fig. 58.—?CHENU, Ill. Conch., 1858, pl. XV, figs. 1, 1a, 1b.—KUSTER, Conch. Cab., 1861, p. 190, pl. LX, fig. 3.

Margarita (Unio) subrotundus LEA, Syn., 1836, p. 34; 1838, p. 23.

Margaron (Unio) subrotundus LEA, Syn., 1852, p. 35; 1870, p. 56.

Quadrula subrotunda SIMPSON, Syn., 1900, p. 791.

Fusconaja subrotunda ORTMANN, Ann. Car. Mus., VIII, 1912, p. 244.

?*Unio brevisalis* CROUCH, Ill. Int. to Lamarck, 1827, p. 16, pl. IX, fig. 3.

Unio personatus CONRAD, New F. W. Shells, 1834, p. 71.

Unio politus SAY, Am. Conch., VI, 1834.—CONRAD, Monog., VIII, 1837, p. 67, pl. XXXVII, fig. 2.—KUSTER, Conch. Cab. Unio, 1852, p. 62, pl. XIV, fig. 4.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXII, p. 168.

It is very hard to draw a satisfactory line between this and *Q. kirtlandiana*. Both have the same scheme of coloring, but the latter is generally larger, more compressed and has lower beaks.

QUADRULA PILARIS (Lea).

Shell irregularly short oval, inflated, solid, inequilateral; beaks rather high and full, turned forward over a lunule; anterior end generally lightly truncated above, rounded below;

base line rounded to almost straight; outline of dorsal slope curved, sometimes elevated just behind the ligament; posterior ridge moderate, rounded; greatest diameter of the shell just below the beaks; surface covered with rude, concentric growth lines; epidermis concentrically wrinkled, of various shades of dull brown or greenish-brown with faint, broken rays when young; pseudocardinals triangular, radially striate; lateral of the right valve inclined to be double; muscle scars small, impressed; beak cavities decidedly deep, compressed; nacre whitish, often blotched, thinner and brownish or bronzy, iridescent behind.

Length 66, height 51, diam. 31 mm.

Length 50, height 45, diam. 27 mm.

Tennessee and Cumberland River systems; Green River, Kentucky; reported from the Ohio River.

Type locality, French Broad and Holston Rivers, Tenn.

Unio pilaris LEA, Pr. Am. Phil. Soc., I, 1840, p. 285; Tr. Am. Phil. Soc., VIII, 1842, p. 209, pl. XIV, fig. 24; Obs., III, 1842, p. 47, pl. XIV, fig. 24.—CHENU, Ill. Conch., 1858, pl. XXIX, figs. 3, 3a, 3b.—KUSTER, Conch. Cab., 1861, p. 255, pl. LXXXVI, fig. 3.—REEVE, Conch. Icon., XVI, 1865, pl. XXVII, fig. 138.

Margaron (Unio) pilaris LEA, Syn., 1852, p. 35; 1870, p. 56.

Quadrula pilaris SIMPSON, Syn., 1900, p. 792.

Unio lesueurianus LEA, Pr. Am. Phil. Soc., I, 1840, p. 286;

Tr. Am. Phil. Soc., VIII, 1842, p. 195, pl. VIII, fig. 6; Obs., III, 1842, p. 33, pl. VIII, fig. 6.—CHENU, Ill. Conch., 1858, pl. XXX, figs. 4, 4a, 4b.—KUSTER, Conch. Cab. Unio, 1861, p. 215, pl. LXXII, fig. 2.

Margaron (Unio) lesueurianus LEA, Syn., 1852, p. 35; 1870, p. 56.

Closest, perhaps, to *Q. subrotunda*. It is a smaller species, the young shell is more evenly curved on the dorsal slope, and the beaks are hardly so high. The posterior part of the nacre is usually darker.

QUADRULA ANDREWSII Marsh.

"Shell smooth, triangular, solid, beaks swollen, incurved, shell very inequilateral, compressed and striate at the base; obliquely rounded before, obtusely biangulate behind; ligament rather short, light brown; epidermis reddish-brown, maculate; growth lines numerous; rather rough; umbonal slope slightly rounded; posterior slope flat, cordate, with very indistinct lines from beaks to basal margin; beak sculpture unknown; cardinal teeth thick, very much sulcate, single in right, double in left valve; lateral teeth thick, short and slightly curved; anterior cicatrices small and deep; posterior cicatrices distinct, small and deep; shell cavity rather deep; cavity of the beaks deep and angular; nacre silver white and iridescent.

Diameter 1.1, length 1.6, breadth 2 (inches)." (Marsh).

Type locality, Holston River, Tenn.

Quadrula andrewsii MARSH, Naut., XV, 1902, p. 115.

Quadrula andrewsæ MARSH, Naut., XVI, 1902, p. 8, pl. 1, upper two figures.

"Several years ago Mrs. Geo. Andrews of Knoxville, Tennessee, sent me a number of these shells. They belong to the group of which *trigonus* Lea is the type, but in no way do they resemble that species. There is no species, which they closely resemble, except *globatus* Lea, but it is a very much less inflated shell than that species, having a differently colored epidermis, rougher and coarser growth lines; at least one-half of the disk is covered with wide, dark green spots, and between these rows of maculations are very narrow, dark green interrupted rays. The outline of *globatus* is rounded, while my shell is triangular."

QUADRULA BEAUCHAMPI Marsh.

"Shell subtriangular, inflated over the umbones and beaks; shell very thick and solid, thicker before; beaks solid, raised and incurved; inequilateral, rounded before, obtusely angular behind; ligament short, thick, light brown; epidermis yellowish-brown; growth lines close, and very prominent, almost

sulcate. Shell compressed at the base, slightly flattened on the sides, umbonal slope rounded, posterior slope rather wide, with a dark impressed line from beaks to basal margin. Beak sculpture unknown. Cardinal teeth heavy and solid, rather compressed, corrugate and sulcate; lateral teeth short, thick and slightly curved. Anterior cicatrices small and deep; posterior cicatrices distinct and well impressed; shell cavity wide; cavity of the beaks deep and obtusely angular; nacre white.

Diam. 1.4, length 2.2, breadth 2.3 inches." (Marsh).

Type locality, Little Tennessee River, Tenn., and Holston River, Tenn.

Quadrula beauchampii MARSII, Naut., XVI, 1902, p. 7, pl. 1, lower two figures.

"I obtained three specimens from Wm. M. Beauchamp a number of years ago; afterwards Mrs. Geo. Andrews sent me several of them from Holston River, Tenn. They are near *globatus* Lea, but were too different to place with that species. In outline they are subtriangular, not spherical and rounded like that species. They are more solid and heavy and a larger species than *globatus*. They have a lighter colored epidermis, with closer growth lines and the surface of the shell is rougher. They need not be confounded with my *andrewsii* as they differ in outline, teeth and character of the rays and are a very much larger species and more solid and heavy. They vary greatly in character of the rays; some are rayless, two have obscure maculations, while some have very obscure, indistinct rays."

QUADRULA CUNEUS (Conrad).

Shell subovate, subinflated to inflated, more or less solid, inequilateral; beaks high and quite full; diameter through the umbonal region greatest; disks flattened behind the middle and descending wedge-shaped to the posterior extremity; anterior end rounded, sometimes slightly truncate above; outline of base and dorsal slope curved; surface with irregular, concentric growth lines; epidermis reddish-brown, more or less rough; teeth heavy; lateral of right valve disposed to be

double; beak cavities moderately deep, compressed; muscle scars small, impressed; nacre rich pink, thinner and iridescent behind.

Length 50, height 45, diam. 33 mm.

Length 50, height 42, diam. 26 mm.

Arkansas; Louisiana; Sabine River, Texas.

Type locality, Little Red River, Ark.

Unio cuneus CONRAD, Monog., XII, 1840, p. 105, pl. LVIII, fig. 1.

Quadrula cuneus SIMPSON, Syn., 1900, p. 792.

There are a number of Conrad's species, which according to his figures and descriptions differ from anything I have ever been able to examine, even though in several cases I have seen material from the type localities, and this is one of them. Conrad's *Unio cuneus* was obtained from the Little Red River, Arkansas, and I have before me specimens from that same stream, which are thinner, smoother, less inflated and not so decidedly wedge-shaped as his description and figures show. Yet I think they must be *cuneus*. I have seen no shells which agree any more closely with his *Unio productus*, *U. contrarius*, *U. furvus*, *U. maculatus*, *U. perovatus*, *Alasmodonta radiata*, *Anodonta subvera*, *A. teres*, etc., though I have seen examples of what are probably a considerable number of these species. Conrad was an excellent naturalist, but was careless and in a number of cases his descriptions are considerably at variance with his figures, and his localities are apparently wrong.

QUADRULA EBENUS (Lea).

Shell subquadrate or subelliptical, inflated, solid, very inequilateral; beaks exceedingly high, full, turned inward and forward over a lunule, their sculpture a few rather feeble corrugations; anterior end squarely or obliquely truncate above under the sometimes overhanging beaks, rounded below; base rounded, straight or incurved in old shells; outline of dorsal slope a full curve: posterior ridge rather low, often somewhat double, curved; surface with low, irregular, concentric ridges; epidermis tawny-brown, reddish-brown or blackish, usually

wrinkled; pseudocardinals subradial, usually curved, split up and torn; lateral of right valve disposed to be double; muscle scars deep; beak cavities very deep, compressed; nacre white, thinner and iridescent behind.

Length 110, height 92, diam. 60 mm.

Length 102, height 75, diam. 55 mm.

Length 90, height 74, diam. 53 mm.

Mississippi drainage generally, except its western portion; Alabama and Tombigbee Rivers; northeast Texas?

Type locality, Ohio River.

Unio ebenus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 84, pl. IX, fig. 14; Obs., I, 1834, p. 94, pl. IX, fig. 14.—HANLEY, Biv. Shells, 1843, p. 202, pl. XX, fig. 47.—CHENU, Ill. Conch., 1858, pl. XV, figs. 7, 7a, 7b.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXVI, fig. 334.

Margarita (Unio) ebenus LEA, Syn., 1836, p. 34; 1838, p. 23.

Margaron (Unio) ebenus LEA, Syn., 1852, p. 35; 1870, p. 56.

Quadrula ebenus SIMPSON, Syn., 1900, p. 793.

Fusconaja ebena ORTMANN, Ann. Car. Mus., VIII, 1912, p. 245.

Unio obovatis SAY, Am. Conch., VI, 1834.

Unio obliquus CONRAD, Monog., IX, 1837, p. 77, pl. XLIII, fig. 2.—KUSTER, Conch. Cab. Unio, 1861, p. 215, pl. LXXI, fig. 4.

Unio mytiloides SWAINSON, Treatise on Mal., 1840, p. 270, figs. 52, 53.

An abundant, widespread and variable form. It is the "niggerhead" of button manufacturers of the Mississippi River and the most valuable and important species used by them. It has exceedingly full, high beaks, which are usually placed at the extreme anterior end of the shell. The lunule is generally placed farther back than in allied species; in fact, the beaks often project in front of it. There is sometimes a faint secondary lunule. The young are often light ashy-brown on the beaks with a pale or whitish area on the dorsal slope, very different from those of any related forms.

QUADRULA GLOBATA (Lea).

Shell suborbicular or subelliptical, very much inflated, solid, inequilateral; beaks very full, high, apparently turned inward and forward over a lunule; anterior end rounded or slightly truncated; outline of base and dorsal slope as well as the posterior part of the shell rounded; posterior ridge but slightly marked, curved; greatest diameter below the beaks, surface with rude, irregular growth lines; epidermis dull, greenish-brown or ashy-brown, often cloth-like, with broken, green rays in the young shell; pseudocardinals triangular, ragged; lateral of right valve double; beak cavities deep, compressed; muscle scars small, deep; nacre bluish-white, thinner and slightly iridescent behind.

Length 52, height 44, diam. 35 mm.

Holston and Tennessee Rivers, Tennessee; Etowah River, Georgia.

Type locality, Holston River, Tenn.; Etowah River, Ga.

Unio globatus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 191; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 5, pl. 1, fig. 1; Obs., XIII, 1874, p. 9, pl. 1, fig. 1.

Quadrula globata SIMPSON, Syn., 1900, p. 793.

While this form is nearly allied to *Q. subrotunda*, I believe it to be a valid species. In all the specimens I have seen the beaks are badly eroded and the outline of the shell is either nearly orbicular or irregularly short elliptical. The posterior ridge is scarcely developed, the disks being almost evenly swollen from the anterior to the posterior ends. The hinder end of the shell is nearly evenly rounded, and in all these characters it differs from *subrotunda*, *pilaris* or any of the allied forms. The name *globata* is very appropriate.

Group of *Q. glandacea*.

Shell rhomboid-oval, nearly straight below and slightly biangulate behind, with a well-defined double posterior ridge; beaks probably full; surface slightly and irregularly sulcate; epidermis wrinkled, tawny; hinge strong, the plate somewhat

flattened; pseudocardinals triangular; laterals strong, secondary lateral of right valve well developed; beak cavities deep, compressed; muscle scars very deep, smooth; nacre dirty straw-color.

QUADRULA GLANDACEA (Lea).

Shell subrhomboid, or rhomboid-oval, somewhat inflated, rather solid, inequilateral; beaks probably full and high; posterior ridge well developed, usually narrowly double, ending below in a blunt point or a biangulation; anterior end rounded, sometimes slightly truncate above; base line straight; outline of dorsal slope curved or raised into an angle behind the ligament; surface with rude, irregular growth lines; epidermis wrinkled, tawny, scarcely shining; pseudocardinals triangular, strongly radially striated; muscle scars small, impressed; beak cavities deep and compressed; nacre whitish or straw-colored, thinner and iridescent behind.

Length 50, height 38, diam. 26 mm.

Coosa and Cahawba Rivers, Alabama.

Type locality, Cahawba River, Ala.

Unio glandaceus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 59; Jl. Ac. N. Sci. Phila., V, 1862, p. 77, pl. IX, fig. 226; Obs., VIII, p. 81, pl. IX, fig. 226.

Margaron (Unio) glandaceus LEA, Syn., 1870, p. 38.

Quadrula glandacea SIMPSON, Syn., 1900, p. 793.

I have seen but a limited amount of material of this peculiar species. It has the texture, form and coloring of many of the members of the genus *Pleurobema*, but the beak cavities of all the specimens I have seen are deep and compressed and this would indicate that it is a *Quadrula*. In two of the shells examined there is a slight, radial groove on the dorsal slope but I do not know whether this is a constant character. There is a somewhat eroded valve in the national museum collection donated by Dr. Powell, labeled "Arkansas" which is marked "*Unio glandaccus*" by Dr. Lewis. While it may be that species, I am a little in doubt concerning it.

Section PACHYNAIAS CROSSE and FISCHER, 1893.

Pachynaias CROSSE and FISCHER, Miss. Sci. Mex., Moll., 1893, p. 556.

Shell elongate-triangular, inflated, truncated above and rounded below in front, straight on the base, with a high, sharp posterior ridge; the post-base slightly biangulate; beaks full, the sculpture consisting apparently of faint ridges, which run parallel with the growth lines; whole surface distinctly concentrically ridged; epidermis without rays; pseudocardinals solid, stumpy, somewhat radiate, roughened; beak cavities rather deep; muscle scars deep, smooth; nacre bluish-white, thicker in front.

Animal unknown.

Type, *Unio spheniopsis* Morelet.

QUADRULA SPHENIOPSIS (Morelet).

Shell subtriangular, subequilateral, solid, inflated, with a high, sharp posterior ridge and a low fainter one not far above it, with a high umbonal region though the beaks are not very prominent; beak sculpture appearing to consist of concentric, irregular ridges much like the strong, rather sharp, irregular sculpture that covers the shell throughout; epidermis greenish-yellow or yellowish-green, showing a few faint rays behind; left valve with two short, remote laterals, the lower higher; hinge plate between the two sets of teeth somewhat narrowed and rounded; right valve with one strong pseudocardinal and a vestigial one above and one lateral; beak cavities deep, scarcely compressed; muscle scars distinct, the anterior ones deep; pallial line deep; nacre whitish or bluish-white, thicker in front.

Length 60, height 47, diam. 35 mm.

Rio Usumacinta, Guatemala; State of Tabasco, Mexico.

Unio spheniopsis MORELET, Test. Nov., I, 1849, p. 29.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 583, pl. LXI, figs. 2a, 2b.

Quadrula spheniopsis SIMPSON, Syn., 1900, p. 794.

The specimen figured by Fischer and Crosse in the Mission Scientifique is not quite adult. The measurements given above

are from a shell taken in the Usumacinta River, Guatemala, and sent to the National Museum by von Ihering. The National Museum has still larger specimens from Tabasco, Mexico. It is shorter, more inflated, and solidier than the nearly allied *rugososulcata* and the pallial line is closer to the shell border than it is in that species.

QUADRULA RUGOSOSULCATA (Lea).

Shell elongately triangular, subequilateral, rather inflated and solid, with a sharp, double posterior ridge, the lower ridge decidedly angled, the upper less pronounced; truncated above and rounded below in front; the base line nearly straight; beaks high and moderately full, their sculpture consisting of rather fine bars running nearly parallel with the growth lines; surface closely and rather sharply, concentrically sculptured throughout; epidermis dirty greenish-brown, darker above, somewhat wrinkled; left valve with two stumpy, radial pseudocardinals and two laterals, the lower larger; the hinge plate flattened under the beak and narrowed behind; right valve with one pseudocardinal, a small tooth in front of it and a vestigial one behind it; beak cavities rather deep, scarcely compressed; anterior scars very deep; posterior scars large and impressed; pallial line deep and broken, distant from the edge of the shell in front; nacre bluish-white, thicker in front.

Length 80, height 57, diam. 35 mm.

Central America.

Unio rugososulcatus LEA, Pr. Ac. N. Sci. Phila., X, 1866, p. 33; Jl. Ac. N. Sci. Phila., VI, 1868, p. 266, pl. xxxiv, fig. 81; Obs., XII, 1869, p. 26, pl. xxxiv, fig. 81.

Margaron (Unio) rugososulcatus LEA, Syn., 1870, p. 35.

Quadrula rugososulcata SIMPSON, Syn., 1900, p. 794.

A fine species, the type being in the Lea Collection. Signor Paz sent Lea two shells, one of which Lea kept and the other he returned. The locality "Central America" is written inside the left valve of Lea's shell. It is longer and less inflated than *Q. spheniopsis*, to which it seems to be nearly related and is not so heavy as that species.

Subgenus *ROTUNDARIA* (Rafinesque, 1820) Simpson.

Rotundaria RAFINESQUE, Am. Gen. Sci. Phys. Brux., V, 1820, p. 308.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 257.

Shell rounded or quadrate, slightly truncate above in front; posterior ridge low; beaks prominent, curved inward and forward over a strongly marked lunule; beak sculpture consisting of numerous (20 to 30) fine, irregular, broken, somewhat concentric corrugations, which extend well on to the second year's growth and gradually blend with the regular sculpture; posterior three-fifths of the shell tuberculate; epidermis brown; beak cavities very deep, compressed; nacre violet.

Animal having the gills very large, inner very much wider in front, free the whole length from the abdominal sac; branchial opening immense, with many small papillæ; anal opening very large, smooth; superanal opening not at all closed below.

Type, *Obliquaria tuberculata* Rafinesque.

Ortmann, (l. c.), raises this group to generic rank.

Group of *Quadrula tuberculata*.

Shell rounded, truncated behind, with a wide depression down the post slope.

QUADRULA TUBERCULATA (Rafinesque).

Shell subelliptical to subquadrate, subcompressed or only slightly inflated, inequilateral, solid or ponderous; beaks elevated but not inflated, turned forward, rather sharp, their sculpture consisting of numerous fine, corrugations that are sometimes broken and doubly looped or zigzagged; anterior end usually evenly rounded; base line curved; posterior end squarely or obliquely truncated with a well-marked sinus above the posterior ridge, usually angled behind the ligament; posterior ridge low, above it is a wide radial depression that ends in a notch or sinus; posterior three-fifths of the shell more or less tuberculate; anterior third concentrically sculptured; epidermis reddish-brown or greenish-brown, scarcely shining;

hinge plate wide and flat, pseudocardinals ragged; lateral of right valve more or less double; beak cavities very deep, compressed; muscle scars well marked; pallial line remote; nacre various shades of purple, thinner behind.

Length 136, height 104, diam. 50 mm.

Length 125, height 111, diam. 55 mm.

Length 90, height 80, diam. 42 mm.

Mississippi drainage generally; southern Michigan; San Saba County, central Texas.

Type locality, Ohio River and adjacent streams.

Obliquaria (Rotundaria) tuberculata RAFINESQUE, Ann. Gen. Sci. Brux., V, 1820, p. 103.

Rotundaria tuberculata AGASSIZ, Arch. für Naturg., I, 1852, p. 48.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 258, fig. 7.

Unio tuberculatus CONRAD, Monog., V, 1836, p. 43, pl. XXII.—KUSTER, Conch. Cab. Unio, 1852, p. 45, pl. IX, fig. 1.—REEVE, Conch. Icon., XVI, 1864, pl. III, figs. 9, 12.

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

Unio verrucosus BARNES, Am. Jl. Sci., VI, 1823, p. 123, pl. v, fig. 6.—HANLEY, Biv. Shells, 1843, p. 180, pl. XXI, fig. 24.

Margarita (Unio) verrucosus LEA, Syn., 1836, p. 16; 1838, p. 15.

Margaron (Unio) verrucosus LEA, Syn., 1852, p. 22; 1870, p. 34.

Unio verrucosus purpureus HILDRETH, Am. Jl. Sci., XIV, 1828, p. 281.

Mya verrucosa EATON, Zool. Text-Book, 1826, p. 216.

Quadrula verrucosa BAKER, Mol. Chicago, Pt. 1, 1898, p. 85, pl. XXIII.

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

This has usually been placed in the *pustulosa* group, but the character of the beak sculpture, a large number of fine, often broken, zigzagged corrugations reaching well out over the disk seems to separate it quite distinctly from that assemblage and ally it to a number of Mexican and Central American

forms. The distinct radial furrow on the dorsal slope, ending in a notch or sinus below and the enormous anal and branchial openings of the animal are good characters.

It has been quite generally believed that the *Unio graniferus* of Lea is merely the young, or a small form of this species, but it seems to me perfectly distinct. It is a much smaller, more inflated, brighter colored form and the nacre is usually differently tinted.

I greatly regret that the well-known name *verrucosus* of Barnes must be changed for the less known *tuberculatus* of Rafinesque. His description of *tuberculatus* applies to this species and cannot be made to cover any other.

QUADRULA GRANIFERA (Lea).

Shell suborbicular or subquadrate, inflated, solid, somewhat inequilateral; beaks high, full; anterior end and base usually rounded; posterior end truncated, often slightly sinused above the posterior ridge; posterior ridge moderately developed; above it there is a light, radial depression; posterior two-thirds of the shell with coarse, scattered tubercles; anterior third without tubercles; epidermis greenish-brown to reddish-brown, usually somewhat shining; hinge plate wide; pseudocardinals radial, torn; laterals short, straight, that of the right valve partly double; beak cavities very deep, compressed; nacre purplish, often coppery and shining.

Length 60, height 60, diam. 35 mm.

Length 46, height 50, diam. 33 mm.

Ohio, Cumberland, and Tennessee River systems; northwest to Iowa.

Type locality, Ohio River, Cincinnati, O.

Unio graniferus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 69, pl. XIX, fig. 60; Obs., II, 1838, p. 69, pl. XIX, fig. 60.—HANLEY, Biv. Shells, 1843, p. 180, pl. XXIII, fig. II.—CHENU, Ill. Conch., 1858, pl. XXV, figs. 3, 3a, 3b.—KUSTER, Conch. Cab. Unio, 1861, p. 212, pl. LXX, fig. 4.—REEVE, Conch. Icon., XVI, 1864, pl. IX, fig. 34.

Margarita (Unio) graniferus LEA, Syn., 1838, p. 15.

Margarca (Unio) graniferus LEA, Syn., 1852, p. 22; 1870, p. 34.

Quadrula granifera SIMPSON, Syn., 1900, p. 795.

Smaller, more inflated, usually brighter, higher in proportion to length, with stronger tubercles, more coppery nacre and a less remote pallial line than *tuberculata*. The young of that species are compressed as are the adults.

Var. *pusilla* Simpson.

Much smaller than the type, with an angled posterior ridge, which ends in a point; posterior furrow deeper than in the type; epidermis less smooth.

Length 34, height 32, diam. 22 mm.

Type locality, Green River, Ky.

Quadrula granifera var. *pusilla* SIMPSON, Syn., 1900, p. 795.

Were it not for the fact that a dwarf form of *Cyprogenia irrorata* was found with this form, I should be inclined to give it specific rank. It is more elongated than the *granifera* and the tubercles are sharper.

Group of *Quadrula ostreata*.

Shell rhomboid, incurved on the base, with a well-developed posterior ridge, somewhat biangulate behind; beak sculpture consisting of a number of fine, concentric ridges showing a tendency to be doubly looped, which gradually change, first to corrugations and then to pustules; pseudocardinals ragged; secondary lateral of right valve but slightly developed.

Animal unknown.

QUADRULA OSTREATA (Morelet).

Shell subtriangular, inequilateral to subequilateral, somewhat inflated, solid in front, thinner behind, with a very high umbonal region, the beaks curved inward and forward; beak sculpture faint, consisting of slight doubly-looped ridges; posterior ridge well developed, double, the lower ridge strong and angular; base rounded, incurved behind in old shells; surface covered with rather strong, irregular, concentric ridges and

nodulous generally throughout; epidermis yellowish-brown to ashy in young shells, darker in old shells; left valve with two rather high, subcompressed pseudocardinals, the anterior one elongated, and there is an indication of a low ragged tooth below and between them, with two nearly straight laterals, the lower larger; right valve with a ragged, solid, but somewhat compressed, pseudocardinal; sometimes there is a second tooth above it and again it is wanting, and one lateral, which shows a tendency to split a little; beak cavities deep, compressed; anterior scars ragged; posterior scars round and shallow; pallial line distant from the border; nacre pale purplish, salmon-rose or deep coppery.

Length 90, height 73, diam. 48 mm.

Length 80, height 64, diam. 37 mm.

Length 68, height 63, diam. 37 mm.

Guatemala: Tabasco, Mexico.

Unio ostreatus MORELET, Test. Noviss., 1849, p. 29.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 573, pl. LXIII, fig. 3; LXX, fig. 4.

Quadrula ostreata SIMPSON, Syn., 1900, p. 796.

Fischer and Crosse have figured a young, very high shell in the Mission Scientifique. As the species grows older it becomes elongated and drawn down at the posterior base. This is more triangular, more solid, and inflated than *quadrata* and is in every way a more robust shell.

QUADRULA PROFUNDA n. s.

Shell irregularly triangular or trapezoidal, very inequilateral, solid in front and thinner behind, inflated, the umbonal region greatly elevated; beaks strongly turned inward and forward, but rather remote from each other, their sculpture not observed; lunule large, truncate in front, extending under the beaks; posterior ridge high, curved, angled with a faint ridge behind it and a shallow, wide radial furrow in front of it and ending at the base in a blunt point; post-dorsal line almost regularly curved from the umbonal region to the posterior base; anterior outline in the form of an ogee, rounded below, incurved sharply above to the overhanging beaks, base line in-

curved behind; surface covered with strong, irregular, concentric, nodulous ridges; epidermis greenish-brown, much denticulated in the only shell seen; left valve with a long, curved upper pseudocardinal formed no doubt by the union of two teeth, and a small ragged tooth below it and two remote, curved laterals, the upper very small; beak cavity enormous and profound, not compressed; dorsal scars at the base of the pseudocardinals; posterior scars shallow; anterior scars ragged; nacre whitish, pink-tinted.

Length 77, height 64, diam. 55 mm.

Usumacinta River, Guatemala.

The National Museum possesses a single valve of this robust species presented by Dr. von Ihering. I at first referred it to the *Unio usumasintæ* with doubt, but I am now satisfied that it is not that, but an undescribed species. It is much more rudely sculptured than that species and has a totally different epidermis, the beaks are nearer the anterior end of the shell, and the outline below them is an ogee, while it is truncate above in *usumasintæ*. Its beaks are turned farther forward and the enormous beak cavity is much deeper. On account of this immense and deep cavity I have called it *Quadrula profunda*.

QUADRULA USUMASINTÆ (Crosse and Fischer).

Shell subtriangular, inflated, very solid, cordiform with a high umbonal region greatly raised above the hinge; beaks turned upward and forward over a wide lunule; anterior end slopingly truncate above, rounded below; posterior end slopingly truncate; posterior ridge distinctly double, ending in a biangulation just at and above the base; beak sculpture consisting of rather fine, irregular, subnodulous ridges; this gradually passes into the strong, irregular, concentric sculpture covering the shell, these ridges are granular in front and feebly subnodulous behind; on the posterior slope there are radial, nodulous wrinkles and a few faint, radial folds on the front part of the shell; ligament long, brown; epidermis ashy or ashy-brown; hinge very strong; left valve with two large, con-

nected, torn pseudocardinals and two curved, heavy laterals, the lower larger; right valve with two pseudocardinals, the lower very large, the upper long and compressed and one strong lateral with a vestige of another above and a third below it; beak cavities very deep, not compressed; dorsal scars in a long row under the pseudocardinals; muscle scars deep, the anterior ones very rough; pallial line distant from the border in front; nacre rose-colored to deep coppery-purple, very much thickened in front.

Length 82, height 70, diam. 55 mm.

Guatemala in the Usumacinta River; Tabasco, Mexico.

Unio usumasintæ CROSSE and FISCHER, J. de Conch., XL, 1892, p. 294.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 574, pls. LXIII, fig. 4; LXVII, fig. 5.

Quadrula usumasintæ SIMPSON, Syn., 1900, p. 796.

The specimen figured by Fischer and Crosse is young and has a pink nacre. I have seen a fine adult specimen of what is undoubtedly this species, which is one of the most robust in the development of its parts of any Naiad I know of. It is larger, more inflated, and solidier than *Q. ostreata*.

QUADRULA GUATEMALENSIS Simpson.

Shell subrhomboid, longer than high, inequilateral, subcompressed, subsolid, with moderately high, but not swollen, beaks, whose sculpture is eroded in the only specimen seen; anterior end narrowed, subangular, rounded in front; posterior ridge low, double, ending in a feeble biangulation behind at the base of the shell; surface with rather close, irregular, nodulous, concentric sculpture; epidermis brown, lighter behind, rayless; left valve with two subcompressed pseudocardinals and one lateral with a vestige of another above it; right valve with a ragged pseudocardinal and one curved lateral; beak cavities only moderately deep; anterior muscle scars impressed; posterior scars shallow; nacre coppery-purple, slightly iridescent behind, thicker in front.

Length 45, height 28, diam. 14 mm.

Rio Usumacinta, Guatemala.

Quadrula guatemalensis SIMPSON, Pr. Acad. N. Sci. Phila., 1900, p. 83, pl. II, fig. 4; Syn., 1900, p. 796.

This has a more elongated form than any member of the group, but it seems to show rather close relationship to *Q. quadrata*. The general external appearance of the shell and its comparatively shallow beak cavities lead me to believe that it is rather young. It differs from *Q. quadrata* in being more elongated, and compressed, in being lighter colored behind, in the shallower beak cavities, color of nacre and size.

QUADRULA RUDIS Simpson.

Shell elongated, somewhat rhomboid, rather inflated, very solid in front but much thinner behind, with a rather sharp, curved posterior ridge, which ends in a blunt point at the base line and there is an indication of a faint secondary ridge on the posterior slope; dorsal line curved rather regularly from the beaks to the post-base; basal line incurved behind; anterior end rounded; umbonal region very high, the beaks curved inward and forward but not approaching, their sculpture seeming to be nodulous, irregular ridges; lunule well marked and passing under the beaks; surface covered with rather close pustules, which gradually change at the border of the shell to slightly nodulous, irregular sulcations; epidermis brown, the only specimen seen nearly decorticated; left valve with three rather strong, but illy separated, ragged pseudocardinals, there being a deep crater between the lower and anterior teeth; laterals two, the lower the larger; right valve with one large pseudocardinal and one lateral; beak cavities very deep, sub-compressed; dorsal scars in a row at the base of the pseudocardinals; anterior muscle scars very rough; pallial line deep, distant from the border, nacre cream-colored.

Length 113, height 65, diam. 46 mm.

Rio Taxtunilha, tributary of Rio de la Pasion, Guatemala
Quadrula rudis SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 82
pl. III, fig. 2.

Unio crocodilarum var. *rudis* VON MARTENS, Biol. Cent. Amer. Moll., 1901, p. 648.

Lea received the only specimen I have seen, the type from Wheatley, who had labeled it *Unio psoricus*. It differs most decidedly from that species, being longer, more inflated, different colored, and having much deeper beak cavities. This species was overlooked by accident when making up the Synopsis.

QUADRULA QUADRATA n. s.

Shell subquadrate, subcompressed to convex, rather solid; beaks located subcentrally or near the anterior end, rather high but compressed and turned inward and forward; posterior ridge rather low, wide and double; posterior end subtruncated; base slightly incurved behind; surface covered with small pustules and irregular, low, concentric ridges; epidermis dirty brown, in places tinted with bottle-green, decorticated on the nodules; left valve with two strong, low, ragged, radial pseudocardinals with an imperfect, much torn tooth between and two small laterals; right valve with one ragged pseudocardinal and one lateral, partly divided; beak cavities deep, compressed; anterior scars rough; pallial line distant from the shell border; nacre creamy-white.

Length 67, height 55, diam. 33 mm.

Length 72, height 53, diam. 27 mm.

Length 60, height 50, diam. 30 mm.

Usumacinta River, Guatemala.

The National Museum possesses three specimens sent by Dr. von Ihering from the above locality, which I at first doubtfully considered to be the *Unio ostreatus* of Morelet and one of them has something of the outline of that species. In general it is much more quadrate, it is a smaller and more delicate, more compressed species and the pseudocardinals are very different. Those of *quadrata* are low and rather wide, while in *ostreata* they are high and subcompressed. The National Museum recently received a fine series of *ostreata* from Messrs. Nelson and Goldman, collected in southern Mexico, and the difference in the two species is at once apparent.

QUADRULA PERCOMPRESSA (von Martens).

Shell large, triangular or subtriangular, solid, greatly compressed, with very high beaks, whose sculpture has not been examined; equilateral or inequilateral; posterior ridge narrowly biangulate; anterior slope often incurved above, rounded below; posterior slope rounded; surface with strong, nodulous, concentric ridges; in some cases the ridges become almost replaced by nodules; epidermis pale brownish, the surface generally nearly decorticated; left valve with two low, solid, radial, rough pseudocardinals and one lateral with a vestige of a second above it; right valve with a large, somewhat divided, pseudocardinal and one lateral; hinge plate very wide and flat and on it there is a wide epidermal deposit under the beaks, which often covers the entire width of the plate; beak cavities very deep and compressed; anterior scars shallow, rough; posterior scars rather long; nacre varying from whitish to purple, greatly thickened in front; pallial line remote from the shell border in front.

Length 110, height 96, diam. 25 mm.

Length 94, height 92, diam. 28.5 mm.

Length 95, height 73, diam. 24 mm.

Rio Usumacinta and Rio de las Salinas, Guatemala.

Unio percompressus VON MARTENS, Sitzungs Ber. Nat. Tr. 1887, p. 107; Biol. Cent. Am. Moll., p. 406, pl. XXXII, figs. 1-3.

Quadrula percompressa SIMPSON, Syn., 1900, p. 796.

A remarkable shell, of which two large, left valves are in the National Museum, both of which turn to the left in front and to the right behind. From an examination of these remarkable valves I believed it best to give the species the rank of a group, but the figures, which von Martens has lately published in the *Biologia*, show much variation in the species and that it varies towards *Q. quadrata* and *ostreata*. I therefore place it in the same group with these species. It cannot be mistaken for any known form.

Subgenus LAMPROTULA Simpson, 1900.

Lamprotula SIMPSON, Syn., 1900, p. 796.

Shell rounded to triangular, inflated, with high beaks; beak sculpture consisting of a few coarse, subparallel ridges, which are slightly doubly looped; surface of the shell generally covered with coarse nodules or knobs; posterior slope radially ridged; epidermis dark; hinge strong; secondary lateral of right valve well developed; cavity of the beaks deep and compressed; nacre mostly whitish, usually radially, granularly striated outside the pallial line, and having one or more peculiar calluses behind and below the laterals, which are iridescent and granularly striate.

Animal unknown.

Type, *Chama plumbea* Chemnitz.

Group of *Quadrula plumbea*.

Shell rounded, slightly angulated behind the ligament, solid, moderately inflated, covered with coarse pustules, and having broken, upcurved corrugations on the posterior slope; epidermis light brownish; hinge rather strong, somewhat flattened; laterals vertically striated.

QUADRULA PLUMBEA (Chemnitz).

Shell suborbicular, solid, somewhat inflated, inequilateral; beaks moderately high, turned forward; surface sculptured with oblique corrugations in the umbonal region, which descend toward the anterior base, having irregular, radial folds below and behind; the basal and anterior parts of the shell are somewhat tuberculous; epidermis brownish; hinge plate wide and flat; pseudocardinals very strong; laterals with strong vertical striation; beak cavities no doubt deep; nacre white.

Length of figure 42, height 45 mm.

South East Asia, probably. The locality, "South Sea," given by Chemnitz is, no doubt, erroneous.

Chama plumbea CHEMNITZ, Conch. Cab., XI, 1795, p. 237, pl. CCIII, figs. 1991, 1992.—WOOD, Ind. Test. Rev., 1856, p. 52, pl. IX, fig. 6.

Quadrula plumbea SIMPSON, Syn., 1900, p. 797.

Unio plumbeus KUSTER, Conch. Cab. Unio., 1862, p. 289, pl. XCVII, figs. 1, 2.

Chemnitz' figures are not carefully finished and they, no doubt, give an erroneous representation of the pseudocardinals. The outline is nearly orbicular; the shell is evidently very solid.

QUADRULA COREANA (von Martens).

Shell subelliptical, inequilateral, not inflated, rather solid; beaks moderately full and elevated, their sculpture not observed; posterior ridge moderately developed, rounded; surface strongly sculptured, there being a row of heavy chevron-shaped folds down the posterior ridge, while the anterior end is somewhat pustulous; epidermis yellowish-green, with greenish cloudings; left valve with two radial pseudocardinals, the hinder heavier, and two remote, delicate laterals; right valve with one pseudocardinal and two vestigial ones, with one vertically striate, slender lateral; anterior scars small, posterior scars faint; beak cavities very deep, compressed; nacre white, thinner behind.

Length 43, height 36, diam. 21 mm.

Seoul, Korea.

Unio coreanus VON MARTENS, S. B. Nat. Fr., 1886, p. 78;

Zool. Jahrb. Suppl., VIII, 1904, p. 50, pl. III, fig. 5.

Quadrula coreana SIMPSON, Syn., 1900, p. 797.

"Among the Chinese species figured by Heude, *Unio affinis*, (*Quadrula similis* Simpson), is the nearest to this Korean species, but in the Chinese species the anterior end is much shorter, so that the form is in a general way more triangular, the folds of the posterior portion are stronger and less numerous, the tubercles are arranged in concentric rows and are longer in this direction; towards the beaks the rows are oblique." (von Martens).

A single specimen belonging to the collection of Mr. Frederick Stearns, from Seoul, Corea, which seems to be von Martens' species, is here described. The specimen was taken dead and the surface is slightly worn. It is apparently a more compressed, less solid species than the *Chama plumbea* of Chemnitz, to which it seems to be closely related.

Group of *Quadrula messengeri*.

Shell subquadrate, almost squarely truncated behind, having a few wavy, almost longitudinal folds on the upper part of the disk.

QUADRULA MESSAGERI (Bavay and Dautzenberg).

Shell subquadrate, solid, inflated, inequilateral, with low, but apparently inflated, beaks, whose sculpture is not known; posterior ridge full and rounded, ending behind at or near the base line; above it there is a wide, very shallow, radial depression; posterior end of the shell almost squarely truncated; dorsal and basal lines slightly and similarly curved toward the somewhat narrow, rounded anterior end; surface sulcated anteriorly, nearly smooth behind and below, having a number of rather strong, wavy, almost longitudinal, folds on the upper part of the disk; epidermis yellowish-brown, faintly rayed; pseudocardinals ragged; laterals curved; nacre whitish, tinted bronze.

Length 44, height 31, diam. 20 mm.

Lang-Son and That-Khe, Indo-China.

Unio messengeri BAVAY and DAUTZENBERG, Journ. de Conch., XLIX, 1901, p. 7, pl. 1, figs. 3, 4.

Protunio messengeri HAAS, Conch. Cab. Unio, 1912, pl. 32, figs. 1-2.

Apparently a *Quadrula* related to the Chinese forms and bearing some resemblance to depauperate, rather smooth, specimens of *Q. undulata* and *perplicata* of the Mississippi Valley. The strong longitudinal or very slightly oblique folds on the upper part of the disk recall the American species.

Haas has recently, (Nachr. Deutsch. Mal. Ges., 1913, p. 37), made this species the type of a new genus, *Protunio*.

Group of *Quadrula nodulosa*.

Shell very solid, oval or rounded, inflated, inequilateral, inequivalve, the valves more or less twisted on their axis or having the appearance as if one of them had been pushed forward on the other, so that a dorsal view shows the outline to

be rhomboid; each valve with a posterior ridge, that on the valve pushed forward less developed; beaks high, full, apparently sculptured with a few coarse, irregular ridges; posterior slope usually having strong, radiating, upcurved ridges; hinge plate generally wide and flattened; pseudocardinals heavy, somewhat radiate, often with the sockets evenly, radially grooved; laterals strong, heavily vertically ridged; secondary lateral of right valve well developed; anterior cicatrices small, deep, posterior shallow; cavity of the beaks enormously deep, compressed; dorsal cicatrices on the under side of the shell.

Animal unknown.

QUADRULA TORTUOSA (Lea).

Shell subelliptical, inequivalve, very inequilateral, twisted, inflated, solid; beaks prominent, terminal, swollen; anterior end cut away below; base line curved; outline of posterior end curved and cut away below; dorsal slope with a gently curved outline; left valve pushed either forward or back on the right; posterior ridge strongest on the valve projecting behind; dorsal slope having subradial, curved, broken corrugations; surface with concentric growth lines but lacking nodules; epidermis somewhat silky when fresh, ashy-brown; pseudocardinals large, heavy, elongated, running almost parallel with the hinge line, a heavy posterior and a smaller split one in the left valve with one in the right valve; lateral of right valve single or partly double, vertically striate; anterior muscle scars small, deep; beak cavities very deep, compressed; nacre silvery white.

Length 67, height 47, diam. 35 mm.

Length 72, height 46, diam. 37 mm.

China.

Unio tortuosus LEA, Pr. Ac. N. Sci. Phila., IX, 1865, p. 76;

Jl. Ac. N. Sci. Phila., VI, 1868, p. 286, pl. XXXIX, fig. 98;

Obs., XII, 1869, p. 46, pl. XXXIX, fig. 98.

Margaron (Unio) tortuosus LEA, Syn., 1870, p. 30.

Quadrula tortuosa SIMPSON, Syn., 1900, p. 798.

Unio (Lampsilis) subtortus BAIRD and ADAMS, Proc. Zool. Soc. Lond., 1867, p. 491, pl. XXVI, figs. 1, 1a.

Unio subtortus SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVII, fig. 465.—HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LXI, fig. 119.

Unio retortus HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LXII, fig. 109.

Two examples of this species are before me, one agreeing perfectly with Dr. Lea's figure, the other differing a little. In one of these the right valve is pushed forward; in the other it is pushed back. The line of junction of the valves is curved somewhat. It differs from the allied forms in having the disk free of nodules and has stronger plications on the posterior slope than *fibrosa* or *tientsinensis*.

It is quite probable that when a large amount of material can be examined some of the species of this group will have to be relegated to the synonymy.

QUADRULA TIENTSINENSIS (Crosse and Debeaux).

*Shell almost evenly elliptical, solid, inflated, one valve decidedly pushed ahead on the other; beaks full and high, subterminal; surface sculptured with strong, irregular, concentric ridges and having in the umbonal region a number of tubercles; epidermis silky, russet or ashy brown, painted with bright, green, narrow bands and small blotches; pseudocardinals strong, striate and crenulate; laterals with vertical striation; beak cavities deep; nacre whitish at the border, yellowish in the center of the shell.

Length 65, height 53, diam. 41.5 mm.

China.

Unio tientsinensis CROSSE and DEBEAUX, Jl. de Conch., III, 1863, p. 257, pl. X, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl. XCI, fig. 514, 514a, 514b.

Margaron (Unio) tientsinensis LEA, Syn., 1870, p. 30.

Quadrula tientsinensis SIMPSON, Syn., 1900, p. 798.

Much more evenly elliptical than *tortuosa*, the sculpture consisting of concentric ridges and nodules being very different. *Q. tortuosa* is uniformly colored, while Crosse and Debeaux' species is painted with green, their shell has yellowish nacre and that of *tortuosa* is silvery.

QUADRULA ZONATA (Heude).

Shell long elliptical, solid, inflated, transversely oblique; beaks terminal, full; posterior ridge only moderately developed; surface with irregular, concentric ridges and more or less nodules on the disk; posterior slope with a few subradial, curved plications, which are more or less subnodulous; epidermis bright, rich chestnut, sometimes slightly rayed, with lighter color; pseudocardinals radial, elongated, radially folded or ridged; laterals with vertical striation; beak cavities deep, compressed; nacre white.

Length 75, height 55, diam. 40 mm.

China.

Unio zonatus HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LXI.

Quadrula zonata SIMPSON, Syn., 1900, p. 798.

Unio tientsinensis HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. I.X, fig. 118.

Very close to *tientsinensis*, but it has higher, larger, more decidedly terminal beaks, the color of the epidermis is different, the concentric ridges are wider and more feeble and the pseudocardinals are longer.

QUADRULA FIBROSA (Heude).

Shell somewhat elongated, irregularly triangular, solid, inflated, the valves asymmetrical; beaks full, high, and terminal; anterior end much cut away below the beaks, its outline slightly curved; base line curved; outline of the dorsal slope a long, low curve; posterior ridge only moderately developed, rounded; surface with irregular, concentric, nodulous ridges; epidermis olive-green or olive-brown; pseudocardinals curved, elongated, roughened; laterals curved, strongly vertically striate; beak cavities excessively deep, compressed; anterior scars deep, narrow, partly filled with rough nacre; nacre white, the posterior calluses strong.

Length 117, height 63, diam. 50 mm.

Length 82, height 57, diam. 37 mm.

China.

Unio fibrosus HEUDE, Conch. Fluv. Nank., II, 1877, pl. XI, fig. 22.

Quadrula fibrosa SIMPSON, Syn., 1900, p. 798.

Unio spurius HEUDE, Conch. Fluv. Nank., II, 1877, pl. XI, fig. 23.

I have examined author's specimens of both *Unio fibrosus* and *spurius* and they so unite the figures given by Heude of the two species that I believe they are both one thing. The form is more elongated than *tientsincensis* or *zonata*, is more triangular and the beaks are higher than in either.

QUADRULA SALAPUTIUM von Martens.

"Shell orbicular-subquadrate, heavy, inflated, sculptured with elevated warts of varied shape, linear, subcircular or forked over the whole surface; epidermis yellowish-brown, not shining; rounded before; subtruncate behind; ventral margin slightly, posterior margin greatly undulated by larger, heavy, elongated, radiating pustules; beaks obtuse, eroded. Three cardinal teeth in the right valve, the middle one heavy, triangular, deeply sulcate, the posterior rather smooth, weak, oblique and the anterior sublinear, small; in the left valve two, triangular, sulcate, anterior moderately, posterior very heavy; lateral teeth quite short, slightly curved, one in the right valve, transversely striate on both sides like a *Castalia*; in the left valve two, parallel, the upper one the smaller, transversely striate on the inner face, the lower swollen posteriorly, transversely striate on the upper face; sinulus none. Nacre yellowish-white, scarcely pearly; impressions of the anterior adductors very deep; accessory impressions small, oblong.

Length 38, height 33, diam. 20.5 mm. Beaks in 2-5 of the length." (von Martens).

Type locality, Thuyen-Quan, Anam.

Quadrula salaputium VON MARTENS, Nachtr. Deutsch. Mal. Ges., 1902, p. 132.

"Only a single specimen is before me, so that I can not tell how largely individual characters, as for instance, the color of the nacre, are included in the above description. It differs

quite strongly from all the Chinese species figured by Heude; especially in that the teeth are not so oblique as in the related forms, such as *plumbeus* Chemn., *polystictus* and *fibrosus* Heude. The striation of the lateral teeth like *Castalia* I find likewise, sometimes stronger, but varying in individual specimens, both in the above named species and in Heude's figures. It is remarkable that in all the species collected by Fruhstorfer in Tonkin, the silky lustre, which is found in so many of the Chinese species, is absent."

QUADRULA NODULOSA (Wood).

Shell subtriangular, inflated, solid, beaks full and high, terminal or subterminal; posterior ridge full, subangular, ending at the posterior base of the shell in a rounded point; anterior end cut away and rounded below; base line somewhat curved; outline of dorsal slope a long, almost even, curve; surface somewhat concentrically ridged and covered with coarse nodules; posterior end with very strong, curved, subnodulous ridges, which are often divaricate on the posterior ridge; epidermis rough, tawny-brown; hinge plate very wide; pseudo-cardinals radial, curved, rough and split, laterals with strong, vertical striæ; anterior muscle scars small, deep; beak cavities very deep, compressed; nacre straw-colored, thinner and iridescent behind.

Length 90, height 69, diam. 45 mm.

China.

Mya nodulosa WOOD (in part), Gen. Conch. 1, 1815, p. 106, pl. XXII, figs. 1, 2; Index Test, 1825, p. 12, pl. II, fig. 29b; Index Test. Rev., 1856, p. 16, pl. II, fig. 29.

Quadrula nodulosa SIMPSON, Syn., 1900, p. 798.

Unio nodulosus SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIII, fig. 439.

Margarita (Unio) nodulosus LEA, Syn., 1836, p. 16; 1838, p. 15.

Margaron (Prisodon) nodulosus LEA, Syn., 1852, p. 27; 1870, p. 27.

Castalia nodulosa H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 509.

Unio grandidens LEA, Pr. Ac. N. Sci. Phila., V, 1862, p. 168; Jl. Ac. N. Sci. Phila., V, 1862, p. 205, pl. xxx, fig. 274; Obs., IX, 1863, p. 27, pl. xxx, fig. 274.

Margaron (Unio) grandidens LEA, Syn., 1870, p. 34.

I have before me two opposite, matched valves of this species, the right valve being Lea's figured type of *Unio grandidens*, the left one accompanying it and sent as from Hot Springs, Arkansas, by Dr. Byrd Powell to the Smithsonian Institution. The valves agree exactly with Wood's figures and brief description of *Mya nodulosa*. This shell certainly never came from Arkansas and it has the characters of Heude's *Unio polystictus* in such a degree that I suspect that the two run together. It is a very heavy shell, much more nodulous and strongly sculptured than *Q. tortuosa*, *tientsinensis*, *zonata* or *fibrosa*.

Wood gives four figures of his *Mya nodulosa*, the first and second being a solid, nodulous, Chinese species; the third and fourth seem to be *Unio pictorum*. Lamarck used the name *nodulosa* for a *Unio* (An. sans Vert. VI, 1819, p. 78), and refers to the Encyclopædia Methodique, pl. 248, fig. 19, 1797, and this figure is no doubt that of *Unio pictorum*. Wood seems to have confounded the two.

QUADRULA LIEDTKEI Rolle.

"This magnificent, heavy, massive, nodulously sculptured species, which is not inferior to the finest North American species, stands nearest to the Chinese *Unio nodulosus* Wood, (*grandidens* Lea), but differs by the incurving of the anterior margin immediately under the beaks, where there is a distinct lunule, which is wanting in the Chinese species. The cardinal tooth of the right valve is also less deeply paralleled grooved. I give four figures of the shell and can well dispense with a precise description.

Length 138, height 90, diam. 90 mm." (Rolle).

Type locality, Riviere Claire, Tonkin.

Unio (Quadrula) liedtkei ROLLE, Nachr. Deutsch. Mal. Ges., 1904, p. 25, pl. 3; pl. 4, fig. a.—DAUTZENBERG and FISCHER, Jl. de Conch., LIII, 1905, p. 211.

Dautzenberg and Fischer, (l. c.), consider this to be only a variety of *nodulosus* Wood.

QUADRULA BLAISEI Dautzenberg and H. Fischer.

"Shell oval, elongated, very thick and heavy, greatly inflated anteriorly and with two diverging carinæ, the lower of which soon disappears, while the posterior, decreasing in size towards the posterior extremity, sharply limits the posterior slope. Surface ornamented with irregular, concentric folds, which towards the summits become more pronounced and are mingled with irregular tubercles, becoming obsolete, however, posteriorly where the shell is compressed and almost smooth. Posterior slope with strong, oblique folds, which undulate the dorsal margin. Ligament corneous, strong, but slightly prominent. Cardinal plate large and overhanging a deep cavity. Hinge very thick, in the right valve a single, large, sulcate cardinal tooth (situated between a deep cardinal pit and the equally deep impression of the anterior adductor muscle) and an elongated lateral; in the left valve, two cardinal teeth (the anterior small, situated between a deep cardinal pit and the equally deep impression of the anterior adductor, the posterior strong, sulcate) and two elongated, lamellar laterals. Impression well marked. Epidermis fibrous, deep olive. Nacre white, iridescent.

Length 98, height 62, diam. 55 mm." (D. and F.).

Type locality, Bas Luc-Nam, village of Van-Ien, Tonkin.

Unio (Quadrula) blaisei DAUTZENBERG and FISCHER, Jl. de Conch., LIII, 1905, p. 210, pl. VI, figs. 1, 2.

"This species is distinguished from *U. lei* Gray by its heavier shell, much more inflated in the umbonal region and by the two, elevated carinæ that diverge from the beaks. It is also related to *Quadrula liedtkei* Rolle (Nachtrichtsbl. d. d. Malak. Ges. 1904, p. 25, pl. 3 and pl. 4, fig. a, a) but this latter species is more regularly oval, does not have the characteristic carinæ of *blaisei* and appears to us to be only a variety of *U. nodulosus* Wood."

QUADRULA MORELETIANA (Heude).

Shell ovate, very heavy, subcompressed; beaks but slightly elevated, placed at the upper part of the anterior end, but not terminal; anterior end widely and almost evenly rounded; post-dorsal and basal lines evenly curved; posterior end narrowed and somewhat rounded; surface with subobsolete, concentric ridges, covered with scattered, coarse nodules, and having a few curved, subnodulous ridges on the posterior slope; epidermis brownish-chestnut; pseudocardinals somewhat elongated, slightly curved; laterals with vertical striation; beak cavities deep, compressed; nacre dirty white.

Length 80, height 55, diam. 40 mm.

River Konang-té-tcheou, China.

Unio moreletianus HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LX, fig. 117.

Quadrula konangensis SIMPSON, Syn., 1900, p. 799.

The outline of this species is almost exactly egg-shaped, and the species differs from all allied forms in this character. In the Synopsis I changed Heude's name *moreletianus* to *konangensis* because the name *moreleti* had been previously applied to a *Unio* by Deshayes. But as the two names differ slightly, it is probably better that Heude's name should stand.

QUADRULA POLYSTICTA (Heude).

Shell somewhat rhomboid in outline, moderately inflated, solid; beaks high, full, terminal; anterior end cut away slopingly below, rounded where it joins the straight or lightly curved base; outline of dorsal slope raised to a low angle behind the ligament; posterior ridge well-developed, subangular; surface covered with rather close, large tubercles; dorsal slope with curved, subnodulous ridges; epidermis light brownish, somewhat silky; pseudocardinals elongated, radial, curved, more or less split; laterals vertically striate; beak cavities very deep; anterior muscle scars small, deep; nacre dirty white, thinner behind.

Length 82, height 58, diam. 36 mm.

China.

Unio polystictus HEUDE, Conch. Fluv. Nank., II, 1877, pl. XII, fig. 25.

Quadrula polystictus SIMPSON, Syn., 1900, p. 799.

Unio polysticto-scriptus HEUDE, Conch. Fluv. Nank., II, 1877, pl. XIII, fig. 26.

Quadrula polysticto-scriptus SIMPSON, Syn., 1900, p. 799.

Unio scripto-polystictus HEUDE, Conch. Fluv. Nank., II, 1877, pl. XIII, fig. 26.

Unio scripto-polystrictus PÆTEL, Conch. Sam., III, 1890, p. 167.

Heude remarks that some of the species of this group apparently hybridise and it is quite likely he is correct. The same remark might be applied to some of the *Anodontas* of the *woodiana* group, on which he has so lavishly bestowed specific names. I have before me a shell of *Unio polysticto-scriptus* from the author, which does not exactly agree with that form or *U. scripto-polystictus*. The National Museum specimen is something like *Q. nodulosa*, but is more decidedly rhomboid and more strongly nodulous. Heude's figures of his two species slightly recall the *Q. leai* of Gray. After further study of these forms I think it best to place them under *polystrictus* as synonyms, as it does not seem to me that any clear specific lines can be established. The species as above constituted is scarcely, if at all, twisted on its axis.

QUADRULA SIMILARIS Simpson.

Shell subrhomboid, solid, inflated; beaks rather full and high, subterminal; anterior end rounded, somewhat slopingly cut away below; base rounded; outline of dorsal slope curved, raised almost to an angle behind the ligament; umbonal region covered with narrow, oblique, corrugated ribs, which run nearly parallel with the dorsal line; surface generally, except the extreme anterior end, covered with pustules; dorsal slope with strong, curved ridges; epidermis brown; pseudocardinals strong, radial, split up into regular divisions; lateral in the right valve somewhat double; beak cavities deep, compressed; nacre white, thinner behind.

Length 85, height 70, diam. 42 mm.

China.

Unio affinis HEUDE, Conch. Fluv. Nank., I, 1875, pl. III, figs. 7, 7a.

Quadrula similis SIMPSON, Syn., 1900, p. 799.

In the shell figured by Heude there are strong, corrugated ridges in the umbonal region running nearly parallel to the dorsal edge of the shell. The author's specimen in the National Museum collection is somewhat eroded in this region, but does not seem to have these plications very much developed and I am not certain that it has been accurately named. It is close to *microsticta*, but is rather shorter, less decidedly rhomboid and is not so finely sculptured. I am doubtful if the two are distinct. The valves of this species and *microsticta* are scarcely, if at all, twisted.

The name *affinis* was used long before by Dr. Lea for a *Unio*.

QUADRULA MICROSTICTA (Heude).

Shell subrhomboid, scarcely inflated, inequilateral, solid; beaks only moderately full and high, placed at some distance from the anterior end; posterior ridge full, rounded; anterior end rounded; base line curved, sometimes having a light sinus in front of the posterior ridge; outline of the dorsal slope curved, sometimes raised into a low angle behind the ligament; surface, except the anterior portion, covered with strong nodules; dorsal slope having heavy, curved, corrugated ridges; epidermis dark brown or blackish; pseudocardinals striate but not much split; laterals short, heavy, vertically striate, that of the right valve partly double; beak cavities very deep, compressed; anterior scars partly filled with rough nacre; nacre white, polished behind.

Length 80, height 63, diam. 34 mm.

China.

Unio microstictus HEUDE, Conch. Fluv. Nank., II, 1877, pl. XII, fig. 24.

Quadrula microstictis SIMPSON, Syn., 1900, p. 799.

The epidermis is quite dark, the outline is rather rhomboid, the inflation is moderate and the ridges on the posterior end are numerous and strong.

Group of *Quadrula rochechouarti*.

Shell rhomboid, with a strong posterior ridge, rounded before, incurved below, and somewhat biangulate on the posterior base, with very strong folds on posterior slope, which begin on the posterior ridge as knobs; surface strongly pustulous; beaks rather well forward, sculpture not seen; epidermis concentrically wrinkled, black and rough; pseudocardinals strong, somewhat radial, rough, striate; laterals more or less vertically striate, secondary lateral in right valve well developed; beak cavities very deep, compressed; posterior calluses faint.

Animal unknown.

QUADRULA ROCHECHOUARTI (Heude).

Shell subtriangular, solid, scarcely inflated, inequilateral; valves scarcely, if at all, twisted; beaks high and full; posterior ridge very strong, curved, subangular, ending at the base of the shell; anterior end evenly rounded; base line decidedly sinused in front of the posterior ridge; outline of dorsal slope lightly curved; post-basal part somewhat obliquely truncated; surface, except the extreme anterior end, covered with very strong, often lachrymose or double, tubercles; dorsal slope sculptured with very strong, curved ridges; epidermis blackish, thick, often cracking off; pseudocardinals strong, radial, radially striate; laterals vertically striate, that of the right valve partly double; anterior muscle scars partly filled with roughened nacre; beak cavities enormously deep, compressed; nacre dull purplish.

Length 130, height 92, diam. 48 mm.

Province of Kiang-su, China.

Unio rochechouarti HEUDE, Conch. Fluv. Nank., I, 1875, pl. v, fig. 13.

Quadrula rochechouarti SIMPSON, Syn., 1900, p. 800.

A remarkably strong, rude species, which recalls certain specimens of our *Tritogonia tuberculata*. The two specimens in the National Museum collection are from Heude, and are more elongated than the figure given by him.

Group of *Quadrula triclava*.

Shell solid, elongate triangular, obtusely pointed at the posterior base, with a decided posterior ridge, along which runs a row of ponderous knobs; beaks high and far forward; surface strongly nodulous; posterior slope slightly corrugated; epidermis dark chestnut; pseudocardinals heavy, subradial, radially striate; laterals vertically striate, secondary lateral of right valve well developed; cavity of the beaks enormously deep and compressed; a granular callus behind the laterals; nacre silvery, radially, granularly striate outside the pallial line.

Animal unknown.

QUADRULA TRICLAVUS (Heude).

Shell long, triangular, solid, scarcely inflated, very inequilateral; beaks elevated, somewhat compressed; posterior ridge high, ending near the base in a blunt point; anterior end rounded and somewhat cut away below; base line nearly straight; outline of the dorsal slope lightly curved; along the posterior ridge there is a row of ponderous knobs; the rest of the disk, except the anterior end, is covered with irregular nodules; epidermis brownish; pseudocardinals strong, radial, slightly curved, granularly striate; laterals vertically striate, that in the right valve somewhat double; beak cavities enormously deep; compressed; posterior callosities well developed; pallial line remote; nacre white, iridescent behind.

Length 110, height 72, diam. 37 mm.

China.

Unio triclavus HEUDE, Conch. Fluv. Nank., II, 1877, pl. x, figs. 21, 21a.

Quadrula triclava SIMPSON, Syn., 1900, p. 800.

A remarkable Naiad, its most prominent character being a row of four or five large, elevated knobs running down the posterior ridge.

Group of *Quadrula bazini*.

Shell elongate-trigonal, with a fairly well developed posterior ridge, pointed behind; beaks not high, almost at extreme front of the shell; surface more or less covered with knobs

and tubercles, which show a tendency to an arrangement in curved lines; epidermis chestnut to blackish; hinge strong; pseudocardinals radial, radiately striate; laterals granular, showing traces of vertical striation; beak cavities very deep, compressed; nacre silvery.

Animal unknown.

QUADRULA BAZINI (Heude).

Shell long ovate, solid, very inequilateral, scarcely inflated; beaks only moderately full, or elevated; anterior end rounded; base and dorsal outlines lightly curved to a point some distance above the base; posterior ridge elevated; surface more or less covered with knobs or tubercles that have a tendency to be arranged in curved, subvertical rows; epidermis light and dark brown, clouded, shining; pseudocardinals radial, radially striate; laterals with slight vertical striation, that of the right valve partly double; beak cavities deep, compressed; pallial line not very remote; nacre white.

Length 105, height 57, diam. 33 mm.

China.

Unio bazini HEUDE, Conch. Fluv. Nank., II, 1877, pl. IX, fig. 20.

Quadrula bazini SIMPSON, Syn., 1900, p. 800.

Heude's figure differs considerably from the specimen from him in the National Museum collection, being much less strongly tuberculate and having the later growth of the shell smooth, while that in the Museum is noded throughout. The shell is more ovate than *triclavus* and lacks the ponderous knobs on the posterior ridge.

Group of *Quadrula leai*.

Shell obovate, obtusely pointed behind; posterior ridge low; whole surface generally tuberculate or knobbed, with strong, radial, curved ridges on the posterior slope; beaks rather low, the sculpture coarse, irregular, broken bars somewhat doubly looped and swollen on the posterior ridge, with strong, radiating ridges behind them; pseudocardinals solid, often com-

pressed in the direction of the axis of the shell; laterals granular; beak cavities moderately deep; one or more granular caluses behind the laterals; nacre white or lurid, slightly radially granular outside the pallial line.

Animal unknown.

QUADRULA LEAI (Gray).

Shell somewhat lengthened, more or less obovate, convex, rather solid, very inequilateral; beaks moderately full and high, their sculpture consisting of strong, slightly doubly-looped ridges, which are sharply angled behind, and radiating liræ back of the main sculpture; posterior ridge somewhat elevated above, fading out below; anterior end narrowed, rounded, often cut away a little below; base line curved, often quite full at or behind the center; outline of dorsal slope curved, sometimes raised to an angle behind the ligament; surface more or less covered with strong, lachrymose pustules; these are often elongated, and arranged in curved or zigzagged patterns; epidermis greenish or greenish-brown in the young shell, becoming dark brown in the adult stage, sericeous; pseudocardinals elongated, when adult nearly parallel with the curved, granular laterals; beak cavities moderately deep, compressed; anterior scars partly filled with rough nacre; nacre white or straw-colored.

Length 101, height 62, diam. 30 mm.

Length 88, height 47, diam. 29 mm.

Length 75, height 52, diam. 28 mm.

China; Tonkin; Mekong River.

Unio leai GRAY, Griff. Cuvier, XII, 1834, p. 600 (index), pl. XXI, fig. 1.—KUSTER, Conch. Cab. Unio, 1861, p. 232, pl. LXXVIII, fig. 3.—?HEUDE, Conch. Fluv. Nank., I, 1875, pl. IV, fig. 10; pl. VI.

Quadrula leai SIMPSON, Syn., 1900, p. 801.

Margarita (Unio) leaii LEA, Syn., 1836, p. 17; 1838, p. 16.

Margaron (Unio) leaii LEA, Syn., 1852, p. 23; 1870, p. 34.

Unio lecai HANLEY, Biv. Shells, 1843, p. 182, pl. XXIII, fig. 55.

Unio nodulosus REEVE, Conch. Icon., XVI, 1864, pl. IX, fig. 32.

This species varies much in outline, occasionally being much narrowed in front, while often shells are quite high anteriorly. Some specimens are rather short and others are considerably lengthened, the latter establishing a connection with Heude's *Unio leleci*.

Var. *leleci* (Heude).

Shell considerably elongated.

Length 72, height 45 mm.

Length of an author's specimen 89, height 45, diam. 29 mm.

Unio leleci HEUDE, Conch. Fluv. Nank., I, 1875, pl. IV, fig. 12; pl. V, fig. 14.

Unio leai var. *leleci* ПÆТЕЛ, Conch. Sam., III, 1890, p. 157.

Quadrula leai var. *leleci* SIMPSON, Syn., 1900, p. 801.

Unio richthofeni VON MARTENS, S. B. Nat. Fr., 1875, p. 3; Nov. Conch., IV, 1876, p. 156, pl. CXXXVI, figs. 1-3.

The figure of *Unio leleci* in the Conchyliologie Fluviale Nanking does not differ from specimens which Dr. Lea has in his collection under the name *Unio leai* Gray. But an author's specimen of *Unio leleci* in the National Museum collection is much elongated, is rather more inflated than typical *leai* and has smaller nodules.

Var. *truncatula* (Neumayr).

"Shell rather small, low, thick, very inequilateral, somewhat elliptical, with a sloping basal margin and a broad, obliquely truncate posterior margin. Dorsal margin curved. Beaks not very prominent, very little eroded. Surface with strong sculpture, which is heavier posteriorly. The beaks are surrounded with coarse ridges, towards the basal margin are more rather irregularly arranged tubercles; posterior slope with coarse, subparallel ridges, which become straight towards the posterior margin. Hinge of the right valve with a prominent, stout, quadrate cardinal tooth; lateral tooth long, lamelliform, curved. Muscular impressions feeble. Nacre white. Color of epidermis. ?

Length 39.5, height 25, diam. 15 mm." (Neumayr).

Type locality, either Lake Tai-hu or the King's Canal, Province of Kiang-su, China.

Unio leai var. *truncatula* NEUMAYR, Ergebnisse d. Reise Szecheny Ostasien, II, 1898, p. 643, pl. III, fig. 8.

"This form belongs to what appears to be a widespread type in China characterized by its rather remarkable sculpture. To it belong *Unio affinis* Heude, *scriptus* Heude, *leai* Heude, *montanus* Heude, *leleci* Heude; the last two mentioned forms should, as it appears, be referred to the very variable *Unio leai* Gray as varieties and to this group, doubtless, belongs the form here described; but it differs from all of the other varieties by its small size, elongate form, straight basal margin and obliquely truncate, pointed posterior end; in spite of these clear differences, I believe that at present it should only be considered as a variety, but a sure decision can only be reached with more material. One, probably full grown, example only."

Var. *ponderosa* Dautzenberg and H. Fischer.

"Form very thick, greatly inflated, very inequilateral, beaks terminal, with a strong carina extending from the beaks and bounding the posterior slope, which is ornamented with large, oblique, regularly spaced folds. Ventral margin curved and sharply bent upwards posteriorly; the ligament appears to be constantly shorter than in typical *leai*. *U. leleci* Heude, (Conch. fluv. pl. IV, fig. 12), appears to be a connecting link between the type and our var. *ponderosa*, while the shell figured by Heude, (pl. v, fig. 14), appears to us to be almost identical with typical *leai*." (D. and H. F.).

Unio (Quadrula) leai var. *ponderosa* DAUTZENBERG and H. FISCHER, Jl. de Conch., LIII, 1905, p. 209.

QUADRULA GOTTSCHKEI (von Martens).

"Shell oblong-elliptical, compressed, epidermis somewhat silky, brown (reddish-yellow in the young), shortly and rather narrowly rounded in front, expanded posteriorly and sculptured in the middle with wart-like tubercles, which become elongated and radially divergent towards the margin, obsolescent in the adults; posterior dorsal margin quite curved, the

hinder end an obtuse, subdeflexed, truncated rostrum; ventral margin in the young decidedly curved, in the adults scarcely at all. Beaks somewhat swollen, eroded. Nacre white, reddish-yellow in the centre. Cardinal teeth almost horizontal, subparallel, two in the left valve; the anterior delicate, smooth, the posterior heavier, subtrigonal, longitudinally sulcate; one in the right valve stout, rugose; lateral teeth slightly curved, rather smooth, elongate, two in the left valve, the lower sub-duplicated posteriorly; one in the right valve. Anterior muscular impressions longitudinally oblong, rugose; pallial line often transversely striate.

Specimen maximum, long. 120, alt. ad vertices 45, posterior 65, diam. 36 mm.

Specimen medium, long. 82, alt. ad vertices 35, posterior 46, diam. 25 mm.

Beaks situated at one-fifth of the length; ligament extended to three-fifths of the length." (von Martens).

Type locality, Soeul, Amnokgang near Wiwon and Pukchang, Korea.

Unio gottschei VON MARTENS, S. B. Nat. Fr., 1894, p. 215.—
SIMPSON, Syn., 1900, p. 862.

Unio (Quadrula) gottschei VON MARTENS, Zool. Jahrb. Suppl., VII, 1905, p. 51, pl. II, fig. 11.

"Groups with the Chinese *U. leai* Gray and, young, scarcely distinguishable, but the anterior end of our species is not so broadly rounded as in *U. leai*, the length of the shell in proportion to its height is greater, the sculpture is weaker and is more closely drawn together in tuberculous ridges, there being few isolated warts. I know of no similar species from Japan."

QUADRULA MANSUYI Dautzenberg and H. Fischer.

"Shell very thick and heavy, elongate trapezoidal, rounded in front, angulated behind, surface with irregular lines of growth and in the centre of the disk some radiating, subvertical, more or less confluent, folds, which on the posterior slope become much stronger, slightly nodulous and divergent; an-

terior part of the disk without folds. Beaks approximate, eroded, a little in front of the anterior one-third of the length. Interior of the valves nacreous, shining, somewhat covered with microscopic granulations. Hinge very heavy; in the right valve two sulcate cardinals, of which the anterior is the larger and more projecting, and a single lateral, strong, elevated, angulated above and separated from the dorsal margin by a wide, deeply grooved space; in the left valve, two sulcate cardinals, of which the posterior is the larger and two lamellar laterals, separated from each other by a deep groove and from the margin of the shell by a rather large, deeply excavated space. Cicatrices of the adductor muscles small, rounded, well marked. Pallial impression entire, ascending anteriorly, where it separates gradually from the margin of the shell. Edge of the shell simple, sharp. Epidermis deep brownish-yellow, slightly fibrous towards the margin. Nacre white, not brilliant and scarcely iridescent.

Length 100, height 64, diam. 37 mm." (D. and F.).

Type locality, Song Bang-Giang à Cao-Bang, Indo-China. *Unio (Quadrula) mansuyi* DAUTZENBERG and H. FISCHER, JI. de Conch., LVI, 1908, p. 214, pl. VIII, fig. 5 and text-fig.

"This species differs from *U. leai* by its posterior region obliquely truncate and acuminate at the post-basal extremity; its sculpture is also different, consisting of folds subvertical in the centre of the disk and sharply diverging on the posterior slope; there are no isolated tubercles as in that species."

QUADRULA OVATA Simpson.

Shell rather small, irregularly ovate, solid, inequilateral, inflated; beaks apparently not very full or high; posterior ridge somewhat double, ending behind in a wide, nearly square bi-angulation: anterior end rounded; base lightly curved, outline of dorsal slope straight in front, curved behind; beaks corrugated; carina spinose; epidermis greenish-black or chestnut, faintly rayed; pseudocardinals short, solid; nacre flesh-color, maculate with white.

Length 45, height 28, diam. 20 mm.

River Ning-Konofou, China.

Unio vestitus var. a HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LVIII, fig. 112.

Quadrula ovata SIMPSON, Syn., 1900, p. 801.

Acuticosta ovata HAAS, Conch. Cab. Unio, 1912, pl. 30, figs. 8 and 10.

Parreysia hunanensis HAAS, Nachr. D. Mal. Ges., 1910, p. 97; Conch. Cab. Unio, 1912, pl. 30, fig. 9.

I have never seen this shell, which does not seem from the figure to be a variety of *Unio vestitus* as Heude believes. The specimen from which it was taken was considerably eroded and the species may not group here at all. The teeth as figured are much like those of *cornuum-lunæ*.

Haas, (l. c. 1912), considers his *hunanensis* a synonym of this species.

QUADRULA CAVEATA (Heude).

Shell slightly obovate, subrhomboid, convex to subinflated, solid, inequilateral; beaks apparently not high nor very full; anterior end somewhat narrowed and rounded; dorsal and basal outlines lightly curved; posterior end somewhat obliquely truncate above; surface with irregular, strong ridges that follow the growth lines and often having a few nodules; epidermis chestnut to blackish; pseudocardinals rather small, almost parallel with the curved laterals; laterals slightly vertically striate, that of the right valve somewhat double; nacre dirty whitish.

Length 89, height 55 mm.

Length 85, height 50, diam. 30 mm.

China.

Unio caveatus HEUDE, Conch. Fluv. Nank., III, 1877, pl. XXIV, fig. 53.

Quadrula caveata SIMPSON, Syn., 1900, p. 801.

Unio contritus HEUDE, Conch. Fluv. Nank., VII, 1881, pl. LVI, fig. 103.

Unio quadrangulosus HEUDE, Conch. Fluv. Nank., VII, 1881, pl. LVI, fig. 104.

I have united under the oldest name three of Heude's forms, which do not seem to me to be separable. The *Unio caveatus*

is a rudely sculptured form; the other two are smoother. The species is heavier than the forms I have united under *cornuum-lunæ*, and are rather more elongated and differently sculptured.

QUADRULA CORNUUM-LUNÆ (Heude).

Shell irregularly elliptical with a tendency to become somewhat rhomboid, subsolid to moderately solid, scarcely inflated; beaks not high or full; posterior ridge low, rounded, sometimes slightly biangulate; anterior end rounded; basal and dorsal lines lightly curved; posterior end somewhat obliquely subtruncate above, rounded or biangulate below; surface, except the anterior end, covered with elongated pustules, which are sometimes developed into radial ridges; epidermis brown or blackish; pseudocardinals rather small; laterals granular, scarcely vertically striate; beak cavities only moderately deep; nacre dirty white or purplish.

Length 62, height 38, diam. 22 mm.

China.

Unio montanus HEUDE, Conch. Fluv. Nank., I, 1875, pl. iv. fig. II.

Unio cornuum-lunæ HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LVII, fig. 105.

Quadrula cornuum-lunæ SIMPSON, Syn., 1900, p. 802.

Unio paschalis HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LVIII, fig. 110.

Unio verruculosus HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LVIII, fig. 111.

Unio abortivus HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LXIII, fig. 124.

Unio monticola HEUDE, Jl. de Conch., XXXII, 1884, p. 19.

In the Synopsis the name *Unio trisulcatus* Heude was by oversight made a synonym of *cornuum-lunæ*. It has a very different shell indeed. Heude changed the name *montanus*, proposed in 1875 for the above species, to *monticola* in 1884 because the former had been used for a *Unio* previously. His name, *cornuum-lunæ*, proposed in 1883 for what I believe is

the same species, will have to stand if my idea as to the identity of these forms is correct. The shell is shorter than *leai*, not narrowed in front and is not so inflated. This species and some of the others of this group approach some of the forms of the *Unio japonensis*, but on the whole they have heavier and ruder shells than that form has and the beak cavities are deeper. I therefore am inclined to believe that they are elongated *Quadrulas*.

Var. *cinnamomea* (Gredler).

Shell almost regularly elliptical or very slightly ovate; beaks not at all prominent; surface, except the anterior end, covered with fine, radiating somewhat broken corrugations, having a few pustules in front.

Hunan, China:

Unio leai var. *cinnamomeus* GREDLER, Jahrb. Deuts. Mal. Ges., VIII, 1881, p. 122, pl. VI, fig. 16.

Quadrula cornuum-lunæ var. *cinnamomeus* SIMPSON, Syn., 1900, p. 802.

This form was made a variety of *leai* by Gredler, but I am inclined to believe it to be nearer *cornuum-lunæ*. Gredler does not give the dimensions.

QUADRULA SCRIPTA (Heude).

Shell irregularly long elliptical, inflated, solid, inequilateral; beaks moderately full and elevated; posterior ridge well developed, subangular above, ending in a point about on the median line; surface having strong, wide, uneven, concentric ridges, which are separated by narrow grooves, and on these ridges irregular knobs, tubercles and subradial ridges; pseudo-cardinals somewhat triangular, split up radially; laterals with faint, vertical striation; beak cavities somewhat deep.

Length 73, height 51, diam. 39 mm.

China.

Unio scriptus HEUDE, Conch. Fluv. Nank., I, 1875, pl. III, figs. 8, 8a.

Quadrula scripta SIMPSON, Syn., 1900, p. 802.

This is a robust, solid, quite inflated form, which has some of the characters of the *nodulosa* group. The form however is much like that of *Q. cornuum-lunæ*.

QUADRULA DIVERGENS (Benson).

Unio divergens BENSON, Jl. As. Soc. Beng., XXIX, 1855, p. 137.

Quadrula divergens SIMPSON, Syn., 1900, p. 802.

Unio divergens Benson, from Chusan Island, China, has never been figured, so far as I know. It probably groups here and may be a form of *Q. leai*. The description is not now accessible to me.

Subgenus DISCOMYA Simpson, 1900.

Discomya SIMPSON, Syn., 1900, p. 802.

Shell subsolid, round obovate or subrhomboid, lenticular, rather compressed, widely, faintly biangulate behind, with scarcely any vestige of a posterior ridge; beaks very low, sculpture not seen; front half of the shell densely covered with fine pustules arranged in curved rows in two directions as if engine-chased, over which the epidermis is wrinkled. The hinder half is covered with fine, radiating and undulating corrugations, curved upward posteriorly, which are slightly nodulous and show through on the inside of the shell; one slightly compressed pseudocardinal in the right valve and two in the left; one delicate, curved lateral in the right valve and two in the left; beak cavities deep, compressed; nacre lurid; pallial line showing a slight posterior sinus.

Type, *Unio radulosus* Drouet and Chaper.

QUADRULA RADULOSA (Drouet and Chaper).

Shell obovate with a tendency towards being subrhomboid, convex, subsolid, inequilateral, lenticular; beaks apparently not full or elevated; anterior end rounded or sometimes a little truncate and angled above; base line lightly curved; dorsal line behind the beaks elevated almost into a wing, the hinder part of the wing and dorsal slope obliquely truncated; posterior

ridge scarcely developed above, sometimes feebly and widely double below and ending in a wide, ill-defined biangulation; surface throughout in front of the posterior ridge densely covered with pustules, looking as if engine-chased, rarely in somewhat chevron-shaped patterns; behind the front part of the posterior ridge is a series of fine, curved, subradial ridges; epidermis wrinkled, scarcely shining, various shades of brown or brown and green; pseudocardinals small, radially striate; laterals rather delicate, curved; beak cavities moderately deep, compressed; muscle scars not deep; nacre lurid brownish, thinner behind where the pattern of sculpture shows through.

Length 58, height 45, diam. 20 mm.

Borneo.

Unio radulosus DROUET and CHAPER, Mem. Soc. Zool. Fr., V, 1892, p. 150, pl. v, figs. 10-12.

Quadrula radulosa SIMPSON, Syn., 1900, p. 803.

Discomya radulosa HAAS, Con. Cab. Unio, 1910, pl. xvii, figs. 1-2.

A decidedly interesting and unique shell. In many cases the sculpture in front of the posterior ridge is almost as perfect and regular as though it had been turned out by machinery.

The lenticular form the curiously variegated epidermis, the visibility of the sculpture through the posterior nacre are striking characters. Although I cannot be certain as to the systematic position of this form, yet I believe that it is rather closely related to the heavy Chinese forms that I have placed in *Quadrula* and probably most near to the group of *Q. lei*.

Var. *rhomboidea* Simpson.

Shell longer than the type, rhomboid, the posterior ridge widely double, ending at and near the base in a wide biangulation; base line incurved behind; nacre lurid, dark purplish lead-color.

Length 57, height 37, diam. 22 mm.

Selrocany, Borneo.

Quadrula radulosa var. *rhomboidea* SIMPSON, Syn., 1900, p. 803.

I have seen only a single shell of this form (No. 126472 of the U. S. Nat. Museum) and it is so different from *radulosa* that if I were positive that it was normal I would give it specific rank. It is badly eroded, but is very differently shaped, has much less strongly marked sculpture and is more tawny than typical shells. With it is a normal younger specimen of *radulosa* from the same locality.

Genus SCHISTODESMUS Simpson, 1900.

Shistodesmus SIMPSON, Syn., 1900, p. 803.

Shell rather solid, triangular, inflated, truncate above in front, somewhat swollen just behind the center of the base, pointed behind; beaks high; beak sculpture not seen; surface thrown up into strong, very wide, concentric ridges, one or two with each season's growth, and pinched up in the central part to form a radiate row of compressed knobs or spines; epidermis shining, greenish-yellow or brownish, having marvelously delicate, concentric, microscopic liræ, often painted with a few elegant, broken, green rays; there is one large, high, triangular pseudocardinal in the left valve under the beak, a deep, triangular pit in front of it, with an erect, radial lamellar tooth in its center and a high, lamellar, curved tooth in front of the pit, parallel with the edge of the shell connected with the central tooth. A heavy triangular bifid or trifid pseudocardinal in the right valve stands close to the anterior edge of the shell and is separated from it by a deep, compressed pit; behind this tooth, deep down at its base, is a narrow shelf, and back of this the entire hinge plate is cut out in a deep sinus to the beak; two laterals in each valve; cavity of the beak in left valve deep, somewhat compressed; in the right entirely opened by the sinus; muscle scars small, deep, smooth; pallial line with a sinus at its posterior end; a beautiful, granularly striate callus is developed behind the laterals; nacre finely, often bifurcately, radiate striate outside the pallial line.

Animal unknown.

Type, *Unio lampreyanus* Baird and Adams.

SCHISTODESMUS LAMPREYANUS (Baird and Adams).

Shell triangular ovate, solid, subinflated to inflated, inequilateral; beaks moderately full and high; anterior end slightly, obliquely truncate above, rounded below; base rounded; outline of dorsal slope lightly curved or straight; posterior ridge low, placed close to the post-dorsal edge of the shell, ending behind in a point about on the median line; surface having a series of strong, concentric ridges, which fade out just in front of the posterior ridge as in *Venus paphia*, each ridge is elevated into an elongated knob about the middle of the disk; epidermis shining, apparently smooth but under a strong glass it is seen to be beautifully concentrically striate, yellowish-green or greenish-yellow with a few, elegant, broken, green rays, the old shells becoming brownish; pseudocardinals elevated, ragged; left valve with one high one under the beak; there is a compressed anterior tooth in front of this, close to the edge of the shell that connects with it and between them there is a deep pit filled with ragged matter; right valve with a somewhat double pseudocardinal in front of the beak; behind this there is a depressed shelf, and behind the shelf, under the beak the hinge plate is entirely cut off; laterals granular, that of the right valve partly double; beak cavities of the left valve deep; that of the right made shallow by the hiatus of the hinge plate; muscle scars small, impressed; callus behind the laterals small and distinct; nacre white, iridescent behind.

Length 45, height 38, diam. 20 mm.

Length 49, height 38, diam. 24 mm.

Length 57, height 37, diam. 28 mm.

China.

Unio (Dysnomia) lampreyanus BAIRD and ADAMS, Proc. Zool. Soc. Lond., 1867, p. 491, pl. XXVI, figs. 2, 2a.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVII, fig. 469.—HEUDE, Conch. Fluv. Nank., VII, 1883, pl. LIX, figs. 114a, 114b.

Margaron (Unio) lampreyanus LEA, Syn., 1870, p. 30.

Schistodesmus lampreyanus SIMPSON, Syn., 1900, p. 804.

Schistodesmus lampreyanus HAAS, Conch. Cab., Unio, 1912, pl. 31, figs. 1-4, 6.

Three shells of this remarkable form are before me and they vary a good deal in dimensions, but agree very well in the essential characters. The one whose measurements are first given is probably hardly adult and is elegantly painted; the other two are older and not so bright. I know nothing whatever of the anatomy of this species and it is only placed near *Quadrula* provisionally. Its form and the deep beak cavities would seem to ally it to that genus.

SCHISTODESMUS SPINOSUS Simpson.

Shell somewhat triangular, inequilateral, subinflated or inflated, moderately solid; beaks rather full and high; posterior ridge apparently well developed, angular, ending in a blunt point not far above the base of the shell; anterior end obliquely truncate above, rounded below; base line rounded; outline of dorsal slope curved; surface apparently sculptured with a few, widely spaced, concentric furrows, having wide, flat ridges between them, having on the posterior ridge one or more, well-developed, short spines; epidermis probably bright, with narrow, scattered, broken rays; right valve having the hinge plate cut off at the beak, its lateral somewhat double.

Length 35, height 30, diam. 20 mm.

China.

Unio vestitus HEUDE, var. β , Conch. Fluv. Nank., VIII, 1883, pl. LIX, fig. 115.

Schistodesmus spinosus SIMPSON, Syn., 1900, p. 804.

Schistodesmus spinosus HAAS, Conch. Cab., Unio, 1912, pl. 31, fig. 5.

Heude makes this a variety of his *Unio vestitus*, but it seems to me to be totally different and closely related to, if not a variety of, *lampreyanus*. He gives no separate description, so I am in the dark regarding several important characters. The ridges are wider than in *lampreyanus* and the latter has no spines.

Genus GIBBOSULA Simpson, 1900.

Gibbosula SIMPSON, Syn., 1900, p. 804.

Shell very solid, inequilateral, triangular, elliptical, arcuate, pointed behind, with a low, well-marked posterior ridge; beaks

rather high; beak sculpture not seen; posterior two-thirds of the shell covered with somewhat radiating corrugations and nodules; posterior slope having strong, subradial folds; epidermis dark; hinge plate very wide; pseudocardinals not large, stumpy, rough; laterals very heavy, club shaped; beak cavities enormously deep and compressed; anterior cicatrices rather shallow, rough in the bottom; posterior cicatrices deep and distinct; a strong rib runs from the front part of the beak cavity toward the posterior base; nacre whitish.

Animal unknown.

Type, *Mya crassa* Wood.

GIBBOSULA CRASSA (Wood).

Shell somewhat elongated, convex, subtriangular, inequilateral, ponderous; beaks rather low, but the umbonal region elevated; posterior ridge well developed, narrowly rounded, not so full as the region in front of it; anterior end rounded; base nearly or quite straight; outline of dorsal slope curved, ending behind in a point at the termination of the posterior ridge, the region between this and the base obliquely subtruncated; surface with rude, concentric growth lines; the hinder three-fifths of the shell covered with broken, subradial ridges, which are divaricate just in front of the posterior ridge; epidermis brown; hinge very heavy, the plate flattened; pseudocardinals low, somewhat ragged; laterals remote, short, solid, that of the right valve partly double; muscle scars deep; beak cavities very deep, compressed; nacre white or flesh-colored, thick in front with an oblique rib running downward and forward from the pseudocardinals, an oblique furrow near the laterals, and having numerous small scars, by which the mantle is attached to it.

Length 110, height 71, diam. 40 mm.

China.

Mya crassa WOOD, Gen. Conch., 1815, p. 106, pls. XX, XXI;
Ind. Test., 1825, p. 12, pl. II, fig. 28*b*; Ind. Test. Rev., 1856,
p. 16, pl. II, fig. 28.

Gibbosula crassa SIMPSON, Syn., 1900, p. 804.

Mya ponderosa DILLWYN, Dill. Cat., I, 1817, p. 51.

Margarita (Unio) ponderosus LEA, Syn., 1836, p. 14; 1838, p. 14.

Unio ponderosus HANLEY, Test. Moll., 1842, p. 177.

Margaron (Unio) ponderosus LEA, Syn., 1852, p. 21; 1870, p. 32.

A remarkable Naiad of whose systematic position I cannot be certain. Its general form is something like that of a very heavy *Margaritana* and the numerous small pits by which in life the mantle is attached to the nacre carry out this resemblance. But the shell is exceedingly ponderous, the hinge plate is wide and flat, the teeth are well developed and *Quadrula*-like, as are the very deep, compressed beak cavities. The oblique rib and furrow in the cavity of the shell recall *Unio gibbosus* or some of the *Ptychobranchi*.

Genus CUNEOPSIS Simpson, 1900.

Cuneopsis STIMPSON, Syn., 1900, p. 804.

Shell solid, elongated, wide and truncate or rounded in front, tapering to a point behind; often twisted on its axis and curved to the right or left; beaks rather high, anterior; beak sculpture apparently a few coarse, subparallel, nodular ridges curved up behind; posterior ridge low, close to the hinge line and in front of it the shell is full; surface slightly, irregularly, concentrically striate; epidermis dark, having a peculiar, dull, silky luster; hinge rather narrow; pseudocardinals two in the left valve immediately under the beak, the anterior compressed, high and nearly parallel with the outer edge of the shell, the posterior heavy, joined to the anterior above, with a deep, triangular cavity between; right valve with one large, triangular, anterior pseudocardinal with a deep, triangular pit back of it, and often a small, low, compressed tooth behind the pit; laterals granularly striate; beak cavities rather deep; anterior muscle scars deep, rough at the bottom; posterior scars large, long and oblique; nacre silvery, sometimes radially striate at the edge; pallial line indented into a sinus at its posterior end, above which is a granular, striate callus.

Animal unknown.

Type, *Unio celtiformis* Heude.

The species, which I have placed in *Cuneopsis*, though varying considerably in details are all evidently closely related and form a natural group. This group is characterized by having elongated, inflated shells with unicolorous, silky, brownish epidermis, two, more or less connected, pseudocardinals in the left valve with a deep pit between them, one in the right valve with a deep pit behind it, very deep beak cavities, and elongated, oblique posterior muscle scars. Owing to our almost total ignorance of the anatomy of most of the Oriental *Naiades* much of the classification I have offered is only tentative. I have endeavored to do the best I could from the shell characters, but in most cases the beak sculpture is completely eroded away, and for some of the species I have only seen figures or descriptions, which do not cover some of the most important points.

Key to species of CUNEOPSIS.

- Shell more or less obliquely truncate above posteriorly.
 Strongly curved and twisted. *pisciculus*.
 Not curved or twisted. *rufescens*.
 Shell not obliquely truncated, pointed behind at the median line.
 Distinctly swollen in front. *capitata*.
 Scarcely swollen in front, inequivalve. *celtiformis*.
 Subtruncate above the posterior ridge, drawn out to a long point behind. *heudei*.
 Truncate anteriorly. *tauriformis*.

CUNEOPSIS CAPITATA (Heude).

Shell wedge-shaped, long triangular, inequilateral, solid, rounded and inflated a short distance in front, becoming suddenly contracted behind the inflation; beaks high, full, placed close to the anterior end; anterior end rounded; anterior part of the base rounded; behind the anterior inflation there is a sinus; outline of dorsal slope nearly straight, the shell ending behind in a point; surface with low ridges, which follow the growth lines; epidermis brownish, silky; left valve with an anterior,

compressed pseudocardinal running parallel with the edge of the shell and an elevated, triangular, striate posterior one, with two straight laterals; right valve with a strong, elevated anterior pseudocardinal and a vestigial posterior one, and a somewhat double lateral, the pseudocardinals fitting into deep cavities in the hinge; muscle scars deep, the posterior ones oblique and elongated; beak cavities very deep, compressed; nacre white, thinner behind.

Length 86, height 44, diam. 31 mm.

China.

Unio capitatus HEUDE, Jl. de Conch., XXII, 1874, p. 114;
Conch. Fluv. Nank., I, 1875, pl. II, fig. 5.

Cuneopsis capitatus SIMPSON, Syn., 1900, p. 805.

A remarkable shell, which is wedge-shaped whether viewed from the side or above. The anterior end is suddenly thickened and this part of the shell is much solidier than the posterior part. In both of the specimens in the National Museum the hinder end is flexed to the left, that of the larger shell being decidedly so. The two pseudocardinals are remarkably large and elevated, and are striate. The National Museum has fossil specimens of this species, which are considerably larger than the above measurements or those given by Heude.

CUNEOPSIS HEUDEI (Heude).

Shell elongate, ovate, inflated, solid, inequilateral; beaks rather high and full, their sculpture appearing to consist of strong, irregular ridges, which curve up decidedly behind; posterior ridge rather low, but pinched up into a sharp angle, nearly straight and close to the dorsal part of the shell, which is somewhat truncated; anterior end rounded; base line lightly curved, ending in a point about on the median line; surface with low, rather fine ridges, which follow the growth lines, sometimes having a few, faint, subradial ridges on the disk; epidermis dark brown, silky; left valve with an anterior compressed pseudocardinal and a triangular, elevated posterior one, with two straight laterals; right valve with a high pseudocardinal and one lateral; the pseudocardinals and sockets rag-

ged; muscle scars deep, the posterior ones oblique and elongated; beak cavities deep, compressed; nacre white.

Length 70, height 33, diam. 24 mm.

China.

Unio heudei HEUDE (Bazin manuscript), Jl. de Conch., XXII, 1874, p. 114.

Cuneopsis heudei SIMPSON, Syn., 1900, p. 805.

Unio corderii HEUDE, Conch., Fluv. Nank., I, 1875, pl. 1, fig. 3.

This species bears a strong superficial resemblance to the *Unio pazi* Lea, but is much solidier and has deeper beak cavities and totally different teeth. The beak sculpture, which is somewhat eroded in the specimens examined, seems most like that of the *Pleurobemas*. The National Museum specimens gape slightly behind, but are not bent to the right or left.

CUNEOPSIS CELTIFORMIS (Heude).

Shell much elongated, slightly inequivalve, inequilateral, solid, wedge-shaped, inflated; beaks full and elevated in old shells; posterior ridge low, rounded, close to the dorsal line; anterior end rounded; base line nearly or quite straight, sometimes rather full towards the posterior end; dorsal line straight or lightly curved; the hinder end of the shell pointed; surface with numerous, low, concentric ridges; epidermis light greenish brown in the young state, dark brown when old, silky; left valve with a compressed anterior pseudocardinal, which is more or less united to an elongated, triangular posterior one, and below and between them there is a deep socket; right valve with one elevated, rather solid, pseudocardinal, pseudocardinals recurved; laterals two in the left valve and one in the right; anterior scars large, deep and rough; posterior scars oblique, impressed; beak cavities very deep, compressed; nacre white, thinner behind.

Length 117, height 38, diam. 31 mm.

China.

Unio celtiformis HEUDE, Jl. de Conch., XXII, 1874, p. 113; Conch., Fluv., Nank., I, 1875, pl. 1, fig. 4.

Cuneopsis celtiformis SIMPSON, Syn., 1900, p. 805.

Old specimens of this species show a little of the sudden swelling forward that is seen so strikingly in *capitata*. The shell is slightly inequivalve, the left valve, in the examples seen, being pushed down so that the right is higher. One of the specimens which I have examined has the posterior end very lightly turned to the left.

CUNEOPSIS PISCICULUS (Heude).

Shell elongated, solid, inequilateral, slightly inequivalve, twisted and very strongly turned to the right behind; beaks full, high, elongated; posterior ridge well developed, placed near the dorsal line, narrowly rounded, or somewhat angular above, ending behind in a point midway between the base and dorsum; anterior end rounded; base line nearly straight; dorsal outline curved a little; surface nearly smooth or with slightly elevated growth lines; epidermis greenish-brown when young, almost blackish when old, silky; left valve with two elevated pseudocardinals, the anterior somewhat spur-like, the hinder long triangular, with a pit between them, and two laterals, the upper small; right valve with one elevated pseudo-cardinal, a vestigial one behind it and a deep pit between, with a strong, faintly vertically striate lateral; anterior scars deep; posterior scars oblique; beak cavities very deep, compressed; nacre white, silvery, iridescent behind; pallial line widely truncate behind, the space outside of it radially striate.

Length 123, height 49, diam. 30 mm.

China.

Unio pisciculus HEUDE, Jl. de Conch., XXII, 1874, p. 115;

Conch. Fluv. Nank., I, 1875, pl. II, figs. 6, 6a.

Cuneopsis pisciculus SIMPSON, Syn., 1900, p. 805.

Unio retortus VON MARTENS, Sitz. Ber. Ges. Nat. Fr., 1875, p. 4; Nov. Conch., IV, 1876, p. 158, pl. CXXXVI, figs. 3, 4.

This species is so contorted that it can scarcely be measured. In this character it is like *Arconaia*, but there is no vestige of an anterior wing, the pseudocardinals are constructed on a totally different plan and the beak cavities are deep, a character common to all the forms I have placed in *Cuneopsis*,

while in both the species of *Arconaia* they are remarkably shallow; in fact they have no beak cavities at all. The elongation of the shells of these forms, their dark, silky, unicolored epidermis, the oblique, elongated posterior muscle scars and the hint at a pallial sinus in some of them and the torsion of the shell are characters common to *Arconaia*. In this species the nacre outside the pallial line is decidedly granularly radiate striate and there are indications of the peculiar nacreous calluses behind the laterals, characters seen to some extent in other species of the group, in some specimens of *Arconaia* and many of the forms I have placed in *Quadrula*.

CUNEOPSIS RUFESCENS. (Heude).

Shell long rhombic, subsolid, inflated, inequilateral; beaks full and high; posterior ridge well developed, narrowly rounded, ending in a point near the base of the shell; above it there is a shallow, radial depression; anterior end rounded; basal and dorsal lines nearly straight and subparallel; posterior end obliquely truncated above; surface nearly smooth, covered with a greenish-brown, silky epidermis; left valve with two high, compressed pseudocardinals, which are partly united, the hinder being slightly triangular, with a deep pit below and between them; left valve with one pseudocardinal; laterals two in the left valve and one in the right; anterior scars deep; posterior scars shallow, slightly oblique; beak cavities deep; nacre warm flesh-color, lighter colored at the edge, thinner and iridescent behind; pallial line with a shallow sinus behind.

Length 70, height 28, diam. 24 mm.

Province of Kiang-Si, China.

Unio rufescens HEUDE, Jl. de Conch., XXII, 1874, p. 113;
Conch. Fluv. Nank., I, 1875, pl. 1, fig. 2.

Cuncopsis rufescens SIMPSON, Syn., 1900, p. 805.

The beak sculpture is partly visible in one of the valves of a specimen in the National Museum collection and the posterior part of it consists of fine, radiating liræ, such as is seen in some of the North American Uniones. This species may at once be distinguished from the other members of the group by its obliquely and decidedly truncate posterior end.

CUNEOPSIS TAURIFORMIS Preston.

"Shell obliquely ovate, truncate anteriorly, wedge-shaped posteriorly, solid, periostracum dark, having a silky lustre, exterior umbonal region with raised zigzag ridges, concentric striæ below, the umbones turned slightly inwards, decorticated: two cardinal teeth in the left valve, the anterior rather thin, the posterior thick with a deep triangular pit between: right valve with one thick cardinal tooth situated below the umbo, lateral teeth long and roughly striated; nacre silvery: a deep pit marks the place of the anterior adductor, the posterior scar being only moderately indented.

Length 31, height 20, diam. 16.5 mm." (Preston).

Type locality, Yunnan-fu, Yunnan.

Unio (Cuneopsis) tauriformis PRESTON, Ann. Mag. Nat. Hist., (7), XVII, 1906, p. 246, pl. IX, fig. 9.

"I have been unable to find any species closely allied to this, which I take to belong to the genus *Cuneopsis* Simpson."

Subfamily HYRIANÆ Swainson.

(ENDOBRANCHIÆ.)

Male and female shells alike, with beak sculpture radial or zigzag-radial; marsupium occupying the inner gills only.

ROSANORHAMPHUS.

Beak sculpture zigzag-radial.

Genus NODULARIA Conrad, 1853.

Nodularia CONRAD, Pr. Ac. N. Sci. Phila., 1853, p. 268.

Pharaonia BOURGUIGNAT, Mat. Moll. Aceph. Syst. Europ., 1880, I, p. 3.

Zairia ROCHEBRUNE, Bull. Soc. Mal. Fr., III, 1886, p. 10.

Reneus JOUSSEAUME, Bull. Soc. Zool. Fr., XI, 1886, p. 481.

Shell elliptical to elongated, pointed behind about midway up from the base, the post-basal part produced; beak sculpture variable, irregularly zigzag-radial, often breaking into nodules.

and extending in many cases over a part or all of the disk; right valve with two, usually compressed, pseudocardinals, one above the other, the lower the more elevated, separated by a parallel-sided socket, and having one lateral; left valve with two compressed pseudocardinals, both in front of the beaks, and two laterals; cavity of the beaks moderate, not compressed; anterior muscle scars deep, posterior shallow; nacre white.

Animal (of *N. japonensis* and *N. æquatoria*) having the inner gills alone filled throughout their entire length with ova, forming a pad-like marsupium, united to the abdominal sac or free from it.

Type, *Unio douglasie* Gray.

The genus *Nodularia* was established by Conrad in 1853 in the Proceedings of the Academy of Natural Sciences of Philadelphia with *Unio douglasie* Gray as the type. The name *Lanceolaria*, with *Unio grayanus* Lea as its type, was given by Conrad a few lines above this on the same page, but as he used this name only in a subgeneric sense I think that the name *Nodularia* should be used for the genus. In his descriptions of the two groups on the following page *Nodularia* is placed first.

I have placed under this name a large number of species from southeastern Asia and Tropical Africa, which are fairly typified by the *Unio douglasie* of Gray. In general the shells are small to moderate in size, only one species, *U. anodontiformis*, becoming large. The structure is usually rather light, the hinder end is nearly always pointed. The posterior base of almost every species is more or less inflated, as are the female shells of many species of *Lampsilis*. Generally the form varies from long elliptical or ovate to very long. The beaks are usually sculptured with zigzag-radial ridges and in a majority of the species this sculpture extends over the disk to a greater or less degree, often breaking up into nodules or granulations. In such species as *U. crispisulcata*, the sculpture of beaks and disks is almost strictly radial, showing, however, slight zigzags and standing as a connecting link between the

ordinary Nodularias, and *Diplodon* with almost or quite strictly radial sculpture.

I have only been able to examine the soft parts of two species, which I have placed in this genus, the *Unio japonensis* of Lea and *U. aequatoria* Morelet. In these there seemed to be no striking differences in the more obvious characters from the majority of the Uniones, but the embryos filled the inner gills above as in *Diplodon*, showing their near relationship with that great group.

Section LANCEOLARIA Conrad, 1853.

Lanceolaria CONRAD, Pr. Acad. Nat. Sci. Phila., 1853, p. 268.

Shell ensiform, solid, with a distinct, pinched-up posterior ridge, rounded in front, the posterior end sharp and generally turned a little to the right or left; beaks low, their sculpture nodulous, zigzag, often extending more or less over the surface; pseudocardinals rather stumpy, ragged, striate above, smooth below; anterior muscle scars distinct, the upper round, very deep, appearing as if bored out; pallial line truncate behind.

Animal unknown.

Type, *Unio grayanus* Lea.

NODULARIA GRAYANA (Lea).

Shell exceedingly elongated, subinflated or inflated, inequilateral, rather solid; posterior ridge pinched up, cord-like, ending behind on the median line in a long, sharp point, sometimes turned down a little; umbonal region compressed; lunule long and well developed; anterior end rounded; base line nearly straight, full near the posterior end; surface more or less sculptured, there being a series of subradial, slightly corrugated ridges at the middle of the disk, and a number of strong, subconcentric folds near the anterior end. There is often some zigzag-radial sculpture in the umbonal region; epidermis olive, often with yellowish or green clouds, somewhat silky when fresh; left valve with two strong, rough, subcompressed pseudocardinals and two long, straight laterals; right

valve with two pseudocardinals, the upper small, and a single lateral; dorsal cavities shallow with a number of pits; muscle scars well impressed, the hinder ones long; nacre brilliant silvery, iridescent.

Length 92, height 22, diam. 13 mm.

China.

Unio grayanus LEA, Tr. Am. Phil. Soc., V, 1834, p. 66, pl. IX, fig. 26; Obs., I, 1834, p. 178, pl. IX, fig. 26.—REEVE, Conch. Syst., I, 1841, p. 118, pl. LXXXVIII, fig. 4.—HANLEY, Biv. Shells, 1843, p. 177, pl. XXIV, fig. 5.—KUSTER, Conch. Cab. Unio, 1856, p. 167, pl. XLVIII, fig. 5.—CHENU, Man., 1859, II, p. 142, fig. 700.—REEVE, Conch. Icon., XVI, 1865, pl. XXV, fig. 191.—HEUDE, Conch. Fluv., Nank., II, 1877, pl. XVI, fig. 36.

Margarita (Unio) grayanus LEA, Syn., 1838, p. 14.

Margaron (Unio) grayanus LEA, Syn., 1852, p. 21; 1870, p. 32.

Unio grayii GRIFFITH, Grif. Cuv., XII, 1834, pl. XXI, fig. 3.

Nodularia grayana SIMPSON, Syn., 1900, p. 806.

Lanceolaria grayana HAAS, Con. Cab. Unio, 1910, p. 44, pl. 2, figs. 1-5.

Unio (Nodularia) gracillimus ROLLE, Nachr. Deutsch. Mal. Ges., 1904, p. 26, pl. IV, figs. b, c.

The posterior end is sometimes turned a little to the right or left, and the laterals show occasional traces of vertical striation. A most striking species and one that is apparently quite abundant, judging from the number of specimens in collections.

NODULARIA FRUHSTORFFERI (Dautzenberg).

Shell much elongated, solid, very inequilateral, subinflated, slightly arcuate; posterior ridge well developed, somewhat rounded, slightly curved; ending in a point at the median line; base line incurved in the middle, very full towards the posterior end; surface with irregular growth lines, and a few, heavy, irregular, nearly vertical folds on its hinder part, also having finer, subradial folds in the umbonal region; epidermis brownish; pseudocardinals strong, somewhat split up into radial denticles; laterals long and slightly curved; muscle scars well im-

pressed, the posterior one elongated; pallial line well marked; nacre brilliant, rose-tinted, iridescent.

Length 110, height 31 mm.

Phuc-son (Annam).

Unio frühstorferi DAUTZENBERG, Jl. de Conch., XLVIII, 1900, p. 429.—BAVAY and DAUTZENBERG, Jl. de Conch., XLIX, 1901, p. 5, pl. 1, figs. 1, 2.

Lanceolaria frühstorferi HAAS, Con. Cab. Unio, 1910, p. 50, pl. 3, fig. 6, text fig. 1.

This species is close to *U. gladiolus* and *grayana*, but is probably perfectly distinct. It differs from both of them in having a slightly arcuate outline, in being decidedly full at the post-basal region and in consequence having a much more blunt posterior point. The specimen referred to in a footnote on page 807 of the Synopsis, belonging to Mr. Bryant Walker, is no doubt this species.

NODULARIA BILIRATA von Martens.

"Shell elongate, heavy, convex above, compressed below, mostly smooth except for the lines of growth; olive-brown, not shining; very shortly rounded in front; produced posteriorly in a long beak, subacutely angled at the end, sculptured above with two elongate, parallel liræ, the lower the more prominent; dorsal margin slightly convex to the end of the ligament, then sloping gradually to the posterior point; ventral margin straight, slightly sinuous. Cardinal teeth sulcate on both sides, unequal, in the right valve the anterior is much compressed, small, the posterior heavy and broadly triangular; in the left valve, the anterior is moderately compressed, small, the posterior broadly triangular; sinulus obsolete. Nacre white: anterior adductor impressions moderate, posterior very superficial.

Length 79, height 25, diam. 17 mm. Beaks in from 1-5—1-6 of the length." (von Martens).

Type locality, Tonkin.

Nodularia (Lanceolaria) bilirata VON MARTENS, Nachr. Deutsch. Mal. Ges., 1902, p. 133.—DAUTZENBERG and FISCHER, Jl. de Conch., LIII, 1905, p. 204.

Lanceolaria bilirata HAAS, Con. Cab., Unio, 1910, p. 55, pl. 4, figs. 3-5.

"Similar to the Japanese *N. oxyrhynca* Marts., not only in the two elevated lines that run down on the upper half of the posterior end, but also in the proportionately shorter form, but not quite so sharply pointed. On a younger specimen, only 54 mm. in length, on the under side of the hinder end, some grooves and swellings are noticeable, which recall those of the Chinese *N. grayana* Lea, and therefore establishes a natural relationship with that group, but nothing of this is seen in the adults."

Dautzenberg and Fischer, (l. c.), consider this species identical with *N. frühstorferi*.

NODULARIA LÆVIS von Martens.

"Shell elongate, thick, above angulated and slightly convex, compressed below, smooth except for the growth lines, brown, paler posteriorly, not shining, anterior end very shortly rounded, posterior produced in a long, narrow, straight beak, obtusely angled at the end; posterior dorsal margin at first horizontal, thence from a little before the end of the ligament descending in a straight line; ventral margin slightly sinuous in the middle and somewhat wider posteriorly; cardinal teeth two in both valves, triangular, sulcate, in the right valve the posterior and in the left valve the anterior is much the heavier; lateral teeth elongate, nearly straight, one in the right valve, slightly bifid, two in the left valve, parallel; sinulus not conspicuous. Interior very pale yellow, somewhat shining; anterior adductor muscle impressions deep, posterior superficial.

Length 73, height 15, diam. 10 mm. Beaks situated at 1-7 of the length." (von Martens).

Type locality, Tonkin.

Nodularia (Lanceolaria) laevis VON MARTENS, Nachr. Deutsch. Mal. Ges., 1902, p. 134.—DAUTZENBERG and H. FISCHER, Jl. de Conch., LIII, 1905, p. 204.

Lanceolaria laevis HAAS, Con. Cab. Unio, 1910, p. 57, pl. 4, fig. 6.

"Near to the Chinese *N. grayana* Lea in form, but without the V-shaped sculpture."

Dautzenberg and Fischer, (l. c.), express the opinion that this is the same as *N. frühstorferi*.

NODULARIA GLADIOLUS (Heude).

Shell greatly elongated, solid, inflated, inequilateral, posterior ridge strong, elevated, somewhat rounded, ending behind in a point at or below the median line, sometimes turned downward or to one side; umbonal region subcompressed; surface with more or less faint, subvertical folds, and strong, irregular growth lines; epidermis coarse, rough, brownish; pseudo-cardinals something like those of *grayana*, but stronger and rougher; laterals elongate, strong; muscle scars well impressed, the hinder elongated; behind the laterals there is in each valve a decided, elongated callus; nacre dull, flesh-color or purplish.

Length 110, height 30, diam. 20 mm.

China.

Unio gladiolus HEUDE, C. Fluv. Nank., II, 1877, pl. XVI, fig. 35.

Nodularia gladiolus SIMPSON, Syn., 1900, p. 807.

Lanceolaria gladiolus HAAS, Con. Cab. Unio, 1910, p. 47, pl. 3, figs. 1, 2.

Closely related to *N. grayana*, but a larger, solider, ruder species. The posterior ridge is not so sharp, there are, apparently, no strong, concentric ridges on the anterior end, the epidermis is rougher than in *grayana* and the nacre is far more dull. The posterior calluses in the nacre of this species are strongly developed and show traces of reticulation, these being feeble in the nearly allied *N. grayana*. These peculiar growths, the twisting and bending of the posterior end of the shell and the vertical striation of the teeth are characters common to many apparently wholly unrelated forms of *Unionida* found in Chinese waters, and with the singular inequality caused by one valve being pushed over the other, seen in many *Quadrulas*, may be the result of some peculiarity of their environment. According to Bavay and Dautzenberg this species attains a length of 160 millimeters.

NODULARIA TRIFORMIS (Heude).

Shell much elongated, solid, inequilateral, subinflated; posterior ridge raised, rounded, ending behind in a point below the median line; umbonal region compressed; anterior end rounded; base line nearly straight; slightly incurved in front of the middle, full behind the middle; surface with indications of subvertical folds; epidermis brownish; teeth much as in *N. gladiolus*, the laterals well impressed, the hinder ones elongated; pallial line with indications of a sinus behind; nacre whitish or bluish, dull brownish in the cavities.

Length 70, height 20, diam. 15 mm.

China.

Unio triformis HEUDE, Conch. F. Nank., II, 1877, pl. XVI, fig. 34.

Nodularia triformis SIMPSON, Syn., 1900, p. 807.

Lanceolaria triformis HAAS, Con. Cab., Unio, 1910, p. 49, pl. 3, figs. 3-5.

Unio distortus HEUDE, Conch. F. Nank., VIII, 1883, pl. LXII, figs. 122, 122b.

Possibly only a small variety of *gladiolus*. The shell figured by Heude appears to turn strongly to the right at the posterior point and the one in the National Museum (an author's specimen) turns sharply to the left. The epidermis is rather more silky than that of *gladiolus*; the surface is not so rude.

NODULARIA ACORRHYNCHIA (von Martens).

"Shell elongate, compressed, epidermis rather silky, blackish-brown, shining, shortly rounded in front, posteriorly sculptured for the most part with subperpendicular, elongated, parallel tubercles and produced into a long, acute beak, with an elevated carina on the upper side extending to the extremity; beaks depressed, eroded. Nacre pale reddish or yellowish-red, slightly showing posteriorly the external tubercles. Cardinal teeth of the left valve two, triangular, subequal, rugose, the anterior directed forward; in the right valve the anterior is small, compressed, nearly parallel to the dorsal margin, the posterior broadly triangular, rugose; lateral teeth elongate,

straight, in the left valve two, slightly rugosely sulcate, in the right valve one, slightly transversely sulcate. Anterior muscular impression large, round, very near to the anterior margin; pallial line in front rather wide, pitted, simple behind.

Length 125, height 34, diam., under the beaks 15 mm. Beaks situated at 1-6 of the length, ligament extends to 4-6 of the length." (von Martens).

Type locality, Naemigang River, near Hatanggyong, and in a tributary of the Imjingang, Korea; also in the Kwanchongang near Pukchan, north of Naga-Naju.

Unio acrorhynchus VON MARTENS, S. B. Nat. Fr., 1894, p. 214.
—SIMPSON, Syn., 1900, p. 861.

Unio (Lanceolaria) acrorhynchus VON MARTENS, Zool. Jahrb., Suppl., VIII, 1905, p. 53, pl. III, fig. 4.

Lanceolaria acrorhyncha HAAS, Con. Cab., Unio, 1910, p. 61, pl. v, fig. 4.

"Groups with the Chinese *U. grayanus* Lea and the Japanese *U. oxyrhynchus* Marts., but larger and proportionately more compressed than either, not so low as *grayanus* and in the general appearance more like *oxyrhynchus*, but longer and at the posterior end more equally pointed above and below, whereas in *oxyrhynchus* the posterior part of the basal margin scarcely ascends, so that the point is lower; also in *acrorhynchus* the carina from the beaks to the posterior end is more prominent. With reference to the sculpture, in *grayanus* the vertical folds are more regular, more numerous, about 20, and consequently closer and also smaller, in *U. acrorhynchus* they are less numerous, about 8, broader and irregular, in *U. oxyrhynchus* they are similar, but decidedly weaker. On comparison of adult examples, the differences are very clear, but the young shells resemble each other very much and especially in a young example of *U. acrorhynchus* from Massangabe, which has the same diameter as *U. grayanus* of the same size."

NODULARIA OXYRHYNCHA (von Martens).

Shell elongated, subsolid, scarcely inflated, inequilateral; posterior ridge full, pinched up, cord-like, ending behind in a point at or above the median line; anterior end rounded, some-

times a little angled above; base line very slightly curved, quite full near the posterior end; surface with irregular growth lines, but with no other sculpture in the specimens seen; epidermis brownish, cloth-like; pseudocardinals triangular, two in the left valve, one and a compressed one in the right; laterals long, slender, straight; muscle scars rather shallow, the hinder ones slightly elongated; nacre bluish, dirty brownish in the cavities.

Length 65, height 20, diam. 12 mm.

Japan.

Unio oxyrhynchus VON MARTENS, Mal. Blatt, VII, 1861, p. 57.

—KOBELT, Abh. Senck. Nat. Ges., XL, 1879, p. 420, pl. XIII, figs. 3, 4.—PFEIFFER, Nov. Conch., V, 1879, p. 192, pl. CLVII, figs. 4, 6.

Nodularia oxyrhynchus SIMPSON, Syn., 1900, p. 807.

Lanceolaria oxyrhyncha HAAS, Con. Cab., Unio, 1910, p. 53, pl. 4, figs. 1, 2.

Less solid, more compressed and higher than any of the related species. In all the examples I have seen there is only irregular, concentric sculpture, though it is probable that some specimens might show traces of corrugation.

Section CYLINDRICA Simpson, 1900.

Cylindrica SIMPSON, Syn., 1900, p. 807.

Shell inflated, solid, cylindrical, smooth, with a rounded posterior ridge; teeth heavy, pseudocardinals radiate, curved.

Type, *Nodularia cylindrica* Simpson.

NODULARIA CYLINDRICA Simpson.

Shell greatly elongated, inflated, rather solid, slightly arcuate, very inequilateral, rounded in front, with a low, rounded posterior ridge, which ends behind in a rounded point near the base line; the dorsal slope is obliquely truncated; ligament large, long; surface apparently without sculpture, with the exception of slight, concentric ridges; epidermis thick, brown; dorsal line wavy at the hinder end where the point is turned

a little to one side; pseudocardinals broken up into several slightly curved, subradial denticles; anterior scars deep and large.

Length 155, height 45, diam. 38 mm.

China.

Unio grayanus SCHRENCK, Reis und Forsch. in Amur-Lande, 1867, p. 694, pl. XXVII, figs. 1-3.

Nodularia cylindrica SIMPSON, Pr. Ac. Nat. Sci. Phila., 1900, p. 84; Syn., 1900, p. 807.

Lanceolaria cylindrica HAAS, Con. Cab., Unio, 1910, p. 58, pl. 5, figs. 1-3.

Schrenck supposes this species to be the *Unio grayanus* of Lea, but it is very different. There is no pinched up or elevated posterior ridge whatever as there is in that and all the species I have placed with it. It is an almost cylindrical, smooth shell, with very thick, apparently silky, epidermis. The line of junction between the valves behind is wavy and the hinder part of the shell is turned to one side a little, as is the case in *N. gladiolus*.

Section NODULARIA s. s.

Characters the same as the genus.

Group of *N. douglasia*.

Shell olive to blackish, subsolid; surface more or less covered with nodules arranged in subradiating or chevron-shaped patterns.

NODULARIA DOUGLASIÆ (Gray).

Shell somewhat elongated, subsolid, subinflated, inequilateral; beaks full, with nodular, zigzag-radial sculpture; anterior end rounded; base line straight or slightly incurved in the middle, full behind; posterior ridge moderate, ending in a point about at the median line; surface in the umbonal region sculptured with nodulous chevron-shaped or irregular corrugations, the remainder of the shell usually smooth; epidermis

varying from greenish through olive to black, usually smooth and shining; pseudocardinals compressed, the two in the left valve often partly united; laterals nearly straight, granular, beak cavities moderately deep; muscle scars shallow; nacre bluish-white.

Length 55, height 27, diam. 18 mm.

China; Amurland; Formosa; Cambodia?

Unio douglasia GRAY, Griff. An. King., XII, 1833, (p. 601 index, 1834), pl. XXI, fig. 2.

Nodularia douglasia SIMPSON, Syn., 1900, p. 808. — HAAS, Con. Cab., *Unio*, 1910, p. 68, pl. VI, figs. 1-10.

Unio murchisonianus LEA, Tr. Am. Phil. Soc., V, 1834, p. 33, pl. III, fig. 6; Obs., I, 1834, p. 145, pl. III, fig. 6. — HANLEY, Biv. Shells, 1843, p. 177, pl. XXI, fig. 53. — KUSTER, Conch. Cab. *Unio*, 1856, p. 166, pl. XLVIII, figs. 3, 4. — CHENU, Man., 1859, II, p. 142, fig. 701. — SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVIII, fig. 207.

Margarita (Unio) murchisonianus LEA, Syn., 1836, p. 14; 1838, p. 14.

Margaron (Unio) murchisonianus LEA, Syn., 1852, p. 21; 1870, p. 32.

Unio osbecki PHILIPPI, Zeits. für Mal., 1845, p. 164; Conch., III, 1847, p. 45, pl. III, fig. 1. — KUSTER, Conch. Cab., *Unio*, 1861, p. 236, pl. LXXIX, fig. 3. — SOWERBY, Conch. Icon., XVI, 1868, pl. LXIX, fig. 353.

Margaron (Unio) osbecki LEA, Syn., 1852, p. 21; 1870, p. 32.

Unio nux-persicus DUNKER, Zeits. für Mal., 1848, p. 83. — MUSGRAVE, Phot. Conch., 1863, pl. I, fig. 10. — SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIII, fig. 373.

Margaron (Unio) nux-persicus LEA, Syn., 1870, p. 32.

Unio wrightii LEA, Pr. Ac. N. Sci. Phila., IX, 1865, p. 75; Jl. Ac. N. Sci. Phila., VI, 1868, p. 283, pl. XXXIX, fig. 97; Obs., XII, 1869, p. 43, pl. XXXIX, fig. 97.

Margaron (Unio) wrightii LEA, Syn., 1870, p. 32.

Unio sculptus DESHAYES, Bull. Nouv. Arch. Mus., IX, 1873, p. 9, pl. I, figs. 3, 3a. — HEUDE, Conch. F. Nank., III, 1877, pl. XXIV, fig. 51.

Unio dactylinus HEUDE, Conch. F. Nank., 1885, pl. LXV.

Unio pictorum var. *longirostris* WESTERLUND, Kong so. vet. Ak. Hand, XIV, No. 12, p. 74.

Unio schrencki WESTERLUND. Where described?

Unio abbreviatus WESTERLUND. Where described?

An abundant and variable form, which has received a number of names. Some of the forms are probably worthy of varietal distinction. The general form is much like that of *Lampsilis subrostrata* of Say, but all the shells appear to have a post-basal swelling. It is probable that the *Unio pictorum*, which Westerlund credits to Amurland, is a form of this. The sculpture sometimes extends well over the disk.

Var. *shanghaiensis* (Lea).

Shell smooth, usually quite dark, and larger than the typical form.

Length 67, height 30, diam. 23 mm.

China; Eastern Siberia; Japan.

Unio shanghaiensis LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 153; Jl. Ac. N. Sci. Phila., IV, 1860, p. 242, pl. xxxvi, fig. 121; Obs., VII, 1860, p. 60, pl. xxxvi, fig. 121.—REEVE, Conch. Icon., XVI, 1865, pl. xxi, fig. 96.

Nodularia douglasiae var. *shanghaiensis* SIMPSON, Syn., 1900, p. 808.—HAAS, Con. Cab., Unio, 1910, p. 71, pl. vii, fig. 1.

Unio pictorum var. *amurensis* MOUSSON, J. de Conch., XXXV, 1887, p. 26, pl. 1, fig. 8.

Sometimes no larger than typical form, but smooth and darker.

Var. *nipponensis* (von Martens).

A rather small, dark form, either nearly smooth or having considerable sculpture on the disk. I have seen shells from Japan, which are nearly smooth and as large as any specimens of *shanghaiensis*.

China; Amurland; Japan.

Unio nipponensis VON MARTENS, S. B. Nat. Fr., 1877, p. 119.—KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 422, pl. xii, fig. 3.

Nodularia douglasiae var. *nipponensis* SIMPSON, Syn., 1900, p. 809.—HAAS, Con. Cab., Unio, 1910, p. 72, pl. vii, figs. 2, 3.

Var. *sinuolata* (von Martens).

"Shell elongate, swollen posteriorly, with a distinct point and with the ventral margin somewhat incurved. Beaks situated at 2-7 of the length, moderately eroded, anterior part of the dorsal margin only slightly sloping and passing with a broad, scarcely noticeable angle into the short and symmetrically rounded anterior margin, the posterior part of the dorsal margin as far as the end of the lateral teeth is almost horizontal, then in a very obtuse angle it slopes and with the much stronger ascending basal margin forms a distinct point. Sculpture only weak remnants of small folds behind the eroded portion, elsewhere only concentric growth-lines, which towards the basal margin become more pronounced. Epidermis shining, dark greenish-brown. Nacre silvery white, in many specimens somewhat ocre-yellowish towards the beaks. Cardinal teeth compressed, the two in the right valve about equal and parallel, the upper one in the left valve much more prominent than the very weak under one; the lower lateral tooth in the right valve is wholly or almost wholly wanting.

a) Length 56, height at beaks 24, at wing 26, diam. 20 mm.

b) Length 50.5, height at beaks 21, at wing 22, diam. 18 mm." (von Martens).

Type locality, Naemingang River, near Hatanggyoen, Province of Choellado and the mouth of the western tributary of the Imjingang, near Ichoen, Province of Kangwoendo, Korea.

Unio douglasia var. *sinuolatus* VON MARTENS, Zool. Jahrb. Suppl., VII, 1905, p. 57.

Nodularia douglasia sinuolatus HAAS, Con. Cab., Unio, 1910, p. 73, pl. VII, fig. 6.

"This form by its somewhat expanded basal margin and the strong inflation of the posterior third of the shell is very remarkable. It is quite possible that this feature is only an unusual strong expression of the characteristic female form, that in this portion lie the swollen gills, in which the embryos live. In the Naemingang another example was found, which represents the usual form of *douglasia* in Korea, rather compressed and high, with a straight basal margin and without

any inflation, 58 mm. long, at the beaks and at the wing 28 and 20 mm. in diameter; this perhaps is the male form. But it is remarkable that in all of the specimens before me, including the possible males, the second (lower) lateral tooth of the right valve is wholly or almost wholly wanting.

Compare with *Unio douglasiae* var. *osbeckii* Phil., in Heude Conch. Fluv. Nank., pl. 65*b*, fig. 128*i*, which represents the Chinese analogue of this form."

Var. *taiwanica* Pilsbry.

"Shell oblong, narrow, inflated, rather solid, the dorsal and ventral margins subparallel, the former slightly arcuate, anterior end rounded, basal margin straightened in the middle, posterior end long, somewhat pointed. Beaks full, swollen, worn, but showing traces of oblique corrugation on the anterior and posterior slopes, situated at the anterior two-sevenths of the length. Exterior covered with a blackish cuticle, somewhat wrinkled along growth-lines. Interior white, iridescent posteriorly. Cardinal teeth compressed, strong, single in the right, double in the left valve. Laterals moderately strong, rather short.

Length 49, alt. 25, diam. 19.7 mm." (Pilsbry).

Type locality, Formosa.

Nodularia douglasiae taiwanica PILSBRY, Pr. Ac. Nat. Sci. Phila., 1905, p. 750.

"A mussel closely related to *N. douglasiae* of China, but showing only very weak traces of corrugation."

Var. *crassidens* Haas.

"Among the typical specimens of *N. douglasiae* of nearly all localities, there occur heavy, inflated shells with extremely thick and jagged cardinals and strongly curved laterals, upon which I bestow the subspecific name of *crassidens*. I have examined specimens from Hainan, from Hunan and from Ningpo, Northern China." (Haas).

Nodularia douglasiae crassidens HAAS, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 499; Con. Cab., Unio, 1910, p. 75, pl. VII, figs. 4, 5.

NODULARIA Pliculosa (von Martens).

"Shell elliptic-oblong, inflated, epidermis brown or blackish, shortly rounded in front, elongate and obtusely subrostrate behind, sculptured with sparse, short, radiating, compressed folds, subparallel in the umbonal region, often interrupted and usually obliquely descending in front, zigzag posteriorly; ventral margin straight in the young, slightly sinuous in the adults; posterior margin above slightly oblique, subtruncate in the middle, slightly ascending below. Nacre bluish. Cardinal teeth compressed, rather stout, the anterior one of the left valve much elongated, those of the right valve are subparallel, the lower the stronger; lateral teeth long, slightly curved, smooth.

a) Length 45, height 22, diam. 15 mm. Beaks situated at 1-4 of the length. Ligament extending to 2-3 of the length.

b) Length 33, height 15, diam. 10.5 mm. Beaks at 2-7 of the length. Ligament extending to about 2-3 of the length." (von Martens).

Type locality, (a) Singei in Southern Korea and (b) between Okkwa and Changpyoeng, Northern Korea.

Unio pliculosus VON MARTENS, S. B. Nat. Fr., 1894, p. 216.—
SIMPSON, Syn., 1900, p. 862.

Nodularia pliculosa HAAS, Con. Cab., Unio, 1910, p. 76, pl. VII, figs. 7-11.

NODULARIA Verrucifera (von Martens).

"Shell oblong-elliptical, slightly inflated, solid, grayish-green, sculptured anteriorly with rows of warts curving upwards, ending in an acute angle at the middle of the shell; rounded in front; posterior portion elongate, subrostrate, sculptured with rather numerous, radiating, compressed folds; ventral margin straight; posterior margin strongly oblique above and somewhat ascending below. Nacre white, reddish-yellow in the centre. Cardinal teeth rather heavy, crenate, the anterior one of the left valve much the longer, the upper one of the right valve slight, small; lateral teeth strong, moderately elongate, nearly straight, rugose.

Length 37, height 18, diam. 12 mm. Beaks situated at 3-5 of the length; ligament extending to 3-4 of the length." (von Martens).

Type locality, Hangang River, Middle Korea.

Unio verrucifer VON MARTENS, S. B. Nat. Fr., 1894, p. 216.—
SIMPSON, Syn., 1900, p. 862.

"The Chinese *Unio douglasii* Gray (*murchisonianus* Lea) is very close to this species, but is more elongate posteriorly and consequently the beaks are proportionately more anterior and the height less."

NODULARIA BÖTTGERI (Neumayr).

"Shell thin, inequilateral, rather long-oval, slightly inflated, beaks situated in the first third of the length; rounded in front, feebly keeled behind, rounded, a little pointed. Beaks not prominent, strongly wrinkled, eroded. Posterior slope feebly defined. Hinge very feebly developed, in each valve a thin, anteriorly directed, long, lamelliform cardinal tooth, in the left valve is a second rudimentary tooth parallel with the first. Lateral teeth feeble. Anterior muscular impressions slight, posterior very faint. Nacre white, iridescent. Epidermis blackish-brown.

Length 55, height 28, diam. 20 mm." (Neumayr).

Type locality, Region of Tsching-kiang, Province of Kiangsu, China.

Unio böttgeri NEUMAYR, Ergebnisse d. Reise Szecheny Ostasien, II, 1898, p. 645, pl. II, fig. 3.

"Of all the allied species, *Unio sculptus* Deshayes, from the Province of Petschili, China, is the nearest and in fact the figure of that species in contour, size, sculpture and indeed in the great part of all the characters shows no important differences; only in the structure of the hinge is there such a marked difference that it is impossible to bring them together as one species. In *Unio sculptus* the posterior cardinal tooth is triangular, whereas in *Unio böttgeri* it is a rudimentary, forward-projecting lamella. *Unio pflisteri* Heude and *rufescens* Heude also clearly differ in the character of the hinge; there is also

a very well recognizable external difference, even if the inner one was not so noticeable. *Unio douglasia* Gray is also related, but differs in its keeled anterior end and olive-green color."

NODULARIA DORRI (Wattebled).

Shell small, elongated, inflated, subsolid, inequilateral; beaks apparently full; posterior ridge well developed, sharp, ending in a point about on the median line; anterior end rounded; base line straight, full behind the middle, from which it is slopingly truncate to the posterior end; outline of the dorsal slope curved; surface with very delicate growth lines and some very slight corrugations on the umbonal region and the dorsal slope; epidermis dark brown, shining; pseudocardinals elevated, ragged, subcompressed, granular and somewhat denticulate; laterals nearly straight; beak cavities rather deep; muscle scars impressed; nacre bluish, sometimes yellowish in the cavity, thinner and brilliantly iridescent behind.

Length 36, height 15, diam. 13 mm.

Cochin China; Anam; Mekong River; Tonquin.

Unio dorri WATTEBLED, Jl. de Conch., XXXIV, 1886, p. 71, pl. v, fig. 5.

Nodularia dorri SIMPSON, Syn., 1900, p. 809.—HAAS, Con. Cab., Unio, 1910, p. 81, pl. VIII, figs. 1, 2.

Close to forms of *N. douglasia*, but very much smaller, having a more sharp and elevated posterior ridge and brighter nacre.

NODULARIA DENSERUGATA Haas.

"Shell elongate-elliptical, rather solid and inflated, rounded in front, distinctly biangulate behind. Posterior ridge rather high, rounded. Basal margin almost straight. Beaks not prominent, situated at 26-100 of the total length, greatly eroded; their sculpture covers the greater part of the disk and consists of concentric, wavy wrinkles standing very close. Epidermis of a dull blackish gray. Hinge consisting of two cardinals and two laterals in the left, one cardinal and one lateral in the

right valve. Cardinals rather solid, stumpy, that of the right valve accompanied in front by a low, lamellar auxiliary tooth. Laterals nearly straight, high. Interval short, rather smooth. Anterior cicatrices distinct, deep; posterior distinct and very faint. Dorsal cicatrices united to a narrow groove situated at the inner side of the interval. Beak-cavities rather deep. Nacre silvery.

Length 53, height 26, diam. 18 mm." (Haas).

Type locality, Hainan.

Nodularia denserugata HAAS, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 496; Con. Cab., Unio, 1910, pl. VIII, figs. 3-4.

NODULARIA BIWÆ (Kobelt).

Shell somewhat elongated, solid, subinflated, inequilateral; beaks apparently rather full, their sculpture not observed; posterior ridge well marked, subangular, ending in a sharp point on the median line; base line nearly straight in front, full behind the middle; anterior end rounded, subangular above; outline of dorsal slope evenly curved; surface with faint, uneven, growth lines; epidermis brown or blackish, shining; pseudocardinals subsolid, somewhat split into denticles; laterals curved; beak cavities impressed; muscle scars rather deep, small; nacre dirty flesh-colored or brownish with a coppery or bronzy iridescence.

Length 45, height 22, diam. 16 mm.

Lake Biwæ, Japan.

Unio biwæ KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 425, pl. XXIII, figs. 2-4.

Nodularia biwæ SIMPSON, Syn., 1900, p. 810.—HAAS, Con. Cab., Unio, 1910, p. 94, pl. IX, figs. 6-8.

A small, solid, shining, dark colored species. At the time of writing the Synopsis I had never seen this shell, but have since had an opportunity of examining authentic specimens. It should be placed in the group of *N. douglasia* instead of that of *N. japonensis*. It differs from the latter species in being considerably more wedge-shaped when viewed from above, and in having different nacre.

NODULARIA DIGITIFORMIS (Sowerby).

Shell elongated, slightly arcuate, solid, inflated, inequilateral; beaks full; outline of dorsal slope curved; anterior end rounded; base line incurved but very full behind the middle; posterior basal part obliquely truncate; posterior ridge full, slightly double, ending below the median line in a narrow biangulation; epidermis black, smooth; pseudocardinals large, ragged; laterals elongated; nacre white.

? Length 100, height 37 mm.

India.

Unio digitiformis SOWERBY, Conch. Icon., XVI, 1868, pl. LXV, fig. 333.

Nodularia digitiformis SIMPSON, Syn., 1900, p. 809.

I have never seen this species, which seems something like a large, elongated, smooth *N. douglasia*. It is more solid than that species and is slightly arcuate according to the figure, which is probably taken from an old shell.

Group of *Nodularia japonensis*.

Shell solid, elliptical, subrhomboid or oval, biangulate, rounded or pointed behind and often produced at the posterior base; posterior ridge low or scarcely developed; beaks moderately full; sculpture zigzag-radial; surface of the valves concentrically striate or more or less covered with corrugated, chevron-shaped sculpture, which often becomes somewhat nodulous; epidermis greenish and sometimes rayed in young shells, becoming brown or blackish when adult.

Animal having the inner gills wider than the outer in front, equal behind, free from the abdominal sac throughout, united to the mantle to the extreme posterior point; palpi rather large, long; mantle double on the border and toothed below; branchial opening large, with well-developed, brown papillæ; anal opening large, with small, tubercular papillæ on its inner edge, covered with wart-like papillæ inside; superanal opening not closed below.

NODULARIA JAPANENSIS (Lea).

Shell rhomboid elliptical, more or less elongated, convex, inequilateral, rounded in front, base line nearly straight, or somewhat curved, usually full behind the middle; posterior ridge but moderately developed, usually feebly double, ending in a faint biangulation below the median line; beaks not full or high, their sculpture zigzag-radial; surface more or less covered with nodulous sculpture, which is usually arranged in zigzags or chevron-shaped figures, the nodules often united together into corrugated ridges; epidermis varying from rich green in young shells to brown or black, dull or shining; pseudocardinals subcompressed to subsolid, rough, two in each valve, the upper one of the right valve small; laterals with traces of vertical striation; muscle scars not deep; beak cavities shallow; nacre dirty or lurid brownish.

Length 62, height 33, diam. 19 mm.

Length 49, height 30, diam. 15 mm.

Japan.

Unio japonensis LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 153;

Jl. Ac. N. Sci. Phila., IV, 1860, p. 244, pl. XXXVI, fig. 123;

Obs., VII, 1860, p. 62, pl. XXXVI, fig. 123.—KUSTER, Conch.

Cab. Unio, 1862, p. 227, pl. XCIII, fig. 4.—SOWERBY, Conch.

Icon., XVI, 1868, pl. LXXX, fig. 420.

Margaron (Unio) japonensis LEA, Syn., 1870, p. 31.

Nodularia japonensis SIMPSON, Syn., 1900, p. 809.—HAAS,

Con. Cab., Unio, 1910, p. 85, pl. VIII, figs. 5-8.

The type of this is not in the Lea collection, there being only a large shell, whose measurements are given above. The species varies considerably in the degree of sculpture, some specimens being only faintly nodulous, while others are strongly and densely sculptured throughout.

Var. *jokohamensis* (von Ihering).

Differs from the typical form in being more blunt and rounded behind. It seems to be connected by intermediate forms.

Japan.

Unio japonensis KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 423, pl. XII, figs. 1, 2.

Unio jokohamensis VON IHERING, Abh. Senck. Nat. Ges., XVIII, 1893, p. 158.

Nodularia japonensis var. *jokohamensis* SIMPSON, Syn., 1900, p. 810.—HAAS, Conch. Cab., Unio, 1910, p. 87, pl. VIII, figs. 9-13.

NODULARIA HAACONENSIS (von Ihering).

Shell rhomboid elliptical, convex, inequilateral, subsolid, rounded in front, slightly curved on the base line and but little produced at the posterior base; obliquely subtruncate on the posterior slope; posterior ridge low, often with a slight tendency towards being double; surface more or less strongly, concentrically sulcate, showing faint traces of nodular sculpture on the middle of the disk; epidermis dirty tawny or brownish, somewhat cloth-like; pseudocardinals rather strong, rough, not split into dentillations; laterals well developed, curved; beak cavities well impressed; muscle scars well marked; nacre dirty, lurid brownish or lead-colored.

Length 47, height 28, diam. 16 mm.

Japan.

Unio haaconensis VON IHERING, Abh. Senck. Nat. Ges., XVIII, 1893, p. 161, fig. 3.

Nodularia haaconensis SIMPSON, Syn., 1900, p. 810.—HAAS, Con. Cab., Unio, 1910, p. 89, pl. IX, figs. 1-3.

Close to *N. japonensis* and possibly a variety of it, but differing in having well marked, concentric sculpture, in being almost destitute of nodules and having a pale brownish or tawny epidermis.

NODULARIA BRANDTII (Kobelt).

Shell rather short, elliptical or rhomboid elliptical, very solid, subinflated, inequilateral; dorsal outline almost evenly curved; basal outline curved; posterior ridge moderate, ending below the median line in a dull point; anterior end rounded; surface with irregular growth lines, blackish-olive; beaks prominent;

teeth strong, the laterals decidedly curved; nacre brownish flesh-colored; muscle scars distinct.

Length 40, height 27, diam. 17 mm.

. Japan.

Unio brandtii KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 426, pl. XXIII, fig. 15.

Nodularia brandtii SIMPSON, Syn., 1900, p. 810.—HAAS, Conch. Cab., Unio, 1910, p. 102, pl. IX, figs. 9-10.

This is something like *N. haconensis*, judging from Kobelt's description and figures, but appears to be very much more solid and a darker shell. A dorsal view shows it to be somewhat wedge-shaped.

For this species and *N. parcedentata* Haas, (Conch. Cab., Unio, 1912, p. 102), has established a new section, *Inversidens*.

NODULARIA PARCEDENTATA Haas.

"Shell irregularly rhomboid, quite thin and inflated. Anterior end straight above, thence regularly rounded; ventral margin straight or slightly convex. Posterior point not prominent; posterior margin obliquely rounded; dorsal margin nearly straight. Beaks situated anteriorly at 24-100 of the total length, prominent in young shells, but in older ones lower than the highest point of the dorsal margin, eroded, but in young shells sculptured with wavy wrinkles, of which remnants are visible on the areola of the adults. Posterior slope high, triangular, compressed and, owing to the elevated posterior ridge, is distinctly separated from the rest of the shell, the inner as well as the upper areal carinae are also recognizable as indistinct lines. The areola is small, compressed. Ligament long, strong; sinus nearly obsolete, long, lanceolate; sinus short, triangular. From above the outline of the shell is sharply pointed in front, rapidly increases in width, reaching its maximum at about the center of the shell, thence gradually decreasing to the posterior end. Epidermis shining black, covered at both ends with a rust-colored deposit. Hinge very variable. Only one cardinal tooth in each valve. That of the right valve lies in front of the beak, square and jagged above;

that of the left valve lies under the beak and is stumpy, triangular and smooth. Laterals short, thick, a little curved, 1-2 in each valve. In the four specimens before me they are as follows:

	RIGHT	LEFT
a)	1	1
b)	2	2
c)	1	2
d)	2	2

The angle of the cardinal teeth is 30° ; of the laterals 0° . Both the anterior and posterior muscular impressions are merged; those of the posterior retractors, however, show a tendency to be differentiated; dorsal scars united in a deep pit under the interval. Nacre reddish in the beak cavities, bluish towards the margin.

Length 50, greatest height 36, at beaks 30, diam. 22 mm." (Haas).

Type locality, Japan.

Nodularia parcedentata HAAS, Con. Cab., Unio, 1910, p. 104, pl. XIII, figs. 3-4; Nachr. Deutsch. Mal. Ges., 1911, p. 43.

NODULARIA CONTINENTALIS Haas.

"Shell elongate-elliptical, solid, inflated, somewhat truncated in front and slightly arcuate behind. Posterior ridge moderately rounded. Basal margin slightly sinuate at its posterior part. Beaks not prominent, eroded, situated at 21-100 of the total length; their sculpture is not to be seen when adult, in young shells it consists of few concentric, slightly looped ridges, the posterior loops running upwards across the posterior slope. Epidermis of a rather dull black. Hinge consisting of two cardinals and two laterals in the left, one cardinal and one lateral in the right valve. Cardinals solid, stumpy, jagged on the surface, a narrow lamellar auxiliary tooth standing in front of the one of the right valve. Laterals long, high and curved. Interval short, broad, covered with small, denticular structures. Anterior cicatrices united to a

narrow, short groove situated at the inner side of the interval. Beak-cavities deep. Nacre silvery, brilliant.

Length 62, height 36, diam. 25 mm." (Haas).

Type locality, Hunan, Middle China.

Nodularia continentalis HAAS, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 497; Con. Cab., Unio, 1910, p. 92, pl. IX, figs. 4-5.

"Very near to *Nod. japonensis* Lea of Japan, the first form of this group recorded from the continent."

NODULARIA OMIENSIS (von Heimbürg).

Shell obovate or subrhomboid, narrow in front, rather thin, convex, inequilateral; beaks apparently not very full; anterior end rounded; base line curved, full behind the middle; posterior end obliquely subtruncate above, somewhat biangulate below; surface with rather fine, concentric ridges, and more or less corrugated subnodulous sculpture; epidermis brownish or blackish; pseudocardinals subsolid; laterals curved; beak cavities moderate; muscle scars not deep; nacre bluish-white, richly iridescent.

Length 51, height 28, diam. 15 mm.

Province of Omi, Japan.

Unio omiensis VON HEIMBURG, Nach. Deuts. Mal. Ges., XVI, 1884, p. 93; Jahrbuch Mal. Ges., XIV, 1887, p. 2, pl. I, figs. 2, 3.

Nodularia omiensis SIMPSON, Syn., 1900, p. 810.—HAAS, Con. Cab., Unio, 1910, p. 95, pl. IX, fig. 11.

Thinner, more obovate and with a richer colored nacre than *N. japonensis*. I have seen a single valve of what may be this species, which is much more strongly corrugately sculptured than the figure given by von Heimbürg. It does not differ any more in this respect than specimens of *N. japonensis* do.

NODULARIA HIRASEI Haas.

"Shell wedge-shaped, thick, heavy, moderately inflated. Anterior margin short, regularly rounded; ventral margin quite convex; posterior point blunt; posterior margin oblique; dorsal margin slightly curved. Beaks well in front at one-fifth of the total length, not very prominent, eroded, rather inflated;

their sculpture, in young shells, consisting of concentric, wavy wrinkles, which become zigzag-shaped posteriorly and are continued over the posterior ridge in curved, parallel lines over the dorsal area. Area low, somewhat compressed, with indistinct areal-lines. Areola very small, compressed. Ligament long and strong. Sinulus broad, lance-shaped. Sinus short, triangular. Epidermis black with a light silky gloss. Dorsal outline lance-shaped, quite blunt in front, abruptly increasing in width, the maximum being at one-fourth of the length of the shell; thence gradually decreasing to the sharp posterior end. Hinge with one cardinal and one lateral in the right, two cardinals and two laterals in the left valve. Cardinal tooth of the right valve blunt, strong, very jagged, in front of it a smaller, weaker, lamelliform auxiliary tooth; anterior cardinal of the left valve small, low, posterior elongated, high jagged. Interval short, broad. Laterals long, strong, in the left valve the lower is the stronger. Angle of the cardinal teeth 15° ; of the laterals 10° . Anterior muscular impressions deep, that of the adductors united with that of the upper retractors; posterior faint; dorsal lying in a row under the interval. Mantle-pad in front quite strong, becoming flattened posteriorly. Nacre reddish, bluish posteriorly.

Length 79, height 46, diam. 30 mm." (Haas).

Type locality, Yamashiro, Japan.

Nodularia hirasei HAAS, Nachr. Deutsch. Mal. Ges., 1911, p. 45; Con. Cab., Unio, 1910, p. 96, pl. XIII, figs. 1-2.

Group of *Nodularia reiniana*.

Shell elliptical oval, very solid, truncated in front and somewhat biangulate behind, slightly produced at the posterior base; beak sculpture not known; pseudocardinals heavy, elongated, parallel with the dorsal line. Animal unknown.

NODULARIA REINIANA (Kobelt).

Shell irregularly long ovate, solid, convex, very inequilateral; beaks nearly terminal and apparently full; posterior ridge widely rounded; anterior end of the shell somewhat

truncated; base line nearly straight; outline of dorsal slope curved; posterior end somewhat narrowed and almost evenly rounded; surface covered with a very thick, dark, rather rough epidermis; teeth strong; pseudocardinals two in each valve, inclined to be parallel with the large, granular laterals; beak cavities moderately impressed; muscle scars roughened; nacre brownish and lead-color, slightly thicker in front.

Length 66, height 36, diam. 22 mm.

Lake Biwæ, Japan.

Unio reinianus KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 424, pl. XXIII, fig. 1.

Nodularia reiniana SIMPSON, Syn., 1900, p. 810.—HAAS, Con. Cab., Unio, 1910, p. 97, pl. X, fig. 1.

A curious form, but apparently related to *U. japonensis*. Since writing the Synopsis I have seen a specimen, in bad condition, which is undoubtedly this species. It came from Lake Biwæ, Japan, and is larger than that measured by Kobelt. Its form, being somewhat long ovate, its solidity, the heavy teeth, the pseudocardinals running nearly parallel with the straight laterals and the brownish and lead-colored, clouded nacre are good characters.

NODULARIA UNDULATA Haas.

"Shell rhomboid-elliptical, rather thin and moderately inflated, rounded in front and nearly vertically truncated behind. Posterior ridge high, distinctly angulated. Basal margin straight or slightly curved. Beaks somewhat prominent, situated at 23/100 of the total length, their sculpture consists of concentric, undulated ridges, covering about one-half of the disk, and running upwards and backwards across the posterior slope. Epidermis of a yellowish-green, shining. Hinge consisting of two cardinals and two laterals in the left, one cardinal and one lateral in the right valve. The cardinals are solid, lamellated, that of the right valve accompanied by a very low, lamellar auxiliary tooth. Laterals long, straight. Interval short, broad, not distinctly separated from the cardinal teeth. Anterior cicatrices distinct, deep; posterior dis-

tinct, faint. Dorsal cicatrices united to a groove situated at the inner side of the interval. Beak cavities shallow. Nacre silvery, iridescent.

Length 43, height 25, diam. 16 mm." (Haas).

Type locality, Pisui, Hainan.

Nodularia undulata HAAS, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 497; Con. Cab., Unio, 1910, p. 100, pl. x, figs. 2-3.

NODULARIA PERSCULPTA Haas.

"Shell elongated, low, quite solid. Anterior end very short, semicircular; ventral margin horizontal or slightly constricted, posteriorly bent upwards angularly to the lower angle of the posterior end; posterior margin first horizontal, then oblique; the posterior point is biangulate, the lower angle being more pronounced than the upper. Beaks anterior, at 19/100 of the length, very prominent, swollen, their sculpture consisting of radial wrinkles, of which the central ones unite below forming a series of successive Vs. Ligament short, weak. Posterior slope low, distinctly defined. On the posterior ridge is a system of wrinkles, which extends in parallel, somewhat wavy lines both over the posterior slope and the posterior part of the disk almost to the ventral margin, these parallel lines meeting on the posterior ridge. In front of the posterior ridge the lines unite with the aforesaid V-shaped wrinkles; the anterior portion of the disk is covered with weaker wrinkles, which are arranged on the edge of the areola as on the posterior ridge. This sculpture covers the whole surface in young shells and nearly all in the adults. Hinge rather weak; cardinal tooth of the left valve bifid, compressed, with a small triangular pit, in which arises a small tooth at right angles to the axis of the shell; cardinal tooth of the right valve triangular, cleft, with a fine vertical slit, in which the lamella in the pit of the left valve fits; laterals long, thin; one in the left valve, two in the right valve, a large one and the other only about half as large, situated at the rear half of the larger one. Cardinal teeth forming an angle of about 45 degrees with the axis; laterals parallel with the axis. Anterior muscular impressions deep, funnel-shaped, posterior shallow. Nacre

bluish-white. Epidermis green or yellow, on the wrinkles yellowish-brown to brown, eroded on the beaks.

Length 38, height 19.5, diam. 16 mm." (Haas).

Type locality, Hunan, Central China.

Nodularia persculpta HAAS, Nachr. Deutsch. Mal. Ges., 1910, p. 98; Con. Cab., Unio, 1910, p. 105, pl. x, figs. 4-7.

Group of *Nodularia sagittaria*.

Shell elongated, the hinder point above the middle of the shell, with a sharp posterior ridge and a faint ridge above it; beaks rather low, their sculpture irregularly radial; disks finely concentrically striate, not otherwise sculptured; epidermis yellowish-olive, cloth-like; pseudocardinals greatly elongated, compressed sometimes dentellate under the beaks; laterals long, compressed. Animal unknown.

NODULARIA SAGITTARIA (Lea).

Shell elongated, subinflated, subsolid, inequilateral; beaks not greatly elevated; posterior ridge rounded or feebly biangulate, sometimes there are two slightly pinched-up ridges, ending in a point above the median line; dorsal and ventral outlines nearly parallel; anterior end rounded, sometimes subangular above; post-basal region but slightly produced, gradually curved up to the much-produced posterior point; surface with irregular growth lines but not otherwise sculptured; epidermis grayish or yellowish-olive to greenish-olive; teeth lamellar, rather feeble, the pseudocardinals sometimes slightly dentellate under the beaks; muscle scars shallow; nacre silvery and iridescent.

Length 50, height 18, diam. 14 mm.

Siam; Cambodia.

Unio sagittarius LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 93;

Jl. Ac. N. Sci. Phila., III, 1857, p. 298, pl. xxvi, fig. 12;

Obs., VI, 1857, p. 18, pl. xxvi, fig. 12.

Margaron (Unio) sagittarius LEA, Syn., 1870, p. 58.

Nodularia sagittaria SIMPSON, Syn., 1900, p. 811.

Oxyaia sagittaria HAAS, Con. Cab., Unio, 1910, pl. xv, figs.

4-6.

Unio dugasti MORLET, Jl. de Conch., XL, 1892, p. 86; XLI, 1893, p. 156, pl. VI, fig. 4.

Unio jaculus ROCHEBRUNE, Bull. Soc. Phila., 1882, p. 44.

Oxy-naia jacula HAAS, Con. Cab., Unio, 1910, pl. xv, figs. 5-6.

Remarkable for its greatly alternated pseudocardinals and laterals and silvery nacre. There are two shells of *Unio dugasti* Morlet from the Mekong River, in the National Museum, which differ from Lea's shell only in being smaller, a little less solid and inflated, and in having a lighter colored epidermis. I believe them to be the young of *N. sagittaria*.

Group of *Nodularia cærulea*.

Shell elliptical, inflated, pointed about on the median line behind, the post-basal region produced, with a well-developed posterior ridge; beaks sculptured with numerous fine, radiating riblets, the central ones of which join below, the whole often more or less zigzagged and extending well over the disk; epidermis generally bluish-green. Animal unknown.

NODULARIA CÆRULEA (Lea).

Shell somewhat elongated, subinflated to inflated, inequilateral, rather thin; beaks moderately full, sculptured with radial ridges, which are somewhat zigzagged; anterior end rounded, sometimes produced slightly above; base line straight or lightly curved, full behind the middle and obliquely truncate behind to the somewhat produced posterior point; posterior ridge well developed; sometimes slightly double, ending in a point about on the median line; surface with delicate, irregular growth lines, and often having radiating folds on the posterior slope and the anterior end; teeth lamellar, delicate, the pseudocardinals somewhat elevated; muscle scars shallow; nacre brilliant silvery-bluish, iridescent behind. The exterior of the shell varies from ashy to bluish-green or nearly blue and is generally dull.

Length 46, height 22, diam. 17 mm.

Length 40, height 21, diam. 14 mm.

Length 26, height 13, diam. 10 mm.

India; southeast Asia.

- Unio cæruleus* LEA, Tr. Am. Phil. Soc., IV, 1831, p. 95, pl. XIII, fig. 25; Obs., I, 1834, p. 105, pl. XIII, fig. 25.—HANLEY, Biv. Shells, 1843, p. 194, pl. XX, fig. 49.—CHENU, Ill. Conch., 1858, pl. XVI, figs. 3, 3a, 3b.—KUSTER, Conch. Cab. Unio, 1861, p. 228, pl. LXXVII, fig. 4.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLII, fig. 230.—HANLEY and THEOBALD, Conch. Ind., 1876, p. 6, pl. XII, figs. 3, 3a.
- Margarita (Unio) cæruleus* LEA, Syn., 1836, p. 26; 1838, p. 20.
- Margaron (Unio) cæruleus* LEA, Syn., 1852, p. 30; 1870, p. 47.
- Nodularia cærulea* SIMPSON, Syn., 1900, p. 811.
- Unio gerbidoni* EYDOUX, Guer. Mag., 1838, p. 9, pl. CXVIII, figs. 2, 2a, 2b.—HANLEY, and THEOBALD, Conch. Ind., 1876, p. 6, pl. XII, fig. 2.
- Unio humilis* LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 93; Obs., VI, 1857, p. 16, pl. XXVI, fig. 10; Jl. Ac. N. Sci. Phila., III, 1858, p. 298, pl. XXVI, fig. 10.
- Margaron (Unio) humilis* LEA, Syn., 1870, p. 32.
- Unio corrianus* KUSTER, Conch. Cab. Unio, 1861, p. 229, pl. LXVII, fig. 5.
- Unio leioma* BENSON, Ann. and Mag., 1862, p. 192.—HANLEY, and THEOBALD, Conch. Ind., 1876, p. 6, pl. XII, fig. 6.
- Unio pilatus* LEA, Pr. Ac. N. Sci. Phila., X, 1866, p. 133; Jl. Ac. N. Sci. Phila., VI, 1868, p. 281, pl. XXXVIII, fig. 95; Obs., XII, 1869, p. 41, pl. XXXVIII, fig. 95.
- Margaron (Unio) pilatus* LEA, Syn., 1870, p. 47.
- Unio evitatus* LEA, Pr. Ac. N. Sci. Phila., X, 1868, p. 133; Jl. Ac. N. Sci. Phila., VI, 1868, p. 279, pl. XXXVIII, fig. 92; Obs., XII, 1869, p. 39, pl. XXXVIII, fig. 92.
- Margaron (Unio) evitatus* LEA, Syn., 1870, p. 47.
- Unio tirostris* SOWERBY, Conch. Icon., XVI, 1868, pl. LXV, fig. 331.
- Unio andersonianus* NEVILL, Jl. As. Soc. Beng., XLVI, 1877, p. 40; Researches Yun. Exp., 1877, p. 900, pl. LXXX, figs. 8, 12.
- Nodularia andersoniana* PRESTON, Rec. Ind. Mus., VII, 1912, p. 291.

An abundant, variable species widely distributed through southeastern Asia. I have united a number of nominal species, not being able to satisfactorily separate them. The species is usually rather thin or barely subsolid, and more or less tinted with blue; the surface is almost always dull, the nacre brilliant and bluish. *Unio exvittatus* of Lea is generally a little higher and more compressed than the type; *U. humilis* of Lea is a small form and might possibly be worthy of varietal rank if there was not so much intermediate material. *Unio andersonianus* Nevill is probably a synonym. *U. gerbidoni* Eydoux seems from the figure to be a rather solid *caerulea*.

NODULARIA SUBSTRIATA (Lea).

Shell small, elongated, subinflated, scarcely subsolid, inequilateral; beaks full, rather high, apparently sculptured with a few irregular nodules; anterior end rounded, subangular above; base line nearly straight to a decided swelling behind the middle, obliquely truncated behind the swelling; posterior ridge somewhat double, ending in a point at or above the median line; surface ashy-greenish, dull; teeth delicate, lamellar; muscle scars shallow; nacre brilliant bluish-silvery, iridescent behind.

Length 26, height 13, diam. 9 mm.

Siam.

Unio substriatus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 93; Obs., VI, 1857, p. 20, pl. XXVI, fig. 14.

Margaron (Unio) substriatus LEA, Syn., 1870, p. 47.

Unio substriatus LEA, Jl. Ac. N. Sci. Phila., III, 1858, p. 300, pl. XXVI, fig. 14.

Nodularia caerulea (part) SIMPSON, Syn., 1900, p. 811.

In the Synopsis I placed this in the synonymy of *N. caerulea*, but the type, the only specimen I have seen, differs in some minor characters. It is a small shell, though no smaller than other specimens before me, which I believe are genuine *caerulea*, and it is possibly a little more elongated than shells of that species of its size. The beaks are slightly eroded but their sculpture occupies a less area than in *caerulea* and appears to be more granulous or nodular.

NODULARIA TERETIUSCULA (Philippi).

Shell elongated, subinflated or inflated, rather solid, inequilateral, with the greatest diameter along and just in front of the angled posterior ridge; anterior end rounded; base line nearly straight, full towards the posterior end and obliquely truncated behind the inflation; posterior point somewhat drawn out, about midway up from the base; dorsal outline slightly curved; post-dorsal slope somewhat obliquely truncated; beaks moderately elevated, with slightly converging, more or less zigzag-radial sculpture; surface with irregular growth lines and sometimes with faint, seminodulous, subplicate sculpture anteriorly and posteriorly; epidermis gray-green to blue-green, generally slightly rayed, dull; left valve with two compressed, elevated pseudocardinals and two slender laterals; right valve with one pseudocardinal, often divided and one lateral; anterior scars impressed; nacre bluish, slightly iridescent.

Length 50, height 20, diam. 16 mm.

Upper Nile drainage.

Unio teretiusculus PHILIPPI, Conch., III, 1847, p. 45, pl. III, fig. 3.—?KUSTER, Conch. Cab., 1856, p. 133, pl. XXXV, fig. 5.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXV, fig. 389.—JICKELI, Faun. N. O. Af., 1874, p. 276, pl. XI, figs. 1, 2.

Nodularia teretiuscula SIMPSON, Syn., 1900, p. 812.

Margarita (Unio) cailliaudi LEA, Syn., 1838, p. 24.

Margaron (Unio) cailliaudi LEA, Syn., 1852, p. 36; 1870, p. 58.

Although this is an African species, it appears to be very closely related to *N. cærulea*, which is confined to southeast Asia. It is a little more elongated than that species, is more solid, is usually somewhat rayed, while *cærulea* is rayless or almost so, and it has duller nacre.

Var. *lithophaga* "Ziegler" Pallary.

"Differs from the type figured by Philippi by its smaller size, its beaks nearer the posterior margin and more elongated anterior end." (Pallary).

Type locality, the White Nile.

Unio lithophagus ZIEGLER, manuscript, probably.

Nodularia (Lanceolaria) teretiusculus var. *lithophaga* "ZIEGLER" PALLARY, Mem. Inst. Egypt., VI, 1909, p. 79.

Nodularia teretiusscula (part), SIMPSON, Syn., 1900, p. 812.

NODULARIA LEDCULXIANA (CHARMES).

Central Africa.

The description of this species is not accessible to me, and I have never seen an authentic specimen. von Martens places it in the group of *Unio teretiusculus*. It has never been figured so far as I know.

Unio ledoulxianus CHARMES, Bull. Soc. Mal. Fr., II, 1885, p. 173.—BOURGUIGNAT, Moll. Af. Eq., 1889, p. 194.—VON MARTENS, Besch., 1897, p. 229.

Nodularia ledoulxiana SIMPSON, Syn., 1900, p. 812.

NODULARIA GAUDICHAUDI (EYDOUX).

Shell irregularly subelliptical, slightly narrower in front, apparently rather solid, inequilateral, convex; beaks moderately elevated, slightly sculptured; posterior ridge well developed, narrowly rounded, ending behind in a blunt point about on the median line; anterior end rounded; base line straight, but very full behind the middle and obliquely truncated behind this point; dorsal line nearly straight; dorsal slope obliquely truncate; epidermis dirty greenish with brown, concentric bands; muscle scars well marked; nacre rose-purple.

Length 40, height 22, diam. 15 mm.

Small streams of Bengal.

Unio gaudichaudi EYDOUX, Guer. Mag., 1838, p. 10, pl. CXVIII, fig. 3.

Margaron (Unio) gaudichaudi LEA, Syn., 1850, p. 32; 1870, p. 50.

Nodularia gaudichaudi SIMPSON, Syn., 1900, p. 812.

Nodularia carulea var. *gaudichaudii* PRESTON, Rec. Ind. Mus., VII, 1912, p. 289.

There are some slight discrepancies between the description and the well-executed, colored figure of this species. The latter shows the shell to be somewhat solid, with brownish,

concentric bands; in the description the shell is said to be thin and no mention is made of the color bands. It is a shorter shell than *caerulea* and differs in the color of its nacre.

NODULARIA KERAUDRENI (Eydoux).

Shell subovate, subinflated, inequilateral; beaks rather full; anterior end narrowed; base line curved, full behind the middle, curving from the swelling to the blunt posterior end; dorsal slope subtruncate; posterior ridge not strongly developed, apparently somewhat double; epidermis brownish or brownish-green; pseudocardinals somewhat compressed, ragged; laterals delicate, curved; anterior scars well marked, posterior scars shallow; nacre yellowish-white.

Length 41, height 22, diam. 15 mm.

Rivers and swamps of Bengal.

Unio keraudreni EYDOUX, Guer. Mag., 1838, p. 8, pl. cxviii, figs. 1, 1a.

Margaron (Unio) keraudreni LEA, Syn., 1852, p. 30; 1870, p. 46.

Nodularia keraudreni SIMPSON, Syn., 1900, p. 812.

Nodularia caerulea var. *keraudreni* PRESTON, Rec. Ind. Mus., VII, 1912, p. 289.

This shell is somewhat obovate, and the outlines are much less angular than they are in *caerulea* and other related forms.

NODULARIA SHURTLEFFIANA (Lea).

Shell somewhat elongated, inflated, rather solid, inequilateral; beaks full and high, sculptured with a great number of fine, radiating, somewhat zigzag ridges, which extend well on to the disk; anterior end rounded; base line straight or lightly curved, rather full behind the middle; posterior ridge full, somewhat double, ending in a feeble biangulation at and below the median line; surface delicately, concentrically, subgranulously ridged, and having more or less fine, subradial, corrugated sculpture; epidermis tawny to greenish, the green predominating behind, slightly rayed, and having two or three broad green rays on the dorsal slope; pseudocardinals

subcompressed, somewhat irregular; laterals delicate; anterior scars impressed; nacre silvery-white, thinner behind.

Length 57, height 27, diam. 21 mm.

India; Siam.

Unio shurtleffianus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 94; Obs., VI, 1857, p. 22, pl. XXVII, fig. 17; Jl. Ac. N. Sci. Phila., III, 1858, p. 302, pl. XXVII, fig. 17.

Margaron (Unio) shurtleffianus LEA, Syn., 1870, p. 32.

Nodularia shurtleffiana SIMPSON, Syn., 1900, p. 813.

A larger species than *carulea*, biangulate, and not so pointed behind. The color of the epidermis is different and the surface is sculptured to a greater extent.

NODULARIA ANCEPS (Deshayes).

Shell irregularly long elliptical, subsolid, convex, inequilateral; beaks neither very full or high, sculptured with fine, radial ridges, some of which are zigzagged and extending well on to the disk; the sculpture gradually changes to fine nodulous corrugations and fades out on the border of old shells: posterior ridge well developed, having a tendency to be narrowly double, ending behind in a point or slight biangulation at or below the median line; anterior end rounded; base line straight or lightly curved, full behind the middle; hinge line lightly curved; dorsal slope obliquely truncated; surface and epidermis roughened, scarcely shining, ashy, yellowish-green or greenish, frequently banded with yellowish and darker behind, where it is sometimes faintly rayed; hinge teeth subsolid; pseudocardinals rather short; anterior scars well impressed; nacre white or flesh-colored, brilliant.

Length 43, height 24, diam. 14 mm.

Cambodia.

Unio anceps DESHAYES, Nouv. Arch. de Mus., X, 1874, p. 127, pl. VI, figs. 8-12.

Nodularia anceps SIMPSON, Syn., 1900, p. 814.

Oxynaia anceps HAAS, Con. Cab., Unio, 1910, pl. XIV, figs. 1-3.

Dr. Lea has a number of specimens which he has called *U. shurtleffianus*, which I am satisfied are not that species, but

are Deshayes' *U. anceps*. The type of the former is not in his collection, but there are two authentic, larger specimens. These are much more inflated, are more elongated than *anceps*, and have three distinct posterior rays. They are on the whole, less strongly sculptured than *anceps*. While it is possible that the two may run together, I am inclined to believe them distinct.

NODULARIA OCCATA (Lea).

Shell subrhomboid, subcompressed, inequilateral, rather solid; beaks low and subcompressed, their sculpture consisting of radial and somewhat zigzag ridges, this sculpture extending over the whole shell and becoming somewhat granulous; anterior end rounded; base line curved, slightly fuller near the posterior end; posterior ridge well developed, ending in a blunt point below the median line; dorsal slope obliquely, strongly truncate; surface covered with granular, concentric sculpture; epidermis dirty greenish, dull; pseudocardinals rather solid; laterals curved; anterior scars well impressed; posterior scars shallow; nacre bluish-white, flesh-colored in the cavities, iridescent.

Length 36, height 20, diam. 11 mm.

India.

Unio occatus, LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 307; Jl. Ac. N. Sci. Phila., VI, 1863, p. 398, pl. I, fig. 304; Obs., X, 1863, p. 34, pl. I, fig. 304.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIX, fig. 412.

Margaron (Unio) occatus LEA, Syn., 1870, p. 31.

Nodularia occata SIMPSON, Syn., 1900, p. 813.

Unio macilentus BENSON, Ann. and Mag., X, 1862, p. 187.—HANLEY, and THEOBALD, Conch. Ind., 1876, p. 5, pl. x, figs. 2, 4; p. 62, pl. CLIV, fig. 5.

Unio rugosus HANLEY and THEOBALD, Conch. Ind., 1876, p. 62, pl. CLIV, fig. 3.

More compressed than any of the allied species. It is a comparatively short, rhomboid form, covered throughout with granular concentric ridges and traces of zigzag sculpture.

NODULARIA MOSSAMBICENSIS (von Martens).

Shell subrhomboid, subsolid, inequilateral, somewhat inflated; beaks moderately full; anterior end rounded; base line curved, not very full behind the middle; dorsal outline lightly curved; dorsal slope obliquely subtruncated; posterior ridge low, rounded, ending in a rounded point below the median line; surface strongly concentrically striate; epidermis olivaceous; pseudocardinals subcompressed, triangular, sulcate; nacre pearly.

Length 41, height 24, diam. 17 mm.

Sennaar, northeast Africa; Mosambique, Zambezi River.

Unio mossambicensis VON MARTENS (Peter's manuscript), Mal. Bl., VI, 1860, p. 218, pl. III, figs. 3-5; Besch. Deuts. Ost. Af., 1897, p. 225, pl. VII, fig. 2.

Nodularia mossambicensis SIMPSON, Syn., 1900, p. 813.

Cafferia mossambicensis CONNOLLY, Ann. S. A. Mus., XI, 1912, p. 273.

Unio sennariensis var. VON MARTENS, Mal. Bl., XXI, 1873, p. 43.

Unio parreysi (v. d. Busch.) var. *schweinfurthi* VON MARTENS, Nov. Conch., IV, 1876, p. 140, pl. CXXXII, figs. 3-5.

I cannot be positive as to the relationship of this species, which I have never seen. The outline is subrhomboid, and in the specimen figured a very little cut away at the anterior base.

NODULARIA INORNATA (Lea).

Shell somewhat elongated, slightly obovate, thin, convex, inequilateral; beaks full and high; posterior ridge rounded, ending in a blunt point about on the median line; dorsal line lightly curved; anterior end rounded; base line rounded or nearly straight, full behind the middle; dorsal slope somewhat obliquely truncated; surface nearly smooth; epidermis dirty bluish-green or yellowish-green, dull, having two or more faint, posterior rays; teeth greatly compressed, attenuated; muscle scars shallow, faint; nacre bluish-silvery, iridescent.

Length 45, height 23, diam. 16 mm.

Siam; Cambodia.

Unio inornatus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 93;
Obs., VI, 1857, p. 13, pl. XXIV, fig. 6; Jl. Ac. N. Sci. Phila.,
III, 1858, p. 293, pl. XXIV, fig. 6.

Margaron (Unio) inornatus LEA, Syn., 1870, p. 47.

Nodularia inornata SIMPSON, Syn., 1900, p. 813.

Physunio inornatus HAAS, Conch. Cab., Unio, 1912, pl. 34,
figs. 3-4.

Much thinner than *carulea*, to which it seems closely related, and not so pointed nor angulated behind. The beak sculpture appears to be zigzag radial, but the beaks are too badly eroded in all the specimens seen to allow of any definite conclusion.

NODULARIA PACHYSOMA (Benson).

Shell somewhat elongated, inflated, rather solid, inequilateral; beaks full and high, their sculpture zigzag radial, not extending over the disk; posterior ridge strong, apparently inclined to be double, curved down in the middle, ending behind in a blunt point on the median line; anterior end rounded, subangulate above; base line lightly curved, quite full behind the middle; dorsal slope decidedly and obliquely truncate; surface apparently nearly smooth; epidermis bright green with faint, yellowish bands, with two or more dark green, posterior rays; hinge line nearly straight; teeth somewhat strong; laterals straight; nacre pinkish.

Length 45, height 22, diam. 20 mm.

Assam.

Unio pachysoma BENSON, Ann. and Mag., X, 1862, p. 186.—
HANLEY and THEOBALD, Conch. Ind., 1876, p. 6, pl. XII,
fig. 1.

Margaron (Unio) pachysoma LEA, Syn., 1870, p. 63.

Nodularia pachysoma SIMPSON, Syn., 1900, p. 813.

Unio pachystoma PÆTEL, Conch. Sam., III, 1890, p. 162.

This species is smoother and much more inflated than *carulea*, to which it is evidently nearly related, and it seems to be solid and brighter. The above description is drawn from the figures of this species in the Conchologia Indica, these figures being made from the type.

NODULARIA CHAUDHURII Preston.

"Shell small, rather thin, elongately ovate, pale olive, covered with a finely laminiferous periostracum; both valves concentrically striate, sculptured with irregular, minute, nodulous, radiate ridges, which appear posteriorly as regular corrugations; umbones small, somewhat prominent; dorsal margin slightly arched; ventral margin straight; anterior side produced, rounded; posterior side bluntly rostrate, abruptly sloping above and below; hinge-teeth elongate, anteriorly projecting; anterior scars deep, roundly triangular; posterior scars scarcely impressed; interior of shell iridescent, nacreous, posteriorly corrugate.

Long. 12.75, lat. 23 mm." (Preston).

Type locality, Upper Burma.

Nodularia (Nodularia) chaudhurii PRESTON, Rec. Ind. Mus., VII, 1912, p. 290.

NODULARIA BONNEAUDI (Eydoux).

Shell irregularly subrhomboid, much inflated, being decidedly fullest in the middle, inequilateral, rather thin; beaks full and high; dorsal outline curved; anterior end narrowed, more full above; base line nearly straight to a remarkable swelling behind the middle, and rounded from the swelling to the hinder end; posterior ridge well developed, subangular, ending in a rounded point a little below the median line; dorsal slope decidedly and obliquely truncate; surface with fine, wrinkled sculpture, especially on the dorsal slope; epidermis greenish, lightly banded with brownish; laterals delicate, curved; nacre bluish-white, brilliant.

Length 43, height 24, diam. 19 mm.

India.

Unio bonneaudi EYDOUX, Guer. Mag., 1838, p. 10, pl. cxix, figs. 1, 1a.—SOWERBY, Conch. Icon., XVI, 1868, pl. xcv, fig. 515.—HANLEY and THEOBALD, Conch. Ind., 1876, p. 5, pl. x, fig. 6.—ANDERSON, Yunnan Exp., 1878, p. 900, pl. lxxx, figs. 8-12.

Margaron (Unio) bonneaudi LEA, Syn., 1852, p. 32; 1870, p. 50.

Nodularia bonneaudi SIMPSON, Syn., 1900, p. 813.

More rhomboid than *N. cærulea* or any of the nearly allied forms, and decidedly inflated. Looking at the shell from above, its greatest diameter is at the middle, decreasing very suddenly toward each end. According to Eydoux the beaks are not roughened.

NODULARIA ASPERULA (Lea).

Shell somewhat obovate, convex or subinflated, thin, inequilateral; beaks high and full; posterior ridge full, narrowly double, ending in a narrow biangulation about on the median line; anterior end rounded, angular above; base line lightly curved, quite full behind the middle; hinge line curved; dorsal slope decidedly obliquely truncated; surface with faint, nodulous corrugations or almost smooth; epidermis yellowish-green, sometimes having feeble, yellowish bands, with two or three dark green rays on the posterior end, shining; teeth very much compressed; pseudocardinals well developed; laterals curved; muscle scars shallow; nacre bluish, brilliant and silvery.

Length 43, height 24, diam. 16 mm.

Siam; Cambodia.

Unio inornatus REEVE, Conch. Icon., XVI, 1865, pl. XXIX, fig. 147.

Unio asperulus LEA, Pr. Ac. N. Sci. Phila., X, 1866, p. 133; Jl. Ac. N. Sci. Phila., VI, 1868, p. 280, pl. XXXVIII, fig. 94; Obs., XII, 1869, p. 40, pl. XXXVIII, fig. 94.

Margaron (Unio) asperulus LEA, Syn., 1870, p. 31.

Nodularia asperula SIMPSON, Syn., 1900, p. 814.

Orynaia asperula HAAS, Con. Cab., Unio, 1910, pl. XIV, fig. 5.

Margaron (Unio) versus LEA, Syn., 1870, p. 46.

This species combines characters of the *cærulea* and *contractus* groups. The younger shells, which I have seen, would indicate close relationship to the former assemblage; adult specimens have characters of the latter. The species is not so elongated as *cærulea* or *inornata* and is more polished.

NODULARIA PUGIO (Eenson).

Shell irregularly long ovate, subsolid to solid, subinflated, inequilateral; beaks somewhat elevated but not very full; posterior ridge strong, sharply angled, nearly straight or lightly curved, ending in a decided, rather prolonged point at or below the median line; anterior end rounded; base line nearly straight, inflated behind the middle and ending behind in a long, oblique, truncation; hinge line decidedly curved behind the pseudocardinals; dorsal slope having a long, oblique truncation; surface irregularly striate; posterior slope often plicate; epidermis yellowish, tawny or greenish, often banded, subshining; pseudocardinals subcompressed, ragged; laterals remote; muscle scars impressed; nacre dirty flesh-color.

Length 60, height 30, diam. 20 mm.

Burma.

Unio pugio BENSON, Ann. and Mag., X, 1862, p. 193.—SOWERBY, Conch. Icon., XVI, 1868, pl. xcv, fig. 516.

Nodularia pugio SIMPSON, Syn., 1900, p. 814.

Orynaia pugio HAAS, Con. Cab., Unio, 1910, pl. xiv, figs. 6-7.

Sowerby's figure represents a young specimen. The color of this species is quite variable, some specimens being almost clear green, others olive-green, while still others are tawny, but all that I have seen are banded. The high, sharp posterior ridge and long, sharp posterior point are good distinguishing characters.

NODULARIA MICHELOTI (Morlet).

Shell subovate, solid, inflated, inequilateral, somewhat narrowed and rounded in front; base line lightly curved, full and rounded behind the middle; dorsal outline almost evenly curved; posterior ridge rather high, subangulate, placed close to the dorsal margin and parallel with it, ending in a blunt point above the median line; surface sculptured with irregular striæ; epidermis olive-green and black; pseudocardinals somewhat solid; laterals strong, nearly straight; anterior scars deep; posterior scars shallow; nacre straw-colored.

Length 38, height 21, diam. 15 mm.

Tonkin.

Unio micheloti MORLET, Jl. de Conch., XXXIV, 1886, pp. 77, 291, pl. XIII, figs. 6, 6a.

Nodularia micheloti SIMPSON, Syn., 1900, p. 814.

Orynaia micheloti HAAS, Con. Cab., Unio, 1910, pl. XIV, fig. 8-9; ("*O. hedeja* MABILLE"), *ibid*, pl. xv, figs. 1-2.

A rather small, solid, inflated, somewhat obovate species, which would seem from the figure to be closely related to *N. pugio*.

NODULARIA GLADIATOR (Ancey).

Type locality, Tonkin.

Unio gladiator ANCEY, Le Nat., III, 1881, p. 468.—SIMPSON, Syn., 1900, p. 862.—DAUTZENBURG and H. FISCHER, Jl. de Conch., LIII, 1905, p. 206.

The description of this species is not now accessible to me. Dautzenburg and Fischer, (l. c.), state that in their opinion the name will have to be dropped, as owing to the lack of a figure and a sufficient description, it is impossible to determine whether Ancey referred to *N. jourdyi* or *N. micheloti*.

NODULARIA FLUCTIGERA (Lea).

Shell somewhat elongated, subrhomboid, scarcely subsolid, convex, inequilateral, a little narrower in front, the anterior end being cut away below and narrowly rounded; base line straight or lightly incurved to behind the middle where it is full; dorsal outline curved a little; dorsal slope obliquely truncate behind; posterior ridge subangular, ending in a blunt point below the median line; beaks moderately full, but little elevated, sculptured with strong, oblique ridges, which are somewhat zigzagged and continued over the whole surface; in addition to this the growth lines are raised into numerous, distinct threads, causing the shell to appear somewhat unevenly reticulate; epidermis dull brownish-green or olive-green; teeth delicate, sublamellar; dorsal scars strong; muscle scars shallow; nacre bluish, iridescent, and in the examples seen, showing something of the external sculpture.

Length 48, height 21, diam. 14 mm.

Southeast Asia, no doubt.

Unio fluctiger LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 152; Jl. Ac. N. Sci. Phila., IV, 1860, p. 250, pl. XXXIX, fig. 130; Obs., VII, 1860, p. 68, pl. XXXIX, fig. 130.—KUSTER, Conch. Cab. Unio, 1861, p. 237, pl. LXXX, fig. 1.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLII, fig. 299.

Margaron (Unio) fluctiger LEA, Syn., 1870, p. 32.

Nodularia fluctiger SIMPSON, Syn., 1900, p. 814.

Nodularia fluctigera HAAS, Con. Cab., Unio, 1910, p. 107, pl. x, fig. 8.

In the description of this species Dr. Lea states that it belongs in the Cabinet of Mr. Cuming, and no locality is given. Two shells, which are labeled *Unio fluctiger*, are in his collection and seem to be genuine. These are said to come from the Yuruari River, British Guiana, received from R. P. Stevens. While this may be true, I am inclined to believe that there is some mistake about the locality, and that these shells came from Southeast Asia. The species is sculptured throughout with oblique, subradial ridges and in Lea's shells this sculpture is most decidedly zigzag. This is a character not found in any South American species, so far as I know, but it is very common in the shells of the Oriental region.

NODULARIA SCOBINATA (Lea).

Shell small, somewhat elongated, convex inequilateral, sub-solid; beaks only moderately full and high, their sculpture consisting of strong, zigzag-radial ridges, which extend over the entire surface; posterior ridge subangular, ending in a point on the median line; dorsal outline almost evenly curved; anterior end rounded; base line a little incurved, but becoming full behind, then obliquely truncated to the posterior point; in front of the posterior ridge there is a wide, radial inflation and in front of this a median depression; epidermis greenish, the ridges upon it bright green; pseudocardinals subcompressed; laterals curved; anterior scars impressed; nacre silvery, iridescent.

Length 34, height 15, diam. 11 mm.

Siam; Cochin-China; Cambodia.

Unio scobinatus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 93; Obs., VI, 1857, p. 19, pl. XXVI, fig. 13; Jl. Ac. N. Sci. Phila., III, 1858, p. 299, pl. XXVI, fig. 13.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXIII, fig. 313.—MORELET, Ser. Conch., IV, 1875, p. 354, pl. XVII, figs. 2-6.

Margaron (Unio) scobinatus LEA, Syn., 1870, p. 32.

Nodularia scobinata SIMPSON, Syn., 1900, p. 815.—HAAS, Con. Cab. Unio, 1910, p. 109, pl. x, figs. 9-11.

Unio mandarinus MORELET, Jl. de Conch., XII, 1863, p. 159.

Unio pellis-lucerti MORELET, Jl. de Conch., XIII, 1865, p. 22.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVI, fig. 457.—MORELET, Ser. Conch., IV, 1875, p. 355, pl. XVII, fig. 5.

Unio venustus MORELET, Jl. de Conch., XIV, 1866, p. 63.

Unio oblitus LEA, Syn., 1870, p. 64.

At first sight this seems to be only a form of Gould's *Unio crispata*, but a careful examination shows that there appears to be differential characters as Dr. Lea has pointed out. It is rather more elongated than *crispata* and has a median radial depression not found in that. The nacre is brighter than in Gould's shell and it is less inflated.

For this species and *N. persculpta* Haas, *fluctigera* Lea, *phaselus* Lea and *nucleus* Lea, Haas, (Conch. Cab., Unio, 1912, p. 105), has made a new section, *Scabies*.

NODULARIA DIESPITER (Mabille).

Type locality, Tonkin.

Unio diespiter MABILLE, Bull. Soc. Mal. Fr., IV, 1887, p. 162.—SIMPSON, Syn., 1900, p. 861.

Oxynaia diespiter HAAS, Con. Cab., Unio, 1910, pl. xv, fig. 3.

The description of this species is not now accessible to me. Haas, (l. c.), figures it and refers it to his new genus *Oxynaia*, but has not yet described it in his new monograph.

NODULARIA GRATIOSA (Philippi).

Shell small, much compressed, somewhat elongated, apparently subsolid; beaks neither full nor high; posterior ridge well developed, ending behind in a point on the median line; ante-

rior end narrowed and rounded; base line straight to behind the middle, where it is very full, behind this swelling the base is obliquely truncated; dorsal line lightly curved; dorsal slope decidedly and obliquely truncated; surface covered with zigzag-radial sculpture, dirty yellowish or greenish; pseudocardinals compressed, triangular; nacre salmon-tinted.

Length 23, height 13, diam. 6 mm.

Southeast Asia, no doubt.

Unio graciosus PHILIPPI, Conch., I, 1845, p. 20, pl. I, fig. 5.—

?KUSTER, Conch. Cab., Unio, 1861, p. 239, pl. LXXX, fig. 3.

Margaron (Unio) graciosus LEA, Syn., 1870, p. 32.

Nodularia graciola SIMPSON, Syn., 1900, p. 815.

A very dubious species, the figure probably representing a young shell. I am very strongly inclined to believe that Deshayes' *Unio anceps* is the adult form of this species, Philippi's figure representing a young, rather compressed form. Philippi's locality, New Holland, is evidently erroneous.

NODULARIA CRISPATA (Gould).

Shell rather solid, inflated or subinflated, ovate or irregularly elliptical; beaks rather full and high, having zigzag-radial sculpture, which extends over the surface of the shell; dorsal outline curved; anterior end rounded; base line lightly curved, full behind the middle; posterior ridge strong, sometimes slightly double, angled, ending in a point at or below the median line; surface dull greenish, the ridges darker; pseudocardinals subcompressed to subsolid, ragged; laterals curved; muscle scars impressed; nacre whitish to dirty flesh-colored.

Length 1.7, height .9, diam. .5 in.

British Burma.

Unio crispata GOULD, Pr. Bost. Soc. Nat. Hist., I, 1843, p. 141.

Unio crispatus HANLEY and THEOBALD, Conch. Ind., 1876, p. 21, pl. XLV, fig. 1.—VON MARTENS, Arch. Naturg., LXV, 1899, p. 42, pl. V, fig. 3.

Margaron (Unio) crispatus LEA, Syn., 1870, p. 32.

Nodularia crispata SIMPSON, Syn., 1900, p. 815.

Generally solider and more inflated than *scobinata*, and lacking the median depression seen in the shell of that species. The nacre is less brilliant and the muscle scars more impressed; the pseudocardinals are usually stronger. Yet there are intermediate specimens, which nearly connect the two.

NODULARIA NUCLEUS (Lea).

Shell very small, solid, inflated, subquadrate or subrhomboid, inequilateral; beaks full and high, with strong, zigzag-radial sculpture, which extends over the shell; dorsal outline curved; anterior end slightly narrowed, rounded; base line lightly curved, rather full behind the middle; posterior ridge high, subangular, ending near the base of the shell; posterior end obliquely rounded, almost truncate below; epidermis pale green, the ridges rich green; pseudocardinals much divided; laterals curved, strong; anterior scars deep; posterior scars shallow; nacre very brilliant, silvery, iridescent behind.

Length 15, height 9, diam. 8 mm.

Siam.

Unio nucleus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 94; Obs., VI, 1857, p. 26, pl. XXVIII, fig. 21; Jl. Ac. N. Sci. Phila., III, 1858, p. 303, pl. XXVIII, fig. 21.

Margaron (Unio) nucleus LEA, Syn., 1870, p. 30.

Nodularia nucleus SIMPSON, Syn., 1900, p. 815.—HAAS, Con. Cab., Unio, 1910, p. 113, pl. x, fig. 13.

If the only shell I have seen, the type, is adult, this is the smallest naiad I know of. The type is solid and much inflated, and has the appearance of being mature. It is shorter, more inflated, solider and more quadrate than *crispata* and has much brighter nacre.

NODULARIA PHASELUS (Lea).

Shell small, elongated, subsolid, inflated, inequilateral; beaks rather full and high, their sculpture apparently zigzag-radial; anterior end rounded and slightly narrowed; base line nearly straight, full near the hinder end; posterior ridge full, rounded, end in a blunt point on the median line; surface nearly smooth, slightly corrugated on the umbonal region and dorsal slope;

epidermis greenish straw-colored, with narrow, broken, green bands and zigzag, green markings, very smooth and shining; teeth compressed; beak cavities rather deep; anterior scars impressed; nacre bluish-white, silvery.

Length 27, height 13, diam. 11 mm.

Siam.

Unio phaselus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 94; Obs., VI, 1857, p. 17, pl. XXVI, fig. 11; Jl. Ac. N. Sci. Phila., III, 1858, p. 297, pl. XXVI, fig. 11.

Margaron (Unio) phaselus LEA, Syn., 1870, p. 32.

Nodularia phaselus SIMPSON, Syn., 1900, p. 815.—HAAS, Con. Cab., Unio, 1910, p. 111, pl. x, fig. 12.

I have seen but a single shell of this species, the type, and it seems nearly related to *N. crispata*. Its smooth surface and shining, greenish-yellow epidermis, marked with rich green, distinguish it from any allied species.

NODULARIA SCOBINA (Hanley).

Shell decidedly rhomboid, subcompressed, rather solid, inequilateral; beaks only moderately full or high; posterior ridge well developed, sometimes slightly double, ending in a point or faint biangulation near the base of the shell; anterior end rounded; base line nearly straight, slightly incurved in the middle, a little inflated near the posterior end; dorsal slope obliquely subtruncate; surface covered with raised, more or less broken, subradial, somewhat zigzag corrugations, in some places resembling a worn rasp; epidermis greenish, with a dark green ray on the dorsal slope; pseudocardinals somewhat rudimentary; nacre bluish, iridescent behind.

Length 32, height 17 mm.

Assam.

Unio scobina HANLEY, Biv. Shells, 1856, p. 382, pl. XXIII, fig. 40.—HANLEY and THEOBALD, Conch. Ind., 1876, p. 22, pl. XLVI, figs. 2, 3.

Nodularia scobina SIMPSON, Syn., 1900, p. 816.

The shell of this species, according to the figures and description, is shaped a good deal like that of *N. fluctigera*, but is more solid, has more broken sculpture and is not so elongated. According to Hanley and Theobald it is very rare.

Group of *Nodularia pazii*.

Shell thin, with the hinder point long drawn out, posterior ridge double, low, and sharp, the dorsal line above this straight or incurved; beak sculpture not seen; surface of the shell smooth, dull olive-colored; teeth exceedingly compressed; pseudocardinals long, lamellar.

NODULARIA PAZII (Lea).

Shell irregularly long ovate, inflated, rather thin, inequilateral; beaks full and high, with a narrow, well-marked lunule in front of them; posterior ridge low, very close to the dorsal margin, angled above, with the outline of the dorsal slope curved downward a little in the middle, ending about on the median line in a long, slightly up-curved beak; anterior end rounded; base lightly curved, slightly prominent behind the middle, behind the prominence obliquely truncated; surface with delicate, irregular growth lines; epidermis dirty olive with lighter bands, silky; teeth lamellar, there being one greatly compressed pseudocardinal and two laterals in the left valve, and two pseudocardinals and one lateral in the right; beak cavities excavated; muscle scars shallow; nacre bluish, faintly iridescent behind.

Length 64, height 29, diam. 22 mm.

China; Siam; Cambodia.

Unio pazii LEA, Pr. Ac. N. Sci. Phila., VI, 1862, p. 176; Jl. Ac. N. Sci. Phila., VI, 1866, p. 61, pl. XXI, fig. 60; Obs., XI, 1867, p. 65, pl. XXI, fig. 60.—SOWERBY, Conch. Icon., XVI, 1868, pl. XCII, fig. 502.

Margaron (Unio) pazii LEA, Syn., 1870, p. 39.

Nodularia pazii SIMPSON, Syn., 1900, p. 816.

Orynaia pazii, HAAS, Con. Cab., Unio, 1910, pl. XIV, figs. 10-11.

A most striking and attractive species. When fresh the epidermis is rather dull and silky but when it is worn it becomes smooth and somewhat shining and exhibits faint traces of rays. I know of no species in which the teeth are more compressed.

For this group Frierson has recently proposed the new generic name of *ENSIDENS*, (Naut., XXIV, 1911, p. 98). He says:

"The *Unio ingallsiana* Lea differs generically from *Nodularia* in having little or no beak sculpturing and in having a smooth shell. Its cardinal teeth are blade-like and double in the right valve and single in the left. The cardinal teeth form a part of the general inner part of the shell, not having a "fulcrum" (as the buttress-like thickening of the noose supporting the cardinal teeth, and extending posteriorly to the adductor scar, may be called), which is so generally shown in most *Unionidae*. The "third anterior muscular scar" is separate from the anterior adductor scar, whereas in *Nodularia* they are always confluent and not easy to differentiate. For those shells, as the *Unio pazii* Lea (and *ingallsiana* Lea), exhibiting these characters as outlined, the writer proposes the new genus *ENSIDENS*. Two other peculiarities of the two species named may prove to be of generic significance, but at present they may be regarded as being of specific import merely. These are the entire confluence of the anterior adductor and the "protractor pedis" muscle scar, and that the escutcheon is half way the length of the lateral teeth."

NODULARIA JOURDYI (Morlet).

Shell somewhat elongated, solid, greatly inflated, inequilateral; beaks full and high, with undulated sculpture; posterior ridge not greatly elevated but decidedly angled, curved slightly downward in the middle; anterior end rounded, somewhat angled above; base line curved, fuller behind the middle with a long, sloping truncation at the posterior end; posterior point above the median line; surface lightly striate; epidermis brownish-green; pseudocardinals subsolid, somewhat compressed; laterals lightly curved; anterior scars deep; posterior scars shallow; nacre white.

Length 50, height 24, diam. 22 mm.

Tonkin.

Unio jourdyi MORLET, Jl. de Conch., XXXIV, 1886, pp. 76, 289, pl. XIII, figs. 5, 5a.

Nodularia jourdyi SIMPSON, Syn., 1900, p. 816.

Orynaia jourdyi HAAS, Con. Cab., Unio, 1910, pl. XVI, figs. 1-2.

Var. *corrugata* (Dautzenburg and H. Fischer).

"In this variety the tuberculous sculpture of the beaks extends down over part of the disk." (D. & F.)

Unio jourdyi var. *corrugata* DAUTZENBURG and H. FISCHER, Jl. de Conch., LIII, 1905, p. 205.

Var. *ponderosa* (Dautzenburg and H. Fischer).

This variety differs from typical *U. jourdyi* by its much thicker shell, its higher and much more inflated anterior region and its more prominent beaks." (D. & F.)

Type locality, Grand Lac, Hanoi.

Unio jourdyi var. *ponderosa* DAUTZENBURG and H. FISCHER, Jl. de Conch., LIII, 1905, p. 453.

In the synopsis I placed this species in the *pazii* group, but it is probable that it should go in the group of *N. carulea*. While its external appearance is something like that of *N. pazii*, the pseudocardinals are much shorter and stronger. It seems to stand between the two groups. The shell is more inflated behind the middle than *N. pazii*.

Haas has recently, (Nachr. Deutsch. Mal. Ges., 1913, p. 34), made this species the type of a new genus, *Orynaia*.

NODULARIA INGALLSIANA (Lea).

Shell elongated, inflated, scarcely subsolid, inequilateral, inflated; beaks full and high; anterior end rounded; base nearly straight in front, full behind the middle, slopingly truncate behind the swelling to the posterior point, which is situated above the median line; posterior ridge near the dorsal line, angled above, straight; surface with delicate, irregular growth lines; epidermis dull, silky, olive with lighter bands, with faint

indications of rays; teeth very greatly compressed; muscle scars shallow; nacre bluish, brilliant and iridescent behind.

Length 49, height 21, diam. 16 mm.

Cochin-China; Siam; Cambodia.

Unio ingallsianus LEA, Tr. Am. Phil. Soc., X, 1852, p. 282, pl. XXIV, fig. 41; Obs., V, 1852, p. 38, pl. XXIV, fig. 41.—REEVE, Conch. Icon., XVI, 1865, pl. XXVI, fig. 126.

Margaron (Unio) ingallsianus LEA, Syn., 1852, p. 36; 1870, p. 58.

Nodularia ingallsiana SIMPSON, Syn., 1900, p. 816.

Oxynaia ingallsiana HAAS, Con. Cab., Unio, 1910, pl. XVI, figs. 3-4.

This differs from *N. pazii* in the following slight characters: It is not so wedge-shaped when viewed from above; it is fuller at the basal inflation; it is more nearly equilateral and the nacre is more brilliant. I have seen only the type, which is smaller than *N. pazii*, while I have before me several specimens of the latter. It is quite probable that a sufficient amount of material would show that these two absolutely blend together.

Group of *Nodularia trompi*.

Shell small, subtrapezoidal, wider behind, slightly inflated, with a rounded posterior ridge; beaks full, sculpture not seen; surface covered with very fine, nodulous, somewhat zigzag corrugations, with upcurved posterior ridges on the posterior slope; epidermis reddish-brown or black; hinge-teeth compressed; pseudocardinals vertically striate.

NODULARIA TROMPI (Drouet and Chaper).

Shell small, subrhomboid, narrower in front, convex, scarcely subsolid, inequilateral; beaks apparently moderately full and not high; anterior end rounded, angled above; base nearly straight, inflated near the posterior end; dorsum slightly curved; dorsal slope obliquely truncate; posterior ridge rounded, ending in a rounded point near the base of the shell; surface covered with fine, subnodulous sculpture, which is sometimes connected and zigzagged; dorsal slope sculptured with fine,

radial wrinkles; epidermis reddish-brown becoming burnt-blackish on the border; pseudocardinals compressed, two in each valve; laterals delicate, curved; muscle scars shallow; nacre rich blue, iridescent behind.

Length 29, height 14.5, diam. 9.5 mm.

Borneo.

Unio trompi DROUET and CHAPER, Mem. Soc. Zool. Fr., V, 1892, p. 153, pl. VI, figs. 8-10.

Nodularia trompi SIMPSON, Syn., 1900, p. 816.

Elongaria trompi HAAS, Con. Cab., Unio, 1910, pl. XVII, fig. 6.

Remarkable for the peculiar subnodulous and granulated sculpture, which, on the anterior end, becomes somewhat connected and zigzagged, and for the intense burnt-brown and blackish epidermis. The nacre in the specimens before me is very rich sky blue, and iridescent behind.

Group of *Nodularia olivaria*.

Shell thin, inflated, blue-green or olive-green, smooth, shining, with two or more faint ridges on the posterior slope; beaks and disk almost or quite destitute of sculpture; teeth greatly compressed, lamellar.

NODULARIA OLIVARIA (Lea).

Shell very thin, subinflated, irregularly long elliptical, inequilateral; beaks moderately full and high, apparently without sculpture, or with only faint indications of it; anterior end rounded; base lightly curved, full behind the middle, obliquely subtruncated behind; posterior ridge showing indications of being double, the region in front of it very full, the ridge ending in a blunt point on or above the median line; surface apparently smooth but having very fine growth lines and often faint, microscopic, radial sculpture; epidermis delicate bluish-green, often with a milky tint, darker on the dorsal slope where there are faint rays; teeth compressed, elevated into sharp lamellæ; beak cavities rather deep; nacre bluish with a decided milky tint.

Length 40, height 22, diam. 15 mm.

India.

Unio olivarius LEA, Tr. Am. Phil. Soc., IV, 1831, p. 108, pl. XVI, fig. 38; Obs., I, 1834, p. 118, pl. XVI, fig. 38.—HANLEY, Biv. Shells, 1843, p. 195, pl. XXII, fig. 32.—CHENU, Ill. Conch., 1858, pl. VIII, figs. II, 11a, 11b.—KUSTER, Conch. Cab. Unio, 1861, p. 244, pl. LXXXII, fig. 2.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVI, fig. 195.—HANLEY and THEOBALD, Conch. Ind., 1876, p. 5, pl. X, fig. 1.

Margarita (Unio) olivarius LEA, Syn., 1836, p. 26; 1838, p. 20.

Margaron (Unio) olivarius LEA, Syn., 1852, p. 30; 1870, p. 47.

Nodularia olivaria SIMPSON, Syn., 1900, p. 817.

Unio pumilio KUSTER, Conch. Cab. Unio, 1862, p. 268, pl. xc, fig. 7.

A very delicate species remarkable for its faint, radial sculpture and milky tint within and without.

NODULARIA THEOBALDI Preston.

"Shell ovately rectangular, very slightly curved, gaping anteriorly, moderately solid, concentrically striate, covered with a dark, olivaceous periostracum; umbones small, not prominent; dorsal margin somewhat arched; ventral margin slightly excavated in the median region, otherwise straight; anterior side slightly produced and somewhat sharply rounded; posterior side very obtusely rostrate, steeply sloping above, then sharply rounded and again sloping inwards below. Cardinal teeth in right valve roughly triangular, jagged, somewhat inwardly projecting, fitting between two teeth in the left valve, which are roughened and of which the anterior is rather broad and massive; lateral teeth in both valves elongate and nearly straight; anterior scars somewhat deeply excavated, especially above; posterior scars ovate, lightly impressed; interior of shell nacreous, shading from pale flesh-color to bluish, iridescent, especially towards the posterior margin.

Long. 34, lat. 60, diam. 90 mm." (Preston).

Type locality, Manipur, Assam.

Nodularia (Nodularia) theobaldi (Nevill, MS.), PRESTON, Rec. Ind. Mus., VII, 1912, p. 292.

NODULARIA PECTEN Preston.

"Shell elongately ovate, rather thin, covered with a finely lamiferous periostracum of a pale bluish-green color shading to yellowish-green towards the margins, finely concentrically striate and posteriorly ribbed, especially on the left valve; umbones rather small, moderately prominent; dorsal margin very slightly arched; ventral margin gently curved; anterior side rounded; posterior side obtusely rostrate below, sloping above; hinge-teeth in both valves weak, anteriorly erect in the right valve, sinuous and almost twisted in the left; posterior teeth nearly straight, moderately elongate; adductor scars scarcely perceptible; interior of shell pearly.

Long. 19, lat. 33.5, diam. 12 mm." (Preston).

Type locality, Pitsanuloke, N. Siam.

Nodularia (Nodularia) pecten PRESTON, Rec. Ind. Mus., VII, 1912, p. 292, pl. VIII, figs. 3, 4.

"The author follows Simpson in placing this and the next two species (*nuttalliana* and *involuta*) in the Section *Nodularia*, though, owing to the very different texture of the shells, it is somewhat difficult to understand his reasons for so placing them."

NODULARIA NUTTALLIANA (Lea).

Shell irregularly elliptical, scarcely subsolid, subinflated, inequilateral; beaks high and rather full; anterior end rounded; base lightly curved, full behind the middle, then obliquely subtruncated; dorsal slope obliquely subtruncate; posterior ridge high, subangular, ending on the median line in a point; epidermis yellowish-green with paler bands and faint rays on the dorsal slope, nearly smooth, shining, feebly rayed; pseudo-cardinals compressed, elevated; laterals curved, high; muscle scars well marked; beak cavities impressed; nacre whitish or yellowish, with a dark, bluish blotch in the beak cavities.

Length 25, height 20, diam. 13.5 mm.

India.

Unio nuttallianus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 103; Obs., VI, 1857, p. 30, pl. XXX, fig. 25; Jl. Ac. N. Sci. Phila., III, 1858, p. 310, pl. XXX, fig. 25.—HANLEY and THEOBALD, Conch. Ind., 1876, p. 19, pl. XLI, figs. 5, 6.

Margaron (Unio) nuttallianus LEA, Syn., 1870, p. 74.

Nodularia nuttalliana SIMPSON, Syn., 1900, p. 817.

More solid and rather shorter than *N. olivaria*, to which it is apparently closely allied. The epidermis is yellowish-green with light bands and is not milky, the nacre is differently colored and in the specimens examined has a dark, bluish blotch in the cavities of the beaks. All the specimens I have seen have the beaks slightly eroded, but they exhibit no traces of sculpture.

NODULARIA INVOLUTA (Benson).

Shell irregularly ovate, slightly inequilateral, compressed behind, swollen below the umbonal region, thin, polished; pale green obscurely radiate with yellowish, bluish above, polished, with two or three dark rays on the dorsal slope; beaks very high and full, with a few light corrugations; anterior end narrowly rounded above, cut away below; base rounded and full about the middle, slopingly cut away behind to a point on the median line; posterior ridge low; pseudocardinals elevated; laterals large, lamellar; nacre silvery.

Length 44, height 30 mm.

Assam.

Unio involutus BENSON, Hanley Biv. Shells, 1856, p. 385, pl. XXIII, fig. 19.—HANLEY and THEOBALD, Conch. Ind., 1876, p. 19, pl. XLI, fig. 2.

Margaron (Unio) involutus LEA, Syn., 1870, p. 37.

Unio involuta SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIV, fig. 177.

Nodularia involuta SIMPSON, Syn., 1900, p. 817.

Differs from *N. olivaria* in being more ovate, in having much higher beaks, which, according to Hanley, have some sculpture, in being cut away at the anterior base, and having rays. A

striking form with an outline something like that of *Plagiola elegans*, though not quite so much cut away on the dorsal slope.

Group of *Nodularia contradens*.

Shell inflated, obovate, rhomboid, with a slight swelling at the post-base, and a well-developed posterior ridge; beaks full and high, the sculpture consisting of wavy, zigzag ridges, which often extend over the shell as somewhat nodulous corrugations; pseudocardinals obliquely or vertically striate; laterals curved; cavity of the beaks rather shallow.

NODULARIA CONTRADENS (Lea).

Shell scarcely subsolid, subrhomboid or obovate, convex to subinflated, inequilateral; beaks but little elevated; posterior ridge inclined to be double, ending in a feeble biangulation at or below the median line; anterior end rounded, somewhat narrowed; base line curved, full behind the middle; dorsal slope obliquely truncate; surface with fine growth lines and indications of nodulous sculpture, the dorsal slope with faint, fine plications; epidermis dirty yellowish-green, darker and somewhat rayed behind the posterior ridge, subshining; teeth much compressed; laterals curved; muscle scars shallow; nacre bluish.

Length 58, height 34, diam. 21 mm.

Length 55, height 32, diam. 18 mm.

Java.

Unio contradens LEA, Tr. Am. Phil. Soc., VI, 1838, p. 75, pl. XVIII, fig. 58; Obs., II, 1838, p. 75, pl. XVIII, fig. 58.—HANLEY, Biv. Shells, 1843, p. 209, pl. XXII, fig. 8.—CHENU, Ill. Conch., 1858, pl. XXIX, figs. 4, 4a, 4b.—REEVE, Conch. Icon., XVI, 1865, pl. XXIX, fig. 149.

Margarita (Unio) contradens LEA, Syn., 1838, p. 25.

Margaron (Unio) contradens LEA, Syn., 1852, p. 39; 1870, p. 46.

Nodularia contradens SIMPSON, Syn., 1900, p. 817.

Contradens contradens HAAS, Conch. Cab. Unio, 1912, pl. 18, figs. 2-5.

Unio javanus LEA, Pr. Am. Phil. Soc., I, 1840, p. 285; Tr. Am. Phil. Soc., VIII, 1842, p. 220, pl. XVIII, fig. 37; Obs., III, 1842, p. 58, pl. XVIII, fig. 37.—CHENU, Ill. Conch., 1858, pl. XXVIII, figs. 4, 4a, 4b.—KUSTER, Conch. Cab. Unio, 1856, p. 138, pl. XII, fig. 3; 1861, p. 236, pl. LXXIX, figs. 4, 6.—SOWERBY, Conch. Icon., XVI, 1868, pl. xc, fig. 489.

Margaron (Unio) javanus LEA, Syn., 1852, p. 30.

Unio exilis DUNKER, Zeits. für Mal., III, 1846, p. 109.—MOUSSON, L. and S. W. Moll. Java, 1849, p. 92, pl. XVI, fig. 3.

Margaron (Unio) exilis LEA, Syn., 1852, p. 29.

Unio mutatus MOUSSON, L. and S. W. Moll. Java, 1849, p. 92, pl. XVI, figs. 1, 2.

Margaron (Unio) mutatus LEA, Syn., 1852, p. 29.

Unio mederianus KUSTER, Conch. Cab. Unio, 1861, p. 242, pl. LXXX, fig. 7.

The type does not seem to be in the Lea collection, but it contains a typical example of larger dimensions, the measurements of which I have given.

Haas has recently, (Nachr. Deutsch. Mal. Ges., 1913, p. 35), made this species the type of a new genus, *Contradens*.

NODULARIA SEMMELINKI (von Martens).

“Shell transversely elliptical, solid, concentrically and rather coarsely striate, yellowish-brown, blackish posteriorly; anterior end short, rounded; posterior end elongate, subrostrate, with three angular lines radiating from the beaks, the lowest very obtuse, raised, then obtusely biangulated; ventral margin slightly arcuate, distinctly ascending anteriorly; beaks situated at $\frac{2}{7}$ of the length; umbones quite inflated, eroded, sculptured in front and behind with elevated, granulated lines, concentric in front and radial behind. Areola distinct, narrowly lanceolate, horizontal, smooth; area prominent, convex. Nacre pale yellowish-flesh-color, with a deeper colored submarginal band. Cardinal teeth compressed, lamellar, obliquely rugose, subcrenulate, two in the right valve, unequal, one in the left valve with an accessory obtuse, subvertical tubercle. Posterior teeth lamellar, not very heavy, quite arcuate, obliquely ru-

gose, subcrenulate, one in the right valve, two in the left, of equal length, the superior much lower. Accessory anterior muscular impression small, subcircular, close to the adductor.

Length 71, height 40, diam. 29.5, length of ligament 20 mm." (von Martens).

Type locality, Tana-laut, Borneo.

Unio semmelinki VON MARTENS, Sitzber. Ges. Nat. Fr. Ber., 1891, p. 111.—SIMPSON, Syn., 1900, p. 834.

Contradens semmelinki HAAS, Conch. Cab. Unio, 1912, pl. 20, figs. 6, 7.

"Related to *U. javanicus* (*mutatus* Mouss), from Java, but larger, proportionately thicker, more inflated, with stronger striæ, more obtuse behind, the beak sculpture extends less widely downward behind and lacks the sharply angled lines that in the example of *U. mutatus* in the Dunker Collection from v. d. Busch (with a proportionately equal erosion of the beaks) are clearly present, though entirely lacking both in the description and the figure of Mousson. The color, both externally and internally, is also different. On the other hand, the hinge is very much the same.

As I have seen only a single specimen from either Borneo or Java, it is impossible to say whether these differences are constant or not."

NODULARIA LATICEPS (von Martens).

"Shell elliptical, inflated, solid, concentrically striate; epidermis brown, opaque; anterior end rounded; posterior elongated, subrostrate; an obtusely angulated line extends backwards and downwards from the beaks, becoming obsolete posteriorly; umbones wide, beaks moderately prominent, at about $\frac{1}{3}$ of the length; anterior and posterior dorsal margin subhorizontal; posterior sloping obliquely; ventral slightly curved; cardinal teeth compressed, subelongate, parallel with the dorsal margin, slightly crenulate; interior bluish-white, pale yellowish towards the umbones.

a. Length 80, height 41, diam. 34 mm.

b. Length 66, height 38, diam. 33 mm." (von Martens).

Type locality, Lake Danau Baru, Indragiri, Sumatra.

Unio laticeps VON MARTENS, Nachr. Deutsch. Mal. Ges., 1900, p. 15.

Conradens semmelinki laticeps HAAS, Conch. Cab., Unio, 1912, pl. 20, fig. 8; pl. 21, fig. 1.

"Greatest diameter in 'a' decidedly, in 'b' only slightly behind the beaks."

NODULARIA HAGENI (Strubell).

"Shell scarcely moderate, elongate-ovate, not at all ventricose, rather thin but quite solid, rudely costulate-striate, somewhat shining, blackish-brown. Anterior end much attenuated, compressed; posterior end elongate, the greatest height being at the junction of the dorsal and posterior margins. Dorsal margin ascending, scarcely curved, meeting the posterior margin at a distinct angle, passing in to the depressed anterior margin in a scarcely angulated curve; ventral margin subhorizontal, forming with the obliquely descending, sub-bian-gulated posterior margin a straight, obliquely rounded-truncate rostrum. Umbones anterior, depressed, much eroded; areola almost obsolete; area elongate, compressed, indistinctly becarinate; ligament thin, quite long. Hinge very weak; tooth of the right valve almost obsolete; lateral elongate, narrow. Muscular and pallial impressions superficial; nacre bluish, livid-brown towards the umbones.

Length 55, height 30, diam. 17 mm." (Strubell).

Type locality, South Sumatra.

Microcondylea hageni STRUBELL, Nachr. D. Mal. Ges. 1897, p. 8.

Conradens hageni HAAS, Conch. Cab., Unio, 1912, pl. 18, figs. 6, 7.

NODULARIA DIMOTA (Lea).

Shell irregularly rhomboid, inflated, subsolid, inequilateral, narrowed and rounded in front; beaks full and considerably elevated; posterior ridge double, ending in a biangulation near the base line; base line curved, fuller behind the middle; dorsal slope obliquely truncate; surface usually more or less covered with fine, subconcentric, slightly zigzagged sculpture, with

radial plications on the dorsal slope; epidermis dark tawny-greenish or brownish with a smoky tint, with one or two posterior rays, somewhat shining; teeth compressed, the laterals curved; muscle scars not deep; nacre bluish-white.

Length 58, height 33, diam. 24 mm.

Sumatra.

Unio sumatrensis LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 153; Jl. Ac. N. Sci. Phila., IV, 1860, p. 239, pl. xxxiv, fig. 118; Obs., VII, 1860, p. 57 pl. xxxiv, fig. 118.

Margaron (Unio) dimotus LEA, Syn., 1870, p. 30.

Nodularia dimota SIMPSON, Syn., 1900, p. 818.

Contradens dimotus HAAS, Conch. Cab., Unio, 1912, pl. 19, figs. 1-5.

Unio hageni STRUBELL, Nachr. Deutsch. Mal. Ges. 1897, p. 10.

Unio hagnei SIMPSON, Syn., 1900, p. 862.

Rather solid, more inflated and darker colored than *N. contradens*. The sculpture is peculiar, and generally more pronounced than in *contradens*.

Changed to *dimotus* by Lea because *sumatrensis* was preoccupied for a *Unio* by Dunker.

NODULARIA FISCHERIANA (Morlet).

Shell subrhomboid, inflated, rather solid, inequilateral; beaks moderately full and high; posterior ridge well developed, subangular above, double below, ending in a biangulation at and below the median line; anterior end a little narrowed, rounded, somewhat angulate above; base line lightly curved, full behind the middle; dorsal line curved; dorsal slope obliquely and decidedly truncated; surface nearly smooth; olive-green with lighter bands; teeth much compressed, lamellar; muscle scars well marked; nacre bluish-white, yellowish in the cavities.

Length 58, height 33, diam. 27 mm.

Cambodia.

Unio fischerianus MORLET, Jl. de Conch., XXXI, 1883, p. 109, pl. iv, fig. 6.

Nodularia fischeriana SIMPSON, Syn., 1900, p. 818.

Contradens dimotus fischerianus HAAS, Conch. Cab., Unio, 1912, pl. 19, fig. 8.

Morlet states that the pseudocardinals are but slightly indicated. The shell appears to be nearly smooth and devoid of folds or nodules.

NODULARIA ANODONTÆFORMIS (Tapperone-Canefri).

Shell large, subrhomboid, subsolid, inequilateral, somewhat inflated; beaks high and full; anterior end subangulate above, rounded below; base lightly curved, full a little behind the middle; from the inflation to the hinder point the outline is straight; posterior ridge well developed, rounded, ending near the base of the shell in a blunt point or feeble biangulation; dorsal slope strongly and obliquely truncate; surface with irregular, concentric sculpture and faint indications of nodulous or zigzag sculpture; epidermis reddish-brown, olive-tinted on the umbonal region, sometimes with a very wide, nearly black posterior ray, shining; left valve with a compressed, ragged pseudocardinal and two remote, delicate laterals; right valve with two pseudocardinals and one lateral; dorsal scars large and conspicuous; anterior scars irregular; posterior scars shallow; pallial line sometimes having indications of a posterior sinus; nacre whitish, brownish, iridescent behind.

Length 121, height 64, diam. 43 mm.

New Guinea.

Unio (Microdontia) anodontæformis TAPPERONE-CANEFRI, Ann. Mus. Genov., XIX, 1883, p. 295, pl. XI, figs. 3-5.

Nodularia anodontæformis SIMPSON, Syn., 1900, p. 818.

Microdontia anodontæformis HAAS, Con. Cab., Unio, 1910, pl. 16, fig. 6.

A fine, large species, of which four matched valves are before me. The beaks of all these are somewhat eroded, but it is probable that they have but slight sculpture. The nacre is slightly thickened in front.

NODULARIA OVATA (Haas).

"Shell almost equilateral, high, solid. Outline elliptical, showing only at the hinder end a blunt angle. Beaks almost central, situated at $41/100$ of the length, rather prominent and

inflated. Beak sculpture unknown on account of the great erosion. Area low. Hinge weak; two small, lamelliform cardinal teeth in the right valve, the lower stronger than the upper; one rather strong cardinal tooth in the left valve. Angle of the cardinal teeth 35° , of the lateral teeth 20° . Muscular impressions, anterior large, ear-shaped, not deep, posterior large, somewhat more shallow; dorsal impressions deep. Nacre porcellaneous, bluish-white. Epidermis chestnut-brown, strongly, but irregularly, furrowed.

Length 81, height 56, diam. 37 mm." (Haas).

Type locality, New Guinea, (Fly River?).

Microdentia ovata HAAS, Nachr. Deutsch. Mal. Ges., 1910, p. 100; Con. Cab. Unio, 1910, pl. 16, fig. 5.

NODULARIA SACELLUS (Drouet and Chaper).

Shell irregularly rhomboid, thin, narrowed in front, inequilateral, convex; beaks only moderately full and high; dorsal line nearly straight; anterior end rounded; base curved and full behind the middle; dorsal slope almost squarely truncated; posterior ridge well developed, somewhat double, ending in a feeble biangulation near the base of the shell; epidermis dirty brownish-green, sometimes banded; surface almost smooth, with a few faint plications on the dorsal slope; teeth very delicate, much compressed; in each valve almost under the beaks there is a rounded tubercle; muscle scars shallow; nacre bluish, salmon in the cavities, iridescent behind.

Length 55, height 35, diam. 18 mm.

Borneo.

Unio sacellus DROUET and CHAPER, Mem. Soc. Zool. Fr., V, 1892, p. 148, pl. v, figs. 4-6.

Nodularia sacellus SIMPSON, Syn., 1900, p. 818.

Conradens dimotus sacellus HAAS, Conch. Cab., Unio, 1912, pl. 19, fig. 6.

I was at first inclined to believe that this and the next species were merely varieties of the same thing, but close examination reveals several minor differences. This species is a little higher in proportion to length, is more squarely truncate

behind, is lighter colored; it has the peculiar tubercles on the hinge, which seem to be lacking in *lugens*, and the nacre is a little different.

NODULARIA LUGENS (Drouet and Chaper).

Shell irregularly rhomboid, narrowed in front, thin, convex, inequilateral; beaks moderately full and high; anterior end rounded, angled above; base line curved, full behind the middle; dorsal line lightly curved; dorsal slope strongly, obliquely truncated, posterior ridge well developed, ending in a point near the base; surface nearly smooth, with some faint plications on the dorsal slope; epidermis rich reddish-brown, subshining; teeth delicate, compressed; muscle scars shallow; nacre blue, iridescent behind.

Length 54, height 32, diam. 18 mm.

Borneo.

Unio lugens DROUET and CHAPER, Mem. Soc. Zool., Fr., V, 1892, p. 147, pl. v, figs. 1-3.

Nodularia lugens SIMPSON, Syn., 1900, p. 818.

Contradens dimotus lugens HAAS, Conch. Cab., Unio, 1912, pl. 19, fig. 7.

The posterior ridge of the specimens I have seen is single, while in *sacellus* it is somewhat double; the nacre is deep blue with only a faint hint at yellowish in the beak cavities, while in *sacellus* it is lighter colored and decidedly flamed with salmon in the beak cavities.

NODULARIA INÆQUALIS (Rochebrune).

Shell subrhomboid, inflated, thin, inequilateral; beaks full and high, ornamented with granulous, angular wrinkles; posterior ridge full, somewhat double below, ending at and below the median line in a faint biangulation; anterior end a very little narrowed, rounded; base line almost evenly curved, slightly fuller behind the middle; dorsal line curved; dorsal slope obliquely truncate; epidermis brown or green-brown; teeth compressed; muscle scars shallow; nacre bluish-white.

Length 47, height 29, diam. 21 mm.

River Sraqueo, Siam.

Unio inæqualis ROCHEBRUNE, Bull. Soc. Phila., 1882, p. 44.—
SIMPSON, Syn., 1900, p. 862.

Orynaia inæqualis HAAS, Con. Cab., Unio, 1910, pl. XIIIa, fig. 5; pl. XV, fig. 7.

Unio semidecoratus MORLET, Jl. de Conch., XXXVII, 1889, p. 192, pl. VIII, fig. 4.

Nodularia semidecorata SIMPSON, Syn., 1900, p. 819.

The figure of this species given by Morlet is rather inferior. The umbonal region seems to be decidedly sculptured; the beaks are higher, and the shell is thinner than is the case with *N. fischeriana*.

NODULARIA RUSTICA (Lea).

Shell subsolid, irregularly ovate, inflated, inequilateral; beaks very full and high, their sculpture coarse, zigzag corrugations, which extend out on to the disk and gradually change to subnodulous sulcations; lunule well marked; anterior end narrow; base line almost evenly curved, but slightly produced behind the middle; hinge line with the compressed teeth curved; posterior ridge angled above; narrowly rounded below and ending in a blunt point near the median line; epidermis dirty yellowish-green, darker behind; beak cavities rather deep; muscle scars impressed; nacre whitish or bluish-white.

Length 59, height 36, diam. 25 mm.

Siam; Cambodia.

Unio rusticus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 93;

Obs., VI, 1857, p. 14, pl. XXV, fig. 7; Jl. Ac. N. Sci. Phila., III, 1858, p. 294, pl. XXV, fig. 7.—MORELET, Ser. Conch., IV, 1875, p. 353, pl. XVII, fig. 7.

Margaron (Unio) rusticus LEA, Syn., 1870, p. 31.

Nodularia rustica SIMPSON, Syn., 1900, p. 819.

Contradens rusticus HAAS, Conch. Cab., Unio, 1912, pl. 21, figs. 2-4.

Unio paivanus MORLET, Jl. de Conch., XIII, 1865, p. 227.

Unio cambojensis SOWERBY, Conch. Icon., XVI, 1866, pl. XLII, fig. 231.

The beaks are fuller and higher than those of *U. dautzenbergi*; the dorsal slope is not truncated; the sculpture on the disk is not so rude or nodulous.

NODULARIA TUMIDULA (Lea).

Shell long ovate, subinflated, subsolid, inequilateral; beaks high and full, with a large lunule in front of them; posterior ridge low, angular above, somewhat double below, ending in a faint biangulation below the median line; anterior end round; base line almost evenly curved, but slightly produced behind the middle; surface almost smooth, with some feeble corrugations and wrinkles on the dorsal slope; epidermis dirty yellowish-green, with two or three faint, dark rays on the dorsal slope; hinge line almost evenly curved; teeth delicate; pseudo-cardinals compressed; laterals wavy; muscle scars well marked; beak cavities impressed; nacre bluish-white, inclining to iridescent.

Length 49, height 27, diam. 18 mm.

Siam; Cambodia.

Unio tumidulus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 93; Obs., VI, 1857, p. 15, pl. XXV, fig. 9; Jl. Ac. N. Sci. Phila., III, 1858, p. 295, pl. XXV, fig. 9.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIX, fig. 482.

Margaron (Unio) tumidulus LEA, Syn., 1870, p. 39.

Nodularia tumidula SIMPSON, Syn., 1900, p. 814.

Oxynaia tumidula HAAS, Con. Cab., Unio, 1910, pl. 14, fig. 4.

I have only seen the type, a dead shell, and not in excellent condition. This species does not seem to be very closely related to any other, but after giving it careful study I am inclined to place it in the *contradens* group.

NODULARIA DAUTZENBERGI (Morlet).

Shell irregularly subelliptical or subrhomboid, rather solid, inflated; beaks full and high, sculptured with strong, zigzag sculpture, which extends well over the umbonal region, gradually changing to irregular folds and nodules on the disk; posterior ridge strong, angled, sometimes faintly double, ending

in a blunt point below the median line; hinge line strongly curved; anterior end rounded, subangulate above; base line curved, quite full just behind the middle; dorsal slope obliquely truncated and having wrinkled, subradial ridges; epidermis yellowish-green, darker behind; teeth lamellar; pseudocardinals and laterals curved; muscle scars impressed; nacre bluish-white.

Length 50, height 31, diam. 24 mm.

River Srakeo, Siam.

Unio dautzenbergi MORLET, Jl. de Conch., XXXVII, 1889, p. 190, pl. VIII, fig. 5.

Nodularia dautzenbergi SIMPSON, Syn., 1900, p. 819.

Contradens dautzenbergi HAAS, Conch. Cab., Unio, 1912, pl. 21, figs. 6-7.

A rather solid species distinguished by its coarse, irregular sculpture. The hinge line is quite strongly curved; the nacre is rather dull.

NODULARIA SOBOLES (Fischer).

Shell irregularly rhomboid, inflated in front, wedge-shaped behind, solid; beaks rather full and high; anterior end somewhat truncated; base line curved, full about the middle, incurved between this and the posterior end; hinge line curved throughout; dorsal slope scarcely truncate; posterior ridge inclined to be double, ending in a blunt, rounded point or faint biangulation at the base of the shell; surface corrugated, the ridges often interrupted; epidermis brownish-green; pseudocardinals not strong; laterals curved; nacre whitish.

Length 68, height 39, diam. 32 mm.

Siam.

Unio siamensis MORLET, Jl. de Conch., XXXVII, 1889, p. 194, pl. VII, fig. 2.

Unio soboles FISCHER, Bull. Soc. d'Aut., 1891, p. 227.

Nodularia sobolus SIMPSON, Syn., 1900, p. 819.

Contradens sobolus HAAS, Conch. Cab., Unio, 1912, pl. 21, fig. 5.

First called *Unio siamensis* by Morlet, but as that name had been used by Lea, Fischer changed it to *Unio soboles*. Closely

related to *N. dautzenbergi* and possibly only an old state of that species. The posterior end is somewhat drawn out and curved downward and the shell is said to be wedge-shaped viewed from above. It is rather more elongated than the single specimen of *dautzenbergi*, which belongs in the National Museum. By a typographical error this name was spelled *sobolus* in the Synopsis.

NODULARIA VERBECKI (Böttger).

Shell subrhomboid, somewhat inflated, inequilateral, sub-solid; beaks only moderately full and high; anterior end narrowly rounded; base line curved; dorsal line curved; posterior ridge full, double, ending at and below the median line in a biangulation; dorsal slope obliquely truncated; surface sculptured with coarse, irregular folds or undulations; the teeth compressed, curved.

Length 47, height 26, diam. 18 mm.

Length 41, height 25, diam. 15.5 mm.

Singkarah Lake, Sumatra.

Unio verbecki BÖTTGER, Zool. Erg. Nied. Ost. Ind., IV, 1897, p. 89, pl. v, figs. 1, 2, 4, 5.

Nodularia verbecki SIMPSON, Syn., 1900, p. 819.

Contradens verbecki HAAS, Conch. Cab., Unio, 1912, pl. 22, figs. 1-4.

Von Martens credits this to Böttger manuscript. He does not give the color of the epidermis or nacre in his description. The species is close to *N. dautzenbergi* but is less inflated and does not have so strong a posterior ridge. It seems to be a little longer in proportion to its height.

Section RADIATULA Simpson.

Radiatula SIMPSON, Syn., 1900, p. 820.

Shell rather solid, triangular oval, with high beaks, which are but little inflated, not very full at post-base, and bluntly pointed behind, the beaks and entire surface covered with radiating, occasionally slightly zigzag or divaricate ridges, which are cut more or less into nodules or cancellations by concen-

tric sulcations, the sculpture of the posterior slope stronger, and curving upward; pseudocardinals of the left valve 2 to 3, ragged, the anterior larger, two in the right valve, with a parallel sided socket, the larger teeth compressed but rather solid.

Type, *Unio crispisulcatus* Benson.

NODULARIA CRISPISULCATA (Benson).

Shell somewhat subtriangulate, slightly inequilateral, convex to subinflated, subsolid; umbonal region high; beaks elevated but rather compressed, pointed, sculptured with numerous, distinct, radial-zigzag ridges, these ridges extending all over the shell and on the later growth are crossed by fine, decided, concentric sculpture causing the surface to be reticulated in a marked degree; along the full, rounded posterior ridge the sculpture is divaricate; anterior end narrowed and rounded; base line lightly curved, usually a little fuller behind the middle; outline of dorsal slope curved down to the rounded or sometimes biangulate point; epidermis yellowish-green to brownish, often with lighter and darker bands, dull; hinge line strongly arched; pseudocardinals subcompressed, ragged; laterals remote, rather short; muscle scars well marked; nacre whitish, often yellowish in the cavities.

Length 52, height 33, diam. 21 mm.

Length 40, height 29, diam. 16 mm.

Burma.

Unio crispisulcatus BENSON, Ann. and Mag., X, 1862, p. 193.

—SOWERBY, Conch. Icon., XVI, 1866, pl. XLIX, fig. 262.—

HANLEY and THEOBALD, Conch. Ind., 1876, p. 6, pl. XI, fig. 5.

Margaron (Unio) crispisulcatus LEA, Syn., 1870, p. 31.

Nodularia crispisulcata SIMPSON, Syn., 1900, p. 820.

A large series of this form is before me. It is one of the few distinctly cancellated Uniones. Notwithstanding its subtriangular form, it shows relationship to the other forms of *Nodularia*, especially to such species as *N. occata* and *N. gratiosa*.

NODULARIA LIMA Simpson.

Shell subrhomboid, inequilateral, subsolid, subcompressed; beaks not greatly elevated; anterior end rounded; base line lightly curved; dorsal line curved; outline of dorsal slope obliquely subtruncated; posterior ridge full, rounded, ending in a rounded point near the base; sculpture said to be something like that of *U. scobina*, but more linear and radial; epidermis olivaceous; pseudocardinals strong, ragged; laterals slightly curved; nacre bluish.

Length 30, height 20 mm.

Assam; Cambodia.

Unio radula BENSON, in Hanley, Biv. Shells, Supp., 1856, p. 382.—HANLEY and THEOBALD, Conch. Ind., 1876, p. 5, pl. x, fig. 3.

Dysnomia radula ROCHEBRUNE, Bull. Soc. Phil., VI, 1882, p. 42.

Nodularia lima SIMPSON, Syn., 1900, p. 820.

I know nothing of this species except from the figures and brief description. It may belong in the group of *Nodularia caerulea*, though the description in the Bivalve Shells would seem to indicate that the sculpture was inclined to be radial. The name *radula* was used by Say for a *Unio* in 1829, hence I have changed the name of this to *lima*.

Var. *siliguriensis* Preston.

"Shell inequilateral, ovate oblong, reddish-brown, sculptured with concentric lines of growth and oblique, transverse wrinkles, these latter being especially marked posteriorly; anterior side rounded; posterior side acuminate rounded; dorsal margin arched; ventral very slightly contracted in the middle; umboes much eroded; interior of shell iridescent, pale bluish-white.

Long. 21, lat. 37.35 mm." (Preston).

Unio siliguriensis PRESTON, Rec. Ind. Mus., Calcutta, II, 1908, p. 47.

Nodularia lima var. *siliguriensis* PRESTON, Rec. Ind. Mus., VII, 1912, p. 293.

Section CÆLATURA Conrad, 1853.

Calatura CONRAD, Pr. Acad. Nat. Sci. Phila., 1853, p. 267.

Shell elliptical, pointed or rounded behind, usually slightly produced at the post-base; beak sculpture consisting of zigzag ridges, which are generally quite pustulous, the sculpture often extending on to the usually rayed disk; teeth compressed; pseudocardinals lamellar.

Animal described under *Nodularia*.

Type, *Unio ægyptiacus* Cailliaud.

Group of *Nodularia ægyptiaca*.

Characters the same as of the section.

NODULARIA ÆGYPTIACA (Cailliaud).

Shell irregularly elliptical, subinflated, usually rather thin, subinequilateral; beaks moderately high and full, their sculpture consisting of subnodulous, zigzag ridges, sometimes of sharp or elevated pustules; dorsal line curved; anterior end narrowed and rounded; basal outline curved, fuller behind the middle; dorsal slope obliquely truncated; posterior ridge rounded, ending in a blunt point about on the median line; surface with irregular growth lines; epidermis generally smooth, with slight wrinkles on the dorsal slope, yellowish-green, banded, with faint, green rays, usually ashy on the umbonal region, somewhat shining; teeth lamellar; pseudo-cardinals one in the left valve and two in the right; laterals two in the left valve and one in the right; muscle scars shallow; nacre bluish.

Length 42, height 29, diam. 19 mm.

Nile system; Upper Cazamance, West Africa (Vignon); both sides of the equator in Central Africa (Dohrn).

Unio species nuovo, SAVIGNY, Icon. Moll., Egypt, 1813, pl. VII, figs. 3-6.

Unio ægyptiaca CAILLIAUD, Voy. à Méroé, II, 1826, pl. LXI, figs. 6, 7.

Margarita (Unio) ægyptiacus LEA, Syn., 1838, p. 21.

- Margarona (Unio) egyptiacus* LEA, Syn., 1852, p. 32; 1870, p. 50.
- Unio egyptiacus* HANLEY, Biv. Shells, 1843, p. 198, pl. xx, fig. 56.—KUSTER, Conch. Cab., 1856, p. 157, pl. XLV, fig. 2.—REEVE, Conch. Icon., XVI, 1865, pl. XXVI, fig. 132.—JICKELI, (part), Faun. Moll. N. O. Af., 1874, p. 271, pl. x, figs. 1-6, 8.—KOBELT, Icon., new ed., 1886, p. 25, pl. XLIV, figs. 262-265.
- Nodularia egyptiaca* SIMPSON, Syn., 1900, p. 821.—PALLARY, Mem. Inst. Egypt, VI, 1909, p. 78, fig. 8.
- Unio eucyphus* BOURGUIGNAT, Rev. et Mag., IX, 1857, p. 19, pl. III, figs. 1-3.—KOBELT, Icon., new ed., XVIII, 1912, p. 55, pl. DVII, fig. 2672.
- Unio bourguignati* LANDRAN, Seance Soc. Sci. Nat. Seine, 1864, p. 5, pl. —, figs. 1-3.
- Pharaonia bourguignati* ROCHEBRUNE, Bull. Soc. Mal. Fr., III, 1886, p. 113.
- Nodularia gaillardoti* "BOURGUIGNAT" PALLARY, Mem. Inst. Egypt, VI, 1909, p. 78, pl. v, figs. 7, 8.

Higher in proportion to length, thinner, more distinctly rayed and having less solid teeth than *N. nilotica*, with which it has been confounded. The beak sculpture is sometimes almost wholly nodulous, at other times it consists of zigzag, sub-nodulous ridges.

NODULARIA NILOTICA (Cailliaud).

Shell long elliptical or somewhat obovate, subinflated, sub-solid, inequilateral; beaks moderately raised, sculptured with broken, subnodulous, zigzag ridges; posterior ridge full, rounded, ending in a blunt point at or below the median line; hinge line lightly curved; anterior end a little narrowed, rounded, sometimes subangulate above; base line curved, fuller behind the middle; dorsal slope obliquely truncate; surface with irregular, subsulcate growth lines, often with slight, subradial ridges behind; epidermis often wrinkled, greenish, often banded and very faintly rayed, with a reddish tint on the umbonal region, subshining; pseudocardinals subcompressed, ragged;

laterals curved; anterior scars well marked; nacre bluish, whitish or reddish.

Length 55, height 32, diam. 19 mm.

Length 52, height 30, diam. 21 mm.

Nile system; Senegal and Upper Cazamance (Vignon).

Unio nilotica CAILLIAUD, Voy à Méroé, II, 1826, pl. LXI, figs.

8, 9.—HANLEY, Biv. Shells, 1843, p. 197, pl. XXI, fig. 39.

Margarita (Unio) niloticus LEA, Syn., 1836, p. 29; 1838, p. 21.

Margaron (Unio) niloticus LEA, Syn., 1852, p. 31; 1870, p. 50.

Nodularia nilotica SIMPSON, Syn., 1900, p. 821.—PALLARY,

Mem. Inst. Egypt, VI, 1909, p. 77, pl. IV, figs. 1, 2.

Unio pumilus ZEIGLER, manuscript and of authors.

Unio parreyssi PHILIPPI, Conch., III, 1848, p. 81, pl. v, fig. 6.

Nodularia (Cælatura) parreyssi PALLARY, Mem. Inst. Egypt,

VI, 1909, p. 78, pl. v, fig. 6.

Unio rugifer KUSTER, Conch. Cab. Unio, 1856, p. 157, pl. XLV,

figs. 3, 4.

Unio sennaariensis KUSTER, Conch. Cab. Unio, 1862, p. 280,

pl. XCIV, figs. 5, 6.

Unio æneus JICKELI, Faun. Moll. N. O. Af., 1874, p. 274, pl.

IX, fig. 2.

This seems to differ from *N. ægyptiaca* with a fair degree of constancy, in being solider, more elongated, more inequilateral, and in having shorter, more solid, ragged pseudocardinals. Many specimens entirely lack rays.

Var. *pruneri* "Bourguignat" Pallary.

"Differs from the type (*parreyssi*), by its smaller size, more elongated, less elevated shape, less thickness, more angulated posterior margin. In this species the anterior and posterior margins are fan-shaped." (Pallary).

Type locality, The Nile between the two cataracts.

Unio ægypticus JICKELI, Fauna N. Ost. Afrik. 1874, pl. x,

fig. 7.

Nodularia (Cælatura) parreyssi var. *pruneri* "BOURGUIGNAT"

PALLARY, Mem. Inst. Egypt, VI, 1909, p. 78.

NODULARIA EURYSSELLINA ("Letourneux" Pallary).

"This form, which belongs to the group of *niloticus*, is an unpublished species, which we found in the album of the Naiades of the Bourguignat collection drawn by M. Locard. The type came from the canal Mahmoudich in Lower Egypt. Our specimens have thin valves, of a beautiful clear rose-color, covered with a greenish epidermis.

Length 25, height 23, diam. 15 mm." (Pallary).

Unio eurysellinus "LETOURNEUX" PALLARY, Bull. Inst. Egypt, III, 1902, p. 94, pl. II, fig. 4.

Nodularia (Calatura) euryssellina PALLARY, Mem. Inst. Egypt, VI, 1909, p. 78.

NODULARIA MYSTICA ("Bourguignat" Pallary).

"We do not find any difference between the specimens from the Upper Nile and those from a canal near Suez, named *Unio mysticus* in the collection Bourguignat. This species, like a large number of the important series that Bourguignat proposed to publish in an "Histoire Malacologique de l'Egypt," is yet unpublished. It is to the courtesy of M. Arnould Locard that we owe our knowledge of this series, which we propose to publish in the near future.

Length 40, height 23, diam. 14.5 mm." (Pallary).

Unio mysticus "BOURGUIGNAT" PALLARY, Bull. Inst. Egypt, III, 1902, p. 94, pl. II, fig. 3.

Nodularia (Calatura) mystica PALLARY, Mem. Inst. Egypt, VI, 1909, p. 78.

NODULARIA GERRARDI (von Martens).

Shell elliptical, inflated, subsolid, inequilateral; beaks full and high, the umbonal region somewhat elongated, sculptured with V-shaped ridges; hinge line curved; anterior end rounded, base lightly curved, a little fuller behind the middle; posterior ridge widely rounded, ending in a blunt point about on the median line; epidermis dark brown; pseudocardinals rather small, compressed; laterals curved; nacre rose-colored or bluish.

Length 51, height 30.5, diam. 26.5 mm.

Lake Tanganyika.

Unio gerrardi VON MARTENS, Besch. Ost. Af., 1897, p. 223, pl. VII, fig. 5.

Nodularia nilotica var. *gerrardi* SIMPSON, Syn., 1900, p. 822.

Possibly distinct from *N. nilotica*. The beaks appear to be fuller, higher and more elongated than those of *nilotica*, and von Martens states that they have V-shaped sculpture instead of scattered pustules, but there is much variation in this character even in different specimens of the same species in this group. The shell is probably more inflated than that of *N. nilotica*.

NODULARIA BAGDADENSIS (Bourguignat).

Shell somewhat elongated, irregularly elliptical, rather thin, convex or but slightly inflated, inequilateral; beaks but little elevated; dorsal outline lightly curved; anterior end rounded; base line curved, fuller behind the middle; posterior ridge low, inclined to be double, ending in a blunt point or a feeble bifurcation about on the median line; dorsal slope obliquely truncate; surface with delicate, concentric sculpture; epidermis brownish-green; teeth lamellar and delicate.

Length 56, height 33, diam. 19 mm.

Environs of Bagdad?

Unio bagdadensis BOURGUIGNAT, Test. Nov. Saulc., 1852, p. 30; Cat. Rais., 1853, p. 78, pl. IV, figs. 4-6.—KOBELT, Icon. new ed., XVIII, 1912, p. 64, fig. 2685.

Margaron (Unio) bagdadensis LEA, Syn., 1870, p. 46.

Nodularia bagdadensis SIMPSON, Syn., 1900, p. 822.

More delicate and compressed than *N. nilotica* and having decidedly lamellar pseudocardinals.

This appears from the figures and descriptions to be a member of the *egyptiaca* group of *Nodularia*. It is possible that it came from Asia Minor, but more likely that it is an African species. The *Unio eucyphus* of Bourguignat, which he credits to this region, is believed by Lea to be the *U. egyptiacus* of Cailliaud, and I agree with him. This may be merely a peculiar form of the same thing.

NODULARIA CHARBONNIERI (Bourguignat).

Shell solid, more or less gaping in front or behind or both, inflated, irregularly elliptical; beaks moderately full and high, rugosely sculptured; hinge line curved; anterior end rounded; base line curved, fuller behind the middle; dorsal slope subtruncate above, rounded below into the posterior point of the shell; posterior ridge full, widely rounded, ending in a rounded point below the median line; surface lightly, concentrically, sculptured; epidermis varying from dark olive to chestnut or reddish-brown; pseudocardinals rather short and strong, ragged; laterals heavy, curved; nacre whitish or flesh-colored.

Length 77, height 48, diam. 39 mm.

Length 64, height 39, diam. 31 mm.

Length 64, height 43, diam. 29 mm.

Lake Tanganyika.

Unio charbonnieri BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 9.

—Icon. Mal. Tan., 1888, pl. XX, figs. 1, 2.—GERMAIN, Moll.

L. Tan., 1908, p. 72.

Unio coulboisi BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 12;

Icon. Mal. Tan., 1888, pl. XX, figs. 3, 4.

Unio dromauvi BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 17;

Icon. Mal. Tan., 1888, pl. XXII, figs. 1, 2.

Nodularia nilotica (part), SIMPSON, Syn., 1900, p. 821.

Probably only a form of *N. nilotica*. It seems to be solid, more inflated, and to be somewhat more decidedly sulcate, as well as rather darker colored. It is more evenly elliptical than *N. randabeli*, and has smaller umbones. The latter may be only a diseased form of this species.

Germain, (l. c.), considers *charbonnieri* a valid species and a *Unio*.

NODULARIA RANDABELI (Bourguignat).

Shell irregularly rhomboid, inflated, rather solid, inequilateral; beaks high and full, elegantly sculptured with roughened, zigzag-radial ridges; hinge line nearly straight; anterior end considerably narrowed and rounded; base line nearly straight, full behind the middle; dorsal slope almost winged

above, decidedly and somewhat obliquely truncate behind; posterior ridge quite high, broadly rounded, ending at the base of the shell in a widely rounded or subbiangulate termination; surface with fine concentric striæ, subshining; epidermis olive, with very numerous fine rays: pseudocardinals compressed, ragged; laterals nearly straight; nacre white and splendidly iridescent.

Length 57, height 35, diam. 31 mm.

Lake Tanganyika.

Unio randabeli BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 22;

Icon. Mal. Tan., 1888, pl. XXI, figs. 3, 4.

Nodularia randabeli SIMPSON, Syn., 1900, p. 822.

The shell figured appears to be somewhat diseased. It differs from *N. nilotica* in its greater degree of inflation, the fuller beaks and more brilliant nacre.

NODULARIA ESSOENSIS (Chaper).

Shell rather large, subinflated, slightly inequilateral, thin, subelliptical or subrhomboid; beaks high and full, their sculpture consisting of delicate, subnodulous, zigzag-radial ridges, with indications of similar sculpture on the dorsal slope; surface with irregular growth lines and faint indications of radial sculpture; hinge line slightly curved; anterior end narrowed and rounded; base line curved, quite full at or behind the middle; posterior slope almost elevated into a wing and rather squarely truncated behind; posterior ridge full, rounded, ending about on the median line; epidermis brownish-green, feebly rayed, dull; teeth lamellar, delicate; nacre bluish.

Length 75, height 53, diam. 35 mm.

Assini, west coast of Africa.

Unio essoensis CHAPER, Bull. Soc. Zool. Fr., X, 1885, p. 481, pl. XI, figs. 8, 9.

Nodularia essoensis SIMPSON, Syn., 1900, p. 822.

This seems to be a larger species than *N. agyptiaca*, to which it is very closely related. It is duller colored and less rayed than that species and the surface is rougher. There is a fine young shell of this species in the National Museum from the Morelet collection taken at the type locality.

Var. *minor* Germain.

"Shell thin, light, with a brilliant chestnut epidermis ornamented with narrow, emerald green rays, more numerous posteriorly. The beaks sometimes have strong tubercles; nacre orange, very iridescent.

Length 26-32, height 20-23, diam. 11-15 mm." (Germain).

Type locality, Le Kanem, eastern Tchad.

Unio (Nodularia) essoensis var. *minor* GERMAIN, Bull. Mus. Hist., Nat., 1906, p. 172.

NODULARIA DECAMPSIANA (Wattebled).

Shell rather short, irregularly elliptical, convex, rather thin, somewhat inequilateral; beaks but slightly elevated; hinge line curved; anterior end evenly rounded; base line curved, a little fuller behind the middle; posterior ridge moderately elevated, inclined to be double, ending a little below the median line; dorsal slope obliquely subtruncate; surface sculptured with rather fine, concentric ridges; epidermis brownish-black; teeth compressed; pseudocardinals sublamellar; muscle scars well marked; nacre purplish, rather brilliant.

Length 40, height 26, diam. 16 mm.

Western Soudan.

Unio decampsianus WATTEBLED, J. de Conch., XXXII, 1884, p. 132, pl. VII, fig. 1.

Nodularia decampsiana SIMPSON, Syn., 1900, p. 822.

Unio campsianus PÆTEL, Conch. Sam., III, 1890, p. 147.

This species probably belongs in this group. It appears to be a little solidier than *N. aegyptiaca*, is more compressed, has apparently decided concentric sculpture and purplish nacre.

NODULARIA BELLAMYI (Jousseaume).

Shell rather small, nearly regularly obovate, being slightly narrowed in front, inequilateral, thin and fragile, inflated; beaks full and high, sculptured with fine, broken, granular wrinkles, this sculpture extending more or less over the shell, especially on the ends of it; epidermis yellowish-gray with a

blackish or brownish band near the border; teeth lamellar; nacre bluish-white.

Length 33, height 20, diam. 15 mm.

Faraba, on the Niger; Upper Senegal.

Pharaonia bellamyi JOUSSEAUME, Bull. Soc. Zool. Fr., XI, 1886, p. 486, pl. XII, figs. 7a, 7b.

Nodularia bellamyi SIMPSON, Syn., 1900, p. 822.

The figure shows this species to be almost evenly obovate, being slightly narrower in front where it is rounded, and the somewhat broader posterior end is almost evenly rounded. The posterior ridge is rounded or feebly double and the surface of the shell seems to be more or less granularly sculptured, the granules being arranged in broken lines. Its form and frail structure should distinguish it from allied species. The specimen described and figured may be young.

NODULARIA RENEA (Jousseauime).

Shell slightly obovate, somewhat inflated, thin, inequilateral; beaks moderately full and high; the umbonal region and surface generally sculptured with fine, zigzag-radial, granulous ridges; anterior end rounded, slightly angled above; base lightly curved, fuller and rounded behind the middle; dorsal slope obliquely subtruncated; posterior termination rounded; posterior ridge widely rounded; epidermis yellowish-brown; teeth delicate, lamellar; nacre bluish-white, somewhat iridescent.

Length 29, height 17, diam. 11 mm.

Niger at Kayon; Senegal River; Upper Senegal.

Reneus reneus JOUSSEAUME, Bull. Soc. Zool. Fr., XI, 1886, p. 482, pl. XII, figs. 4a, 4b.

Reneus faidherbi JOUSSEAUME, Bull. Soc. Zool. Fr., XI, 1886, p. 483, pl. XII, figs. 5, 5a.

Nodularia renea SIMPSON, Syn., 1900, p. 822.

Less high in proportion to length than *N. bellamyi* and the basal outline is not so rounded. There is a shell and a left valve in the National Museum collection from Morelet labeled *Unio faidherbi* by him, which are feebly rayed and have but little zigzag sculpture.

NODULARIA LACOINI Germain.

"Shell elongate-oval, quite inflated, solid, opaque; dorsal margin almost straight; anterior margin rounded, slightly angulated above; ventral margin regularly convex; posterior region elongated, one and one-half to two times as long as the anterior, with the dorsal edge quite sharp in young shells, becoming obtuse in the adults; beaks prominent, often eroded, and, in such cases, showing a white nacre, upon which the apical sculpture is clearly defined; two cardinal teeth in the right valve, relatively quite elongate, the lower higher than the upper, separated by a deep groove; in the left valve a single, high, stout, slightly compressed and finely sulcate cardinal; laterals two in the left valve, thin, compressed, parallel and separated by a deep groove; in the right valve one, very long, elevated and quite sharp; anterior muscular impressions round and quite deep; posterior superficial. Epidermis pale chestnut, sometimes tinged with yellow; lines of growth very fine, but irregular; umbonal region tuberculate or with zig-zag ridges; nacre iridescent, bluish or roseate.

Length 30-36, height 19-22, diam. 14-16 mm." (Germain).

Type locality, Kanassarom, on the north-east side of Lake Tchad. Also, Faguibine, Upper Senegal.

Unio (Nodularia) lacoini GERMAIN, Bull. Mus. Hist. Nat., 1905, p. 489; Mem. Soc. Zool. Fr., XIX, 1906, p. 237, pl. IV, figs. 11, 12; l'Afrique Cent. Fran., 1907, p. 545.

"This species is excessively polymorphic both in form and sculpture. Thus the following mutations can be distinguished, which define themselves:

Var. ex-forma: *elongata* Germain.

curta Germain.

compressa Germain.

The sculpture of the shell consists, fundamentally, of quite fine striæ, which, in some examples, become strong, quite heavy and very irregular. To this is added, sometimes, in the umbonal region either tubercles or chevrons or occasionally both.

Unio lacoini resembles both *Unio (Nodularia) ægyptiaca* Cailliaud, from which it differs by its more elliptical shape, much longer cardinals, etc., and *Unio (Nodularia) faidherbei* Jousseau, from which it is distinguished by its less convex shape, more anterior beaks, etc."

Var. *chudeaui* Germain.

"Shell irregularly elongate-elliptic, very globosely inflated, most so in the umbonal region; dorsal margin a little convex and slightly oblique; ventral margin irregularly convex; anterior region short, somewhat rounded, cut away towards the ventral margin; posterior region a little more than twice as long as the anterior, terminating in a tapering point, somewhat elevated; beaks very large, very prominent, tuberculate; dorsal edge blunt; the cardinal tooth in the left valve is very stout, erect and cleft under the beak, and the two laterals are long and unequal; anterior muscular impressions very deep, posterior well marked, pallial line superficial.

Shell thick, slightly cretaceous, solid, with very heavy, very irregular, elevated and very unequal striæ; large wrinkled tubercles on the beaks; nacre very iridescent, slightly tinged with salmon.

Length 42, height 26.5, diam. 26 mm." (Germain).

Type locality, N'Guigmi, Lake Tchad.

Unio (Nodularia) lacoini var. *chudeaui* GERMAIN, Bull. Mus. Hist. Nat., 1909, p. 541.

"This very beautiful shell, which I refer as a variety to *Unio lacoini* Germain, is distinguished especially by its somewhat cuneiform appearance, its very prominent beaks and its peculiarly inflated form."

NODULARIA NGUIGMIENSIS Germain.

"Shell small, rounded-oval, very slightly subpentagonal, moderately compressed; valves gaping at both ends; dorsal margin straight, ventral margin very convex; antero-dorsal and postero-dorsal angles subacute; anterior end rounded, slightly cut away towards the base; posterior end one and

one-half times as long as the anterior, very high; beaks small, somewhat incurved, very tuberculate; dorsal edge blunt; ligament 4.75 mm. long; in the right valve, two strong cardinal teeth, quite long (4 mm.), very stout, subequal and well curved and a single, long lateral, at first straight, but curved in the last third, high and sharp; in the left valve, one very large cardinal, decidedly cleft under the beak, (the cleft part has the form of a triangular tooth made of four denticles in the form of triangular prisms united at the base), and two, long, elevated laterals, the lower the larger; anterior muscular impressions irregularly oval, very deep, especially near the inner side, posterior moderate, pallial line weak.

Shell solid, rather thick, slightly shining, coffee-colored, becoming yellowish-chestnut near the ventral margin; lines of growth fine, quite regular, subequal; some chevrons and tubercles well rounded and prominent near the beaks; nacre white, a little milky, quite iridescent.

Length 18.5, height 14.5, diam. 9.5 mm." (Germain).

Type locality, N'Guigmi, Lake Tchad.

Unio (Nodularia) nguigmiensis GERMAIN, Bull. Mus. Nat. Hist., 1909, p. 540, fig. 40.

This little species is quite distinct from *Unio (Nodularia) lacoini* Germain and its numerous varieties. It is easily distinguished by its round, subpentagonal form, more central beaks, peculiar character of the hinge and, finally, by the more solid shell."

NODULARIA FOULADOUGOUENSIS (Jousseau).

Shell irregularly elliptical, somewhat inflated, inequilateral, subsolid; beaks but slightly full or elevated; anterior end rounded, decidedly cut away below; base lightly curved, quite full behind the middle, behind this inflation it is obliquely truncated to the posterior point; dorsal outline a little arched; dorsal slope obliquely subtruncated; posterior ridge rounded, ending behind in a somewhat drawn out, but blunt, point about on the median line; surface with granulous, somewhat zigzag-

ged growth lines; epidermis yellowish-brown with a few faint rays; teeth compressed, lamellar; nacre bluish-white.

Length 26, height 16, diam. 10 mm.

Fouladougou, Niger; Upper Senegal.

Reneus fouladougouensis JOUSSEAUME, Bull. Soc. Zool. Fr., XI, 1886, p. 485, pl. XII, figs. 6, 6a.

Nodularia fouladougouensis SIMPSON, Syn., 1900, p. 823.

It is quite difficult to be sure, from the figures and often imperfect descriptions, of the validity of a number of the so-called species of this group. This seems to be very close to *N. renea*, but it is more angularly full at the posterior base and more drawn out behind than that species. In outline it is much like *Lampsilis vanuxemensis* of the Southeastern United States.

NODULARIA GABONENSIS (Kuster).

Shell rhomboid elliptical, rather inflated, thin, inequilateral; beaks high and full, with zigzag, subnodulous sculpture; posterior ridge full near the beaks, rounded, fading out below and ending below the median line; anterior end a little narrowed, rounded; base line well curved, slightly fuller behind the middle; hinge line lightly curved; dorsal slope obliquely subtruncate; surface nearly smooth, with a few wrinkles on the dorsal slope and faint indications of corrugations on the anterior end; epidermis ashy-greenish or yellowish-green, lightly rayed, somewhat shining; teeth delicate and lamellar; beak cavities well impressed: nacre bluish or whitish, somewhat iridescent.

Length 38, height 23, diam. 16 mm.

Gaboon River, West Africa.

Unio gabonensis KUSTER, Conch. Cab. Unio, 1862, p. 291, pl. XCVII, fig. 7.

Margaron (Unio) gabonensis LEA, Syn., 1870, p. 47.

Nodularia gabonensis SIMPSON, Syn., 1900, p. 823.

There is a shell in the Lea collection named *Unio gabonensis*, from Isabon, that exactly agrees with the form and dimension of Kuster's figure, but is not quite so brightly colored or so decidedly rayed. In outline it is not so angular as *N. aequatoria*.

NODULARIA ÆQUATORIA (Morelet).

Shell irregularly obovate, subinflated, rather thin, inequilateral; beaks full and high, their sculpture consisting of a few nodules and zigzag-radial ridges; hinge line nearly straight; anterior end narrowed and rounded, cut away a little below; base line nearly straight to behind the middle, where it is full and almost forms an angle, rising in an oblique direction to the produced posterior point; dorsal slope obliquely truncate; posterior ridge full, rounded, ending about on the median line; surface with strong growth lines in front, nearly smooth on the center of the disk, ashy-green or brownish-green, feebly rayed; epidermis either smooth or roughened; teeth delicate, lamellar; nacre bluish-white.

Length 55, height 32, diam. 23 mm.

Length 48, height 31, diam. 20 mm.

Length 28, height 20, diam. 13 mm.

Congo drainage.

Unio æquatorius MORELET, Jl. de Conch., XXXIII, 1885, p. 31, pl. II, fig. 9.

Nodularia æquatoria SIMPSON, Syn., 1900, p. 823.

Unio landanensis SCHEPMAN, Notes Leyden Mus., VIII, 1891, p. 113, pl. VIII, figs. 3a, 3b.—GERMAIN, Bull. Mus. Nat. Hist., 1907, p. 430, fig. 29.

A number of specimens are before me from different localities in the Congo basin showing much variation in size and form. Two lots are from Leopoldville, each showing decided variation among the individuals of each lot. It may be well to retain the name *landanensis* in a varietal sense for the smaller, rougher forms. I have examined gravid females of the *æquatoria* and found the inner gills only filled with embryos, forming smooth, even pads, like those of the *Uniones* of South America.

By an error the name *æquatoria* was misspelled in the Synopsis.

NODULARIA ELEGANS (Rochebrune).

"Shell elliptic-oval, quite inflated, well rounded anteriorly, with the posterior region almost twice as long as the anterior. The shell, which is quite strongly anodonti-form in appearance.

is thin, of an olive-green, a little yellowish towards the beaks and anterior margin, with a few, narrow, emerald-green rays. Lines of growth not strong, irregular, slightly lamellose towards the basal margin. Nacre rose-tinted, slightly iridescent.

Length 50, height, at 15 mm. from the beaks, 25.5, under the beaks 23, diam 17.5 mm." (Germain).

Type locality, The Congo.

Zairia elegans ROCHEBRUNE, Bull. Soc. Mal. Fr., III, 1886, p. 12.—SIMPSON, Syn., 1900, p. 862.

Unio (Nodularia) roubaudi GERMAIN, Bull. Mus. Hist. Nat., XX, 1907, p. 429, fig. 28.

The new name proposed by Germain, (l. c.), is unnecessary in *Nodularia*.

The original description not being accessible at the present time, I have copied that given by Germain. That author further remarks that the species resembles the *U. landanensis* Schepman very closely, that being a shell of practically the same character, but of a more elongated form with the basal margin more oblique, but it is probable that they are the same species.

NODULARIA GEAYI Germain.

"Shell elongate-oval, slightly subcuneiform, somewhat inflated, the greatest width posteriorly; valves gaping anteriorly; anterior end rounded, sloping towards the base; posterior region more than two and one-half times as long as the anterior, terminating in a slight, post-basal point; dorsal edge blunt; dorsal margin subconvex, ascending obliquely to the postero-dorsal angle, which is not strong and from which it merges into the convexly descending posterior margin; ventral margin convex, slightly subsinuous in the middle; beaks small, not prominent, much eroded; anterior ligament thin, scarcely projecting, 7 mm. long; posterior ligament not very strong, of a rather dull reddish-brown, 12 mm. long. Hinge weak; in the right valve, two, short, rather low, subequal cardinals and one long, straight, not prominent, thin and sharp lateral; in the left valve a single, weak, low, subtriangular cardinal and two, thin, rather long, nearly straight laterals, the lower slightly the

higher. Posterior muscular impressions faint, round; anterior large, deep; pallial impression visible the whole length of the shell, but not strong.

Shell light, thin, fragile; epidermis of a deep brown and not very bright, more or less eroded towards the beaks; lines of growth quite fine and regular. Nacre bluish, slightly iridescent, lead-color under the beaks.

The young have the posterior region more expanded, owing to the ventral margin being more constricted in the middle, and the posterior extremity is nearer the median line. The shell is brighter and the lines of growth are very regular.

Length 54, height at 18 mm. from the beaks 30, length of anterior region 14.5, of posterior region 41, diam. 17 mm." (Germain).

Type locality, Madagascar.

Unio (Nodularia) geayi GERMAIN, Bull. Mus. Hist. Nat., 1911, p. 137, pl. 1, figs. 1, 2, 6, 7.

"The *Unio geayi* Germain has affinities on one hand with the species of India belonging to the subgenus *Lamellidens* and, on the other, with the African species of *Nodularia*. Compared with the *Lamellidens* it reminds one, by its thin shell and hinge characters of *Unio (Lamellidens) marginalis* Lamarck from India and Ceylon; *Unio (Lamellidens) thwaitesii* Lea of Ceylon, etc.

Compared with the African species, it is closely related to the *Nodularia* of the equatorial regions, (*Unio (Nodularia) aequatorialis* Morelet; *gaillardi* Germain, etc.), by reason of thin, light shell, character of the nacre and reduction of the hinge."

NODULARIA HOREI (E. A. Smith).

Shell subrhomboid, slightly inequilateral, rather thin, compressed; beaks full and high, with zigzag corrugations, and having radial plications in front of and behind them, the rest of the surface concentrically striate; posterior ridge low, rounded or semi-double, ending bluntly behind below the median line; base curved; anterior end rounded; dorsal slope almost

squarely subtruncate; teeth thin, lamellar; scars shallow; nacre white pearly.

Length 25, height 16.5, diam. 9.5 mm.

Lake Tanganyika.

Unio horei E. A. SMITH, Ann. and Mag., VI, 1880, p. 429;

Pr. Zool. Soc. Lond., 1881, p. 299, pl. XXXIV, fig. 37.

Grandidieria horei BOURGUIGNAT, Bull. Soc. Mal. Fr., II, 1885, p. 6.

Nodularia horei SIMPSON, Syn., 1900, p. 823.

Smith believes that the shell from which his description and figure were made is young. It is quite thin and compressed and has an almost square subtruncation behind.

NODULARIA BORELLII (Ancy).

Shell almost regularly obovate, greatly inflated; subsolid, somewhat inequilateral, beaks only slightly elevated; anterior end narrowed and rounded, slightly cut away below; base almost evenly curved, but a little fuller behind the middle; outline of dorsal slope rather full, almost squarely subtruncated behind; anterior and posterior ends undulately rugose; epidermis dirty brown; hinge lightly arcuate; nacre brilliant, iridescent.

Length 29, height 19, diam. 16.5 mm.

Lake Nyassa and vicinity.

Unio borellii ANCEY, Bull. Soc. Zool. Fr., VII, 1894, p. 226, fig. 2.

Nodularia borellii SIMPSON, Syn., 1900, p. 823.

A small, inflated species with the umbones, the anterior and posterior ends of the shell corrugately wrinkled, dirty fuscous epidermis, and brilliant iridescent nacre.

NODULARIA EMINI (von Martens).

Shell subrhomboid, subinflated, subsolid, inequilateral; beaks full and high, but not elongated; posterior ridge well developed, rather narrowly rounded above, fading out somewhat below, ending near the base; hinge line slightly sinuous; anterior end angled above, rounded and cut away a little below; base line curved; dorsal slope obliquely truncate, the lower

posterior part of the shell widely rounded; surface with moderate growth lines; epidermis yellowish-brown, the umbones white, marked with orange-red; nacre whitish, tinted reddish.

Length 43, height 25, diam. 20 mm.

Victoria Nyanza.

Unio emini VON MARTENS, Besch. Deuts. Ost-Af., 1897, p. 224, pl. VII, fig. 14.

Nodularia emini SIMPSON, Syn., 1900, p. 823.

The distinguishing characters of this species seem to be its rather short, rhomboid form and the somewhat sinuous hinge plate. The color of the beaks and umbonal region is peculiar.

NODULARIA BOHMI (von Martens).

Shell rather large for a member of the group, long, rhomboid, somewhat inflated and solid, quite inequilateral; beaks large, high and full; posterior ridge only moderately developed, rounded, inclined to be double below, ending in a feeble biangulation near the base of the shell; hinge line strongly curved; anterior end rounded, lightly angled above; base line faintly curved; dorsal slope obliquely subtruncate; surface with delicate, concentric sculpture, brownish; pseudocardinals quite strong, subcompressed, ragged; laterals decidedly curved, lamellar; anterior muscle scars well impressed; beak cavities well excavated; nacre whitish, iridescent.

Length 62, height 37.5, diam. 27 mm.

Lake Tanganyika.

Unio bohmi VON MARTENS, Besch. Deuts. Ost-Af., 1897, p. 223, pl. VII, fig. 9.

Nodularia bohmi SIMPSON, Syn., 1900, p. 823.

A large, somewhat ponderous member of the *egyptiaca* group, considerably inflated and long rhomboid in outline.

NODULARIA AMBIFARIA (von Martens).

Shell rather small, subquadrate or subrhomboid, convex, solid, somewhat inequilateral; beaks only moderately full or high; posterior ridge not elevated, rounded; hinge line nearly straight; anterior end rounded and angled above; base line straight and parallel with the dorsal outline; posterior end

almost squarely subtruncate above, bluntly pointed below the median line; surface sculptured with V-shaped ridges and strong subradial folds on the dorsal slope, epidermis brownish-green with green rays, which are stronger on the posterior end; hinge teeth sublamellar, but strong.

Dar-es-Ssalam, East Africa.

Unio ambifarius VON MARTENS, Besch. Deuts. Ost-Af., 1897, p. 225, pl. VII, fig. 20.

Nodularia ambifaria SIMPSON, Syn., 1900, p. 823.

The shell of this species is almost regularly long quadrate, the dorsal and ventral outlines being parallel and the posterior end nearly squarely subtruncate above. It seems to be covered with delicate, zigzag sculpture, and has strong folds on the dorsal slope. It is strongly rayed for a member of this group.

NODULARIA LECHAPTOISI (Ancey).

Shell subelliptical, subinflated, slightly gaping in front, and solid; beaks apparently rather low, dorsal outline curved; anterior end rounded, very slightly cut away below; base line almost evenly curved; dorsal slope obliquely subtruncate; posterior ridge rounded, ending below the median line in a rounded point; upper part of the anterior and posterior ends sculptured with strong wrinkles; epidermis fuscous, blackish behind; beaks roughened; nacre pale salmon.

Length 38, height 21.5, diam. 17 mm.

Shire River, Lake Nyassa.

Unio lechaptosi ANCEY, Bull. Soc. Zool. Fr., VII, 1894, p. 228, fig. 3.

Nodularia lechaptosi SIMPSON, Syn., 1900, p. 823.

More nearly elliptical than *N. borellii* and having different nacre.

NODULARIA LIEDERI (von Martens).

Shell decidedly rhomboid, somewhat elongated, inequilateral, solid, subinflated; beaks moderately full and high with two divergent rows of tubercles; posterior ridge well developed, subangular, ending in a blunt point below the median line;

hinge line nearly straight; anterior end rounded but considerably cut away below; base line almost straight and subparallel with the hinge line to behind the middle, where it is inflated; dorsal slope decidedly and obliquely truncate; pseudocardinals compressed, strong; nacre bluish, reddish in the cavities.

Length 33, height 17, diam. 10 mm.

Lake Nyassa.

Unio liederi VON MARTENS, Besch. Deuts. Ost-Af., 1897, p. 226, pl. VII, fig. 19.

Nodularia liederi SIMPSON, Syn., 1900, p. 824.

A rather elongated species, which does not seem to have any very striking characters, yet it does not appear to be referable to any other species.

Species INCERTÆ SEDIS

NODULARIA DUPONTI (Rochebrune).

Reneus duponti JOUSSEAUME, Bull. Soc. Zool. Fr., XL, 1881, p. 481.

Unio duponti ROCHEBRUNE, Bull. Soc. Philom., VI, 1882, p. 34; Bull. Mus. Hist. Nat., 1904, p. 258.—GERMAIN, Bull. Mus. Hist. Nat., 1906, p. 304.

Parreysia duponti (part) SIMPSON, Syn., 1900, p. 846.

Type locality, Backoy River, Senegal.

In the Synopsis this species was united with the *U. duponti* of Bourguignat. But both Rochebrune and Germain (l. c.), consider it distinct.

The original description is not now accessible to me.

NODULARIA CHIVOTI Germain.

"Shell small, quite regularly oval, much compressed; valves thin, but quite solid, slightly gaping anteriorly; dorsal margin regularly subconvex; ventral margin very regularly and decidedly convex; anterior end rounded, slightly sloping towards the base; hinder end one and one-half times longer than the anterior, ending in a slightly truncated point; beaks eroded, not very prominent, rather large and obtuse; dorsal edge not very acute; in the right valve, two medium-sized cardinal teeth, the lower more elevated than the upper, almost smooth, slightly crenulated at the anterior extremity, the upper a little

longer, less high, thinner; lateral tooth long, thin, elevated; in the left valve, one, subtriangular, rather elevated cardinal tooth and two very long, thin, quite elevated laterals, the lower higher than the upper: anterior muscle impressions moderate, posterior very superficial; ligament very short, brilliant chestnut-color.

Epidermis deep chestnut-color, passing into blackish-brown anteriorly; lines of growth fine, quite regular, very crowded, finer and more irregular posteriorly, and ornamented, besides, with more or less prominent folds radiating from the beaks. These folds are only found on the umbonal region, where they surround, so to speak, the beaks; they are more developed posteriorly and in the centre and anteriorly become projecting granules. This sculpture of the shell is, in every way, comparable with that of the *Unio* of the Victoria-Nyanza. Nacre very iridescent, quite deep Prussian blue.

Length 31, height at 10.5 mm. from the beaks 19, diam. 10 mm." (Germain).

Type locality, Le Mamoun, Country of Senoussi.

Unio (Nodularia) chivoti GERMAIN, Bull. Mus. Hist. Nat., 1907, p. 66; l'Afr. Cent. Fran., 1907, p. 542, pl. v, fig. 23.

NODULARIA BANGORANENSIS Germain.

"Shell small, elongate-oval, rather convex; gaping considerably in front, very slightly posteriorly; dorsal margin regularly convex; ventral margin very convex; anterior margin rounded, slightly curved in towards the base; posterior end not quite one and one-half times as long as the anterior, terminating in a small point; beaks slightly obtuse, a little compressed; dorsal edge very blunt; hinge having in the right valve, two, not very long, cardinal teeth, the lower subtriangular, much elevated, much more so than the upper, which is very slight and a long, rather low lateral; in the left valve, one rather high cardinal with two projecting points, the first, very sharp, almost under the beaks, the other longer and blunter near the antero-dorsal angle, and two very long laterals; anterior muscular impressions deep, posterior very superfi-

cial; ligament short, rather stout. Epidermis very deep brown, much eroded about the beaks; lines of growth fine, close and irregular; nache bluish, sometimes salmon-tinted, quite iridescent.

Length 23-26, height 13.5 (at 5.5 mm. from the beaks)—21.5 (at 12 mm. from the beaks), diam. 10-14 mm." (Germain).

Type locality, Le Bangoran, affluent of the Chari, Country of Senoussi.

Unio (Nodularia) bangoranensis GERMAIN, Bull. Mus. Nat. Hist., 1907, p. 66; l'Afr. Cent. Fran., 1907, p. 543, pl. v, fig. 22.

"This species resembles in shape *U. chivoli*, but differs by its more truncate form, the posterior region being notably more expanded; by its more inflated shell, gaping at both ends (in *chivoti* only the anterior end is gaping); and especially by the entirely different sculpture of the surface."

NODULARIA KÖHLERI Germain.

"Shell quite large, elongated-suboval, very globose; valves slightly gaping posteriorly, much swollen and with the greatest convexity near the dorsal edge; dorsal margin straight; ventral margin regularly convex, sloping upwards slightly anteriorly, almost parallel with the dorsal margin; antero-dorsal and postero-dorsal angles well marked; anterior end short and rounded; posterior region a little more than twice as long as the anterior; beaks large, prominent, incurved and with strong, zigzag ridges; dorsal edge blunt; ligament 12.5 mm. long; in the right valve two strong cardinal teeth, the lower higher and sharper than the upper and a very long, straight, sharp lateral; in the left, a large cardinal tooth, faintly serrate, and two, subequal, long, thin and sharp laterals; anterior muscular impressions deep, posterior superficial; pallial line very faint.

Shell moderately thick, very solid, dark chestnut-colored, greenish towards the beaks, with a yellowish zone well marked, near the ventral border. Sculpture consisting of very irregu-

lar, strong, plicate lines of growth and in the umbonal region strong, zigzag ridges, tuberculate and very irregular. Nacre Prussian blue, very iridescent, sometimes salmon-tinted towards the ventral margin.

Length 40, height 26, diam. 21 mm." (Germain).

Type locality, Swamps of Kollangui, French Guinea.

Unio (Nodularia) kahleri GERMAIN, Bull. Mus. Hist. Nat., 1909, p. 541, pl. VIII, figs. 43, 44, 47.

"This very beautiful species cannot be compared with any African *Unio* now known. It resembles a little, by its globose form and zigzag sculpture the *Unios* of Lake Victoria-Nyanza, such as *Unio hypsiprimus* Martens and *Unio hauttecauri* Bourguignat. Its sculpture, moreover, is very similar to that of *Spatha vignoni* Bernardi."

NODULARIA GAILLARDI Germain.

"Shell quite small, very elongate-elliptic, much compressed; thin, light, slightly gaping posteriorly; dorsal margin subconvex, slightly oblique; ventral margin regularly rounded, almost parallel to the dorsal margin; antero-dorsal angle well marked; postero-dorsal angle slight; anterior margin short, rounded, cut away towards the base; posterior region much developed, at least three times as long as the anterior, posterior end elongated, submedian, somewhat pointed; beaks very small, not prominent; dorsal edge very blunt; ligament thin, 15 mm. long; hinge not very strong; in the right valve, two short cardinals, rather high, crenate, the lower notably higher and stronger and a single, long, subconvex, very thin lateral; in the left valve, one very feeble, low cardinal and two subequal, weak, thin laterals; muscular impressions faint.

Shell thin, rather fragile, light; epidermis a clear chestnut, slightly tinged with gray; lines of growth fine and irregular; nacre violet, very iridescent.

Length 42, height 20.5 at 9.5 from the beaks, diam. 10 mm." (Germain).

Type locality, Senegal.

Unio (Nodularia) gaillardi GERMAIN, Bull. Mus. Hist. Nat., 1909, p. 542, pl. VIII, figs. 41, 42.

"This interesting species, collected by Verreaux in 1845, inhabits Senegal. The exact locality, where it was found, is unknown to me."

NODULARIA ERLANGERI Kobelt.

"Shell rather small, oval, shortly rounded in front, subrostrate posteriorly, rather solid, but not heavy, very coarsely striate, scarcely shining, olive-brown. Dorsal and ventral margins nearly parallel, slightly curved, the latter sometimes a little subsinuate posteriorly. Beaks anterior, situated at $1/4$ the length, not prominent, greatly eroded in the specimens examined. Cardinal teeth of the left valve compressed, conical, the anterior the larger, separated by a sublateral pit; cardinal tooth of the right valve obtusely conical, lightly crenulate, separated from the margin by a deep groove; laterals thin, sharp, and at a decided angle with the cardinals, from which they are separated by a long interdentum; anterior muscular impressions distinct, tripartite, the posterior superficial: *callus humeralis* distinct, continued almost to the posterior end; nacre suffused with brown in the center.

Length 40, alt. 22, diam. 15 mm." (Kobelt).

Type locality, Somaliland.

Unio (Nodularia) erlangeri KOBELT, Abh. Senck. Nat. Ges., 32, 1909, p. 49, pl. VII, fig. 8.

"Germain, to whom I sent the types for comparison with Bourguignat's types, was unable to refer them to any of the described species. He writes: 'The *Unio* is unknown to me. It resembles in general appearance some examples of *Unio plicatulus* Lea from the Cape, but is quite distinct by its lines of growth. But your shell belongs to the group of *Unio abadianus* Bgt., and is very close to *Unio hamyi* Bgt. It differs principally by being more elevated at the postero-dorsal angle. This is the result of the comparison that I have made with the types of Bourguignat'."

NODULARIA SUBNIGRA Preston.

"Shell oblong-ovate, covered with a dark brown periostracum, smooth centrally, but becoming laminiferous towards the margins, especially posteriorly; umboes moderately small,

situated subcentrally; dorsal margin slightly arched; ventral margin gently curved; anterior side flattened, bluntly rounded; posterior side very obtusely angled; left valve bearing a cardinal, jagged lamelliform tooth; anterior teeth wedge-shaped, with jagged edges; posterior teeth fine, elongate, smooth; interior of shell pale flesh-color, changing towards the anterior and posterior margins to iridescent livid blue.

Long. 31.5, lat. 49 mm." (Preston).

Type locality, lower Belgian Congo.

Unio (Nodularia) subnigra PRESTON, Ann. Mag. Nat. Hist., (8), IV, 1909, p. 89, pl. IV, fig. 5.

NODULARIA VERRUCOSA Haas.

"Shell elongated, low, rather solid. Anterior end short, semicircular; ventral margin at first horizontal, then bent upwards in an obtuse angle to the posterior end; posterior margin at first horizontal, then oblique; posterior ridge distinct, somewhat biangulate. Beaks slightly prominent, quite inflated, situated at 29/100 of the total length. Beak sculpture consisting of wart-like elevations, which are connected by low curves to concentric, wavy wrinkles, which cover nearly the whole shell; vertical under the beaks and on the areola, the wrinkles become zigzag-shaped, then extend almost straight to the posterior ridge, where they bend upwards and extend over the posterior slope, gradually becoming weaker, towards the beaks, which, however, only the upper ones reach as low striae. As a whole, the lower area appears to be quite smooth, while the areola is entirely covered with the wavy wrinkles, the warts being very close to each other and almost confluent. Ligament weak. Hinge delicate; the cardinal tooth of the right valve is lamelliform, striate above; both of the cardinals of the left valve are also lamelliform, the anterior twice as long as the posterior, which stands under the beak; the laterals begin directly behind the cardinals, are long and somewhat bent in the middle. The cardinal teeth and the anterior half of the laterals are parallel with the axis of the shell. Anterior muscular impressions deep; posterior shallow. Nacre

bluish-white. Epidermis dark green, lighter towards the margins, eroded on the beaks.

Length 31, height 16, diam. 11 mm." (Haas).

Type locality, The Nile.

Nodularia verrucosa HAAS, Nachr. Deutsch. Mal. Ges., 1910, p. 99.

The following species are unfigured, and it is impossible to make out what they are. According to von Martens they belong in this group. I have not seen any of them.

NODULARIA CALATHUS (Bourguignat).

Unio calathus BOURGUIGNAT, Esp. Ouk. et Tan., 1885, p. 23.

Nodularia calathus SIMPSON, Syn., 1900, p. 824.

Tanganyika.

NODULARIA BAKOYI (Rochebrune).

Unio bakoyi ROCHEBRUNE, Bull. Soc. Phil., 7th ser., VI, 1882, p. 33.—GERMAIN, Jl. de Conch., LVI, 1908, p. 112.

Nodularia bakoyi SIMPSON, Syn., 1900, p. 824.

Bakoy, Upper Senegal.

Germain, (l. c.), states that this is probably the same as the subsequently described *U. faidherbei* Jous. He says, "the author's type; which is in the Museum of Paris, is a shell 35 mm. long, 19 mm. high at 11.5 mm. from the beaks and 13 mm. in diameter, presenting all of the principal characters of that species and especially the same peculiar convexity of the valves with the greatest diameter near the beaks. Only the dorsal margin is less elevated, which causes the shell to appear a little more elongated."

NODULARIA RATIDOTA (Charmes).

Unio ratidotus CHARMES, Bull. Soc. Mal. Fr., II, 1885, p. 166.

Nodularia radiota SIMPSON, Syn., 1900, p. 824.

Central Africa.

NODULARIA JULIANI (Rang).

Unio juliani RANG, Nouv. Ann. Mus., 1835, p. 309.

Nodularia juliani SIMPSON, Syn., 1900, p. 248.

Senegal.

NODULARIA POIRIERI (Rochebrune).

Type locality, The Congo.

Zairia poirieri ROCHEBRUNE, Bull. Soc. Mal. Fr., III, 1886, p.

11.—SIMPSON, Syn., 1900, p. 862.

Nodularia ARANEOSA (Rochebrune).

Type locality, The Congo.

Zairia araneosa ROCHEBRUNE, Bull. Soc. Mal. Fr., III, 1886,

p. 11.—SIMPSON, Syn., 1900, p. 862.

NODULARIA SORDIDA (Rochebrune).

Type locality, The Congo.

Zairia sordida ROCHEBRUNE, Bull. Soc. Mal. Fr., III, 1886, p.

13.—SIMPSON, Syn., 1900, p. 862.

NODULARIA DISCIFORMIS (Rochebrune).

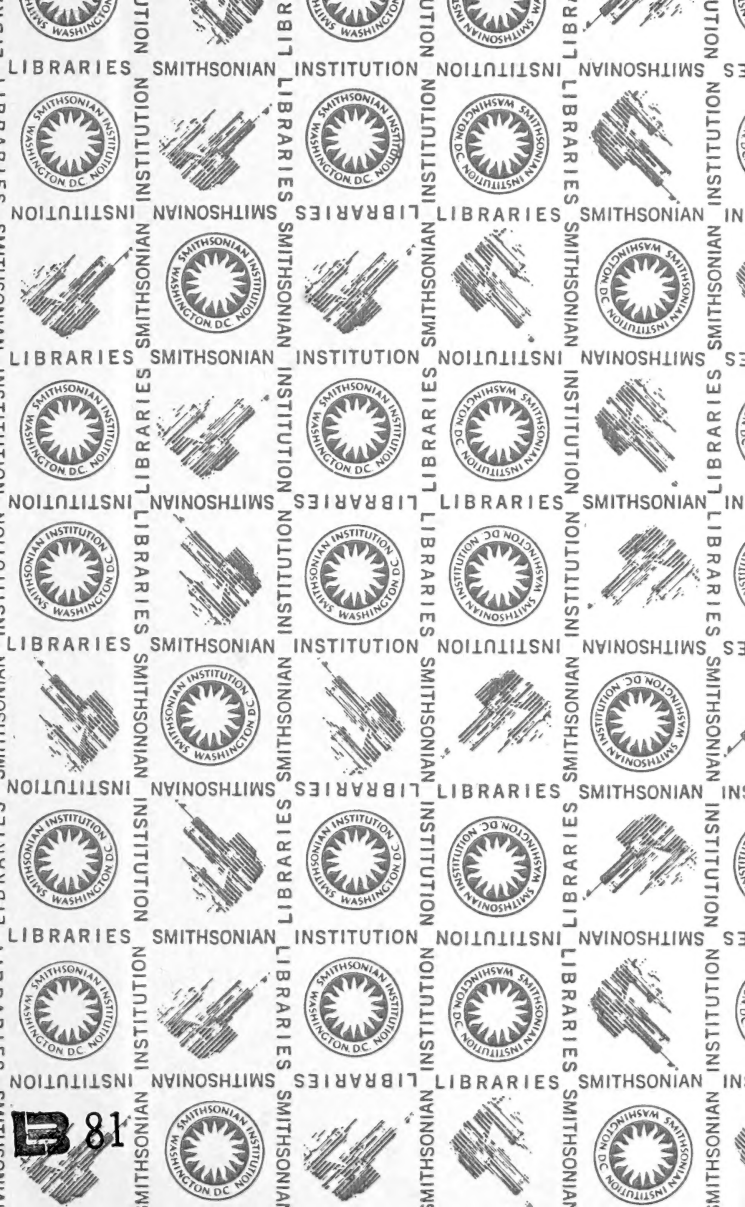
Type locality, The Congo.

Zairia disciformis ROCHEBRUNE, Bull. Soc. Mal. Fr., III, 1886,

p. 10.—SIMPSON, Syn., 1900, p. 862.

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